WASHINGTON STATE
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Upper Chehalis River
Dry Season
Total Maximum Daily Load Study

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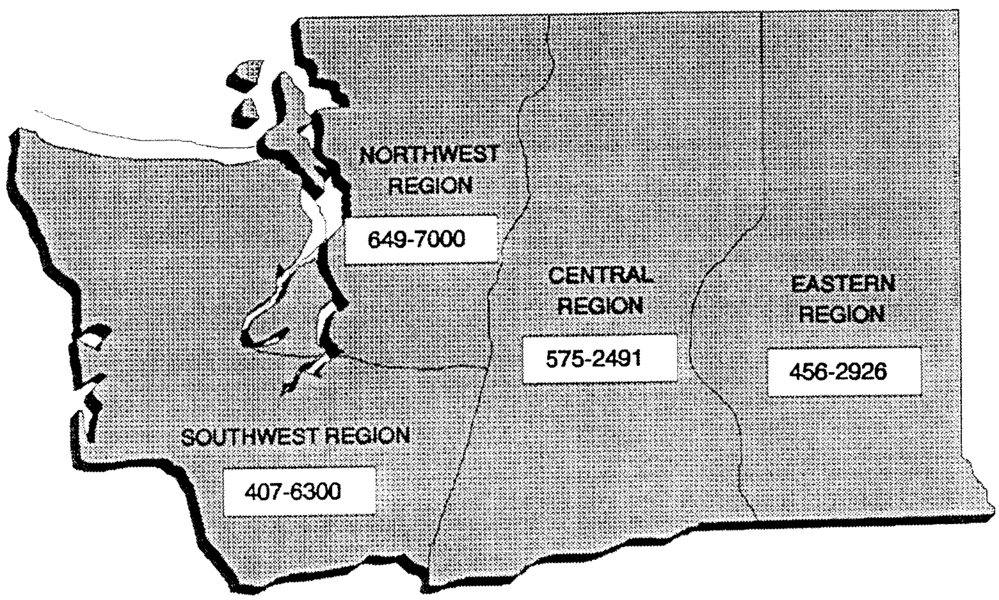

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Upper Chehalis River Total Maximum Daily Load Study

by
Paul J. Pickett

Washington State Department of Ecology
Environmental Investigations and Laboratory Services Program
Watershed Assessments Section
Olympia, Washington 98504-7710

Water Body Numbers
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WA-23-1018, WA-23-1019, WA-23-1023, WA-23-1024, WA-23-1027,
WA-23-1028, WA-23-1030, WA-23-1043, WA-23-1050, WA-23-1070,
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This study has definitely been a team effort by a multitude of people who care about the environment and love that special place called the Chehalis Basin.

Abstract

A Total Maximum Daily Load (TMDL) study was conducted to evaluate dry season water quality in the Upper Chehalis River (from the Porter bridge upstream). Past studies have documented areas of low dissolved oxygen (DO) during the summer in the "Centralia reach" of the Chehalis River (between the Newaukum and Skookumchuck Rivers). The Chehalis River and tributaries were evaluated for loading sources and other physical, chemical, and biological river conditions that contribute to the oxygen deficit.

Several surveys were conducted in the study area during the dry seasons of 1991 and 1992. Survey results showed widespread thermal stratification in the Centralia reach during the summer months. Stratification was associated with hypoxic and anoxic conditions in deeper waters. Dissolved oxygen below water quality criteria was widespread in surface waters and tributaries of the Chehalis River. Temperatures in mainstem and tributary surface waters often exceed the water quality criterion of 18.0°C. Violations of fecal coliform bacteria criteria were also found in the mainstem and some tributaries.

Modeling analysis using the WASP5 water quality model predicted that DO for existing critical conditions would fall below water quality criteria over much of the mainstem study area in both mid-summer and early fall. When loading was reduced to background levels (no point source and significant nonpoint loading), modeling predicted DO below criteria during mid-summer in the upper study area (Ceres Road to the Newaukum River) and in the lower study area (Galvin Road to Porter), and during early fall in the Centralia reach.

Loading capacities (LC) for carbonaceous biochemical oxygen demand (CBOD) and ammonia nitrogen (NH_3-N) were evaluated, based on meeting DO water quality criteria where background conditions met criteria, and allowing no significant degradation of DO where background conditions fell below criteria. A phased TMDL is recommended for CBOD and NH_3-N during the period May 1 to October 31. Wasteload Allocations (WLAs) are proposed for the existing Pe Ell discharge and the proposed Grand Mound discharge. No CBOD or NH_3-N loading capacity above background exists in the Centralia reach above the Mellen Street bridge. Two potential WLA alternatives are proposed for either a reduced Centralia discharge, or for a combined discharge for Centralia, Chehalis, and Darigold between Mellen Street and Galvin Road. Load Allocations (LAs) are proposed for existing levels of nonpoint sources from Galvin Road to Porter. No LAs above background are proposed for nonpoint sources upstream of the Galvin Road bridge and for future growth. The phased TMDL will allow the reassessment of the TMDL after implementation of nonpoint source controls.

Implementation strategies are suggested that include modification of existing NPDES and state permits to meet WLAs and LAs. Best management practices should be implemented to control nonpoint sources, particularly for livestock impacts and for urban stormwater from Galvin Road upstream. A monitoring strategy is proposed to evaluate the effectiveness of the TMDL. Additional studies are recommended for the following: eutrophication in the mainstem Chehalis River and Scatter Creek, ground water interactions, and sediment oxygen demand.

1. Introduction

1.1 Basin Description

The Chehalis River drains an area of over 2,000 square miles in Western Washington (Figure 1.1), discharging to Grays Harbor near the city of Aberdeen. The study area for this report is the upper Chehalis River basin, which is defined as the river and its tributaries upstream of the Chehalis River bridge at Porter, corresponding to Water Resource Inventory Area (WRIA) 23. Reference to the Chehalis River and basin made throughout the rest of this report will mean the upper river and basin.

The Chehalis River basin within the study area lies in northwestern Lewis County, southwestern Thurston County, and eastern Grays Harbor County, with small portions in Pacific and Cowlitz Counties. The city of Olympia is near the northern end of the basin, and the river passes near the cities of Chehalis and Centralia in the center of the basin. The Chehalis Reservation is at the western end of the basin.

Major tributaries of the Chehalis River in the study area are the South Fork Chehalis River, the Newaukum River, the Skookumchuck River, and the Black River. Numerous creeks are tributary to the mainstem, of which the largest are Elk, Bunker, Stearns, Dillenbaugh, Salzer, Lincoln, Scatter, Rock, and Cedar Creeks. The headwaters of the mainstem and South Fork Chehalis Rivers lie in the eastern Willapa Hills; the headwaters of the Newaukum and Skookumchuck lie in the Bald Hills, a westward spur of the Cascade Range; and the Black River and Cedar Creek drain the Black Hills.

The mainstem Chehalis River in the study area can be divided into three reaches that exhibit distinct physiographic features. The upper reach of the study area, running from above the town of Pe Ell, past the South Fork and the Newaukum River, down to the State Route (SR) 6 bridge near Chehalis at River Mile[1] (RM) 74.9, has mixed features of riffles, swift glides, and occasional deeper pools. The middle reach, from the SR 6 bridge near Chehalis to the Skookumchuck River (RM 67.0), is a stretch of slow, relatively deep water, referred to as the "Centralia reach" in this report. In the lower reach of the study area, from the Skookumchuck River downstream to Porter (RM 33.8), the river is much swifter, again exhibiting a riffle/glide/pool character.

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[1]River Mile designations are based on the river miles indicated on the USGS topographic maps. As a convention for this report, the river mile at Porter has been adjusted upward (33.8 instead of 33.3) to account for a one-half mile river bend that was cut off in 1990.

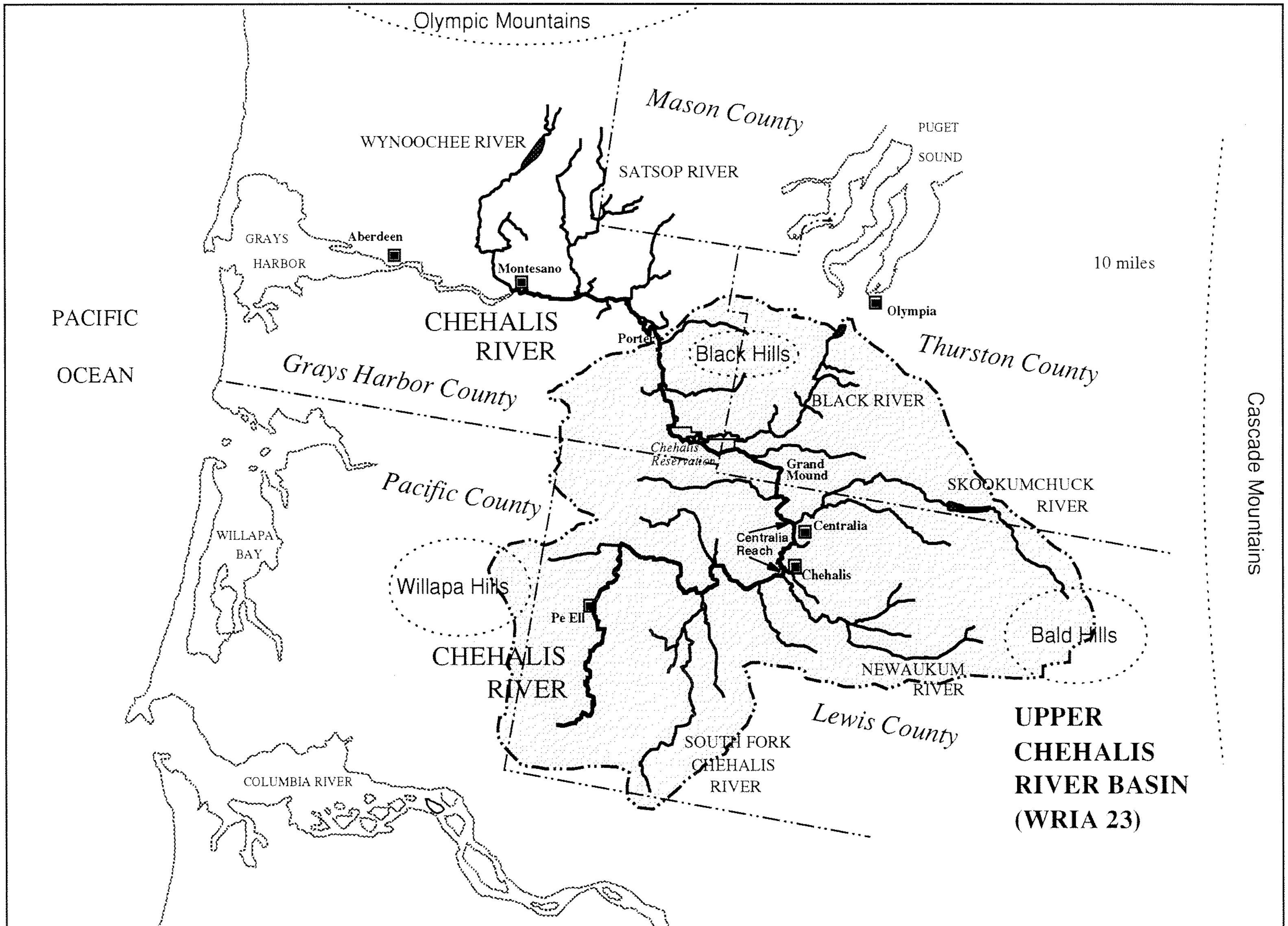

Figure 1.1 Upper Chehalis River System Location Map

1.2 Pollutant Loading Sources

Loading sources to the Chehalis River system consist of point and nonpoint sources. Point sources are discharges from a distinct location and are regulated under the federal and state National Pollutant Discharge Elimination System (NPDES). Nonpoint sources are diffuse discharges that include, for example: stormwater runoff, livestock access, and ground water discharge. Land use activities that generate nonpoint pollution include: agriculture and livestock; urban commercial and residential development; timber harvest; and the land disposal of industrial waste, solid waste, and residential sanitary waste.

A number of facilities in the Chehalis River basin discharge as point sources under the NPDES system. There are also several facilities that are regulated under State Waste Discharge Permits for land application of wastewater. Permitted facilities in the Chehalis River basin are listed in Table 1.1.

Two of the permitted facilities, the Cities of Centralia and Chehalis, are major municipal wastewater treatment plants (WTPs) that discharge directly to the mainstem Chehalis River. Both facilities are built to secondary treatment standards using trickling filters. Darigold treats cheese production wastewater in a trickling filter system, and discharges to the mainstem about 50 feet upstream of the City of Chehalis outfall. Pe Ell treats its wastewater with an oxidation ditch system and discharges to the Chehalis River downstream of the city. A detailed description of these facilities can be found in Das (1993).

Thurston County has proposed a new WTP at Grand Mound, and the proposal is in an engineering review phase. The proposed outfall location for Grand Mound would be near the Maple Lane School. The sewage lagoon at Maple Lane School during the summer months discharges entirely by percolation; this facility is planning to connect to the proposed Grand Mound WTP.

National Frozen Foods (NFF) and Midway Meats land apply wastewater on fields that border the Chehalis River and Salzer Creek. The National Frozen Foods spray irrigation system was the source of a major wastewater spill to Salzer Creek in 1979 that caused an extreme dissolved oxygen (DO) sag in the Chehalis River. Carey (1992) conducted ground water sampling at one of the land application fields, and more information about the fields can be found in that report.

Another site with a potential to affect the river through ground water, storm water, or treated leachate discharge is the Centralia Landfill, a CERCLA (Superfund) Cleanup site that borders Salzer Creek. Remediation of the Centralia Landfill is currently underway, and a wastewater permit has not been issued.

Table 1.1 Permitted Dischargers, Chehalis River Basin Dry Season Study Area.

Receiving Water/Facility Name	Permit Type	Facility Type
Chehalis River (Mainstem)		
City of Centralia	NPDES	Wastewater Treatment Plant
City of Chehalis	NPDES	Wastewater Treatment Plant
Grand Mound (Proposed)	NPDES	Wastewater Treatment Plant
City of Pe Ell	NPDES	Wastewater Treatment Plant
Maple Lane School	NPDES	Wastewater Treatment Plant
Darigold	NPDES	Dairy Products
Weyerhaeuser/Pe Ell	NPDES	Truck Wash
Midway Meats	State	Meat Packing Plant
National Frozen Foods	State	Food Processing (land application site)
Sea Fresh Fish Co.	NPDES-EPA	Upland Finfish Aquaculture
Black River		
Global Aqua/Black River	NPDES	Upland Finfish Aquaculture
Swecker Salmon Farm	NPDES	Upland Finfish Aquaculture
Cedar Creek Corrections (Mill Cr)	NPDES	Wastewater Treatment Plant
Scatter Creek		
Global Aqua/Scatter Creek	NPDES	Upland Finfish Aquaculture
Seafarm of Washington	NPDES	Upland Finfish Aquaculture
Skookumchuck River		
Skookumchuck River Ponds	NPDES	Upland Finfish Aquaculture
Hanaford Creek		
Centralia Mining (WIDCO)	NPDES	Surface Coal Mining
Pacific Power & Light	NPDES	Electric Generating Plant
Salzer Creek		
Centralia Landfill	CERCLA	Municipal Landfill (Clean-up site)
I.P. Callison & Son	NPDES	Mint Oil Production
National Frozen Foods	State	Food Processing (land application site)
Dillenbaugh Creek		
National Frozen Foods	State	Food Processing Plant
PPG Industries	State	Float Glass Plant
Washington Army Natl Guard	NPDES	Vehicle Maintenance Shop
Quali-cast	NPDES	Steel Foundry
Newaukum River (South Fork)		
Lewis County Water Dist #2	NPDES	Sewage Treatment Plant

Wastewater discharges from the aquaculture facilities in the Chehalis basin are permitted under the Upland Finfish Aquaculture NPDES General Permit, with the exception of the Sea Fresh facility. Sea Fresh is located on the Chehalis Reservation, and has applied directly to the U.S. Environmental Protection Agency (EPA) for an NPDES permit. The facilities on the Black River are discussed in detail in Pickett (1994). Discharges from the two aquaculture facilities on Scatter Creek are of interest because they constitute almost the entire flow of the creek in summer. The facilities on Dillenbaugh Creek are located in the Chehalis Industrial Park area, and are probably not significant sources of oxygen-demanding pollutants or nutrients. Likewise, sources in the Skookumchuck and Newaukum basins are far up in the sub-basin and probably have little effect on the mainstem. However, in the course of this study, the influence of all sources on the Chehalis River was examined.

A number of nonpoint sources are of potential significance in the Chehalis River basin. Septic systems can be a source of pollutants to the river if they are substandard, failing, or located adjacent to a waterbody. Stormwater runoff from residential, commercial, light industrial, and construction areas are potential sources of pollutants, especially in urban areas and other rapidly growing areas such as Grand Mound. Streets, roads, and highways, including Interstate 5, could discharge pollutants in stormwater or through spills to the Chehalis River and its tributaries. A number of stormwater sources have been identified in the Chehalis and Centralia areas, both in this study and in previous studies (Crawford, 1987a and 1987b).

A dominant activity in the Chehalis River basin is agriculture. A number of dairies are in the basin, and some may be candidates for coverage under the Dairy General Permit that has been drafted. The largest dairies mostly range in size from 100 to 300 head of cattle, but a few are even larger, with up to 3,000 head. There are also livestock rearing operations, auction yards, and other holding areas; poultry operations; nurseries; turf, berry and Christmas tree farms; row-cropping; and numerous hobby farms. Timber harvest and management activities occur throughout the basin, especially in upland areas.

1.3 Water Quality Standards

Water Quality Standards for Surface Waters for the State of Washington (Chapter 173-201A WAC) establish the water quality standards for the Chehalis River basin. The entire upper Chehalis River basin is classified as Class A, except for the Skookumchuck River above Bloody Run Creek and the Chehalis River above Rock Creek, which are Class AA waters. Beneficial uses include domestic, industrial and agricultural water supply; stock watering; fish and shellfish migration, rearing, spawning, and harvesting; wildlife habitat; primary contact recreation (swimming and bathing); sport fishing, boating, and aesthetic enjoyment; and commerce and navigation.

Several parameters were of particular interest in this study (temperature, pH, DO, fecal coliform bacteria [FC] and ammonia) because they have water quality criteria specified in the Water Quality Standards, and levels have been observed in previous studies that approach or exceed the standards. Also, special conditions for dissolved oxygen apply to the Chehalis River between Scammon Creek (RM 65.8) and the Newaukum River (RM 75.2), and to Hanaford Creek from its mouth to stream mile 4.1. The Class A criteria and special conditions for these parameters are summarized in Table 1.2.

If natural conditions in a water body result in DO less than the water quality standards, then the antidegradation policy applies (WAC 173-201A-070). Section 2 of this policy states that "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." Natural conditions are defined as "surface water quality that was present before any human-caused pollution" (WAC 173-201A-020).

The primary mechanism for implementing Washington's water quality standards is provided under Section 303 of the Clean Water Act. Section 303(d) requires the states and EPA to establish total maximum daily loads (TMDLs) for all water quality limited segments (*i.e.*, those waters which cannot meet water quality standards after application of technology-based source controls). After the Loading Capacity (LC) for a given pollutant in the water body is established, loading sources are apportioned between point sources (waste load allocations--WLAs) and nonpoint and natural background sources (load allocations--LAs), which forms the TMDL. The WLAs and LAs are implemented though NPDES permits, grant projects, and nonpoint source controls.

The Southwest Regional Office Section of Ecology's Water Quality Program has requested that the Watershed Assessments Section of the Environmental Investigations and Laboratory Services Program (EILS) evaluate stream segments in the Chehalis River basin to determine if a TMDL is needed, determine the LC for pollutants of concern, and recommend the appropriate TMDL, including WLAs and LAs (Kendra and Dickes, 1991).

The Chehalis River was chosen for a TMDL study for a number of reasons. Foremost, although the Chehalis River has not been formally placed on the 303(d) list as water quality limited for DO (Ecology, 1992a), a large body of historical data indicate that water quality standards for DO are not being met (Pickett, 1992). The river has been identified as an important fisheries resource, and a major fish kill in 1989 demonstrated the sensitivity of that resource to the water quality of the river (Ecology, 1989). One of the objectives proposed under the Chehalis River Basin Fishery Resources Study and Restoration Act is to "improve water quality to meet

Table 1.2 Freshwater Quality Criteria for Selected Parameters.

Parameter	Criteria
Temperature	Shall not exceed 18.0°C in Class A waters, or 16.0°C in Class AA waters, due to human activities. When natural conditions exceed this temperature, no temperature increases will be allowed which will raise the receiving water temperature by greater than 0.3°C. Incremental temperature increases resulting from point source activities shall not, at any time, exceed $t=28/(T+7)$ in Class A waters, or $t=23/(T+5)$ in Class AA waters. Incremental temperature increases resulting from nonpoint source activities shall not exceed 2.8°C. For purposes thereof, "t" represents the maximum permissible temperature increase measured at a mixing zone boundary; and "T" represents the background temperature as measured at a point or points unaffected by the discharge and representative of the highest ambient water temperature in the vicinity of the discharge.
pH	Shall be within the range of 6.5 to 8.5, with a human-caused variation within a range of less than 0.5 units in Class A waters, and 0.2 units in Class AA waters.
Dissolved Oxygen	Shall exceed 8.0 mg/L in Class A waters, and 9.5 mg/L in Class AA waters. Special conditions: Chehalis River between Scammon Creek (RM 65.8) to Newaukum River (RM 75.2) shall exceed 5.0 mg/L from June 1 to September 15, Class A the remainder of the year; Hanaford Creek from mouth to stream mile 4.1 shall exceed 6.5 mg/L.
Fecal Coliform Organisms	Shall both not exceed a geometric mean value of 100 colonies/100 mL in Class A waters, or 50 colonies/100 mL in Class AA waters, and not have more than 10 percent of all samples obtained for calculating the geometric mean value exceeding 200 colonies/100 mL in Class A waters, or 100 colonies/100 mL in Class AA waters.

State standards year-round in the middle and upper Chehalis River System" (Hiss and Knudsen, 1993). In addition, parts of the basin are experiencing significant growth. These reasons support the development of preventative TMDLs for those pollutants that could degrade water quality and threaten beneficial uses of the Chehalis River.

1.4 Project Goals and Objectives

The goal of the TMDL study was to assess the water quality of the Chehalis River basin, develop LCs, and recommend WLA/LAs for appropriate parameters and reaches of the river for protection of dissolved oxygen water quality standards. The specific objectives of the study were:

1. Assess water quality on the mainstem Chehalis River and significant tributaries and point sources during the dry season (late spring to early fall) to identify reaches which may be water quality limited for dissolved oxygen, identify significant loading sources, and provide data for computer modeling.

2. Identify and evaluate significant loading sources that appear to lack "all known available and reasonable methods . . ." (AKART) of pollution control, and refer same to regional staff for action.

3. Evaluate the cumulative effect of pollutant loadings through data analysis and computer simulation of water quality in the Chehalis River.

4. Evaluate sampling data and modeling results for historical conditions and estimated critical conditions.

5. Estimate natural conditions in the river system and compare the State Water Quality Standards to those conditions.

6. Establish LCs for pollutants most impacting dissolved oxygen levels.

7. Propose WLA/LA alternatives for control of point and nonpoint sources of pollution.

1.5 Other Water Quality Activities

A number of groups in the Chehalis River basin are engaged in water quality activities relevant to this study. Under a grant from Ecology, the Lewis County Conservation District (CD) has organized the Chehalis River Council (CRC), a citizen's committee whose goal is the protection of aquatic resources in the Chehalis basin. Under the grant, the CRC developed the Chehalis River Basin Action Plan

(Chehalis River Council, 1992) to address nonpoint source pollution control efforts. The Lewis County CD and the CRC have received grant funding to conduct the Dillenbaugh Creek Model Watershed Project. The CRC with its Action Plan should continue to play a key role in the identification and implementation of nonpoint source controls.

The U.S. Fish and Wildlife Service (USFWS) is implementing the Chehalis River Basin Fishery Resources Study and Restoration Act of 1990. The study mandated by this Act (USFWS, 1993) has conducted an inventory of fishery habitat degradation, which includes water quality problems and pollutant sources. Water quality was identified as one of the critical areas needing improvement to restore the Chehalis River fishery. USFWS will annually be awarding grant funds for habitat improvement, which should be an important source of funding for nonpoint source controls.

Also active in water quality issues in the Chehalis River basin is the Confederated Tribes of the Chehalis Reservation (Chehalis Tribe). The Chehalis Tribe has received grant money from USFWS for fishery improvement projects, and is beginning a water quality monitoring program on the Chehalis River as follow-up to the work done in this study. Environmental issues on the Chehalis Reservation are under the direct jurisdiction of EPA, and implementation of the TMDL on the Reservation would be conducted by the Tribe and EPA.

2. Methods

2.1 Data Collection

Two main components were included in the Chehalis River DO TMDL study--water quality data collection and computer modeling. The objectives of data collection were to assess the quality of the Chehalis River and its tributaries, identify the significant sources of pollutant loading, and provide input data for a water quality model. The model was used to mathematically simulate the dynamic systems of the river which control dissolved oxygen levels. Based on the analysis of data and modeling results, LCs were determined and TMDLs were recommended for the river.

Water quality data were collected from July to October 1991 and May to September 1992. Data collected consist of hydrodynamic and channel morphology measurements (flow, gage height, channel cross-section, and velocity by drogue); physical and chemical field measurements (vertical profiles and 24-hour time series with Hydrolab® multi-parameter meters, grab measurements with meters and thermometer, Secchi depth, and vertical profiles of light intensity); and chemical and biological sampling and laboratory analysis.

Data were collected from stations in the mainstem Chehalis River, and from tributaries, point sources, and other loading sources. The selection of sampling station locations and water quality parameters for monitoring was based on EPA guidance for waste load allocation and model development requirements (EPA, 1983a; Mills *et al.*, 1986; Ambrose *et al.*, 1993.), with consideration of site access and sampling logistics. Maps which show the location of sampling stations are provided in Figures 2.1 and 2.2. A list of the sites used for sampling and measurement (other than flow) is provided in Table 2.1.

A detailed description of study design and sampling and measurement methods is provided in Appendix A. Model development methods are described in Section 4 and Appendix G.

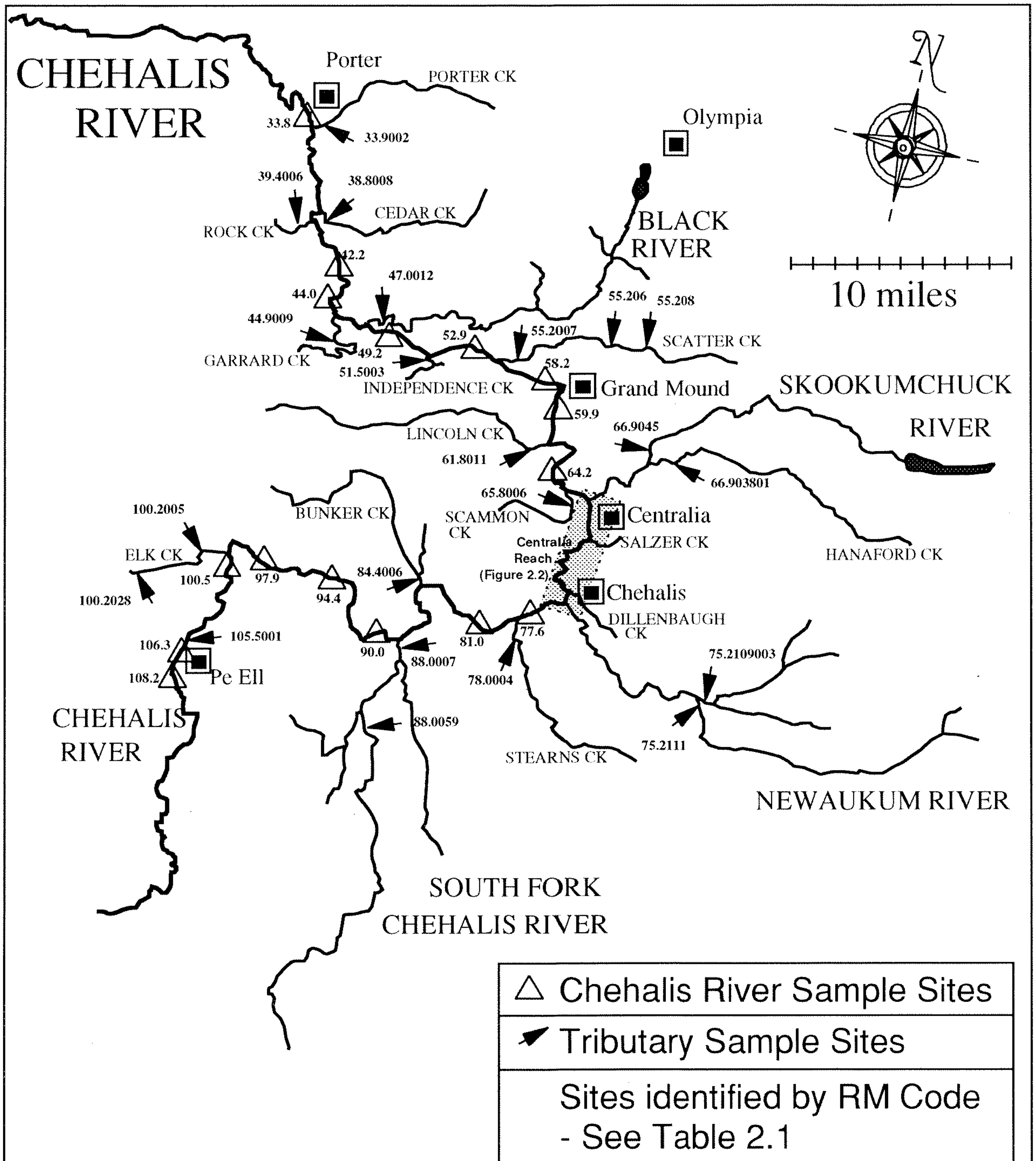

Figure 2.1 Chehalis River and Major Tributaries: Study Sites outside Centralia/Chehalis Area

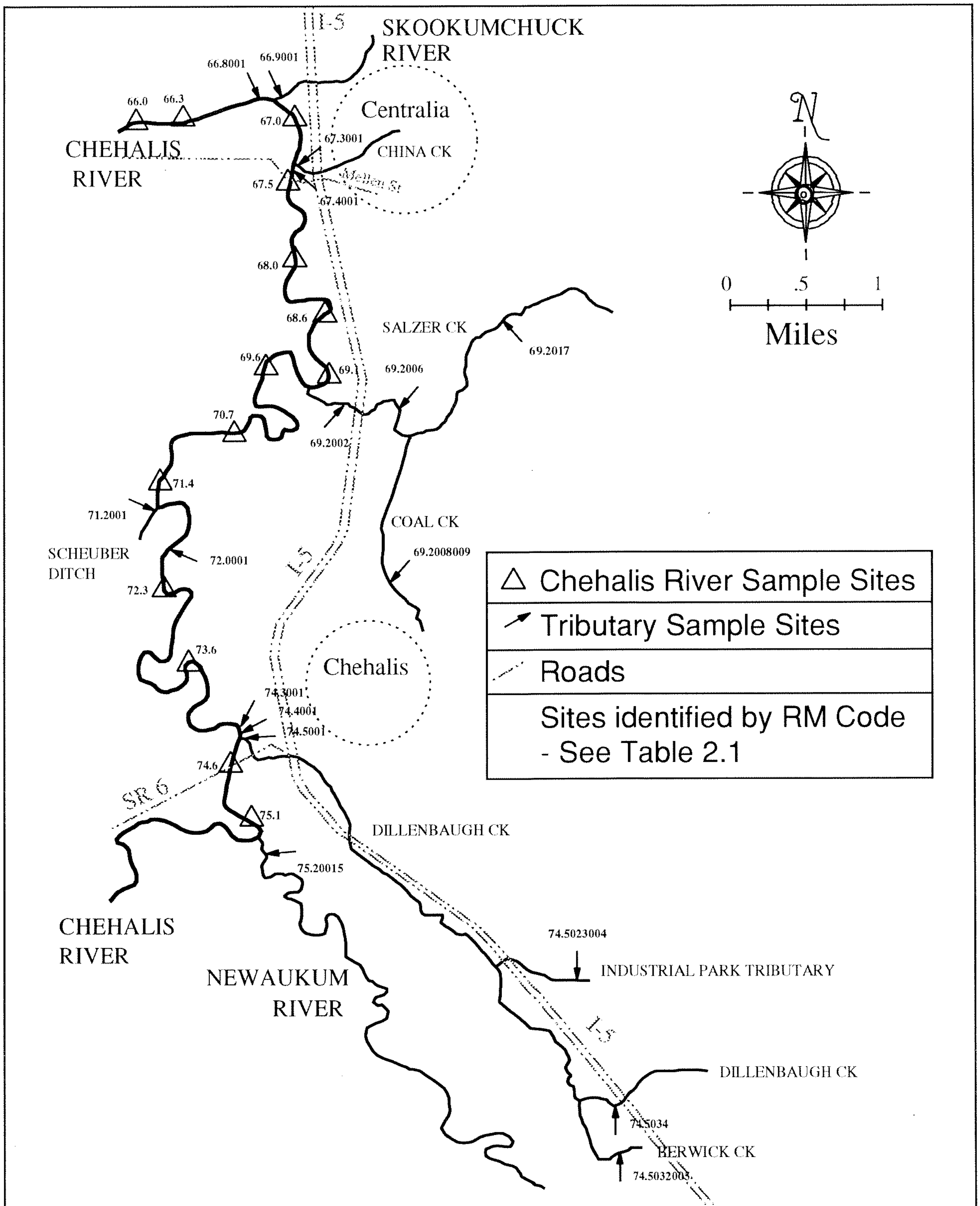

Figure 2.2 Chehalis River and Major Tributaries: Study Sites in Centralia/Chehalis Area

Table 2.1 Chehalis River Sampling Sites by River Mile			
Chehalis R Station Name	RM Code		Trib Station Name
CR @ Porter (Porter Rd Br)	33.8		
		33.9002	Porter Ck @ RR Trestle
		38.8008	Cedar Ck @ Elma-Gate Rd
		39.4006	Rock Ck @ South Bank Rd
CR blw Oakville BL	42.1		
CR nr Oakville BL	42.2		
CR @ Sickman Ford Br	44.0		
		44.9009	Garrard Ck @ Mattson Rd
		46.6002	Sea Fresh Fish Co.
		47.0012	Black R @ Howanut Rd Br
CR abv Black River	49.2		
		51.5003	Independence Ck @ 201st St
CR nr Independence	52.9		
CR @ Independence Bridge	54.2		
		55.2007	Scatter Ck @ Br abv mouth
		55.206001	Global Aqua/Scatter Ck
		55.208001	Seafarm WA/Scatter Ck
CR nr Blanksma Dairy Pump	58.2		
		58.2001	Blanksma Dairy Pump Springs
CR nr Grand Mound (Prather Rd)	59.9		
CR @ Cable abv Prather Rd	60.0		
CR @ Riffle abv Prather Rd	60.3		
		61.8011	Lincoln Ck @ Lincoln Ck Rd
CR @ Galvin (Galvin Rd Br)	64.2		
		65.8006	Scammon Ck @ County Rd
CR @ Riffle blw Centralia BL	66.0		
CR blw Centralia BL	66.3		
		66.8001	Stormwater Drain blw Skook R
		66.9001	Skookumchuck R nr mouth
		66.903801	Hanaford Ck abv Skook R
		66.9045	Skookumchuck R abv Hanaford
CR abv Skookumchuck R	67.0		
		67.3001	China Ck nr mouth
		67.4001	Centralia WTP
		67.4002	Stormdrain @ Centralia WTP
CR @ Centralia (Mellen St Br)	67.3		
CR abv Mellen St Br	67.6		
CR blw Midway Meats	68.0		
CR blw Midway Meats	68.2		
CR nr Midway Meats	68.5		
CR abv Midway Meats	68.6		
CR blw Salzer Ck	69.1		
		69.2002	Salzer Ck @ Airport Rd
		69.2006	Salzer Ck @ BN/UP Trestle
		69.2006002	Stormwater Ditch nr Fairgnds
		69.2008009	Coal Ck @ National Ave
		69.2017	Salzer Ck @ Fair St

Table 2.1, page 2		
Chehalis R Station Name	RM Code	Trib Station Name
CR blw Overhanging Tree	69.6	
CR abv Overhanging Tree	69.8	
CR abv Overhanging Tree	70.0	
CR north of Airport	70.7	
	71.2001	Seeps blw Schueber Ditch
CR blw Schueber Ditch	71.4	
	71.6001	Schueber Drainage Ditch
	72.0001	Golf Course Discharge Pipe
CR blw Golf Course intake	72.3	
CR abv Golf Course intake	72.5	
CR blw junk cars	73.1	
CR @ junk cars bend	73.6	
CR blw Chehalis WTP	74.2	
	74.3001	Chehalis WTP
	74.4001	Darigold WTP
	74.5001	Dillenbaugh Ck nr mouth
	74.5002	Dillenbaugh Ck abv mouth
	74.5003	Dillenbaugh Ck nr I-5
	74.5023004	Indust Pk Trib @ Bishop Rd
	74.5032005	Berwick Ck @ Hamilton Rd
	74.5034	Dillenbaugh Ck @ LaBree Rd
CR @ SR 6 Br nr Chehalis	74.6	
CR abv SR 6 Br nr Chehalis	74.9	
CR @ Old Riverside Rd Br	75.1	
	75.20015	Newaukum R @ mouth
	75.2109003	NF Newaukum R @ Forest
	75.2111	SF Newaukum R @ Forest
CR @ SR 603 Br nr Claquato	77.6	
	78.0004	Stearns Ck @ Twin Oaks Rd
CR nr Goff Rd abv Claquato	79.8	
CR @ Adna (SR 6 Br)	81.0	
	84.4006	Bunker Ck @ Br abv mouth
	88.0007	SF Chehalis R @ Tanker Intake
	88.0059	SF Chehalis R @ Boistfort Br
CR @ Ceres Rd Br	90.0	
CR abv Ceres Rd Br	90.1	
CR @ Meskill Br	94.4	
CR @ Dryad	97.9	
	100.2005	Elk Ck @ Elk Ck Rd Br
	100.2028	Elk Ck blw Seven Ck
CR @ Elk Ck Rd nr Doty	100.5	
	105.5001	Pe Ell WTP
CR @ SR 6 Br nr Pe Ell	106.3	
CR @ Pe Ell Water Intake	108.2	

RM Code is a unique station ID code based on river or stream mile. The first decimal place is the Chehalis River mile where the tributary enters, the second through fourth place is the tributary stream mile, and the fifth through seventh decimal place the secondary tributary stream mile. Example: 74.5032005 = Chehalis RM 74.5, Trib mile 3.2, 2d trib mile 0.5.

3. Survey Results

3.1 Hydrodynamic and Channel Morphology Measurements

3.1.1 Flow Measurements

Flow, channel dimension, and gage height measurement results are shown in Appendix Table C.1. An estimation of the quality of the flow measurement data is also provided, which indicates the relative level of accuracy and variability. An explanation of the quality qualifiers for flow data is provided in Appendix Section B.1.

USGS measures flow at eight locations in the study area (Williams and Pearson, 1985). The USGS stations of interest to this study are: Chehalis River at Porter (Station Number 12031000; RM 33.8), Chehalis River near Grand Mound (12027500; RM 59.9), Skookumchuck River near Bucoda (12026400; Skookumchuck River Mile 6.4), Newaukum River near Chehalis (12025000; Newaukum River Mile 4.1), and Chehalis River near Doty (12020000; RM 101.8).

The seven-day low flow with an average return time of 10 years (7Q10) is a standard measure of critical low flow. The 7Q10 in the Chehalis River at Porter is 198 cfs, at Grand Mound 114 cfs, and at Doty 21.4 cfs. Low flows in 1992 were 182 cfs at Porter, 117 cfs at Grand Mound (both on August 31), and 16 cfs at Doty (on September 3). In 1991, low flows were 337 cfs at Porter, 197 cfs at Grand Mound, and 32 cfs at Doty (all on August 25). The mean monthly flow for August from the historical record was 402 cfs at Porter, 237 cfs at Grand Mound, and 47.2 cfs at Doty. Based on the USGS Chehalis River data, flows were somewhat less than average for the 1991 low flow period, and critically low in 1992. In late August 1992, flows in the Chehalis River were near or below 7Q10 levels, with flows at Doty reaching the lowest on 53 years of record.

The Water Quality Standards (WAC 173-201A-020) specify that "critical condition may be assumed to be equal to the 7Q10 flow event" for use in standards compliance, "unless determined otherwise by the department." Because the Centralia reach of the Chehalis River between the Newaukum and the Skookumchuck Rivers is ungaged, use of a 7Q10 for critical flow conditions in this stretch was not feasible. In addition, this stretch of the river is governed by a special condition that creates two separate DO criteria for semiannual periods, and therefore critical flow conditions must be separately defined for each of the two semiannual periods.

Flows in the Chehalis River above the Skookumchuck are best evaluated by taking the difference between Skookumchuck flows and flows in the Chehalis downstream. However, this approach is complicated by the fact that Skookumchuck flows are affected by releases from the Skookumchuck Dam, and by diversions to and return flows from the Centralia Power Plant. Dam releases often cause sudden changes in Skookumchuck flow, and there is a time lag between the USGS gaging stations on the Skookumchuck and the USGS Grand Mound station. Thus, a simple difference calculation may not be accurate, and must be evaluated with care.

To estimate flows in the Chehalis River between the Newaukum and Skookumchuck Rivers, regression equations were developed from discharge data measured at the nearest USGS stations. Appendix Table C.2 presents that analysis. As part of this study, flows were measured in the Chehalis River below the Newaukum River and below the Skookumchuck River, and in the Skookumchuck River at the mouth. These flows were compared to both the difference between the flows at the USGS Grand Mound station and flows at the USGS Skookumchuck station, and the sum of flows at the USGS Newaukum station and the USGS Doty station. Flows were evaluated for the same day as well as for one day before or after, depending on station location. Both linear regression and log-log regression were used to develop flow estimate equations. Equations were evaluated both by their goodness of fit and by the reasonableness of extrapolated results during the late August 1992 low flow period.

Flows in the Chehalis River above the Skookumchuck were predicted using a linear regression from the difference between the previous day's flow at the USGS Skookumchuck station and the next day's flow at the USGS Grand Mound station. Flows in the Chehalis River below the Newaukum were predicted from a linear regression using the sum of the flows at the USGS Doty station from the previous day and flows at the Newaukum station from the same day. The equations for estimated flows, shown in Appendix Table C.2, provide a good fit to observed data: $r^2 = 0.98$ ($p<0.005$) for flows above the Skookumchuck, and $r^2 = 0.92$ ($p<0.0025$) for flows below the Newaukum. The regression assumes steady-state low flow conditions.

To evaluate critical conditions for two semiannual periods, the total annual risk from the two semiannual periods should be no greater than the annual risk for one annual period. The equivalent for 7Q10 flows would be 7Q20 flows for each semiannual period. Flow data at the three USGS stations were divided into two semiannual sets based on the special condition of the water quality standards: one set for June 1 through September 15, and one set for September 16 through May 31. The 7Q20 flows for these two periods were only slightly different (<10%) than the annual 7Q10. Therefore, the critical low flow on an annual basis can be considered to be equivalent to the critical low flow for both the semiannual periods for use in modeling.

The critical low flow conditions in 1992 created a fortuitous situation where critical flow could be evaluated from real time measurements. Using the equations from Appendix Table C.2, low flows in the Centralia reach were estimated from the USGS flows during the low flow period around August 31. Table 3.1 shows the results of that analysis. Critical flow conditions were estimated from these time series. Low flow in the Chehalis River above the Skookumchuck occurred at the same time as low flow at Grand Mound and reached a value of 68 cfs. Critical low flow in the Chehalis River just below the Newaukum was estimated at 59 cfs and occurred at the same time as the low flow period for the Newaukum. Therefore, the mainstem Chehalis River critical condition low flows used for modeling were 68 cfs above the Skookumchuck River and 59 cfs below the Newaukum River.

WAC 173-522-020 specifies base flows for the Chehalis River basin. Twelve control stations on the mainstem Chehalis River and its tributaries are listed for which flow was measured during the TMDL study. Of those twelve control stations, only three (Cedar Creek, Salzer Creek and the Skookumchuck River) had flows higher than base flows during August 1992. However, Cedar Creek was less than 1 cfs over the base flow, and the base flow for Salzer Creek is extremely low. The other nine (four stations on the Chehalis River; the Black, Newaukum, and South Fork Chehalis Rivers; and Porter and Elk Creeks) all were well below base flows during August 1992. Only two of the nine water bodies that were below base flows are closed to further consumptive appropriations.

3.1.2 Drogue Results and Time of Travel

Table 3.2 presents the results of the drogue work. The slow velocities of the Centralia reach of the Chehalis River can be clearly seen. One drogue showed no movement at all, while very low velocities were measured with others. The Chehalis River's time of travel for this stretch based on these velocities varied from 0.3 to 1.2 days per mile.

Using the "Occupied Channel Volume" method (Velz, 1970), the time of travel for the entire river was estimated. A copy of the spreadsheet used is provided in Appendix Table C.3. The estimated time of travel down the 72.5 miles of the Chehalis River from Pe Ell (RM 106.3) to Porter (RM 33.8) was 16 days. The vastly different flow characteristics of three reaches of the Chehalis River in the study area are revealed by the travel times of each. The estimated travel time from Pe Ell to the SR 6 bridge near Chehalis was 7.1 days to travel 31.7 miles, or 0.22 days per mile. The river took an estimated 6.0 days to travel 7.7 miles from the Newaukum River to the Skookumchuck River, for a rate of 0.78 days per mile. From the Skookumchuck River to Porter, the river's travel time was estimated as 2.9 days to flow 33.1 miles, or 0.09 days per mile.

Table 3.1 Critical Low Flow in August/September 1992

Date (t)	USGS Gaging Station Flow (cfs) Grand Mound	Skook R nr Bucoda	GM(t+1) -SK(t-1)	Estimated Flow Chehalis R above Skookumchuck R	Comments
08/25/92	137	55			
08/26/92	132	55	72	73	
08/27/92	127	54	69	72	
08/28/92	124	54	66	70	
08/29/92	120	54	63	68	
08/30/92	117	54	63	68	* (Low flow at
08/31/92	117	59	74	(ns)	* Grand Mound)
09/01/92	128	79	94	(ns)	
09/02/92	153	97	87	(ns)	(ns) = not steady state
09/03/92	166	87	67	70	
09/04/92	164	90	79	78	
09/05/92	166	90	80	78	
09/06/92	170	89	81	79	
09/07/92	171	90	90	84	
09/08/92	179	94			
Critical Condition				68	
Date (t)	**Doty**	**Newauk R nr Chehalis**	**NW(t) +DY(t-1)**	**Chehalis R below Newaukum R**	**Comments**
08/25/92	22				
08/26/92	20	28	50	69	
08/27/92	19	26	46	63	
08/28/92	18	26	45	62	
08/29/92	18	25	43	59	* (Low flow on
08/30/92	18	25	43	59	* Newaukum R)
08/31/92	17	26	44	60	
09/01/92	17	26	43	59	
09/02/92	17	28	45	62	
09/03/92	16	26	43	59	
09/04/92	16	27	43	59	
09/05/92	18	29	45	62	
09/06/92	18	29	47	65	
09/07/92	17	29	47	65	
09/08/92		40	57	79	
Critical Condition				59	

Table 3.2 Drogue Study Results for Chehalis River, September 1-3, 1992

RM	Time (min)	Dist (ft)	Speed (ft/sec)	Time of Travel (days/mile)
74.6	18.3	200	0.183	0.3
74.6	19.4	200	0.172	0.4
73.7	>10	No Movement		
73.5	11.2	100	0.149	0.4
73.5	12.3	100	0.135	0.5
72.7	15.8	100	0.105	0.6
72.2	23.6	100	0.071	0.9
72.2	32.8	100	0.051	1.2
71.2	16.0	100	0.104	0.6
71.2	16.7	100	0.100	0.6
69.7	21.2	100	0.079	0.8
68.8	23.3	100	0.072	0.9

The estimate of 0.78 days per mile for the Centralia reach is consistent with other measures of travel time. This value falls midway within the range of travel times estimated using drogues. Joy (1984) found estimated travel times between 0.5 and 1.0 days per mile associated with the lowest flows. In addition, the minimum DO found during the October 1991 low DO event (Section 3.6) was observed to move down the river at a rate of about 1 day per mile.

A time of travel estimate and channel dimensions are needed for model development. The flow balance, ground water flows, and surface withdrawals used in the time of travel estimate are only a "first-cut" estimate. To improve the estimate of inflows, outflows, and flow balance, a dissolved conservative tracer mass balance was developed, using the WASP5 model with chloride as the tracer. The conservative tracer modeling effort is discussed in Section 4.

3.2 Mainstem Survey Results

Data collected from the mainstem during the scheduled sampling surveys are discussed in this Section and in Appendix D. Diurnal measurements and other productivity-related measures are discussed in Section 3.3 and Appendix E. Tributary and point source data are discussed in Section 3.4 and in Appendix F. Section 3.5 presents a discussion of stratification and the quality of the deep anoxic waters of the Centralia Reach. An emergency sampling survey was conducted on October 10-14, 1991, in response to an oxygen depletion problem observed during a scheduled survey on October 8, 1992. Data collected during the emergency sampling is discussed separately in Section 3.6. Data quality assurance/quality control issues are discussed in Appendix B.

3.2.1 Conductivity

Conductivity (or specific conductance) is a measure of how easily electricity can pass through the water. It is an indirect measure of the amount of dissolved ions, since when more ions are present, more electricity can pass. Conductivity can often be used to predict total dissolved solids (TDS), but the relationship is site-specific, because different ions conduct at different rates, and some dissolved substances are non-ionic. Conductivity was used in this study primarily to characterize the spatial pattern of dissolved materials and to identify suspected pollutant sources that exhibit unusually high concentrations of TDS. There are not water quality standards for conductivity. Conductivity results can be found in Appendix Tables D.1 and D.2.

In the upper basin, conductivity was lowest at the headwaters, between 70 and 80 μmho/cm, and increased in the downstream direction. Conductivity at the SR 6 bridge near Chehalis ranged from 72 to 112 μmho/cm, with the lowest values earliest in the season and the highest values in late summer.

In the surface waters below the Chehalis and Darigold WTPs, conductivity increased again, with many values between 130 and 150 μmho/cm, as a result of those two discharges and other sources in this stretch. Deeper waters in stratified areas had considerable higher conductivities (see Section 3.5).

Conductivity drops below the Skookumchuck, ranging mostly between 90 and 120 μmho/cm downstream to Porter. Conductivities as low as 76 μmho/cm were found in May 1992 below the Centralia boat launch, and generally increased through the late summer until dropping again in the fall. This reflects the pattern of higher rainfall and river flow in the spring and fall that provides dilution flows low in TDS, as compared to the higher TDS of point and nonpoint sources and ground water inflow that occur throughout the summer low flow period.

3.2.2 Temperature

Temperatures in the Chehalis River (Appendix Table D.1) were often higher than the criterion of 18°C specified in the Water Quality Standards. Figure 3.1 summarizes the temperatures measured from grab and vertical profile measurement. The figure shows that over most of the mainstem Chehalis River in the study area, 50 percent or more of the measurements during the dry season exceeded the criterion. Although the upstream portion of the river was generally cooler, temperatures were still greater than 18°C in almost half the measurements. The surface waters of the Centralia reach showed the highest temperatures, with almost two-thirds of the measurements exceeding the 18°C criterion. The vertical distribution of temperature in the Centralia reach is discussed in Section 3.5.

The Water Quality Standards include criteria for maximum temperature increases. An adequate understanding of the thermal balance of the Chehalis River, and of the relative contribution of natural conditions and human impacts on temperature, is beyond the scope of this report and could only be achieved with a separate study. However, based on field observations and other studies of stream temperature, some conclusions can be drawn.

A study done by the Timber/Fish/Wildlife Temperature Work Group (TFW, 1990) found that "very low elevation streams (less than 100 m or 300 ft) were the most dependent on shade, requiring significant amounts to maintain temperatures". The report notes that the temperature of rivers can adjust to a new equilibrium based on downstream shading conditions.

In 1992, the U.S. Fish and Wildlife Service conducted a habitat degradation survey of the Chehalis River basin (Wampler *et al.*, 1993), which included loss of riparian canopy as one of the observations. Widespread loss of riparian canopy was documented over the entire mainstem Chehalis River. From Rock Creek above Pe Ell downstream to the mouth, 63% of the river showed reduced tree canopy from agricultural practices, 5% of the river showed reduced canopy from logging practices, and other causes reduced the tree canopy for 25% of the river. A total of 93% of the mainstem Chehalis was documented as impacted by reduced tree canopy.

This evidence strongly suggests that the removal of the tree canopy that normally provides riparian shading has contributed to the elevated water temperatures found in the Chehalis River. Restoration of the tree canopy on the mainstem Chehalis River would very likely maintain or reduce river water temperatures, and any additional significant loss of shade on the river would tend to increase water temperatures. The amount of temperature increase caused by shade tree removal or temperature decrease from shade tree restoration cannot be quantified without further study. However, temperatures are greater than the water quality criterion, and the lack of riparian shading is contributing to that situation.

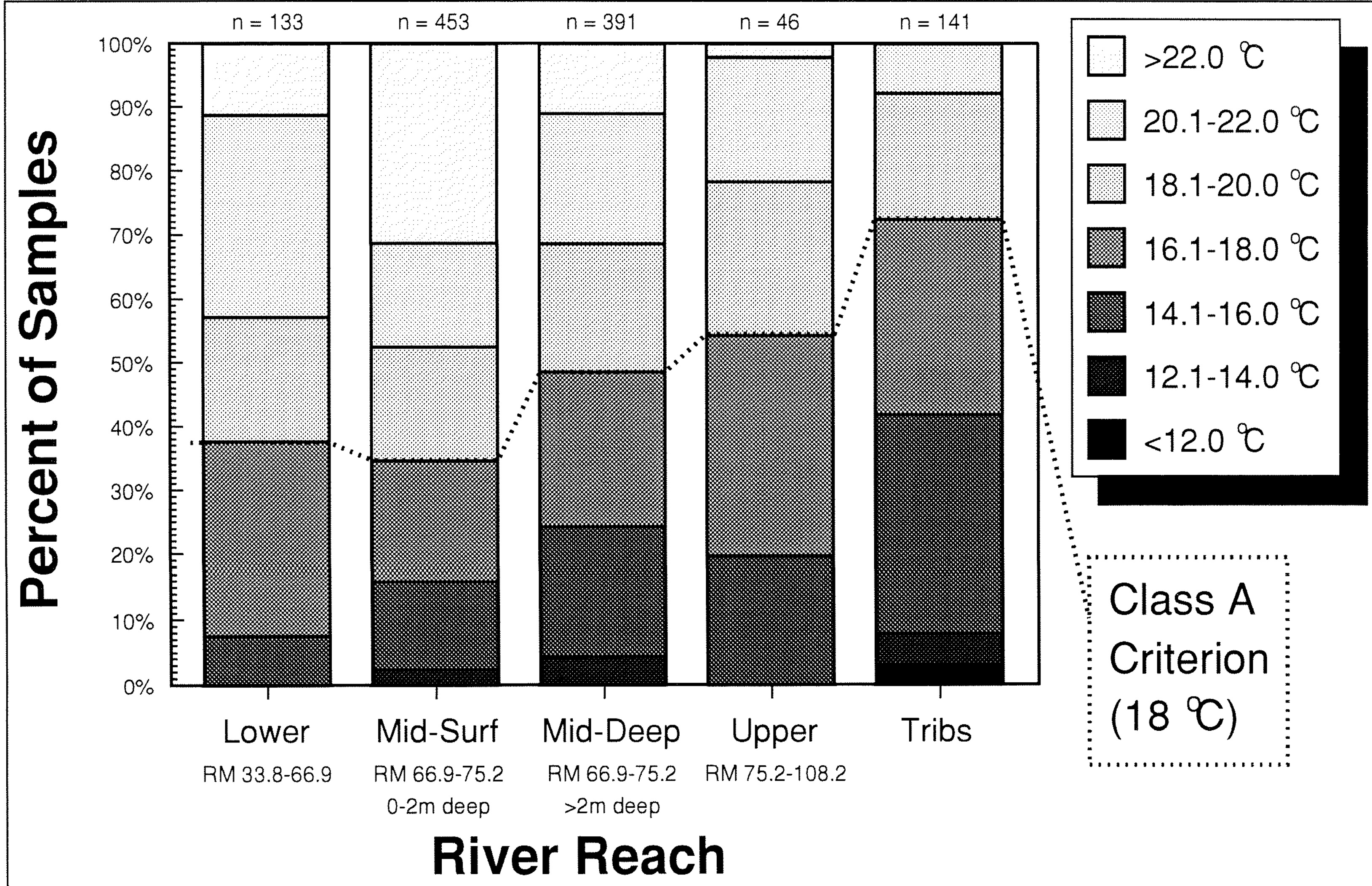

Figure 3.1 Distribution of Temperatures

Chehalis River TMDL Survey Results

To achieve Class A standards for temperature, a strategy of best management practices (BMPs) is recommended. Projects that plant riparian shade trees should be encouraged, and existing riparian shade trees should be protected. This approach would constitute a phased approach to a TMDL for temperature in the upper Chehalis River (RM 106.3 to 33.8).

3.2.3 pH

The distribution of pH in the Chehalis River is shown in Figure 3.2, and the pH data for this study are listed in Appendix Table D.1. For the upper and lower Chehalis River, the pH of the river generally did not exceed the range of 6.5 to 8.5 specified by the Class A criteria (except for a single value of pH 6.3). However, in the Centralia reach pH values were found that were less than 6.5. In the surface waters, all the pH values below 6.5 occurred during the October 8, 1992 survey, suggesting that the low pH was associated with the low DO (see Section 3.6). In the deeper waters of the Centralia reach, pH tended to decrease with depth in most locations. This pattern is discussed in detail in Section 3.5.

3.2.4 Dissolved Oxygen

Dissolved oxygen varied widely throughout the Chehalis River. Measurements by meter and by Winkler analysis showed areas that ranged from anoxic to supersaturated. Appendix Table D.1 lists the DO concentration data. Figure 3.3 shows the distribution of DO concentrations in the different areas sampled. The observed DO levels in the Chehalis River must also be evaluated with respect to the seasonal criteria for the river. Figure 3.3 shows the data divided into sets based on whether the Class A criterion of 8.0 mg/L or the Special Condition for the Centralia reach of 5.0 mg/L was in effect. Figure 3.4 shows the distribution of measurements expressed as a percentage of the DO saturation concentration.

In the upper river, the DO measurements below the criterion were found at the Claquato bridge and the Ceres Road bridge. Measurements above Ceres Road all met the Class A DO criterion. Two samples were taken where the Class AA DO criterion of 9.5 mg/L applies, and one of the two was slightly below the criterion.

In the Centralia reach, the Class A DO criterion of 8.0 mg/L was met in less than half the measurements made from the surface to 2 meters. While the Special Condition was in effect, virtually all surface water measurements were above the criterion. In waters 2 meters and deeper, over 70% of measurements did not meet the Class A criterion, and over 40% of measurements were less than the criterion when the Special Conditions were in effect. Dissolved oxygen levels less than

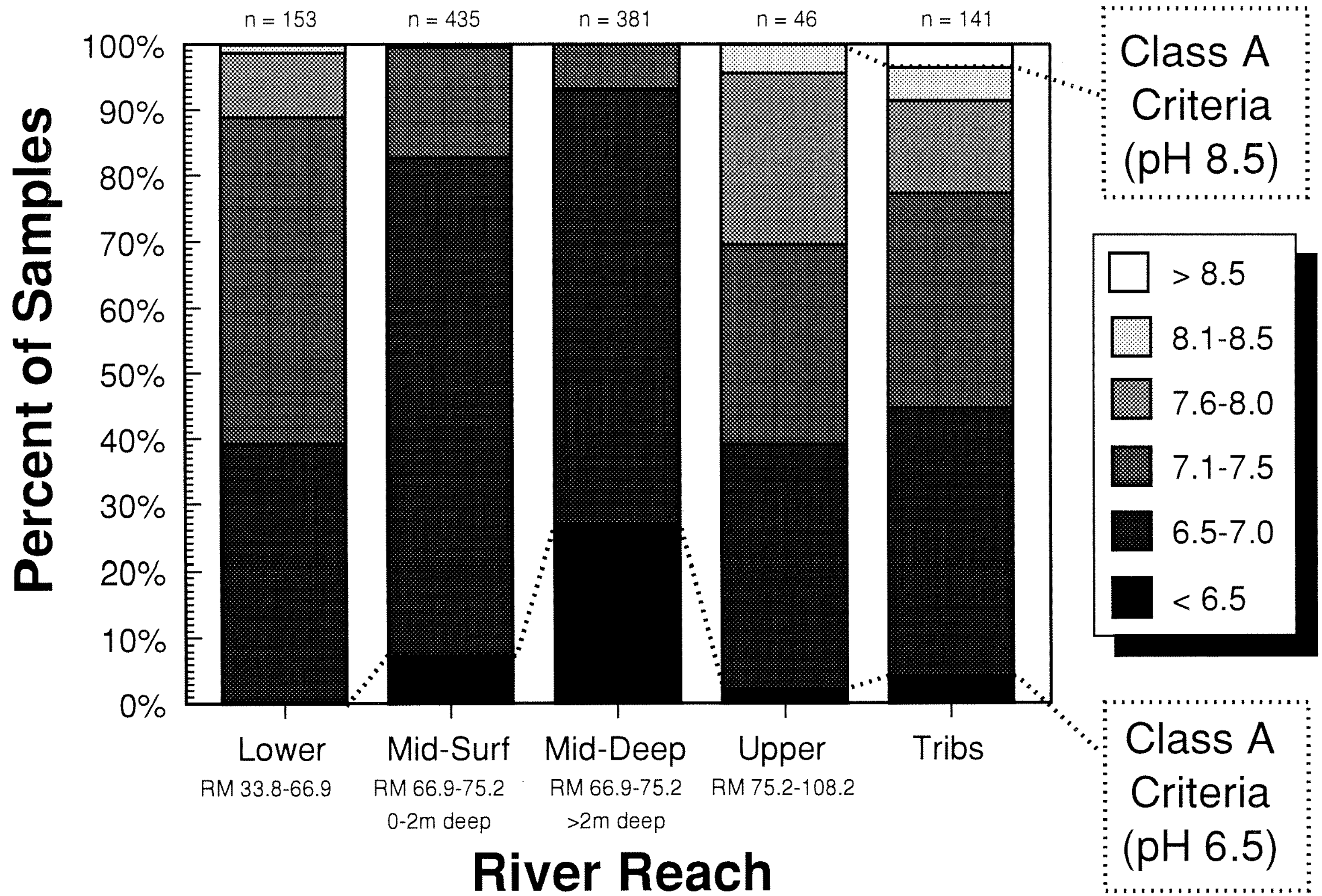

Figure 3.2 Distribution of pH
Chehalis River TMDL Survey Results

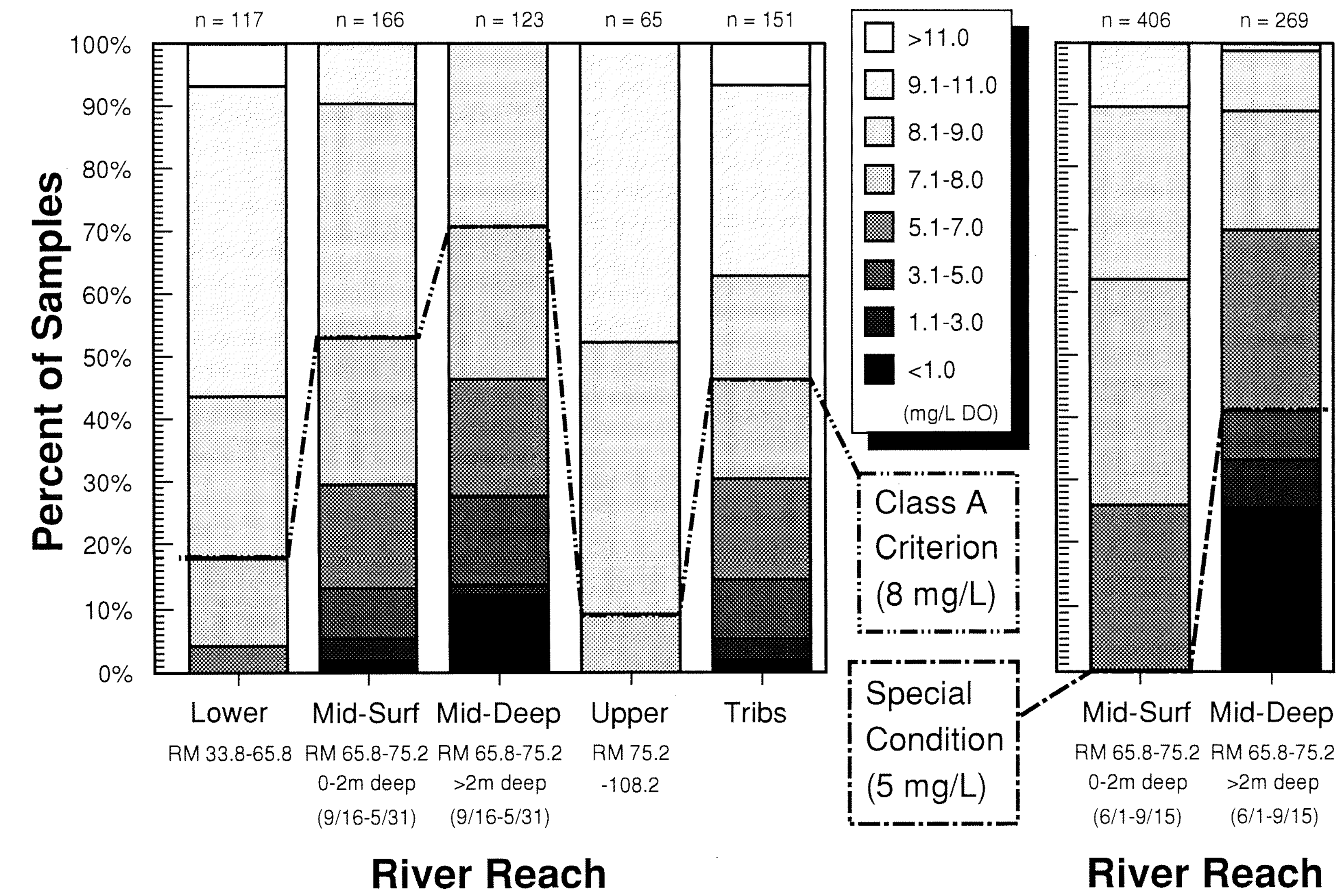

Figure 3.3 Distribution of Dissolved Oxygen
Chehalis River TMDL Survey Results

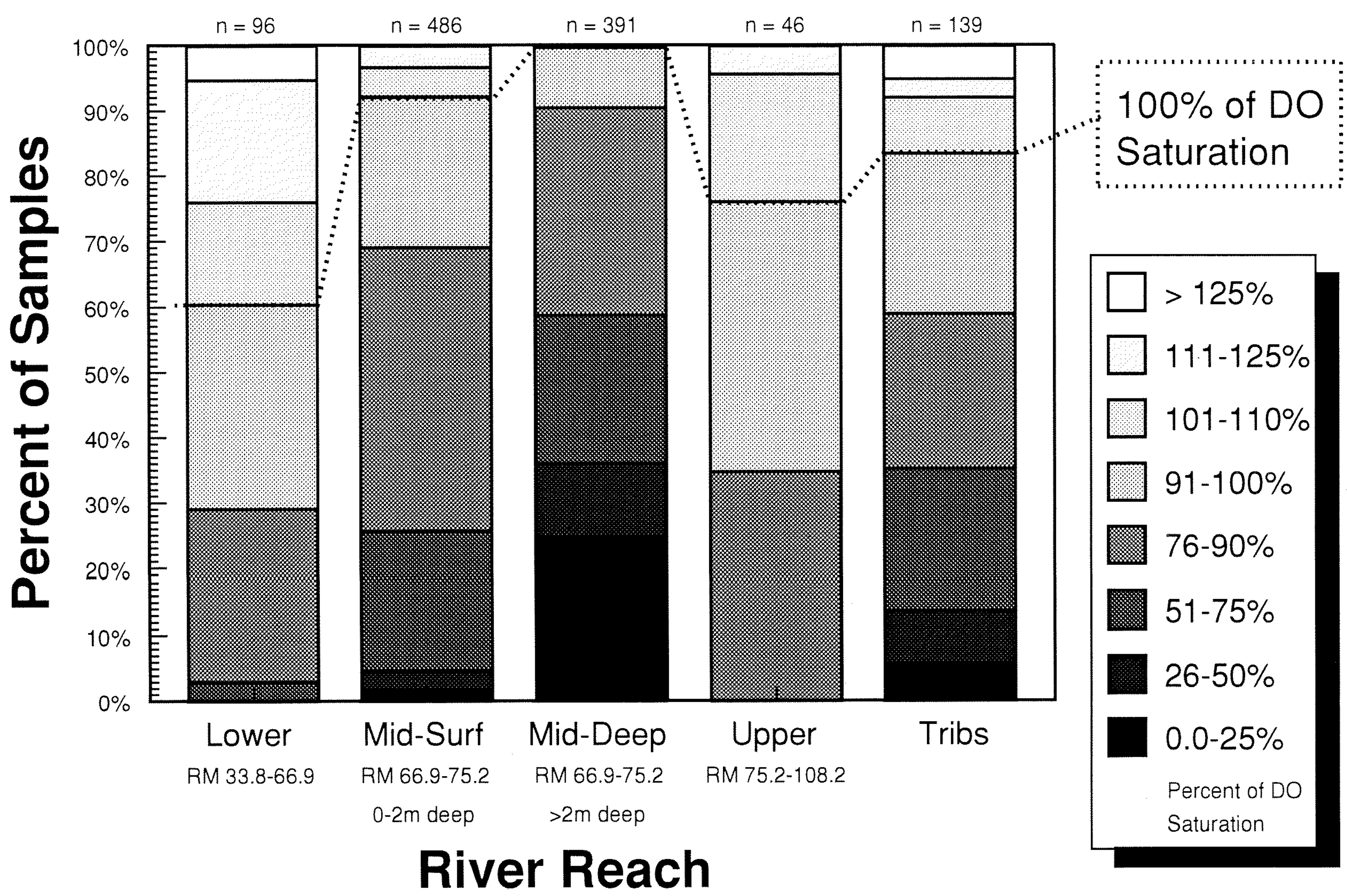

Figure 3.4 Distribution of DO Percent Saturation

Chehalis River TMDL Survey Results

1.0 mg/L were observed in over 10% of measurements deeper than 2 meters in the spring and fall, and in over 25% of the deep measurements during the Special Condition period. The anoxic conditions of these deep areas are discussed in detail in Section 3.5.

In the lower river, DO was below the criterion in about 18% of measurements. These low measurements were all found at the Galvin (RM 64.2) and Grand Mound (RM 59.9) sampling sites. This is consistent with Joy (1984), who also observed a DO sag at these sites. DO at all sites downstream of Grand Mound was greater than the 8.0 mg/L criterion.

With respect to DO saturation, the number of measurements that showed supersaturation of DO were proportionally higher in the lower river. The upper river showed a smaller proportion of supersaturated samples and mostly at a lower percent saturation compared to the lower river. Supersaturation was relatively rare in the middle river: over 90% of the measurements from the surface to 2 meters and all of the measurements from deeper than 2 meters showed DO depressed below the saturation level. Saturation percentages of less than 75% were not found in the upper river and were rare in the lower river, but were found in over one-quarter of the shallow measurements and over one-half of the deep measurements from the Centralia reach.

This pattern of DO saturation suggests that primary productivity was highest in the lower river where it caused DO supersaturation. DO was apparently depressed in the middle river by oxygen demand and poor reaeration. Significant primary productivity appeared to either be absent from the middle river, or more likely difficult to detect due to the depressed DO conditions that were prevalent.

3.2.5 Conventional Parameters

Laboratory results for conventional parameters (alkalinity, turbidity, total suspended solids, and total dissolved solids) are shown for mainstem Chehalis River sampling sites in Appendix Table D.2.

Alkalinity in surface waters ranged generally from 30 to 50 mg/L (all alkalinities measured as $CaCO_3$). Values were lowest (32 to 34 mg/L) in the upper river stations (RM 90 to 106.3) and highest in the Centralia reach. Alkalinity in combination with pH indicates the availability of carbon dioxide for photosynthetic uptake. Water bodies with low alkalinity may be carbon limited if they are highly productive, as well as poorly buffered. High alkalinities generally indicate a large buffering capacity. Cole (1979) points out that alkalinities above 40 mg/L as $CaCO_3$ in lakes indicate an adequate supply of CO_2 for primary productivity, especially if phosphorus is limiting. Considering the level of productivity in the Chehalis River and the alkalinities measured, carbon is probably available in adequate amounts for primary productivity. Buffering in the Chehalis River appears to be moderate -- neither highly buffered nor poorly buffered.

Turbidity in the surface waters of the Chehalis River were below 1 NTU upstream of Elk Creek (RM 100.2), and generally ranged from 1 to 3.5 NTU in the rest of the river. TSS was mostly in the range of 1 to 7 mg/L. Thus, turbidity and suspended solids can be characterized as being at fairly low levels in the Chehalis River during the summer low flow study period. Two exceptions to this pattern should be noted. Slightly elevated turbidity was measured during the September 1992 mini-survey. Given the apparent travel time of the river, this may have been the result of heavy rains a week earlier. Relatively high turbidity was also found in some of the deep stratified areas (Section 3.5).

3.2.6 Metals

Two metals were monitored in this study - total iron and total dissolved silica. Iron was measured in coordination with the Salzer Creek survey as a tracer for Centralia Landfill leachate. A discussion of the iron results can be found in Appendix Section F.6. Silica was measured to assess its availability for diatoms, which require silica for their frustules. Welch (1980) states that a level of 500 μg/L is the minimum that will sustain growth of diatoms. Levels of silica in the Chehalis River ranged between 6,800 to 8,100 μg/L, indicating an ample supply for diatom growth (Appendix Table D.2).

3.2.7 Biological Parameters

Laboratory analysis results for biological parameters from the mainstem Chehalis River sampling sites are presented in Appendix Table D.3. Samples were also collected and analyzed for percent klebsiella and fecal streptococcus during the October 1991 emergency survey, which is discussed in Section 3.6.

Chlorophyll *a* is one of the pigments used by algae and plants for photosynthesis, and its concentration in the water column is an indicator of the biomass of photosynthetic algae. Chlorophyll *a* may also include sources other than algae, such as detritus sloughed from rooted or floating macrophytes.

Chlorophyll *a* can be used to define the trophic state of a lake. The implications of the trophic state to a river system may be different than for a lake, but the characteristics of the Centralia reach that are similar to a lake make the comparison appropriate. Welch (1980) proposed an index of the trophic state of a lake based on the seasonal average chlorophyll *a* levels of epilimnetic water samples: levels of 0 to

4 μg/L indicate oligotrophy, and levels above 10 μg/L indicate eutrophic waters. Carlson (1977) defined a lake trophic state index, in which a chlorophyll *a* value of 6.4 μg/L corresponds to mesotrophic conditions and a chlorophyll *a* value of 20 μg/L corresponds to eutrophic conditions; concentrations between these values are undefined.

Levels of chlorophyll *a* measured in the Chehalis River during this study range from not detected to 7.4 μg/L, which would correspond to conditions ranging from oligotrophic to mesotrophic. The trophic state index also uses Secchi depth as a trophic measure. The Secchi depths measured in the Centralia reach ranged around 2 meters, which also corresponds to mesotrophic conditions at a level similar to that indicated by the higher chlorophyll *a* results.

While chlorophyll *a* is an indirect assessment of phytoplankton biomass, phytoplankton can also be directly assessed. In the Chehalis River, samples were collected and the algal units were counted, measured, and identified (Sweet, 1992). Biovolume and algal density for the whole sample and for the most common species were reported. A summary of the results of phytoplankton identification is shown in Appendix Table D.5, and a detailed discussion of phytoplankton identification results can be found in Appendix Section D.1

Sweet (1986) describes how the algal biovolume and density levels can be associated with trophic states. Algal biovolumes found in the Chehalis River were occasionally near mesotrophy, but mostly lower. Algal densities often indicated mesotrophic conditions, with a few samples in the oligotrophic and eutrophic ranges. These values generally support the evaluation of the trophic level of the Chehalis River made with chlorophyll *a*, which indicated conditions during the dry season ranging from oligotrophy to mesotrophy.

Fecal coliform bacteria in the mainstem Chehalis River were measured at levels that ranged from not detected to almost 700 #/100 mL. The criteria from the Water Quality Standards were not exceeded in the Class AA waters above Pe Ell and in the lower river from Prather Road (RM 59.9) downstream. Sample results exceeded the 100 #/100 mL criterion in numerous locations in the mainstem from Pe Ell (RM 106.3) to the Galvin Road bridge (RM 64.2). A list of the sites with fecal coliform values over 100 #/100 mL is provided in Table 3.3.

Most of the exceedances occurred during the intensive sampling on August 27 and 28, 1991, which took place during a period of significant rain (1.44 inches recorded at Olympia from August 26 to 28). Other exceedances were observed during the July 1992 survey during which significant rain fell in the upper Chehalis basin. A number of nonpoint sources are suspected for these increases, primarily stormwater from urban/residential areas and runoff from livestock areas. A detailed description of the sources that are suspected is provided in Appendix Section D.2.

Table 3.3 Mainstem Sampling Sites with Fecal Coliform Exceeding Criteria

RM Code	Site Description	Date	Time	Depth (m)	FC (#/100 mL)
106.3	CR @ SR 6 Br nr Pe Ell	08/27/91	1333	0	510
106.3		08/27/91	1333	0	690
106.3		08/28/91	1210	0	170
100.5	CR @ Elk Ck Rd nr Doty	08/27/91	830	0	230
100.5		08/27/91	1423	0	330
100.5		08/28/91	820	0	270
100.5		08/28/91	1255	0	210
90.0	CR @ Ceres Rd Bridge	08/28/91	1400	0	200
74.6	CR @ SR 6 Br nr Chehalis	08/27/91	1600	0	110
74.6		08/28/91	1310	0	230
72.5	CR above Golf Course intake	08/28/91	1325	1.3	140
67.5	CR @ Centralia (Mellen St Br)	08/27/91	1615	2.5	190
67.5		08/27/91	1550	0.7	120
67.5		08/27/91	1550	0.7	120
67.5		08/28/91	1420	0.7	460
66.0	CR @ riffle blw Centralia BL	08/27/91	1951	0	220
66.0		08/27/91	1951	0	160
66.0		08/28/91	1817	0	150
64.2	CR @ Galvin Rd Bridge	08/28/91	1545	0	140
106.3	CR @ SR 6 Br nr Pe Ell	07/22/92	1340	0	120
74.6	CR @ SR 6 Br nr Chehalis	07/22/92	1424	0.5	120
74.6		07/22/92	1445	0.5	200

3.2.8 Biochemical Oxygen Demand and TOC

Five-day biochemical oxygen demand (BOD_5) results are shown for mainstem sampling sites in Appendix Table D.3. The two columns in this table are laboratory duplicates. BOD_5 values in the mainstem were mostly 2 mg/L or less, with a few exceptions. BOD_5 values between 2 and 4 mg/L were found in the Centralia reach during the July 1992 survey and at Prather Road (RM 59.9) during the August 1992 survey.

Ultimate Carbonaceous BOD (UBOD) represents the theoretical "total" amount of carbonaceous BOD (CBOD) that would occur if the oxygen use of a sample were monitored for an indefinite amount of time. UBOD and five-day CBOD ($CBOD_5$) analysis results are provided in Appendix Table D.6. Ultimate and $CBOD_5$ values in the mainstem mostly indicated the same low levels as observed with most of the standard BOD_5 values. The exceptions were samples from Pe Ell and Ceres Road (RM 106.3 and 90.0) taken on August 27, 1991, that showed BOD_5 concentrations of 5.0 mg/L (average of duplicates) and 3.8 mg/L, respectively, with UBOD values of 10 mg/L or greater. Again, this suggests stormwater runoff-related sources, such as were discussed for fecal coliform bacteria earlier.

Total organic carbon (TOC) indicates the quantity of organic material in the water, and can be used to identify sources that are high in organic material and thus potentially high in BOD. TOC values were generally in the range of 2 to 5 mg/L, with a few notable exceptions:

- Samples collected on August 27, 1991, in the upstream end of the study area (RM 90.0 to 106.3) were relatively high in TOC--the value of 9.2 mg/L at Pe Ell was the highest recorded in the study. These values match well to the high fecal coliform bacteria and UBOD detected during this survey.

- Samples collected above Elk Creek (RM 106.3 and 100.5) in 1992 were the lowest observed--less than 2 mg/L.

- Relatively high values were measured in deep samples ($>$ 6 meters) in the 1992 surveys at the station below Salzer Creek (RM 69.1). This area is discussed later in Section 3.5.

3.2.9 Nutrients and Chloride

Results for parameters discussed in this section--ammonia nitrogen (NH3N), nitrate/nitrite nitrogen (NO23N), total persulfate nitrogen (TN), total phosphorus (TP), soluble reactive phosphorus (SRP), and chlorides--are presented for mainstem Chehalis River sampling sites in Appendix Table D.4. A detailed description of the pattern of nutrient concentrations is provided in Appendix Section D.4.

In the upper study area, nutrients were generally at fairly low levels for all parameters. Below the Chehalis and Darigold WTP discharges, levels of all nutrients increased dramatically. Organic nitrogen and orthophosphate made up a large proportion of the nutrient load in the Centralia reach. Below the Skookumchuck River, NH3N and TP declined as the river moves downstream, while NO23N increased. The relationship of NH3N to NO23N indicate that nitrification was active in the Chehalis River in both the Centralia reach and downstream of the Skookumchuck River.

The ratio of TN to TP can be useful to indicate the likely limiting nutrient, if nitrogen or phosphorus are indeed the limiting factor to primary productivity.[2] A TN:TP ratio below 7 indicates nitrogen limitation, and above 7 indicates phosphorus limitation (Welch, 1980). Most freshwater systems are phosphorus-limited. In the upper Chehalis River, the TN:TP ratio was in the range indicating phosphorus limitation. After the Chehalis and Darigold discharges enter the river, the river is nitrogen-limited due to the high levels of phosphorus discharged. The river starts to switch back over to phosphorus limitation around Prather Road (RM 59.9), and becomes phosphorus-limited for the rest of the mainstem in the study area.

Chloride generally began at relatively low concentrations at the upstream end of the study area, less than 4 mg/L at Pe Ell (RM 106.3), and increased to relatively high concentrations at the downstream end of the Centralia reach, up to 14 mg/L above Midway Meats (RM 68.5). Below the Skookumchuck River (RM 66.9) levels dropped and were generally in the range of 6 to 9 mg/L.

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[2]The ratio is used here as an illustration of the chemical dynamics of the Chehalis River; more analysis would be necessary before any firm conclusions could be made about productivity and nutrient limitation.

3.3 Productivity and Diurnal Measurements

3.3.1 Data-logging Meter Measurements

Hydrolab® Datasonde 3 (DS3) measurements provide an indication of primary productivity through the diurnal variation in DO and pH. Diurnal temperature and conductivity readings are also collected. Appendix Table E.1 presents a summary of the DS3 results, with maximum, minimum and average values and the range from maximum to minimum. Complete results of the DS3 deployments are provided in Appendix Table E.2. Data quality assurance/quality control issues are discussed in Appendix B.

The diurnal range of temperature at the measurement sites varied from as little as 0.4°C to a maximum of 3.7°C. The greatest ranges of diurnal temperature were found at the stations farthest upstream (RM 100.5 and 90.1). The highest temperatures were observed at stations in the Centralia reach (RM 68.5 to 74.9), exceeding 24°C in August 1992 and 25°C in August 1991. Sustained temperatures this high are reaching levels that have been found to be lethal to adult salmonids (Hynes, 1970; Welch, 1980).

The daily range for pH tended to be fairly steady, with a maximum range of only 0.7. Productivity effects were greatest at the downstream end of the study area (RM 33.8 to 52.9), where the highest maximum value and greatest range of pH were observed.

Percent DO saturation had diurnal variations as high as 42 percentage points, and ranges of 20 to 30 percent were common in late summer. Supersaturated conditions were observed in the lower river (RM 33.8 to 52.9), and occurred occasionally in the Centralia reach, although most of the time the maximum DO levels in the Centralia reach did not reach saturation. Moderate diurnal ranges of saturation with slight supersaturation were observed at the upper basin stations (RM 79.8-100.5).

The diurnal range of DO concentrations were generally greatest during the late August measurement dates in the Centralia reach, when the range was over 2 mg/L and on one occasion greater than 3 mg/L. Diurnal ranges of greater than 2 mg/L were also observed at the farthest downstream stations. As with the surface DO readings with the Hydrolab® Surveyor S (S2), none of the measurements dropped below the 8.0 mg/L DO criterion.

3.3.2 Other Measurements

In addition to the diurnal DS3 measurements, morning and evening DO samples were collected at several mainstem Chehalis River stations and analyzed using the Winkler method. The results are shown in Table 3.4. The daily range of DO indicated by

Table 3.4 AM/PM Dissolved Oxygen Sampling Results

(All DO results in mg/L)

Station	RM Code	AM Sampling Date	AM Time	AM DO	PM Sampling Date	PM Time	PM DO	Range
CR @ SR 6 Br nr Pe Ell	106.3	08/27/91	809	9.2	08/27/91	1333	10.1	1.0
		08/28/91	802	9.6	08/28/91	1212	10.3	0.7
CR @ Elk Ck Rd nr Doty	100.5	08/27/91	830	8.8	08/27/91	1423	9.8	0.9
		08/28/91	825	9.0	08/28/91	1259	9.4	0.4
		09/11/91	925	9.6	09/10/91	1320	10.5	0.9
CR @ Dryad	97.9	08/26/92	700	8.6	08/25/92	1703	10.3	1.7
CR abv Ceres Rd Br	90.1	07/22/92	910	8.1	07/22/92	1450	9.0	0.9
		08/04/92	820	7.5	08/04/92	1340	8.2	0.7
CR @ Ceres Rd Br	90.0	08/27/91	740	8.2	08/27/91	1415	8.7	0.5
		08/28/91	730	8.6	08/28/91	1400	8.8	0.2
		08/26/92	730	8.4	08/25/92	1720	9.0	0.6
CR @ Adna (SR 6 Br)	81.0	08/27/91	810	8.1	08/27/91	1500	8.7	0.6
		08/28/91	800	8.3	08/28/91	1430	8.8	0.5
CR nr Goff Rd abv Claquato	79.8	09/11/91	1025	8.7	09/10/91	1405	10.0	1.3
CR @ SR 603 Br nr Claquato	77.6	08/26/92	750	8.0	08/25/92	1750	9.0	1.0
CR @ SR 6 Br nr Chehalis	74.6	08/27/91	830	8.1	08/27/91	1600	8.7	0.6
		08/28/91	820	8.2	08/28/91	1310	8.4	0.2
		07/22/92	905	7.3	07/22/92	1435	8.1	0.8
		08/04/92	837	7.3	08/04/92	1350	8.2	0.9
		08/26/92	800	8.0	08/25/92	1800	9.7	1.7
CR @ Centralia (Mellen St)	67.5	10/10/91	858	5.8	10/10/91	1445	6.1	0.4
		08/04/92	1000	7.8	08/04/92	1620	8.8	1.0
		08/27/91	800	6.0	08/27/91	1550	5.8	-0.2
		08/28/91	755	5.2	08/28/91	1420	5.5	0.3
		08/04/92	1000	7.8	08/04/92	1620	7.8	-0.0
CR @ Galvin (Galvin Rd Br)	64.2	08/27/91	900	7.2	08/27/91	1730	7.8	0.5
		08/28/91	835	6.6	08/28/91	1545	8.0	1.4
		08/26/92	820	7.5	08/25/92	1820	9.3	1.8
CR nr Grand Mound (Prather Rd)	59.9	08/27/91	929	7.4	08/27/91	1820	9.3	1.8
		08/28/91	905	7.1	08/28/91	1630	8.6	1.6
		09/10/91	710	8.5	09/10/91	1230	9.2	0.8
		09/11/91	740	7.8	09/11/91	1305	9.2	1.4
		09/12/91	740	7.9	09/12/91	1130	8.2	0.4
		07/21/92	816	7.1	07/21/92	1615	8.3	1.2
		08/05/92	740	7.7	08/05/92	1511	9.2	1.5
		08/26/92	835	7.9	08/25/92	1837	10.4	2.5
CR @ Independence Bridge	54.2	09/10/91	745	9.1	09/10/91	1305	10.2	1.0
		09/11/91	810	8.5	09/11/91	1355	9.4	0.9
		09/12/91	805	8.3	09/12/91	1150	8.8	0.4
		08/25/92	710	8.5	08/24/92	1820	12.0	3.4
CR @ Sickman Ford Br	44.0	09/10/91	750	8.7	09/10/91	1645	11.5	2.8
		09/11/91	735	8.6	09/11/91	1450	10.2	1.6
		09/12/91	810	8.6	09/12/91	1350	9.9	1.3
CR @ Porter (Porter Rd Br)	33.8	09/10/91	840	9.1	09/10/91	1815	11.2	2.1
		09/11/91	825	9.1	09/11/91	1550	10.6	1.5
		09/12/91	855	9.0	09/12/91	1455	10.6	1.6
		07/21/92	930	7.9	07/21/92	1535	9.7	1.8
		08/05/92	900	8.8	08/05/92	1750	10.9	2.1
		08/25/92	818	9.1	08/24/92	1940	11.3	2.2

these measurements reached a maximum value of 1.7 mg/L in the upper river (RM 106.3 to 77.6) and in the Centralia reach. Maximum ranges in the lower river (RM 64.2 to 33.8) were often higher than 2 mg/L and reached 3.4 mg/L on one occasion. These observations confirm that relatively greater primary productivity appears to be occurring in the lower river than in the Centralia reach or upper river.

Light/dark bottle measurements were made at four locations, and the results are shown in Table 3.5. Virtually no productivity was observed by this method in the upper basin (RM 100.5). Since DS3 measurements showed an increase in DO saturation with increasing temperature during the daytime, some primary productivity in the upper basin did apparently occur, most likely a result of periphyton and aquatic macrophyte photosynthesis. In the Centralia reach, rates upstream (RM 72.5) were less than 0.1 mg/L/hr, increasing downstream (68.5 and 67.0) to near 0.2 mg/L/hr. The higher productivity near the surface as compared to the 2 meter depth at these two stations was consistent with phytoplankton productivity stimulated by greater light levels near the surface.

Secchi depth measurements were made during a few of the survey dates (Table 3.6). From upstream to downstream, no pattern in the Secchi depths was apparent. Since measurement of the Secchi depth may vary depending on the light levels for the particular day and on the eyes of the observer, several years of data are desirable to detect a pattern of Secchi readings. The data available from the TMDL study is probably too limited to determine any trend of Secchi readings that may be of significance.

3.4 Tributary Survey Results

Detailed descriptions of the water quality and suspected pollutant sources described in this section are provided in Appendix F. Tributary survey results are presented in Appendix Tables F.1 through F.5. Data quality assurance/quality control issues are discussed in Appendix B.

A number of tributaries surveyed as part of the TMDL study did not meet water quality standards. Table 3.7 lists these tributaries and indicates the parameters that did not meet the standards and the suspected causes of the violation. Compliance with the standards was based on the guidelines for assessment of water quality for the 303(d) list (Ecology, 1993).

Many of the tributaries were found to have DO less than 8.0 mg/L on several sampling dates. A few of the tributaries (Bunker, Lincoln, and Independence Creeks) had fairly low flow which may have contributed to the low DO. Dillenbaugh Creek has extensive wetlands near the mouth that may produce low DO by natural processes. All the creeks with low DO had livestock impacts documented by the USFWS habitat degradation survey (Wampler *et al.*, 1993). Stormwater discharges

Table 3.5 Light/Dark Bottle Experiment Results

RM Code		100.5	72.5	72.5	68.5	68.5	67.0	67.0
Depth	(m)	0.5	0.5	2.0	0.5	2.0	0.5	2.0
Date		09/10/91	08/20/91	08/20/91	08/21/91	08/21/91	08/22/91	08/22/91
Time In		845	1005	1020	955	1005	925	940
Time Out		1320	1500	1510	1458	1500	1330	1335
DO-Initial	(mg/L)	9.7	7.0	7.0	8.0	7.6	7.2	6.3
DO-Light	(mg/L)	9.6	7.2	7.1	8.9	8.2	7.8	7.2
DO-Dark	(mg/L)	9.6	6.9	6.8	7.8	7.8	7.0	6.9
DO-Respiration Use	(mg/L)	0.1	0.1	0.2	0.2	0.0	0.1	0.0
DO-Net Production	(mg/L)	0.0	0.2	0.1	0.9	0.6	0.6	0.9
DO-Gross Production	(mg/L)	0.0	0.3	0.3	1.1	0.4	0.7	0.3
Average Hourly Gross DO Productivity	(mg/L/hr)	0.01	0.06	0.06	0.21	0.08	0.18	0.08

Table 3.6 Secchi Depth Measurements

(All measurements in meters)

RM Code	Site Description	Date	Time	Secchi
66.5	CR blw Centralia BL	02-Aug-91	1610	1.9
67.0	CR abv Skookumchuck R	02-Aug-91	1530	1.6
67.5	CR @ Centralia (Mellen St Br)	02-Aug-91	1515	1.7
68.2	CR blw Midway Meats	02-Aug-91	1500	1.9
68.5	CR nr Midway Meats	02-Aug-91	1445	1.4
69.6	CR blw Overhanging Tree	02-Aug-91	1410	2.6
70.7	CR north of Airport	02-Aug-91	1345	2.6
72.5	CR abv Golf Course intake	02-Aug-91	1250	2.4
73.6	CR @ junk cars bend	02-Aug-91	1226	2.2
66.5	CR blw Centralia BL	14-Aug-91	1550	1.6
67.0	CR abv Skookumchuck R	14-Aug-91	1540	2.2
67.5	CR @ Centralia (Mellen St Br)	14-Aug-91	1510	2.0
68.5	CR nr Midway Meats	14-Aug-91	1430	1.9
69.1	CR blw Salzer Ck	14-Aug-91	1350	2.3
69.6	CR blw Overhanging Tree	14-Aug-91	1315	2.2
70.7	CR north of Airport	14-Aug-91	1245	2.1
72.5	CR abv Golf Course intake	14-Aug-91	1205	2.3
73.6	CR @ junk cars bend	14-Aug-91	1140	2.0
74.6	CR @ SR 6 Br nr Chehalis	14-Aug-91	1045	2.2
67.0	CR abv Skookumchuck R	21-Aug-91	1400	2.5
68.2	CR blw Midway Meats	20-Aug-91	1550	2.0
70.7	CR north of Airport	20-Aug-91	1520	2.2
74.9	CR abv SR 6 Br nr Chehalis	19-Aug-91	1315	2.5
66.5	CR blw Centralia BL	07-May-92	1415	2.1
67.0	CR abv Skookumchuck R	07-May-92	1400	2.4
67.5	CR @ Centralia (Mellen St Br)	07-May-92	1350	2.3
68.6	CR abv Midway Meats	07-May-92	1330	2.2
69.1	CR blw Salzer Ck	07-May-92	1315	1.9
67.5	CR @ Centralia (Mellen St Br)	28-May-92	1320	2.7
68.6	CR abv Midway Meats	28-May-92	940	2.6
68.6	CR abv Midway Meats	28-May-92	1300	2.5
69.1	CR blw Salzer Ck	28-May-92	1242	2.7
69.6	CR blw Overhanging Tree	28-May-92	1225	2.7
70.7	CR north of Airport	28-May-92	1203	2.5
72.5	CR abv Golf Course intake	28-May-92	1145	2.8
73.6	CR @ junk cars bend	28-May-92	1135	2.7
67.5	CR @ Centralia (Mellen St Br)	16-Jun-92	1555	2.1
68.6	CR abv Midway Meats	16-Jun-92	1205	2.3
69.6	CR blw Overhanging Tree	16-Jun-92	1220	2.3
72.3	CR blw Golf Course intake	16-Jun-92	1244	2.7
72.3	CR blw Golf Course intake	16-Jun-92	1420	2.5
73.6	CR @ junk cars bend	16-Jun-92	1400	2.2

from the Centralia/Chehalis urban area to Dillenbaugh and Salzer Creeks have been identified in past studies (Crawford, 1987a; 1987b).

In addition to these sources, "mini-survey" sampling data suggests that several other sources are impacting Salzer Creek. Wastewater from land application at the National Frozen Foods Field #1 is a likely source of low DO at the Airport Road sampling site. In addition, a drainage sump at the Southwest Washington Fairgrounds that pumps into Salzer Creek was characterized as having high BOD, probably from a combination of livestock and urban stormwater sources. Low DO was also measured at the Burlington Northern/Union Pacific (BN/UP) trestle, which appears to be the result of unidentified sources between the trestle and National Avenue, or in the Coal Creek drainage. The Centralia Landfill Superfund cleanup site is another possible source of pollutants, but evidence of impacts from this source could not be discerned from the data.

Temperatures in a number of tributaries were above the 18°C criterion on several dates. As discussed earlier in Section 3.2.2, the most significant cause of increased water temperature is usually loss of riparian canopy vegetation. On all the tributaries with high temperatures, extensive stretches where riparian canopy had been removed were documented by the USFWS degradation survey. Restoration of the riparian canopy on these tributaries would likely reduce water temperatures.

Most of the fecal coliform violations found on the tributaries were observed during the August 1991 intensive survey, which took place during a rainy period. All tributaries with fecal coliform above the water quality criteria had livestock impacts identified by the USFWS degradation survey. In addition, several of these creeks drain rural residential areas where failing or inadequate on-site sewage disposal should be suspected. In the Centralia/Chehalis area, urban stormwater was likely an additional contributor of high fecal coliform levels to creeks in the area. The sources discussed above for Salzer Creek DO also should be suspected for elevated fecal coliform.

Elevated fecal coliform levels in the Dillenbaugh Creek basin were mostly found in Berwick Creek and at the upper sampling site above Berwick Creek. Fecal coliform levels near the mouth were surprisingly low. This was most likely the result of the wetlands in the lower basin, but toxic effects of the American Crossarm and Conduit site cannot be ruled out.

High pH values were measured in the Skookumchuck River and Scatter Creek. The values in the river were associated with the rainy sampling period in late August 1991, and were from an unidentified source, probably associated with stormwater runoff. The high pH in Scatter Creek appears to have been the result of high primary productivity in the creek, since supersaturated DO levels were also measured. High

Table 3.7 Tributaries Exceeding Water Quality Standards
(shaded dark)

Water Body Name	Parameters				Suspected Causes				
	DO	Temp-erature	Fecal Coliform	pH	Failing On-site Septic	Livestock Impacts	Urban Storm-water	Riparian Canopy Loss	Permitted Sources
Elk Creek									
South Fork Chehalis River									
Bunker Creek									
Stearns Creek									
Newaukum River (confluence NF/SF to mouth)									
Dillenbaugh Creek									
Salzer Creek									
Skookumchuck River (Hanaford Creek to mouth)									
Lincoln Creek									
Scatter Creek									
Independence Creek									
Garrard Creek									
Black River									

productivity probably was the result of several factors. A primary cause appears to have been the high nutrient loading from the two aquaculture operations that maintain most of the summertime flow in Scatter Creek. Other causes could be livestock impacts, inadequate on-site sewage disposal, and the loss of riparian canopy.

3.5 Stratification and Hypolimnetic Conditions

One of the significant characteristics of the Chehalis River is stratification of the water column in the middle reach. Most rivers and streams, including the upper and lower Chehalis River, are isothermal, that is, the temperature is essentially the same at all depths. The turbulence of the flowing water keeps the water column fully mixed. However, during this study thermal gradients (thermoclines) were found in the middle Chehalis River (surface waters were warmer than bottom waters).

Stratification was generally found in pools deeper than 5 meters between RM 71 and RM 67. Differences between surface and bottom temperatures of 6 to 8°C, and as high as 11°C, were found at these sites during maximum stratification. Slight stratification was also found at other deep and shallow areas in the Centralia reach. Generally, stratified conditions set up between mid-June and early July, reached a maximum in late July to late August, and were mostly gone by early October. The river appeared to be fully vertically mixed from early October to mid-June (except for the local zone of mixing for tributary or point source inflows).

Because of the vertical temperature gradients, the warmer, less dense surface water overlaying colder, denser bottom water creates a very stable formation. The density gradient is more stable with greater temperature differences and with warmer water. The water column stability resists mixing and dispersion of dissolved materials. Thus, oxygen entering the water column from the surface moves towards the bottom very slowly, and oxygen demand from the bottom sediments outstrips re-oxygenation from the surface. Also, materials released by the sediments do not mix into the upper waters. The result is that in the hypolimnion (below the maximum temperature gradient), the water is often low in oxygen and high in other constituents compared to surface waters.

Figures 3.5 and 3.6 illustrate this phenomenon in the Chehalis River. In Figure 3.5, vertical temperature profiles are shown at three locations in the Centralia reach at eight different dates in 1992. The pattern at the north of airport site and the site below Salzer Creek were similar: no stratification was apparent in May and June; a thermocline was found in early July that began at about 6 meters; the thermocline rose to about 3 meters from late July through late August; the thermocline dropped by

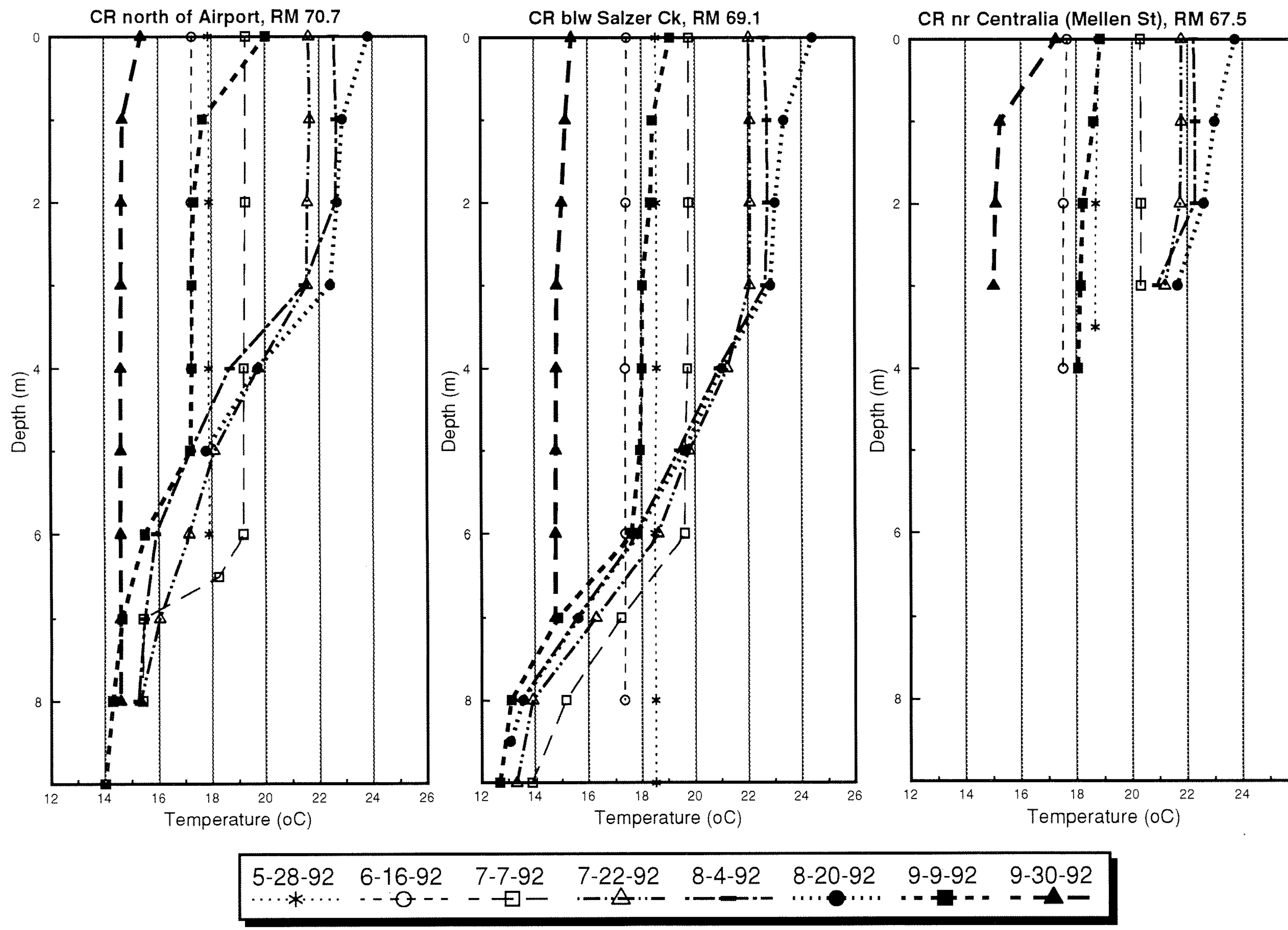


Figure 3.5 Vertical Temperature Profiles

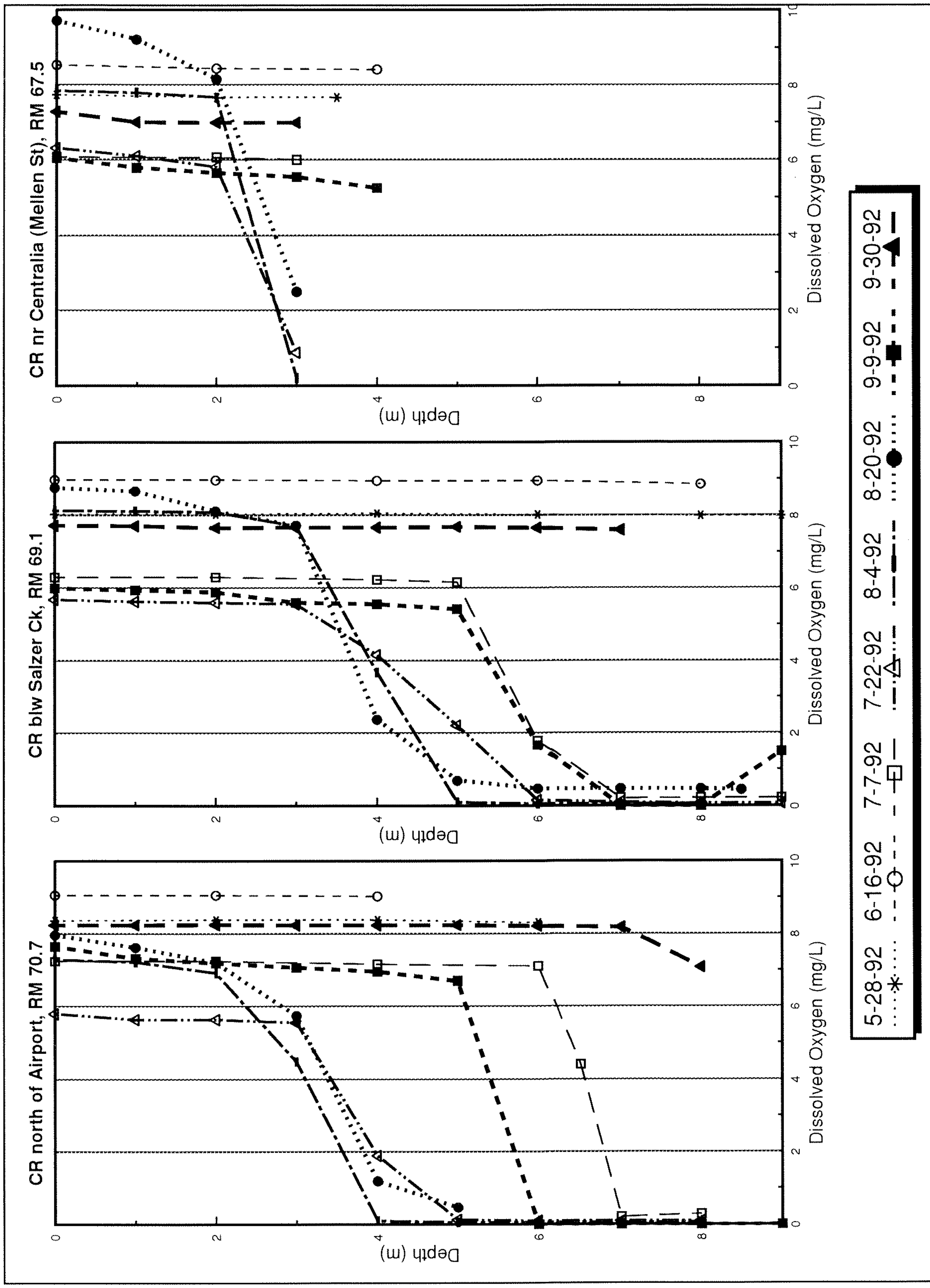


Figure 3.6 Vertical Dissolved Oxygen Profiles

early September; and by the end of September no stratification was observed. At Mellen Street, a strong gradient wasn't found, probably because the site is shallower. However, a slight thermocline was found at 2 to 3 meters from late July through late August.

The response of DO to stratification, shown in Figure 3.6, followed the same pattern as the temperature profiles. In all cases, the DO dropped dramatically below the level of thermocline. The depth of the steepest DO gradient was nearest the surface in late July through late August, and was deeper in early July and early September. No variation of DO with depth was found in May, June, or late September.

The anoxic layers in the stratified locations can be attributed to sediment oxygen demand (SOD). Without SOD, DO should be present at the bottom, although perhaps at low levels, because DO would diffuse from the surface and be available at a low level in ground water. The complete absence of oxygen must be attributed to a demand from deposited organic materials. These materials can be from autochthonous sources, that is, sources internal to the river. Internal biomass growth, death, and decay are the principal autochthonous sources, and modeling can indicate the contribution of phytoplankton to autochthonous SOD. Organic materials may also originate from allochthonous sources, which are sources external to the river such as a point source discharge, field runoff, or leaf fall.

Other constituents showed vertical differences associated with the observed stratification. Conductivity tended to increase with depth, and pH tended to decrease. Conductivities greater than 300 μmho/cm were common near the bottom where the river was thermally stratified, which can be attributed to a combination of ground water inputs with higher conductivity and the release of dissolved materials under reducing conditions. The lower pH in the deeper waters may be produced by the decomposition and leaching of organic sediments at the bottom producing organic acids and carbon dioxide.

Other chemical changes were observed that can be attributed to the anoxic conditions and low redox potential in the hypolimnion. The higher levels of TOC, ammonia, phosphorus, iron, and alkalinity found in the deeper waters are consistent with anoxic, reduced conditions. Anoxia also is responsible for the relatively low levels of nitrate/nitrite nitrogen found in some of the deep areas.

In all, anoxic hypolimnetic conditions were observed in six locations where measurements were made in the Centralia reach. Three sites were particularly deep and showed consistent stratification: the stations north of the airport (RM 70.7), below the overhanging tree (RM 69.9), and below Salzer Creek (RM 69.1). Although these sites were fairly close to each other, the sites north of the airport and below Salzer Creek stand out due to their exceptional levels of water quality constituents as compared to the overhanging tree site.

The sites north of the airport and below Salzer Creek were colder at the bottom and had stronger temperature gradients. Both were characterized by anoxic layers that extended closer to the surface than other sites (at times to within 4 meters). This would partially explain the more extreme levels of many constituents. At the site north of the airport pH values as low as 5.9 were found, and the decrease in pH from surface to bottom was 0.6 to 0.8 units. Unusually high alkalinities were measured at the two locations: north of the airport an alkalinity of 81.9 was measured at 6.6 meters in August 1991; below Salzer Creek the measured alkalinity was 143.0 mg/L at 7.7 meters in July 1992 and 97.6 mg/L at 6.7 meters in August 1992. The highest levels of ammonia in the mainstem were found in the hypolimnion of these two sites: between 0.6 and 1.3 mg/L. Total phosphorus was between 1.5 and 1.6 mg/L in the hypolimnion below Salzer Creek, the highest level found in the mainstem.

Although the density characteristics of the sites north of the airport and below Salzer Creek partially explain the extreme levels of constituents found, the evidence also suggests that these two sites have been impacted by local sources of pollutants. Since the three sites are similar in depth and all anoxic, differences in oxygen transfer rates do not seem to completely explain the extremely high ammonia and total phosphorus in the hypolimnions of the sites north of the airport and below Salzer Creek. The possibility of a local sources of nutrient loading is supported by the relatively high levels of total nitrogen found in the hypolimnions of these two sites. Also, although alkalinity is typically a measure of inorganic carbon, it can also measure organic ions. Cole (1979) states that pollutants may contribute significant levels of organic ions to total alkalinity. Pollutant loading to these locations may contribute to the elevated alkalinities that were observed.

Other parameters that cannot be attributed just to anoxic reducing conditions also suggest local sources of pollutants to the sites north of the airport and below Salzer Creek. The highest conductivity found in the mainstem was 744 μmho/cm at 9.0 meters north of the airport. Elevated levels of chloride were detected in the deep waters north of the airport and below Salzer Creek (RM 70.7 and 69.1), with high concentrations of 37.2 and 20.1 mg/L, respectively. Relatively high turbidity and TSS levels were also measured in the deep areas north of the airport and below Salzer Creek (RM 70.7 and 69.1).

Sources of pollutants to the pool below Salzer Creek would most likely be found in that tributary's subbasin; these sources are discussed in Appendix Section F.6. The evidence points to the National Frozen Foods wastewater application Field #1 as the principal source of pollutants. However, the Centralia Landfill, a sump discharge on the Southwest Washington Fairgrounds, and other sources in the upper Salzer Creek basin may also contribute pollutants to the pool below Salzer Creek. These possible sources should be further investigated and corrective actions taken.

For the pool north of the airport, the most likely pollutant source is a dairy farm located on the east side of the river. Two small channels were observed cut into the river bank in the vicinity of the dairy farm and the sampling site. This could indicate a wet weather direct discharge to the river. In addition, the farm may have a strong influence on ground water that reaches the river. This dairy farm should be a high priority for investigation and implementation of a farm plan to eliminate direct discharge to the Chehalis River and minimize degradation of ground water near the river.

3.6 October 1991 Low DO Event

On October 8, 1991, during a scheduled survey of Chehalis River water quality, DO was found at very low levels in the Centralia reach, dropping to less than 1 mg/L at RM 71.4. In response, an emergency survey was conducted on October 10, during which laboratory samples were taken at several locations on the river and tributaries, and DS3 meters were placed in the river and picked up on October 14. Data from the emergency survey are provided in Appendices D, E, and F.

The DO sag was characterized by an area that was anoxic from bank to bank and top to bottom, extending roughly a half mile up- and downstream, with recovering DO levels farther upstream and DO dropping as the slug of low DO water moved downstream. Conductivity and temperature were not unusual, but pH was slightly depressed. Surprisingly, no fish kill was discovered due to this event. Tracking of the sag over several days indicated a travel time of about one mile per day, which would have placed the sag or its cause at the SR 6 bridge near Chehalis on October 5, 1991.
Discharge monitoring report results indicate that the Darigold WTP suffered an upset on October 4, 1991, which resulted in a BOD of 40 mg/L being discharged on October 5. Thus it appears that an upset at Darigold contributed, at least in part, to the low DO conditions observed. However, DO at the SR 6 Bridge was 5.5 mg/L on October 8, which was far lower than the range of 7 to 9 mg/L observed at this location at other times during the study. On October 10, DO at the old Riverside Road bridge (RM 75.1) was still at 5.4 mg/L.

Coincidentally, there was a reservoir collapse on a hill near Centralia only a few days before this event. However, the water appeared to have mostly collected in a field away from the Chehalis River, so there is no indication of a direct impact on the river from that event.

Of the laboratory parameter results, the most remarkable were samples from the Claquato bridge (RM 77.6). A BOD of 12 mg/L was detected there during the emergency survey, which is extremely high for surface waters and strong evidence of a pollutant source upstream of this location. Additional supporting evidence of a discharge of pollutants was that conductivity, TOC, NH3N, TP, and chloride concentrations were all higher than any other measurements from the Chehalis River above the Newaukum River. Although conductivity, NH3N, and chloride were slightly elevated on the Newaukum, no other parameters were unusually high. At the SR 6 bridge at Chehalis, conductivity, TN, and TP were elevated. Below the Chehalis and Darigold WTPs, no unusual levels of laboratory parameters were observed, but elevated nutrients and conductivity would be expected to be masked by the effect of the wastewater discharges.

Thus, the evidence suggests that a pollutant source above the Claquato bridge and below the Ceres Road bridge (where no DO problems were found in October 1991) was a contributing cause of the low DO found in the Centralia reach. The nature of the upstream source is unknown, but several facts may be relevant. There are many livestock operations in the area upstream of Claquato that are a source of materials that could produce the observed problem. The parameter levels observed in the river fits the characteristics of cattle waste, and there are no other facilities or operation that could be sources of high-strength waste. Early fall is a time when large livestock operations are undertaking their final disposal of waste before winter rains. Also as discussed earlier, sampling in August 1991 indicated a source on the Chehalis River below Adna or in the Stearns Creek basin.

The relative contribution of the unknown source upstream and the Darigold upset is difficult to know with certainty. However, the lesson of this event is clear. In the late summer and early fall while flows in the Chehalis River are still low, the Centralia reach is extremely sensitive to any discharge of oxygen-demanding materials. An upset at a WTP or poor management practices along the Centralia reach or in the basin upstream can have a catastrophic effect on DO in the river.

4. Modeling Results

4.1 Modeling Methods

The Chehalis River system was modeled using version 5.10 of the WASP5 model, with its eutrophication kinetic subroutine EUTRO5 (Ambrose *et al.*, 1993). This model is supported by EPA, and was adapted for 486 32-bit personal computer application by AScI Corporation of Athens, Georgia. WASP5 allows time-dependent three-dimensional modeling of oxygen, nutrients, BOD, and phytoplankton and conservative parameters.

A schematic of the segment network used for the model is provided in Figure 4.1. The model was used in a steady-state mode, with multiple vertical elements. A single-layer segmentation with only surface water elements was used in the upper and lower ends of the river (segments 1-8 and 17-37). A two-layer segmentation with both surface and subsurface elements was used in the stratified stretch of the river (segments 9-16 and 38-45). Elements were bounded on the bottom by benthic segments that routed ground water and settled phytoplankton (segments 46-60). A "dummy" element was provided on the side to route surface water withdrawals (segment 61).

The section of the mainstem Chehalis River chosen for modeling starts at the SR 6 bridge in Pe Ell (RM 106.3), and extends downstream to the Porter Road bridge at Porter (RM 33.8). The headwaters boundary was chosen to be upstream of the discharge point for the Pe Ell WTP. Upstream of Pe Ell the Chehalis River is Class AA, and the only significant land use is timber.

The overall water flow balance was estimated with a spreadsheet. For each segment, a mass balance was calculated that included vertical and horizontal inflows and outflows; pumping withdrawals; and ground water, point source, and tributary flows. The segments's flows were then balanced for the whole river, and all flows were specified in the "Flows" data group of the input file.

Tributaries were not directly modeled, but instead were treated as inputs to the mainstem. Salzer Creek temperatures were less than the temperature of the river in the stratified Centralia reach, so its flows and loads were routed into the subsurface layers. Ground water was routed through the benthic segments into the water column segment above.

WASP5 allows pollutants to be input to the system either as boundary conditions or as waste loads. Boundary conditions are concentrations which are multiplied by the flow across the boundary to determine the load to the segment. Waste loads are input specifically as a loading rate (pounds per day, or equivalent), and need not be

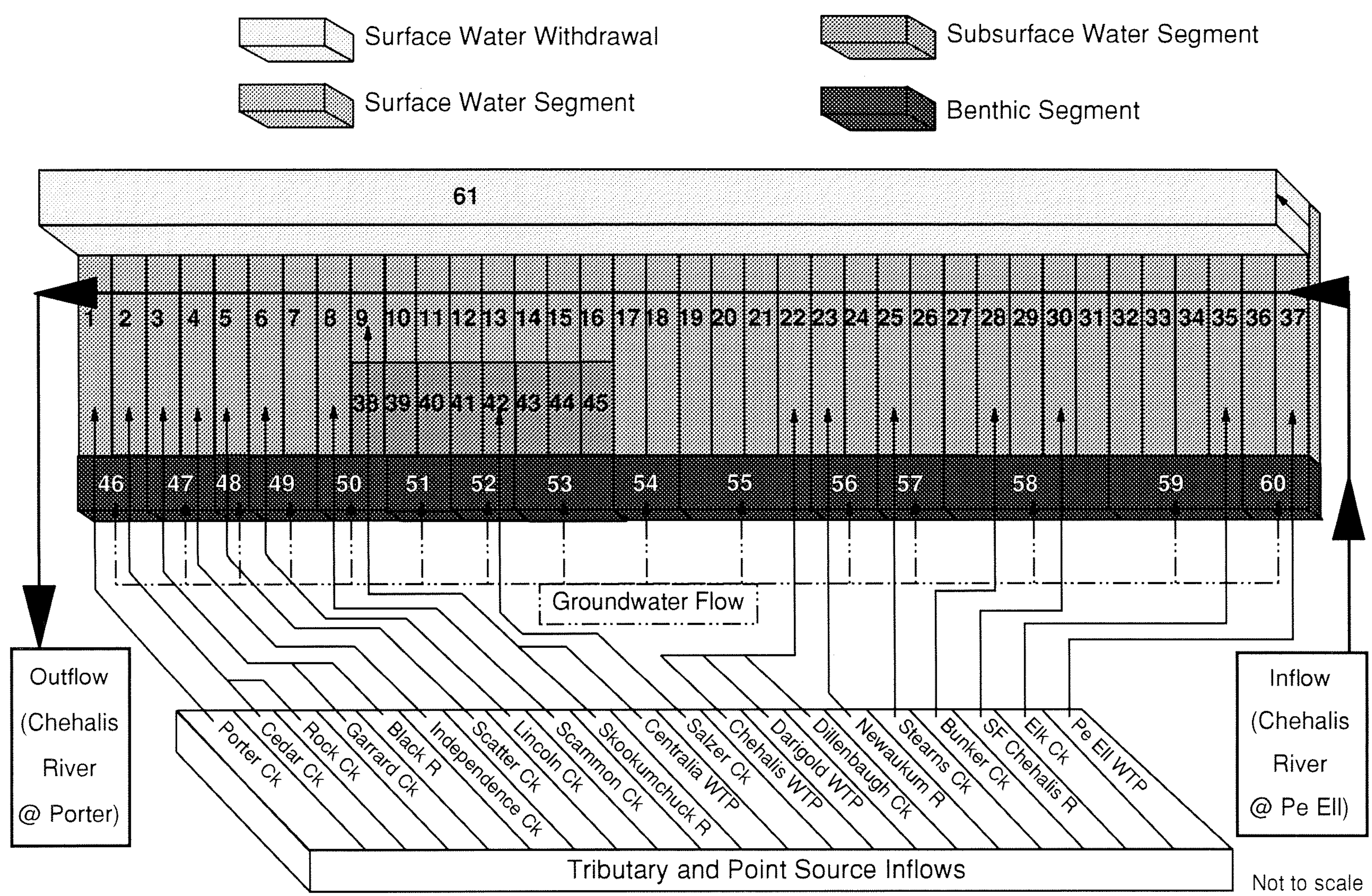


Figure 4.1 WASP Model Segment Layout

(Showing Water Flow Paths)

associated with an inflow. Loading sources, tributaries, and headwaters were input in the "Wasteload" data block, and background ground water quality was input in the "Boundary Condition" data block.

In order to calibrate the dispersion coefficients, refine the water flow balance, and estimate unknown loading sources, WASP5 was first run in a conservative mass-balance mode using chloride as a tracer. The ground water flow patterns illustrated in Figure 4.1 are based on results of the conservative tracer modeling. After the chloride and flow mass balance was evaluated, the full eutrophication model was run. July and August 1992 conditions were modeled independently to calibrate the model. August and September 1991 conditions were then simulated to verify the modeling approach. Critical flow conditions were then estimated and the model applied to evaluation of the Chehalis River LC.

A number of challenges present themselves in modeling the Chehalis River. Segmentation and hydrodynamics for the model must be established that reflect the true characteristics of the physical system. Because of the stratification of the middle river, a model with both horizontal and vertical dimensions is more appropriate than a one-dimensional model. However, use of a two-dimensional model increases the complexity of the simulation and the data that are required.

The WASP5 system allows for time-variable dynamic modeling. However, for simplicity, the Chehalis River was simulated in a steady-state mode. This is a reasonable assumption for summertime low flow, although like all assumptions, it must be examined against the real system for validity. All input parameters were treated as 24-hour average values for conditions observed at the time of sampling, or for critical design conditions.

Several studies have shown that the Chehalis River is characterized by significant ground water inputs. Erickson (1993) estimated ground water inflows from above Bunker Creek (RM 86.0) to Prather Road (RM 59.9). Average inflow rates ranged from 0.5 cfs/mile at the upstream end of this area to 4.5 cfs/mile near the mouth of Lincoln Creek (RM 64.2 to 62.0). Based on those estimated inflows, ground water inputs to the mainstem may constitute up to one-third of the low flow reaching the Mellen Street bridge (RM 67.5). Ground water inflow from Mellen Street to Prather Road may produce an additional 15% increase during low flow. Sinclair and Hirschey (1992), using the surface flow difference between two measurement sites, estimated the average seepage gain in late August 1987 to be 3.1 cfs/mile in the lower Chehalis River from Prather Road to upstream of the Independence bridge (RM 54.7). This represents a 5% increase in flow for this stretch.

The quantification of ground water inflows in detail adequate for modeling is therefore clearly necessary, but also difficult. In addition to ground water flow rates, the quality of the ground water influencing the river and the effect of pollutant loads on ground water quality may significantly affect the water quality of the river. Another complication to modeling the Chehalis River is the presence of pumping withdrawals from the river. An overall flow balance for the Chehalis River may underestimate ground water inputs if pumping withdrawals are not accounted for.

In general, the stratified areas in the Chehalis River are separated from each other by shallower, fully mixed areas. This was observed in the field and confirmed with field and laboratory data. In addition, the observed characteristics of the stratified areas indicate that the surface waters are relatively well-mixed, while the hypolimnetic areas differ substantially from the surface waters. To simulate these characteristics of the river, the model was structured so that downstream flow occurs in the surface segments, but subsurface segments are not connected to each other. Each subsurface segment mixes by dispersion with the surface segment above, and any ground water or tributary inputs that are routed through subsurface segments cause advective flow into the surface segment above. Each subsurface segment in stratified areas and surface segment in unstratified areas is bounded below by a benthic segment that routes ground water into the segment.

To estimate inputs to the Chehalis River from ground water and other nonpoint sources, the WASP5 model was run with a conservative tracer. Chloride data were used for this purpose. Chloride is useful as a tracer since it is highly soluble, non-adsorbing, chemically conservative, and easily measurable. A number of other studies have used this ion as a tracer to estimate flows where direct measurement was difficult or impossible (e.g., Walker *et al*, 1991). EUTRO5, the WASP5 eutrophication model, allows conservative tracers to be run by using the ammonia system alone with all kinetics set to zero.

Using the chloride tracer model, a refined flow balance was developed for observed conditions, and input loads detected from changes in chloride loading were estimated. The flow balance thus developed was applied to the full EUTRO5 simulation. Input loads for EUTRO5 were estimated for unmeasured sources as a proportion of chloride loads.

EUTRO5 simulates eight different systems in combination: ammonia nitrogen, nitrate nitrogen, ortho-phosphate, phytoplankton carbon, biochemical oxygen demand, dissolved oxygen, organic nitrogen, and organic phosphorus. If the model simulates the physical system correctly, each of the state variables for the eight systems ought to match observed data.

The overall strategy employed in modeling the Chehalis River was to use the chloride tracer to establish the flow balance, dispersion coefficients, and distribution of loads. The full EUTRO5 was then calibrated using the two sets of data collected in July and August 1992. The model was verified with the August and September 1991 data sets. The flow balance for verification was established using a mass balance of 1991 chloride data and simple systematic adjustments to the calibrated model. Similarly, model input data files for critical conditions were developed from the calibration flow balance adjusted to fit critical low flow estimates.

4.2 Calibration Modeling

4.2.1 Chloride Tracer Modeling

For chloride tracer modeling in the Chehalis River, ground water chloride sources were input as boundary concentrations. Boundary concentrations for ground water were set to levels that appeared to be typical for the region. Tributary, point source, and headwater chloride sources were input as waste loads. Loading was calculated from measured or estimated flows and chloride concentrations measured during the surveys. Where necessary to meet the chloride mass balance, additional loading was input as a waste load to benthic segments, under the assumption that unknown sources were reaching the river through ground water.

A detailed description of the development of the model input data set is provided in Appendix G. The chloride boundary concentrations and waste loads used in the July and August 1992 calibration modeling are shown in Appendix Tables G.1 and G.2.

The calibration of the Chehalis River model to a chloride tracer was an iterative process. Different flow and chloride mass balances were modeled until a best fit was found for both the July and August 1992 survey data. Best fit was evaluated by calculating the root mean square error (RMSE) of the residuals between the modeled and observed data. Mass balances were adjusted by varying pumping withdrawals as a percentage of the water right, and by varying ground water flows and chloride levels within a reasonable range suggested by other studies. A best fit for calibration occurred when the RMSE was about the same for the two calibration simulations and both RMSEs were as low as could be achieved. Appendix Table G.3 shows both the chloride and flow modeling results compared to observed data, and the RMSE analysis results. Figure 4.2 shows the chloride and flow calibration results for July 1992 conditions, and Figure 4.3 shows August 1992 results.

Through the simultaneous evaluation of flow and chloride mass balance for the two data sets, a number of significant features of Chehalis River flow and water quality were identified and quantified. The overall flow balance shows the relative importance of the Newaukum, Skookumchuck, and Black Rivers in contributing flow to the mainstem, and lesser contributions from other tributaries and from ground water. The downstream pattern of chloride is characterized by increases in chloride concentrations below the South Fork Chehalis River, the Newaukum River, and the Darigold WTP. Chloride concentrations drop below the Skookumchuck River and then exhibit a slight downward trend downstream to Porter.

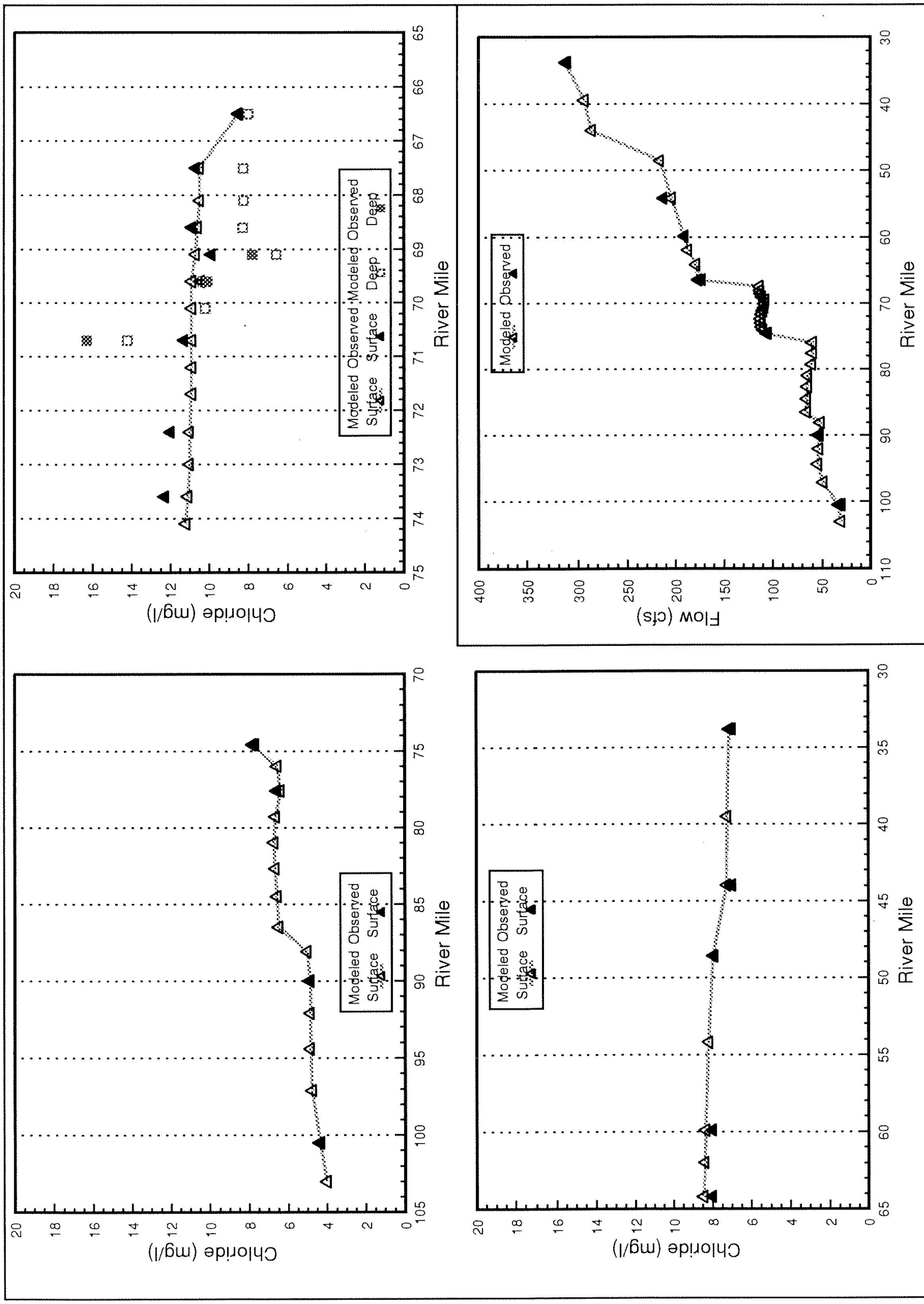


Figure 4.2 Chloride and Flow Calibration - July 1992

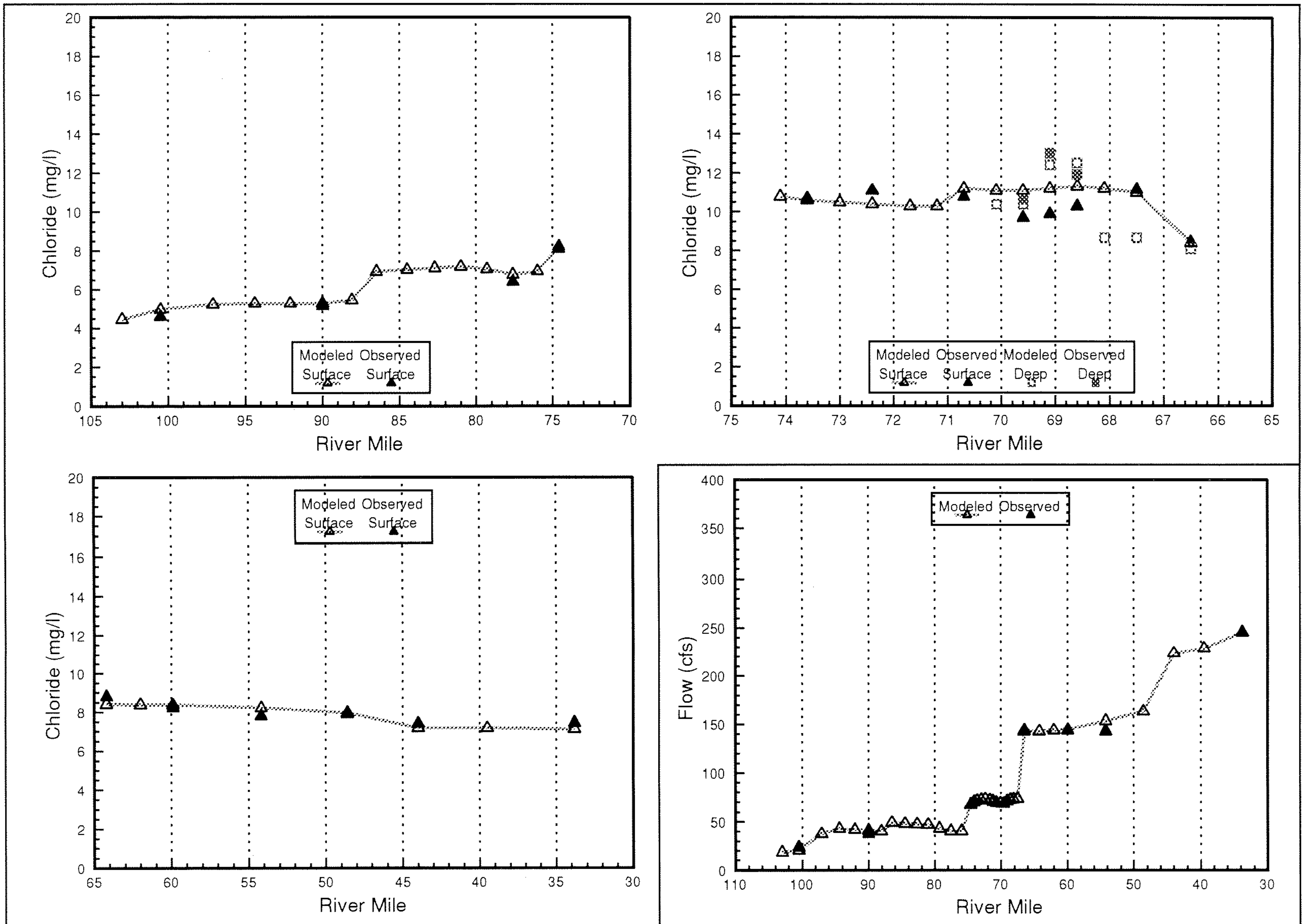


Figure 4.3 Chloride and Flow Calibration - August 1992

The RMSE for the flow calibration was around 4 cfs. This represents an error of 15% or less, calculated as the RMSE divided by the modeled flow, which is roughly the same level of error as the measurement method. The RMSE for chloride was about 0.2 mg/L in the upper stretch of the study area; 0.3 mg/L in the lower stretch; and 0.7 to 0.8 mg/L in the surface waters and as high as 1.4 mg/L in the deep waters of the Centralia reach.

There are several likely reasons for not achieving a better model fit. In the upper basin, little data was available on ground water flow and quality, which introduced uncertainty into the model's predictions. In the surface waters of the Centralia reach, extremely high chloride loads are introduced by Darigold and by the NFF operations on Salzer Creek. The nature of the operations at Darigold (batch operations and intermittent wash cycles) produces a discharge that is irregular in quality. Similarly, NFF generates wastewater at irregular intervals and applies the water to the fields in batches. Therefore these two sources introduce slug loads into the Centralia reach, which cannot be modeled in a steady-state mode. This effect is likely exerted downstream, which increases the variability of the observed values in the lower stretch. In the deep waters of the Centralia reach, the high chloride levels are fairly local, and the spatial resolution of the model is not adequate to capture the local variability.

The locations where chloride loading was added to the Chehalis River model illustrates the sources of variability described above. Chloride loading is relatively high from the South Fork Chehalis River (segment 28). Whether this is from natural or nonpoint sources is unknown, but a small variation in chloride levels in this tributary will have an effect on downstream values.

Chloride loading from Darigold used in the model is from one-half to three-quarters of the loading in the Newaukum River, but Darigold flows are one-fifth to one-seventh of the river flow (segment 22, tributary #2). In fact, in order to approximate steady-state conditions, the loading used in the model for Darigold was different than the loading actually measured, since downstream values appeared to reflect earlier loading that must have been either higher or lower.

Loading from Salzer Creek (segment 42) was applied in two parts: a background load, using concentrations at the BN/UP trestle, and a load to reflect input from NFF Field 1. A slot for additional loading was also included for NFF Fields 2 and 3 (segments 41 and 40). Loading was added for Field 2 in August 1992; no loading was applied for Field 3 since that field was not in use by NFF during the study period.

An additional chloride loading source was identified in the stretch from the Black River downstream to Porter (RM 47.0 to 33.8). Based on the land use of this area, livestock operations are the most likely source of this loading. The USFWS habitat degradation survey (Wampler *et al.* 1993) found livestock impacts along the mainstem Chehalis River upstream of the mouth of Cedar Creek and near the mouth of Gibson Creek.

4.2.2 Eutrophication Modeling

For full eutrophication modeling, boundary conditions and waste loads must be specified for the state variables of eight systems. The method to set the inputs for the eight parameters was similar to the way chloride inputs were set. Boundary conditions were set to background levels for regional ground water quality. Tributaries and point sources were given loadings for the eight systems calculated from measured flows and concentrations. Pollutant sources identified by the chloride mass balance were assigned loading using several different approaches depending on the probable source and pathway to the river (see Appendix Section G.3). The parameters, constants, and time functions required by the eutrophication model are described in Appendix Section G.4.

Appendix Tables G.4 and G.5 show the waste loads and boundary conditions for July and August 1992 conditions, respectively. Point source loads for the upstream boundary on the mainstem, the permitted NPDES dischargers, and major natural tributaries were measured directly by intensive survey sampling.

Appendix Tables G.6 and G.7 compare modeled to observed results for the July and August 1992 simulations. These tables also show the RMSE analysis for the eight water quality systems, separated into the lower study area (segments 1 through 9), the Centralia reach surface segments (10 through 22), the upper study area (segments 23 through 37), and the Centralia reach subsurface segments (38 through 45). The observed results are based on: the 24-hour average of DS3 datasonde data, if available; an average of vertical profile values taken from 0 to 2 meters at the surface sampling locations without DS3 data but with multiple data points; or an average of vertical profile values taken from 3 meters and deeper at the deep sampling locations.

To calibrate the Chehalis River model, various modeling parameters were adjusted to achieve the best fit, as measured by the RMSE between the modeled and observed results. The RMSE was chosen since it is a simple but statistically valid measure of the goodness of fit. Minimization of the RMSE was a time-consuming iterative process that involved numerous model runs with various input parameters. In consideration of the variability inherent in the model, and in environmental data in general, no calibration exactly predicted observed conditions. Nonetheless, the model was adapted to describe the physical, chemical, and biological systems as well as was possible.

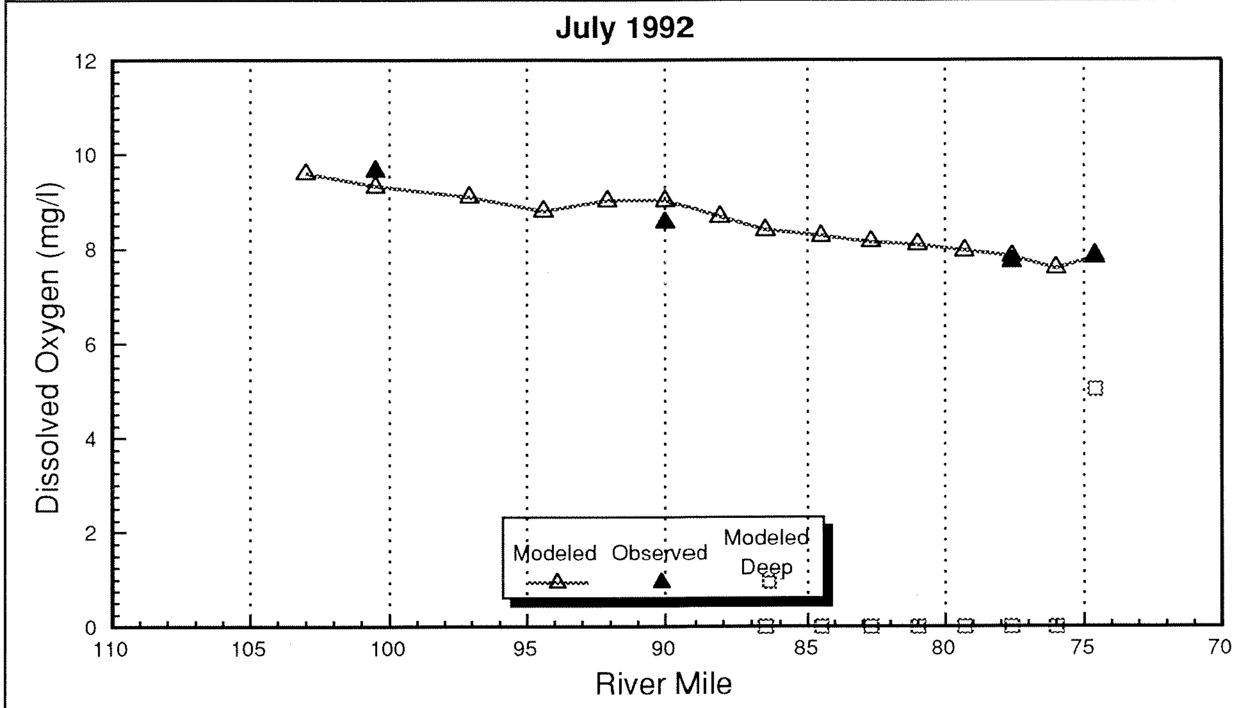
Figures 4.4 through 4.6 show the calibration results for DO, which is the target parameter of the TMDL. Close agreement between modeled and observed oxygen concentrations was not expected, since the field data for DO showed a great deal of diurnal and vertical variability, while the model simulates conditions that are averaged over 24-hours and spatially through the segment. The variation in the model results with respect to the observed data will be taken into consideration in the evaluation of simulation results.

Chlorophyll *a* model results were found to be very sensitive to certain model parameters, in particular, the maximum growth rate and the settling rate. Without settling, modeled chlorophyll *a* levels were an order of magnitude too high. Therefore, after reasonable values were selected for all inputs affecting phytoplankton biomass, the settling rate was increased to produce the best fit. A high settling rate probably also accounts for other mechanisms of phytoplankton reduction, such as filtering in macrophyte beds and zooplankton predation. Since the observed results for chlorophyll *a* had high variability, the large RMSE between modeled and observed results was deemed acceptable, and probably unavoidable.

Nutrient levels did not calibrate well, particularly in the deep segments of the Centralia reach and the lower study area. In the deep areas, anoxic reducing conditions had produced very low levels of nitrate. The chemical dynamics of reducing conditions could not be directly modeled, resulting in some inaccuracy. In the lower river, macrophyte and periphyton photosynthesis appear to play a major role in primary productivity. The model does not capture this additional productivity, resulting in modeled nutrient levels much higher than observed. The dynamics of macrophyte and periphyton growth is beyond the scope of this study. All in all, the nutrient calibration is acceptable, but model results should be interpreted with caution.

The ability to fit ultimate CBOD and organic nutrients modeling results to observed data was of lesser concern due to the high variability of observed results at instream concentrations. In the course of calibration, the RMSE for each of these parameters was kept as low as possible, and the fit of the model to observed values for these parameters was also deemed acceptable.

In general, the Chehalis River model did not calibrate as well as would be desired. There were many reasons for this, and some were discussed above. One additional reason is that a number of sources to the Chehalis River are intermittent or subject to slug loading. For example, a number of stormwater sources were observed in July 1992 which discharge only at times of rainfall. Evidence suggests that several sources in Salzer Creek also discharged intermittently. The Darigold plant appeared to have a variable loading pattern as well. The result was that slugs of pollutants moved through the Centralia reach and on down the Chehalis River below the Skookumchuck River, introducing a great deal of spatial and temporal variability that



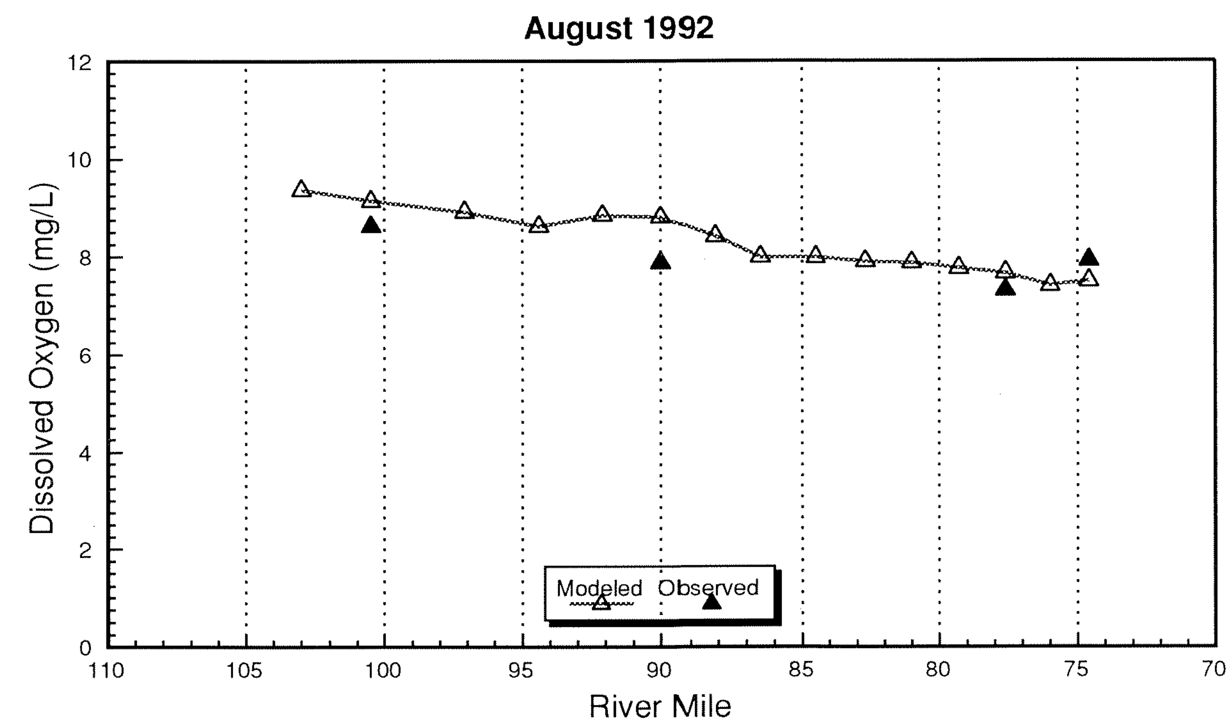


Figure 4.4 Dissolved Oxygen Calibration Results - Upper Study Area

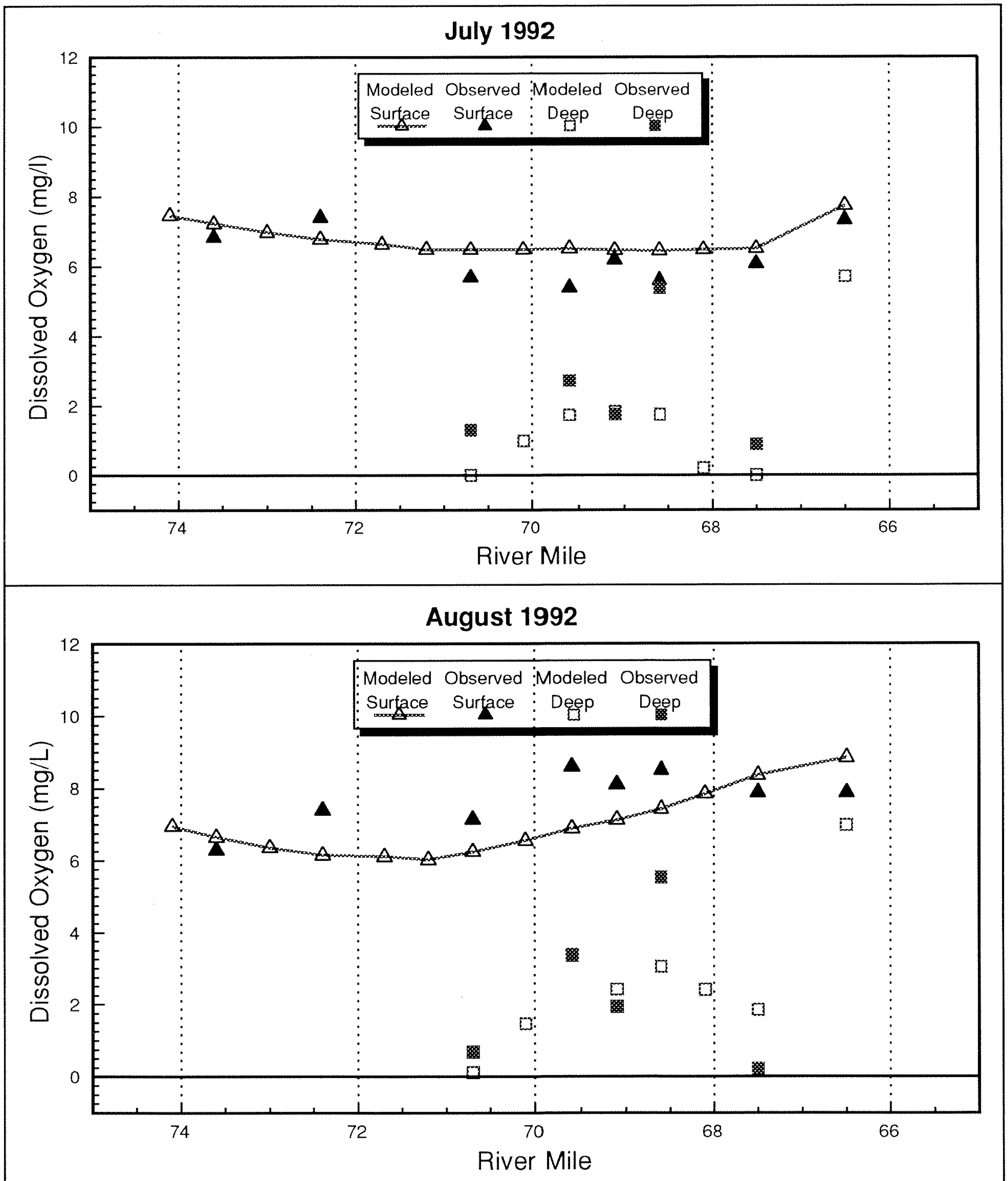


Figure 4.5 Dissolved Oxygen Calibration Results - Centralia Reach

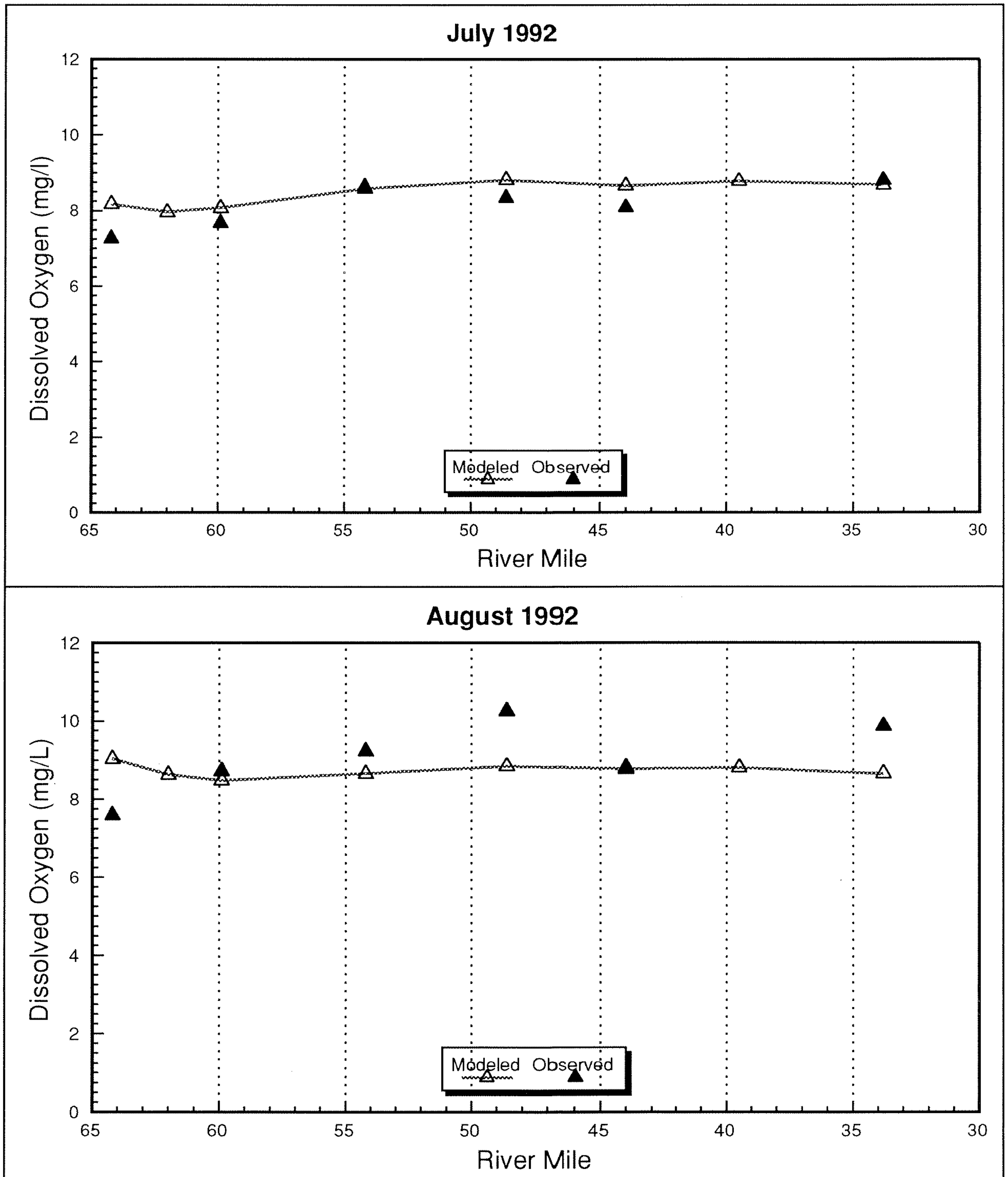


Figure 4.6 Dissolved Oxygen Calibration Results - Lower Study Area

could not be captured by the steady-state model. An extremely intensive sampling plan and a highly refined model network would be necessary to improve modeling accuracy.

4.3 Verification Modeling

4.3.1 Chloride and Flow Analysis

In the Chehalis River model verification, unknown flows and loads were estimated by conservative tracer modeling with chlorides. Starting with the calibration data set, ground water flows were adjusted upward or downward globally by reach until the RMSE was minimized between the observed and modeled flows. Then additional chloride loading was added to minimize the RMSE of observed versus modeled chloride concentrations in the river.

Results from the 1991 intensive surveys were used for verification. Due to the structure of the 1991 sampling, data from August 27, 1991, were used for modeling upstream of the Prather Road site (RM 59.9), and averages of data from September 10-12, 1991 were used from Prather Road to the downstream boundary. Sampling in August occurred during a rainy period; data collected August 27 were slightly affected by changes in flow from rainfall, but data from August 28 were strongly affected by changing flows.

The flow balance and chloride waste loads and boundary conditions are presented in Appendix Tables H.1 and H.2. The best fits for the flow and chloride load balances were achieved in the lower study area (September 1991 data), with ground water flows 30% lower as compared to 1992. In the areas modeled after August data, ground water flows were reduced 20% upstream of the Newaukum River and increased 20% in the downstream areas. Elk Creek flows were adjusted downward, since flows in this tributary appeared to have increased due to the rainfall, but the change had not yet propagated to downstream flow gaging sites. Appendix Table H.3 compares the observed to modeled results for the chloride and flow analysis, and Figure 4.7 illustrates those results. The RMSE for the flow modeling was less than 10% of observed flows, which is similar to the variability of the flow measurements themselves.

For the chloride modeling, ground water boundary conditions were kept the same as for the calibration modeling. Waste loads were either those measured during the intensive survey, or were the loads developed in the calibration modeling. Additional chloride loads were added in several locations, and were most likely attributable to dairy waste practices and National Frozen Food wastewater application. The RMSE for chloride verification was about the same as for calibration.

4.3.2 Eutrophication Modeling

Setup of the verification run of the Chehalis River eutrophication model was done in the same fashion as the calibration model. Beginning with the calibration input file, the flows were changed to those derived from the verification chloride/flow analysis. Loads were then determined either by using sampling results or by the methods described in Appendix section G.3. Boundary conditions were the same as for calibration. The waste load and boundary conditions for the verification modeling are presented in Appendix Table H.4. Water and air temperatures were set to conditions at the time of the survey, and the time functions for light were seasonally adjusted.

Verification modeling results and observed data are presented in Appendix Table H.5, and the results for DO are shown in Figure 4.8. The RMSEs between modeled and observed results for the eight system variables were comparable to the calibration results in the surface segments. The fit for the subsurface segments was poorer than the fit for the calibration results, and that error will be taken into account when interpreting model results. Overall, the spatial trends and significant features of the Chehalis River system were reproduced by the model. Taking into consideration the model assumptions and the inherent variability of model results and the natural system being modeled (as indicated by the RMSE results), the Chehalis River eutrophication model can be used with confidence to develop a Total Maximum Daily Load and evaluate alternative loading scenarios.

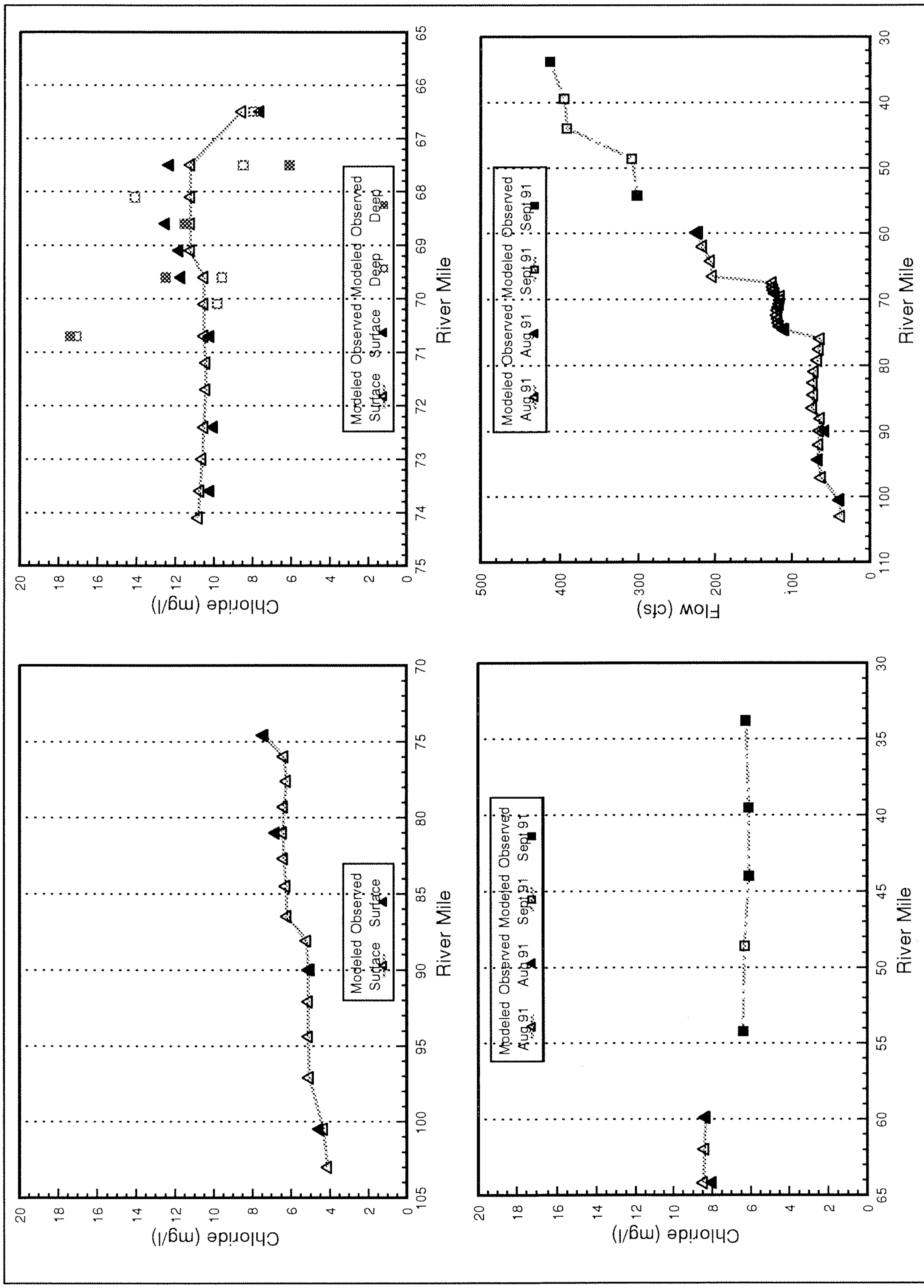
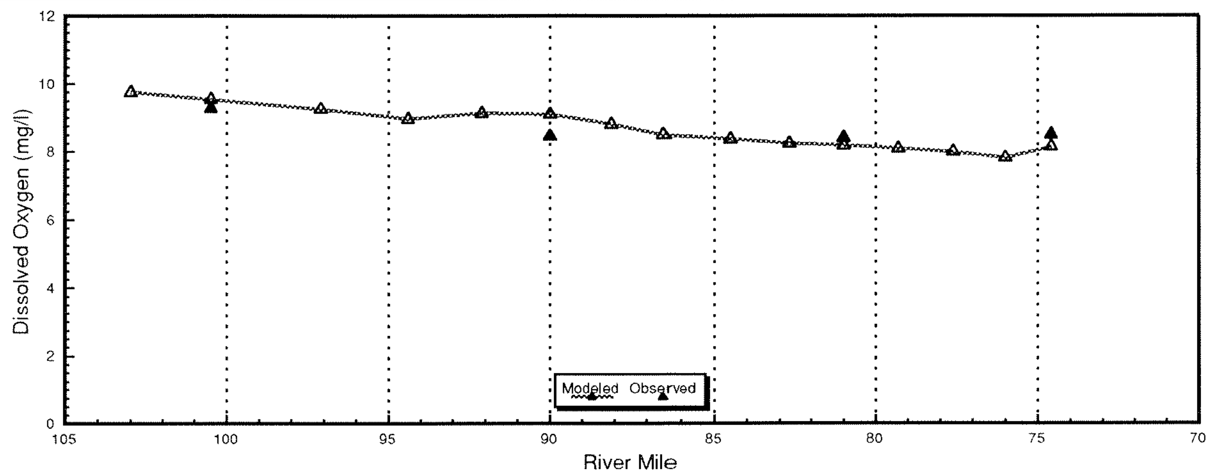
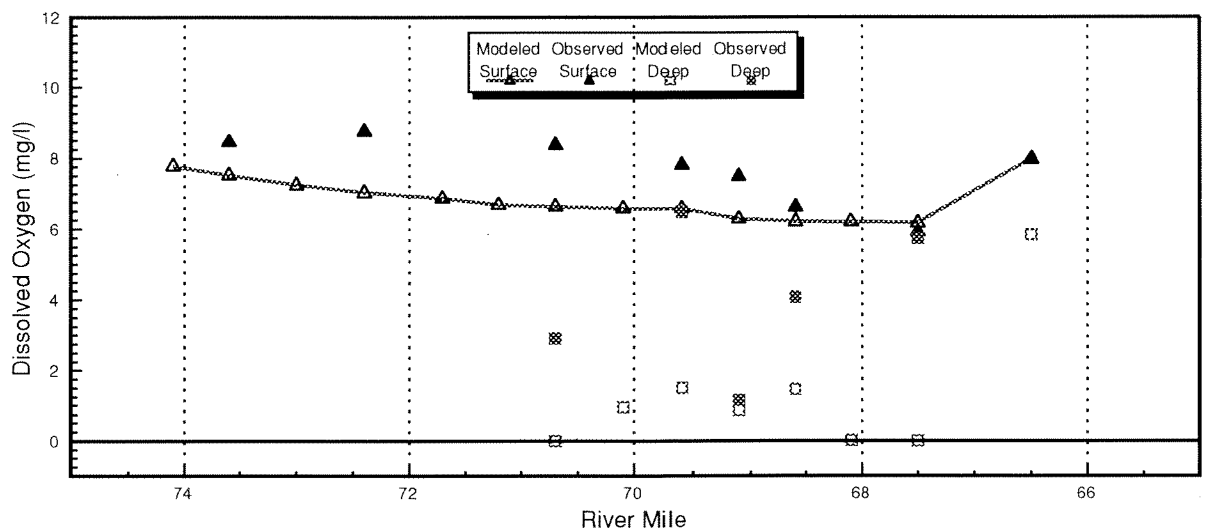


Figure 4.7 Chloride and Flow Verification - Aug/Sept 1991





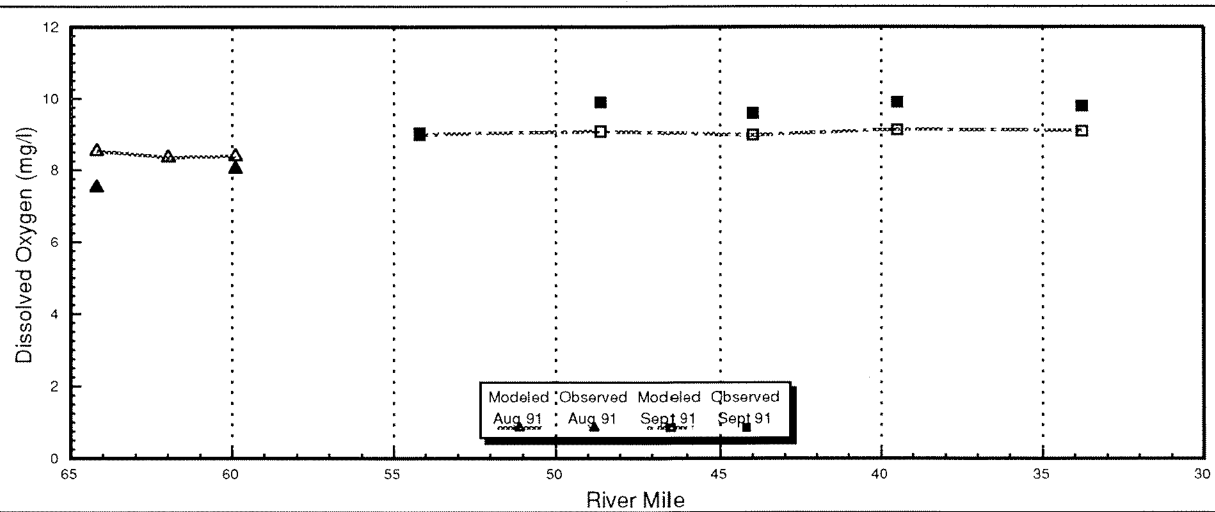


Figure 4.8 Dissolved Oxygen Verification Results

5. Total Maximum Daily Load Analysis

5.1 TMDL Strategy

5.1.1 Regulatory Approach

Ecology uses two approaches to control the discharge of pollutants to surface waters. The technology-based approach requires that wastes be provided with "all known available and reasonable methods . . . to prevent and control the pollution of the waters of the state" (RCW 90.48.010). For point sources, the "AKART" requirement may be specified under federal regulation (such as secondary treatment, or BPT/BAT/BCT), under state regulations or guidelines, or on a case-by-case basis through the submittal and review of an engineering report.

The technology-based AKART requirement for nonpoint sources consists of the application of enforceable best management practices (BMPs). BMPs usually must be selected individually for each situation. However, many efforts have been made to define a variety of possible BMP methods for categories of sources, including the Puget Sound Stormwater Manual, Section 6217 of the Coastal Zone Reauthorization Amendments of 1990 (CZARA), the Forest Practice Rules, and development of farm plans by the U.S. Soil Conservation Service.

The second approach is the water quality-based approach. As described earlier, the Clean Water Act requires that water bodies that do not meet water quality standards, even after the full application of technology-based pollution controls, must be placed on the state's Section 303(d) list. All water bodies on the Section 303(d) list must undergo an analysis for the maximum pollutant loading capacity (LC) of the water body that will allow the water quality standards to be met.

Once the LC is established, the total loading available is allocated to different areas or sources. LAs are set for background/natural sources and scientific uncertainty. If capacity remains, Waste Load Allocations (WLAs) may be set for permitted point sources, Load Allocations (LAs) for nonpoint sources, or loading may be set aside as a reserve for future growth. The sum of LAs and WLAs that will stay within the loading capacity and allow the water quality standards to be met, and that have been determined through a public process, is termed the "Total Maximum Daily Load," or TMDL.

If information is limited and future activities are dependent on the outcome of initial efforts, the TMDL may be defined as a "phased TMDL." A phased TMDL is typically applied to a situation dominated by nonpoint sources, where the results of BMPs may be uncertain and more detailed study may be needed. In this case, follow-up monitoring to track the effectiveness of the TMDL is essential.

The Chehalis River model provides the tool to analyze the LC and possible TMDL scenarios. The analysis used for this study was to first run the Chehalis River model for existing critical conditions: all flows at 7Q10 critical low flow, all sources at maximum pollutant and minimum DO loading, and all instream parameters such as temperature at reasonable worst-case levels. Separate analyses were made of summer conditions (late July) and fall conditions (late September). Model simulations were then run with tributary and other nonpoint source loading to the river reduced, assuming the maximum likely benefits of nonpoint source controls, and assuming point source ammonia limitations based on mixing zone considerations. Additional model simulations were then run with reduced nonpoint loading and all point sources removed, as an estimate of background loading levels and DO concentrations. Finally, loading was added back into the background run to determine the LC for different reaches of the river.

5.1.2 Uncertainty and Diurnal Variation

Before analyzing critical conditions and alternative loading scenarios, the element of scientific uncertainty must be considered. The target for any TMDL analysis is the water quality standards. However, prior to accepting the results of the model, the uncertainty of modeling results must be taken into account. Uncertainty in the Chehalis River model comes from many sources, which can be categorized into several key areas: the inability of the model to capture temporal variability, especially diurnal; the inability of the model to capture spatial variability, especially on a scale smaller than the segments; and the quality of the observed data to which the model is compared.

Conservative assumptions that have been made for modeling critical conditions incorporate a portion of modeling uncertainty. Maximum temperatures, 7Q10 low flows, and conservative reductions in nonpoint loading and SOD all help to reduce the possibility of underestimating the impact of pollutants on the Chehalis River.

The Chehalis River model simulates steady-state, daily-averaged conditions. Therefore, the diurnal variation of DO due to productivity must be separately accounted for. Model DO results were reduced by a diurnal range factor of one-half the maximum observed diurnal range. The diurnal range factor accounts for difference between the average DO simulated by the model and the minimum DO which is the critical condition of interest. Different diurnal range factors were applied to the upper study area, Centralia reach waters, and the lower study area, and were calculated separately for the summer and fall months.

In the upper river (segments 23 to 37), the maximum observed DO range was 1.7 mg/L, so a daily range factor of 0.8 mg/L was used for the summer. A maximum range of 1.4 was observed in September, so a daily range factor of 0.7 was used for the fall.

In the Centralia reach (segments 9 to 22 and 38 to 45), the maximum observed diurnal range in surface waters (not including the DO sag of October 1991) was 3.4 mg/L for the summer months, and 0.7 mg/L in the fall. Therefore, daily range factors of 1.7 and 0.4 were applied to Centralia reach model results the summer and fall, respectively.

In the lower river (segments 1 to 8), the maximum observed diurnal DO range in the summer was 3.4 mg/L, and 2.8 mg/L in early September. Therefore, the modeled DO results were reduced by diurnal range factors of 1.7 mg/L for the summer simulation and 1.4 mg/L for the fall.

5.1.3 Eutrophication and Productivity

Determining the interactions of primary productivity and DO levels is very difficult in the Chehalis River for a number of reasons. The model is based on average steady-state conditions, and the daily diurnal swing cannot be directly modeled. The analysis of data earlier in Section 4 indicated that macrophyte and periphyton growth were the primary sources of primary productivity in the upper and lower stretches of the study area, and also appear to contribute to productivity in the Centralia reach. A strong statistical relationship could not be found between nutrient and chlorophyll *a* survey data.

The WASP5 model does not simulate macrophyte or periphyton productivity. The effect of the diurnal DO swing caused by benthic productivity is taken into consideration in the daily range factor. Phytoplankton productivity was modeled based on nutrient inputs from existing sources, but the overall effect of nutrient levels on the DO in the Chehalis River was not evaluated. Loading capacity for BOD and ammonia were evaluated separately from nutrient considerations.

5.2 Existing Critical Conditions

A number of assumptions were made to simulate existing critical conditions. A flow balance was developed that included calculated or approximated 7Q10 flows for the study area (Appendix Table I.1). Point source discharges were set to the maximum flows based on values provided in NPDES permits.

Point source loading was either set to the maximum permit condition, where provided, or to the maximum concentration observed in the study surveys. All tributaries were also set to the maximum concentrations observed in the surveys. Additional loading sources, where identified in the calibration or verification runs, were set to the maximum loading used in any of the simulations. Boundary conditions were not adjusted. Loading and boundary conditions used in the model are shown in Appendix Table I.2.

The summer and fall input files have identical flows and loads, since potential critical conditions in late September are not appreciably different from the late summer. The photoperiods were set to seasonal values based on late July and late September. Water temperatures were set to critically high values for the season, using the August 1992 temperatures for summer critical conditions, and using an adjusted set of temperatures for late September, proportioned from measured data to meet the critical temperatures at ambient monitoring locations.

Results from the existing critical conditions model simulations are shown for the upper study area, Centralia reach, and lower study area in Figures 5.1, 5.2, and 5.3, respectively; Appendix Tables I.3 and I.4 show results for summer and fall, respectively. The summer simulation resulted in DO that fell below the water quality standard from RM 86.5 to 71.2, in most of the Centralia reach subsurface segments, and from RM 54.2 to 33.8. In the fall, the water quality standards for DO are not expected to be met from RM 79.3 to the RM 59.9, in both surface and subsurface waters. Consequently, load reductions are necessary to ensure that water quality standards will be met under reasonable worst-case conditions.

5.3 Critical Condition with Reduced Loading

As a first step to evaluating the loading capacity of the Chehalis River, the existing critical condition loading was reduced. Appendix Table I.5 presents the loading and boundary conditions for these simulations. Point source ammonia nitrogen was reduced to levels recommended for the protection of toxicity criteria at the edge of the mixing zone (Pickett, 1993a and 1993b). All extra loading sources established by chloride data were set to zero (segments 1, 40, 41, 42, and 45). These reductions would be expected from improved controls on local sources, such as livestock (segments 1 and 45), National Frozen Food land application (segments 40 through 42), and other sources within the Salzer Creek drainage (segment 42).

Nonpoint source controls were incorporated into the model in several ways. All tributaries were set to ammonia nitrogen concentrations of 0.005 mg/L (a nominal value for levels below detection), and to UBOD values of 1.5 mg/L. These concentrations represent minimum levels that should be achievable in the dry season

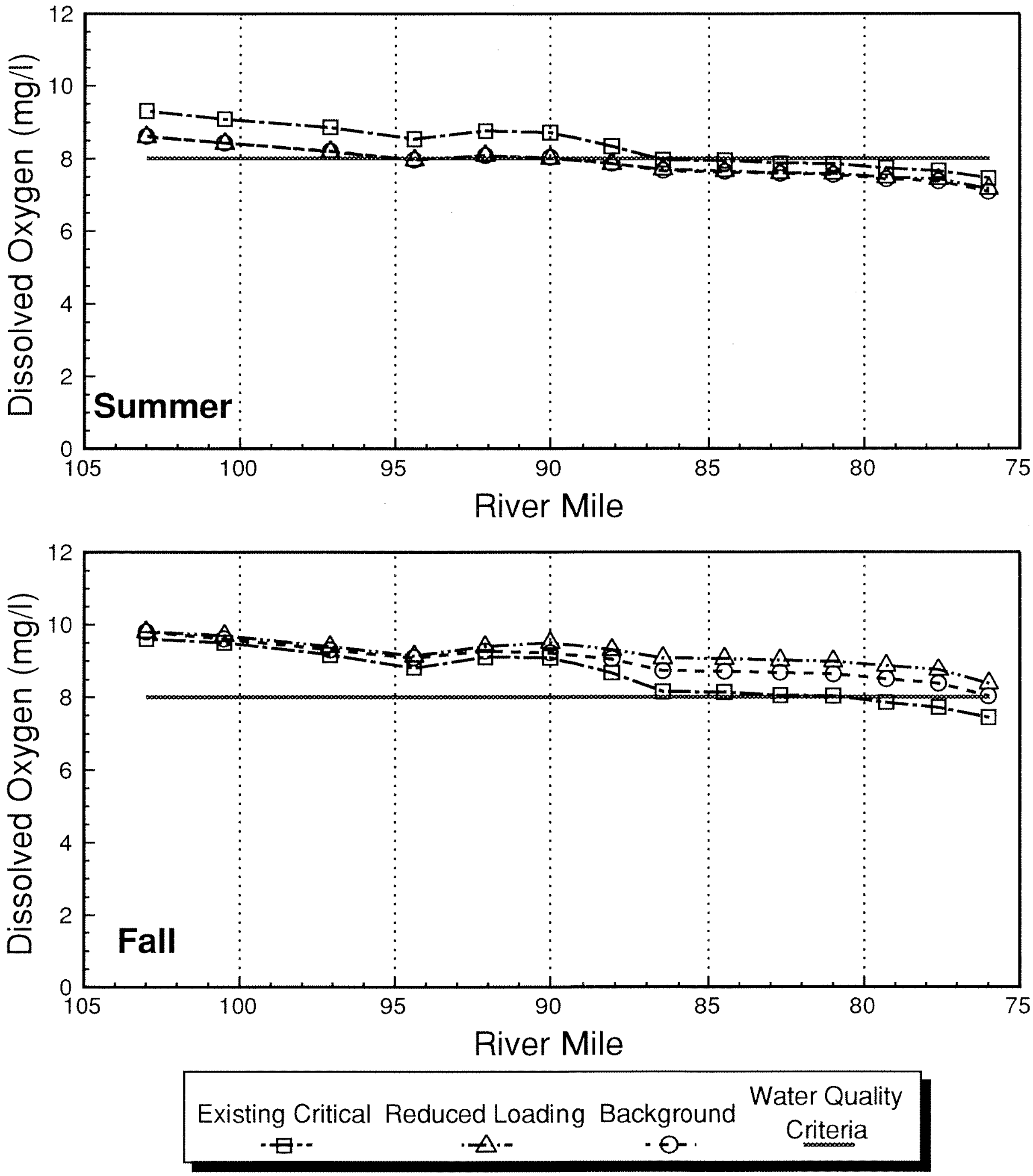


Figure 5.1 Model Results: Existing Critical, Reduced Loading, and Background Conditions - Upper Study Area

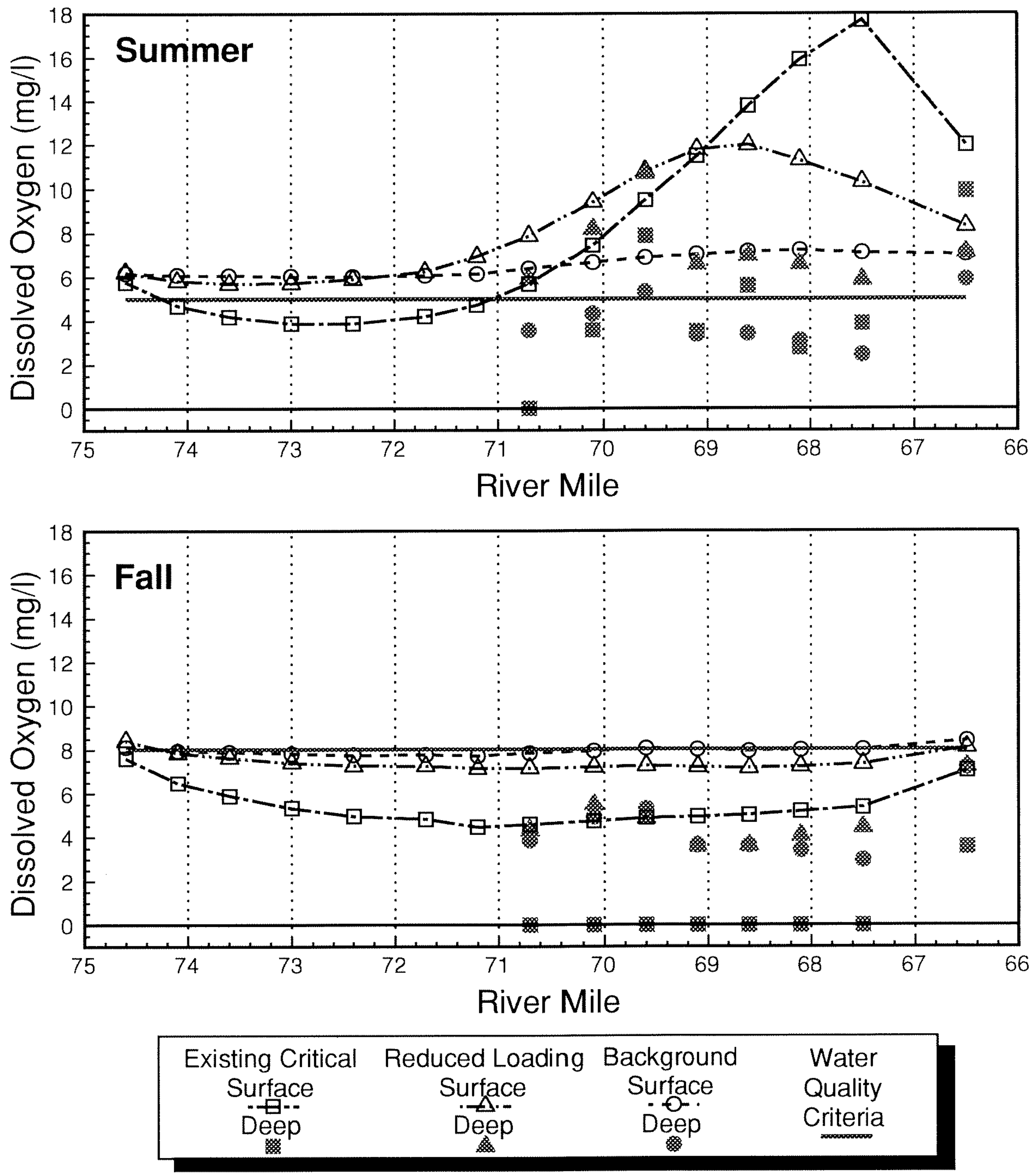


Figure 5.2 Model Results: Existing Critical, Reduced Loading, and Background Conditions - Centralia Reach

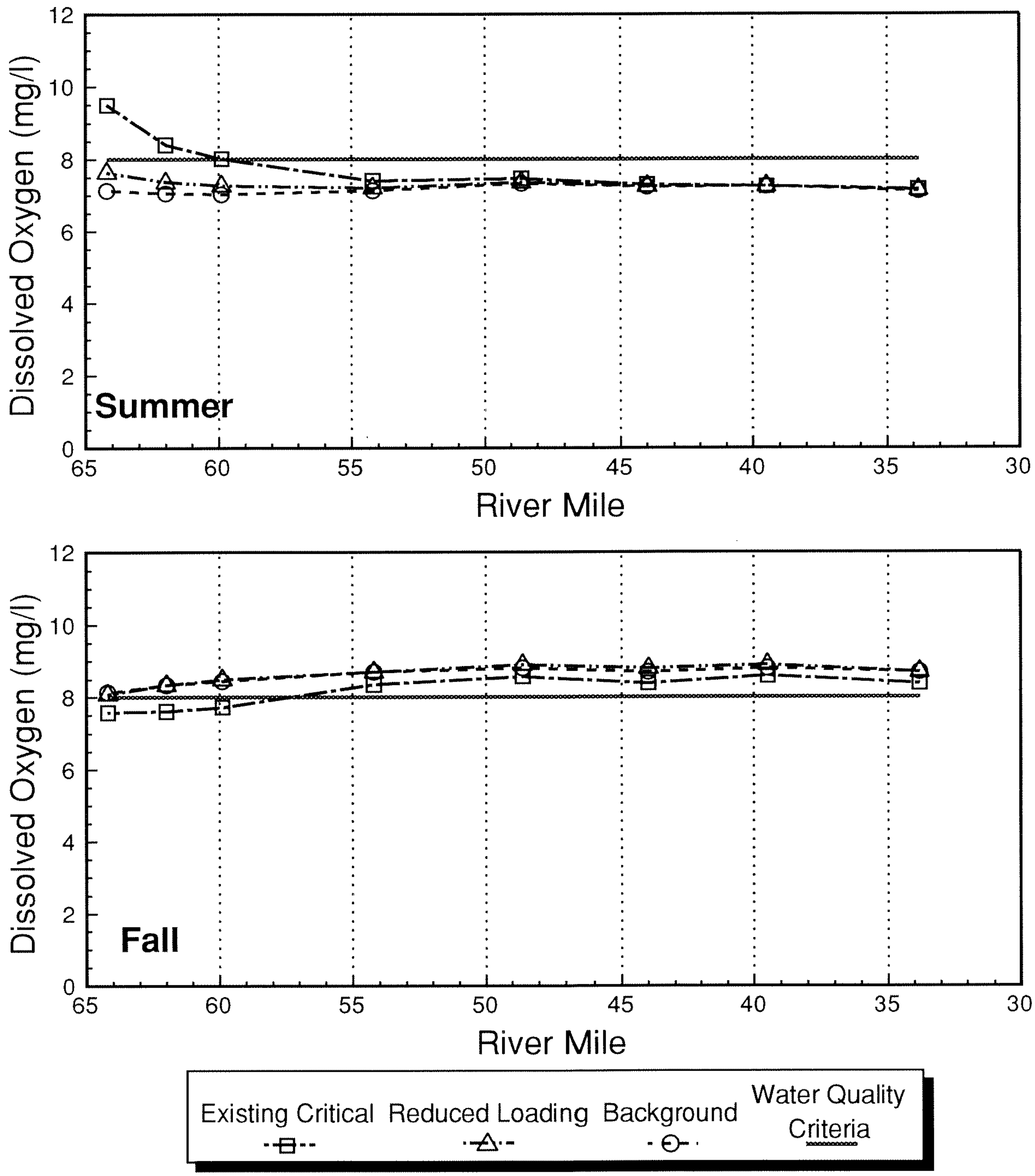


Figure 5.3 Model Results: Existing Critical, Reduced Loading, and Background Conditions - Lower Study Area

with adequate BMPs in place. The DO levels in all tributaries were set to at least 8.0 mg/L, unless the levels were already higher. This assumes the implementation of BMPs for ammonia and BOD will bring all tributaries at least to the water quality standards.

SOD is entered into the model as a fixed parameter, but in reality is typically a function of loading sources and instream biomass. Although review of the literature indicates that several attempts have been made at modeling SOD as a function of sediment and water column physical and chemical characteristics, there are no models of SOD widely accepted or easily available. Therefore, changes to SOD, either due to changes in external loading of oxygen-demanding particulates, or due to changes in phytoplankton biomass caused by nutrient loading changes, cannot be easily estimated or modeled.

To estimate the effects of load reductions, model input values of SOD for the reduced loading analysis (as well as the natural background and TMDL analyses) were reduced by one-half. The effect of implementation of the WLAs and LAs on SOD can be reviewed in the future by modeling or direct measurement, and addressed under a phased TMDL approach. Any additional loading capacity above the water quality standards realized in the future because of the reduction of SOD due to WLA/LA implementation should be considered part of the future growth allocation.

Figures 5.1 through 5.3, and Appendix Tables I.6 and I.7 show the modeling results for summer and fall. In the summer, the Centralia reach with load reductions is expected to meet the DO criterion of 5.0 mg/L. However, during summer, DO is still projected to fall below the 8.0 mg/L criterion in upper study area (at RM 94.4 and from RM 88.1 to 76.0) and in the lower study area (RM 64.2 to 33.8). In the fall, DO is expected to be below the water quality criterion of 8.0 mg/L in the Centralia reach from RM 74.1 downstream to 67.5, including the subsurface segments. Therefore, additional load reductions must be evaluated.

5.4 Background Conditions

As a first step beyond the reduced loading described in the last analysis, all point source loading was removed from the model input file (the Pe Ell, Darigold, Chehalis, Centralia, and Sea Fresh Fish Company discharges). This was considered to be an estimate of background loading, that is, the loading with nonpoint and point sources having minimal effect. No attempt was made to model "natural" conditions (entirely without human influence), since the study area is large and complex and the impacts of human activities wide-ranging. Factors that could not be evaluated in the TMDL study include: water withdrawals from the river or from ground water near the river; the natural chemistry of the ground water entering the river; and the true natural background levels of SOD and of all parameters in the tributaries. Therefore, this background conditions simulation can be considered the current best estimate of natural conditions for the purpose of applying the antidegradation policy of the water quality standards (see Section 1.3).

Figures 5.1 through 5.3, and Appendix Tables I.8 and I.9 show the results of the background conditions simulation for summer and fall. In the upper study area, DO levels changed only slightly from the reduced loading conditions, and still did not meet the water quality standards in the same areas in the summer. In the Centralia reach, the simulated fall water quality improved both in surface and subsurface waters over the quality in the reduced loading simulation. However, the DO still did not meet the 8.0 mg/L criterion from RM 74.1 to 68.1, and in the subsurface segments.

In the lower study area, DO was still projected to be below the water quality criterion in the summer. Although the model results indicate less DO without loading than with loading, this result should not be given much credence. The model is predicting increased daily average DO from increased productivity when nutrient loading is higher, but is not accounting for lower morning DO due to a wider range of diurnal variation. The important point is that even under background conditions, the water quality standards for DO are still not expected to be met.

Because background conditions model runs predicted DO below the criteria in some areas, and the modeled background conditions can be considered a best estimate of natural conditions, background must be treated as the criteria in these areas. In practical terms, this means that the loading capacity of the Chehalis River in these areas will not produce a significant degradation of the DO in the river under critical conditions.

For the purposes of the modeling in this study, a DO decrease of 0.2 mg/L was chosen as a guideline for significant decrease. This value was chosen because, although computer results can give an answer to many decimal places, the minimum accuracy of DO measurement is on the order of magnitude of 0.1. The manufacturer's specification for the DS3 and S2 meters is 0.2 mg/L, which is also the approximate accuracy found in this study when the meter results were corrected to field Winkler verification measurements. Defining insignificant DO depletion as no more than 0.2 mg/L also has precedent in the marine DO standards of WAC 173-201A and has been approved in NPDES permits to protect Washington's freshwater standards (e.g., EPA Permit No. ID-000116-3; Potlatch Corporation, Lewiston, Idaho; discharge to the Snake River at the state line).

For the loading capacity analysis, loading will be added to the system until the water quality criteria are just met in all locations where background conditions are 0.2 mg/L or more above the criteria, and until a degradation of no more than 0.2 mg/L is predicted where background conditions are below or within 0.2 mg/L of the criteria.

5.5 TMDL Loading Capacity Alternatives

5.5.1 Loading Capacity Strategy

To determine the loading capacity of the Chehalis River, critical loading was restored sequentially from downstream to upstream. Two alternatives were considered based on possible decisions about where discharges would be removed.

For both alternatives, tributary DO levels were maintained at a minimum of 8.0 mg/L. In addition, both alternatives allowed loading from the proposed Grand Mound WTP to be included. Effluent flows at the Grand Mound WTP were set to 1.2 cfs, which is the proposed design flow for the maximum month (TCEH, 1989). Loading for ammonia for the Grand Mound WTP was set to 25 mg/L, BOD was set to 45 mg/L, and the other parameters were set at flow-proportioned averages of loading from the Chehalis and Centralia WTPs. It was also possible to return in full the Sea Fresh Fish Company discharge and existing loading to tributaries from Porter to below the Skookumchuck River.

From Mellen Street upstream to the Newaukum River no capacity exists for a discharge of ammonia or BOD without a significant degradation (0.2 mg/L or more) of DO below the water quality criteria. Therefore, no point or nonpoint source loading above background can be allocated in the Centralia reach.

Loading capacity exists for the Pe Ell WTP discharge at its current permit levels. Very little additional capacity is available. Therefore, all tributaries from the Skookumchuck River upstream, including the Chehalis River headwaters from Pe Ell upstream, would need to be allocated only background levels of ammonia and BOD.

5.5.2 Loading Capacity Alternative #1

For Alternative #1, the final loading levels selected are shown in Appendix Table I.10, and the model results are shown in Figures 5.4 through 5.6, and in Appendix Tables I.11 and I.12. The assumption made for this alternative was that the Chehalis and Darigold WTPs would remove their discharge from the river by finding an alternative disposal method, such as irrigation or industrial re-use, during the dry season TMDL period.

Centralia would continue to use its existing discharge location, but at reduced loading. Centralia was set to 1.5 mg/L ammonia, based on mixing considerations, and 15 mg/L BOD, using the maximum design flow. These loading levels were the maximum that could be assimilated under critical conditions without a violation of the water quality criteria.

5.5.3 Loading Capacity Alternative #2

Alternative #2 is similar to #1 with only a few changes. The assumption made for Alternative #2 is that Centralia, Chehalis, and Darigold WTPs establish a combined outfall below the Skookumchuck River near Borst Park. This would allow a higher ammonia concentration for the discharge, based on mixing calculations. The revised ammonia concentration would be 6 mg-N/L using the combined existing design flows. The maximum capacity for BOD of the combined discharges was found to be 288.2 lb/day. The loading used is shown in Appendix Table I.13, and the model results are shown in Figures 5.4 through 5.6, and in Appendix Tables I.14 and I.15.

Except for how the Centralia, Chehalis, and Darigold discharges are handled, the loading for the two alternatives are the same. The trade-off between the two proposed alternatives would be between the amount of ammonia allowed in the effluent based on toxicity considerations, the total design flow, and the BOD concentration that would meet the loading limits. Many other possible alternatives exist, but these are beyond the scope of analysis in this report. As economic and technological feasibility are explored, other alternative TMDL strategies can be analyzed with the Chehalis River model. However, all alternatives will be based on the amount and location of discharges from Mellen Street downstream. The loading restrictions from Mellen Street upstream allow very little flexibility for pollutant sources in this area.

5.6 Mainstem Chehalis River TMDLs for Ammonia and CBOD

A TMDL is recommended for ammonia nitrogen and CBOD in the mainstem Chehalis River upstream of Porter (RM 33.8). The exact TMDL values depend on the relative loading levels of ammonia and CBOD, and on the location of loading sources. Therefore, modified values for the TMDL may arise as future scenarios are evaluated. Based on this study, several principles will need to be applied to any alternative TMDL. The two specific alternatives described above are proposed here as two possible TMDL alternatives (Tables 5.1 and 5.2). The model results, which show UBOD, have been converted to BOD_5 using an ultimate/five-day ratio of 2:1.

The TMDL for ammonia nitrogen and CBOD is recommended from May 1 to October 31 of each year. This period of time is based on the evaluation of temperature and flow data, both from this study and from the ambient data base. From November 1 to April 30, the combination of low temperatures and high flows produce a negligible risk that the water quality standards for DO will be exceeded. From May through October during this study, DO levels fell below the water quality standards in the Chehalis River.

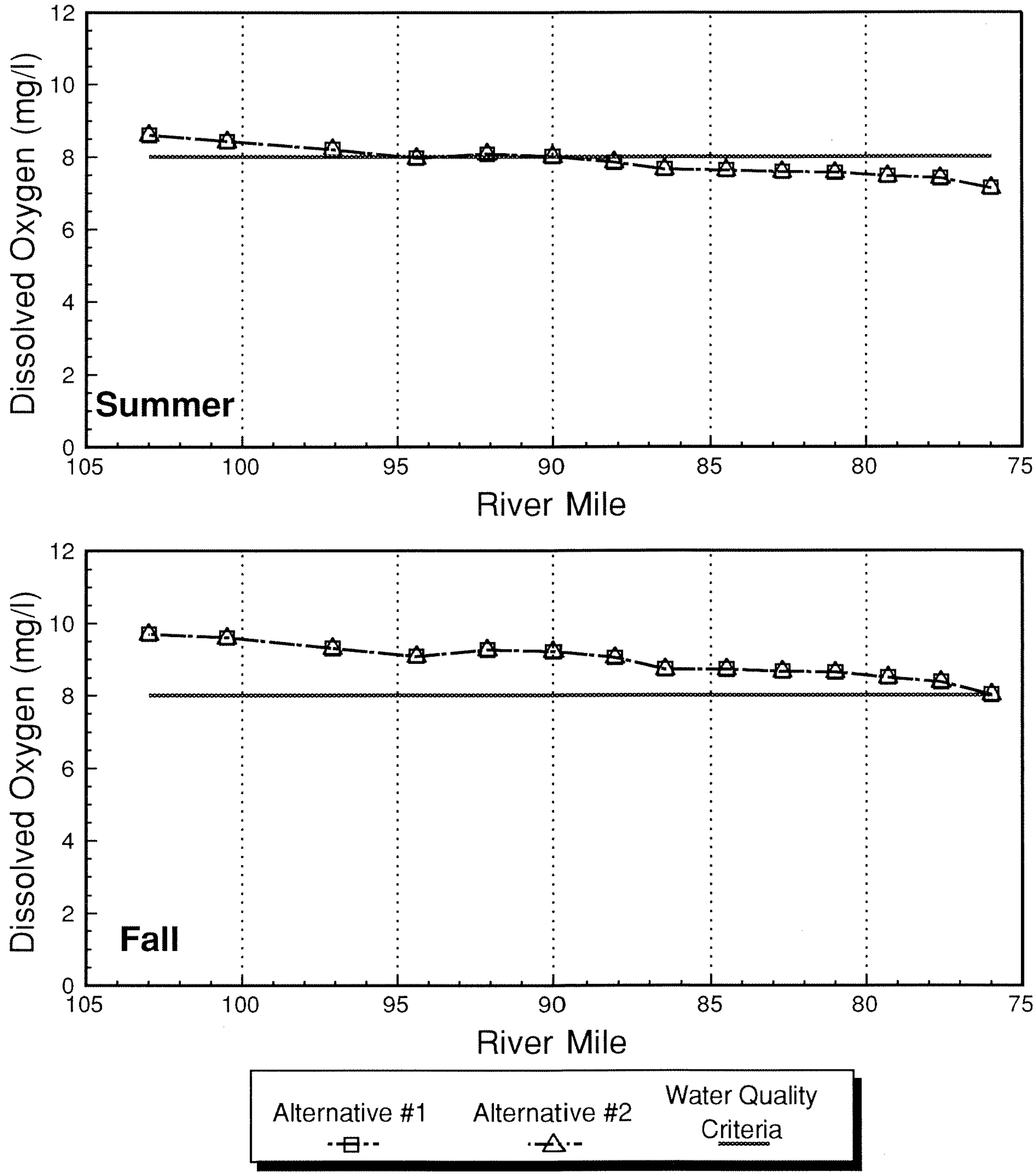


Figure 5.4 Model Results: Loading Capacity, Alternatives #1 and #2 - Upper Study Area

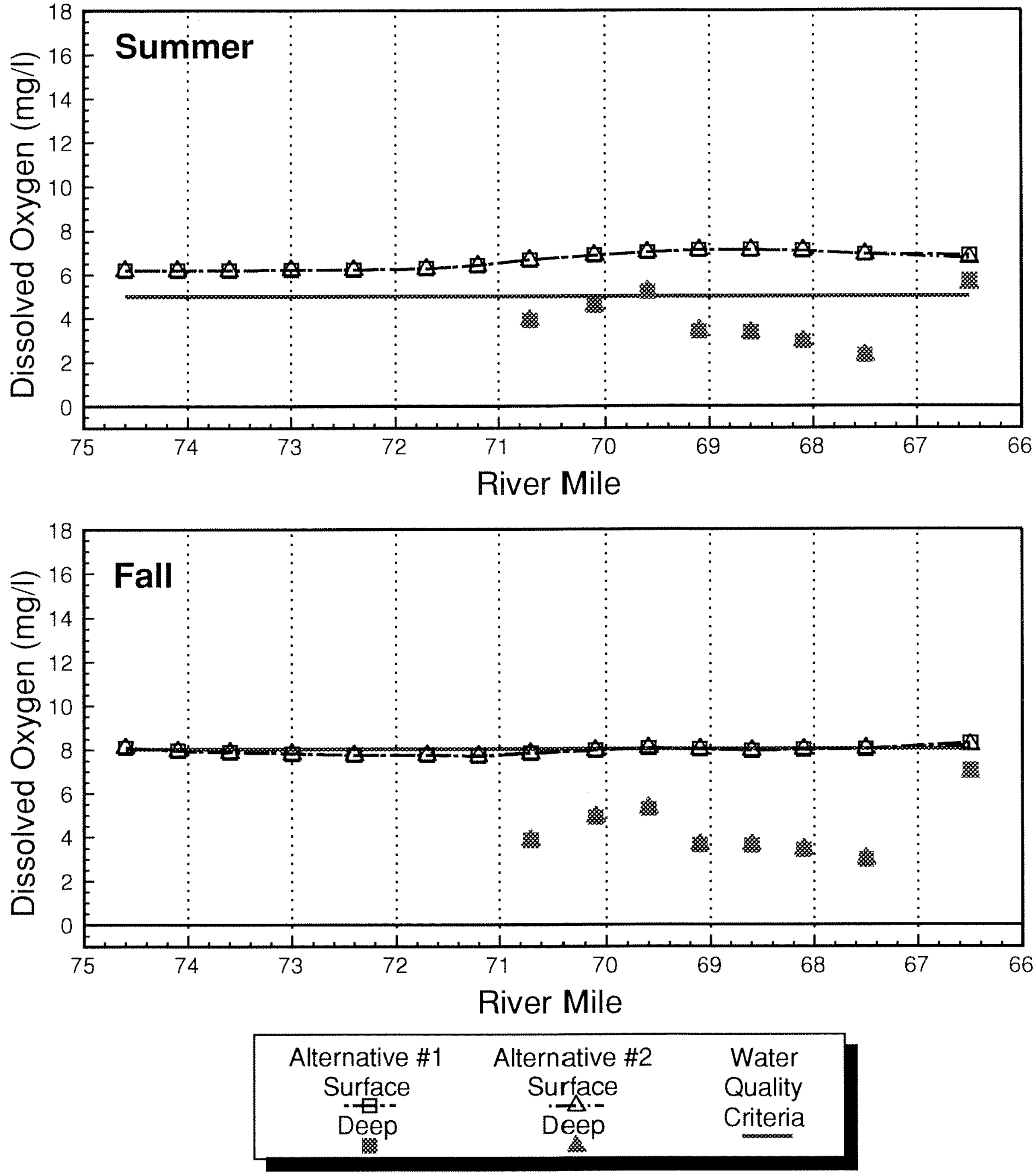


Figure 5.5 Model Results: Loading Capacity, Alternatives #1 and #2 - Centralia Reach

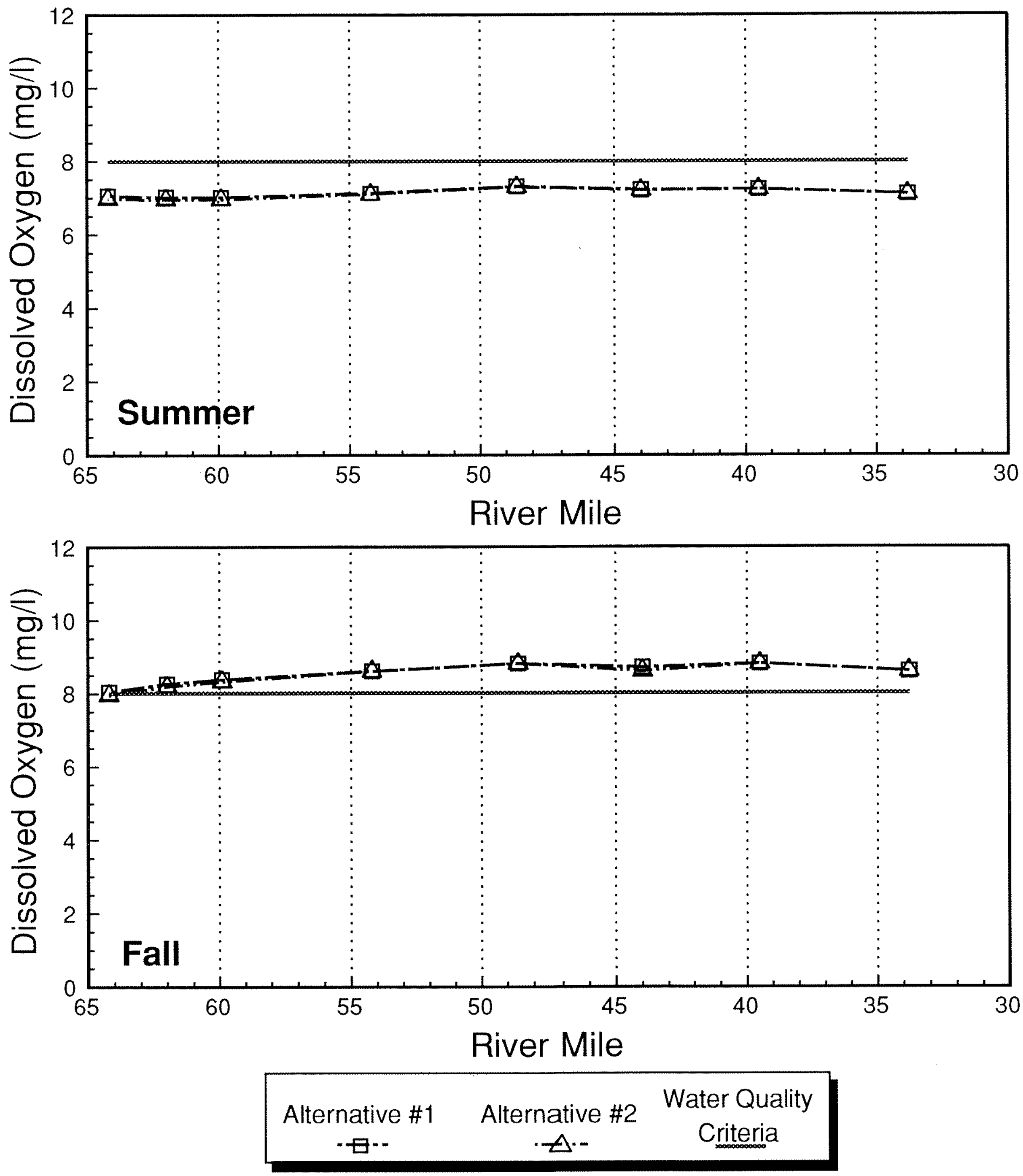


Figure 5.6 Model Results: Loading Capacity, Alternatives #1 and #2 - Lower Study Area

Table 5.1 Ammonia Allocation, TMDL, and Loading Capacity

		Alternative #1						Alternative #2					
RM		Allocation				Loading Cap.		Allocation				Loading Cap.	
Code	Location	Bckgd	WLA	LA	TMDL	Summ	Fall	Bckgd	WLA	LA	TMDL	Summ	Fall
106.3	Chehalis River Headwaters	0.54		0.00				0.54		0.00			
105.5	Pe Ell WTP		9.69						9.69				
100.2	Elk Creek	0.19		0.00				0.19		0.00			
106.3-97.9	Ground Water & Misc. Sources	5.94		0.00				5.94		0.00			
97.9	CR @ Dryad				16.4	12.4	13.2				16.4	12.4	13.2
88.0	South Fork Chehalis River	0.18		0.00				0.18		0.00			
84.4	Bunker Creek	0.00		0.00				0.00		0.00			
78.0	Stearns Creek	0.03		0.00				0.03		0.00			
97.9-77.6	Ground Water & Misc. Sources	7.04		0.00				7.04		0.00			
77.6	CR @ SR 603 Br nr Claquato				23.6	4.0	8.1				23.6	4.0	8.0
75.2	Newaukum River	0.58		0.00				0.58		0.00			
74.5	Dillenbaugh Creek	0.01		0.00				0.01		0.00			
74.4	Darigold WTP (Existing)		0.00						0.00				
74.3	Chehalis WTP (Existing)		0.00						0.00				
69.2	Salzer Creek	0.00		0.00				0.00		0.00			
77.6-67.5	Ground Water & Misc. Sources	4.67		0.00				4.67		0.00			
67.5	CR @ Centralia (Mellen St Br)				28.9	3.8	7.8				28.9	3.8	4.6
66.8	Centralia WTP (Existing)		54.33						0.00				
66.9	Skookumchuck R nr mouth	1.23		0.00				1.23		0.00			
66.8	Centralia WTP (Alternative)		0.00						213.2				
66.8	Darigold WTP (Alternative)		0.00						109.8				
66.8	Chehalis WTP (Alternative)		0.00						22.62				
61.8	Lincoln Creek	0.01		0.17				0.01		0.17			
67.5-59.9	Ground Water & Misc. Sources	0.17		0.00				0.17		0.00			
59.9	CR nr Grand Mnd (Prather Rd)				84.8	36.0	58.9				376.2	212.5	269.8
58.2	Grand Mound WTP		161.54						161.54				
55.2	Scatter Creek	0.02		0.13				0.02		0.13			
51.5	Independence Creek	0.01		0.09				0.01		0.09			
47.0	Black River	0.81		6.78				0.81		6.78			
46.6	Sea Fresh Fish Co.		3.28						3.28				
44.9	Garrard Creek	0.05		0.22				0.05		0.22			
39.4	Rock Creek	0.04		0.00				0.04		0.00			
38.8	Cedar Creek	0.03		0.29				0.03		0.29			
59.9-33.8	Ground Water & Misc. Sources	1.25		7.44				1.25		7.44			
33.8	CR @ Porter (Porter Rd Br)				266.8	115.0	166.1				558.1	205.4	299.9

(Loading in pounds/day Ammonia as Nitrogen)

Table 5.2 CBOD Allocation, TMDL and Loading Capacity

RM		Alternative #1						Alternative #2					
		Allocation				Loading Cap.		Allocation				Loading Cap.	
Code	Location	Bckgd	WLA	LA	TMDL	Summ	Fall	Bckgd	WLA	LA	TMDL	Summ	Fall
106.3	Chehalis River Headwaters	80.8		0.0				80.8		0.0			
105.5	Pe Ell WTP		48.5						48.5				
100.2	Elk Creek	28.3		0.0				28.3		0.0			
106.3-97.9	Ground Water & Misc. Sources	18.6		0.0				18.6		0.0			
97.9	CR @ Dryad				176	211	209				176	211	209
88.0	South Fork Chehalis River	27.1		0.0				27.1		0.0			
84.4	Bunker Creek	0.4		0.0				0.4		0.0			
78.0	Stearns Creek	4.1		0.0				4.1		0.0			
97.9-77.6	Ground Water & Misc. Sources	28.7		0.0				28.7		0.0			
77.6	CR @ SR 603 Br nr Claquato				236	165	116				236	166	117
75.2	Newaukum River	86.9		0.0				86.9		0.0			
74.5	Dillenbaugh Creek	1.2		0.0				1.2		0.0			
74.4	Darigold WTP (Existing)		0.0						0.0				
74.3	Chehalis WTP (Existing)		0.0						0.0				
69.2	Salzer Creek	1.8		0.0				1.8		0.0			
77.6-67.5	Ground Water & Misc. Sources	33.0		0.0				33.0		0.0			
67.5	CR @ Centralia (Mellen St Br)				359	338	98				359	336	76
66.8	Centralia WTP (Existing)		533.1						0.0				
66.9	Skookumchuck R nr mouth	184.2		0.0				184.2		0.0			
66.8	Centralia WTP (Alternative)		0.0					0.0	177.7	0.0			
66.8	Darigold WTP (Alternative)		0.0					0.0	91.6	0.0			
66.8	Chehalis WTP (Alternative)		0.0					0.0	18.9	0.0			
61.8	Lincoln Creek	2.0		3.0				2.0		3.0			
67.5-59.9	Ground Water & Misc. Sources	8.5		0.0				8.5		0.0			
59.9	CR nr Grand Mnd (Prather Rd)				1090	1222	967				845	1462	1262
58.2	Grand Mound WTP		290.8						290.8				
55.2	Scatter Creek	2.9		3.0				2.9		3.0			
51.5	Independence Creek	0.8		1.2				0.8		1.2			
47.0	Black River	121.2		56.5				121.2		56.5			
46.6	Sea Fresh Fish Co.		121.2						121.2				
44.9	Garrard Creek	7.3		10.7				7.3		10.7			
39.4	Rock Creek	6.5		9.5				6.5		9.5			
38.8	Cedar Creek	48.1		16.0				48.1		16.0			
59.9-33.8	Ground Water & Misc. Sources	62.6		22.2				62.6		22.2			
33.8	CR @ Porter (Porter Rd Br)				1870	1778	1639				1625	1891	1826

(Loading in pounds/day as BOD5)

The TMDL is being defined for five specific locations: at the Dryad bridge (RM 97.9), at the State Route 603 bridge near Claquato (RM 77.6), at the Mellen Street bridge in Centralia (RM 67.5), at the Prather Road Bridge near Grand Mound (RM 59.9), and at the Porter bridge (RM 33.8). These locations are at the boundaries of reaches with similar characteristics, and several coincide with existing or historical ambient water quality and flow monitoring stations.

The recommended ammonia TMDLs (Table 5.1) for Alternative #1 (lbs-N/day) are 16.4 at Dryad, 23.6 at Claquato, 28.9 at Centralia, 84.8 at Grand Mound, and 266.8 at Porter. Under Alternative #2, the ammonia TMDLs are the same, except that Grand Mound is 376.2 lb-N/day, and Porter is 558.1 lb-N/day. The increase in Alternative #2 reflects the effect of relocating the three WTPs from the critical Centralia reach to a downstream reach where the loading capacity is greater.

The recommended CBOD TMDLs (Table 5.2) for Alternative #1 (lb-BOD_5/day) are 176 at Dryad, 236 at Claquato, 359 at Centralia, 1090 at Grand Mound, and 1870 at Porter. Under Alternative #2, the CBOD TMDLs are the same, except that Grand Mound and Porter decrease to 845 and 1,625 lb-BOD_5/day, respectively. This decrease accounts for the increased nitrogenous BOD which would be expected from the relocated combined ammonia discharge of the three WTPs.

Tables 5.1 and 5.2 also show the instream loading capacity as predicted by the Chehalis River model. These values are generally lower than the TMDLs, due to loading removed by pumping and by ambient pollutant assimilation. CBOD loading capacity values are sometimes higher than the TMDLs due to internal BOD generation by phytoplankton growth. Loading capacity also varies by season due to differences in temperature and light that influence degradation rates and phytoplankton growth.

The TMDL for protecting DO in the Chehalis River is proposed as a "phased TMDL." The phased TMDL approach is used when significant uncertainty exists and future information may produce changes in the TMDL. The uncertainty that exists in the Chehalis River TMDL comes from several sources:

- Background conditions assume that implementation of Best Management Practices for nonpoint sources will produce tributary ammonia nitrogen concentrations below detection, UBOD concentrations of 1.5 mg/L and DO concentrations of at least 8.0 mg/L. Site-specific information is very limited on the extent of nonpoint problems and the methods that will effectively reduce pollutant loading. The long-term effectiveness of BMP implementation needs to be evaluated to have a better estimate of the potential for water quality improvement.

- Much of the lower and upper study area are dominated by macrophyte and periphyton productivity. The relationship between nutrients, biomass, and DO is not understood and was not addressed by this study. Further work in this area is needed to improve the predictive capabilities of DO modeling.

- The SOD in the Chehalis River, especially in the Centralia reach, is estimated from calibration of the model. The relationship of phytoplankton and nutrients to SOD from settled biomass is unknown, as is the relationship of tributary nonpoint sources to SOD. Improvements in nonpoint source loading to the water column may also reduce SOD levels, but this is not certain. Future work may better quantify SOD, evaluate its sources, and perhaps even allow modeling of it.

- High temperatures reduce the capacity of the Chehalis River to assimilate ammonia and CBOD without degrading DO. A model simulation was run with temperatures set to a maximum of 18°C, and DO levels improved. Successful implementation of a phased TMDL for temperature may allow for increased loading of ammonia and CBOD.

Under the phased TMDL approach, allocations would be established and a program developed to implement the TMDL. A set of phased activities would be defined with evaluations made of improvements due to the activities. For nonpoint sources, this would entail BMPs being implemented over time on a priority basis as resources allow. For point sources, a schedule could be developed where activities were planned for phased implementation, with the TMDL revisited at key points in the schedule to determine if additional activities were needed, or if the TMDL could be revised based on new information. Implementation of a phased TMDL will be discussed in more detail later.

5.7 Other TMDLs

A number of tributaries in the study area have also been identified as having DO or fecal coliform bacteria violating the water quality criteria, and therefore have been proposed for the inclusion on the 1994 Section 303(d) list. The corrective actions identified in this report to reduce ammonia and CBOD loading in these tributaries are expected to also increase DO and reduce bacteria levels. Therefore the TMDL proposed for the mainstem essentially addresses potential TMDL requirements for each of the tributaries that have been proposed for the Section 303(d) list due to DO and fecal coliform impairment.

As discussed earlier in Section 3, temperature has been identified as exceeding water quality criteria in the mainstem Chehalis River and many of its tributaries. These water bodies have been proposed for inclusion on the 1994 Section 303(d) list as water quality-limited for temperature. The USFWS habitat degradation survey identified loss of riparian canopy in areas where higher temperature was documented. A phased TMDL is recommended for temperature, whereby replanting and protection of riparian canopy is implemented in those areas of the basin where temperature is an identified problem.

6. Wasteload and Load Allocations

6.1 Recommended Allocations

The allocation of loading within the TMDL is intimately tied to the loading capacity analysis that the TMDL is based on. The final allocations will also be a result of the most economically, socially, and technologically feasible solutions that result from a public process that includes: the USEPA; tribes; other federal, state, and local government agencies; regulated entities; environmental and economic development interests; and the general public. Therefore, the allocations presented in this report are preliminary recommendations, and will likely be modified as a result of the public process.

The recommended allocations are shown in Tables 5.1 and 5.2. Regardless of the final distribution of the allocations or possible modifications due to the phased approach, the significant characteristics of the Chehalis River that are the basis of the recommended TMDL and allocations must be taken into account in any scenario.

The LA for scientific uncertainty is not specified in pounds per day, because it has been included by the use of conservative assumptions, and by estimating the minimum DO using a daily range factor. Therefore, the allocations discussed in this section already have scientific uncertainty factored in.

The Centralia reach does not meet the water quality criteria for DO under critical conditions, even with loading reduced to background conditions. This reach is very sensitive to any loading, and the model predicts DO degradation with even very small increases in BOD loading. Therefore no WLAs or LAs above background are recommended for any part of this reach, from the Mellen Street bridge in Centralia (RM 67.5) to the State Route 6 bridge near Chehalis (RM 74.6). This includes two tributaries, Salzer Creek and Dillenbaugh Creek. This recommendation affects several activities along the river:

- No Wasteload Allocation is recommended for the Chehalis and Darigold WTPs during the TMDL period (May through October). These two dischargers should begin planning for alternatives for their wastewater disposal during the dry season.

- No Load Allocation is provided for nonpoint sources. This applies to: livestock impacts on the mainstem and on Salzer and Dillenbaugh Creeks and their tributaries; activities that affect ground water quality where the Chehalis River or its tributaries are downgradient; stormwater runoff from urban areas, clean-up sites, and agricultural activities; and poor waste handling activities that result in the discharge of waste to the Centralia reach or its tributaries. The LAs recommended for Salzer and Dillenbaugh Creeks are based on the estimated background concentrations of ammonia and CBOD if BMPs were adequately implemented.

No LAs are recommended for future growth in the Centralia reach. Although the TMDL is proposed as a phased TMDL, due to the sensitivity and naturally low DO levels of this reach, no allocations are anticipated to be available in the future. Given the current tools available for modeling and the complexity and natural variability of the Chehalis River in the Centralia reach, additional data collection and modeling efforts are not likely to significantly reduce the scientific uncertainty applied to this reach.

The Centralia reach is sensitive to loading from as far upstream as Pe Ell. Capacity exists to allow a WLA for the Pe Ell WTP at current design discharge levels. The model predicts very little capacity beyond the WLA for Pe Ell. Therefore, no LAs above background are recommended for the Chehalis River and its tributaries from the Newaukum River upstream, and no LA is recommended for future growth. The recommended LAs for these tributaries are based on the estimated background concentrations of ammonia and CBOD if BMPs are adequately implemented. Since the TMDL is proposed as a phased TMDL, revisions to the TMDL in the future may allow LAs above background for some tributaries or for future growth.

The two alternative allocations schemes presented in this report assume that the most likely discharge locations for the Centralia, Chehalis, and Darigold WTPs will be either be just upstream or downstream of the Skookumchuck River. Therefore, WLAs were offered to the fullest extent possible within the loading capacity, and no LA above background is recommended for the Skookumchuck River. If a combined outfall is proposed farther downstream (for example, at the Galvin Road bridge or combined with the Grand Mound outfall), then an LA would be available for the Skookumchuck River based on existing pollutant loading levels.

Ample loading capacity appears to exist downstream of the Skookumchuck River to allow a WLA for the proposed Grand Mound WTP and LAs for the mainstem and tributaries at their current levels. However, some of the tributaries do not meet water quality standards for DO and fecal coliform, and therefore may still need pollutant load reductions. No LA is offered for future growth for two reasons: the allocation would depend on the pollutant make-up of the source, and therefore would require separate analysis; and the effect of nutrient loading on the macrophyte and periphyton productivity of this part of the river is unknown, and should be addressed as part of the phased TMDL before additional loading is allocated.

The LAs recommended for the tributaries of the Chehalis River would be applied at the downstream sampling station of each tributary. Loading sources in the basin could be acceptable if the loading at the mouth was still within the LA. Thus, for example, capacity may be available within the Skookumchuck River basin for existing and proposed discharges, while still meeting the applicable LA. This situation would require a separate analysis.

Small tributaries and ground water loading sources not specifically addressed with an LA would be expected to meet loading levels consistent with the LAs of neighboring tributaries or background ground water quality in the same reach of the river.

7. Implementation and Monitoring

7.1 WLA Implementation

This report recommends that no WLAs be provided from the Mellen Street bridge upstream. Clearly, removing the existing Chehalis and Darigold discharges from the river in the May through October dry season will have major impacts on these dischargers. Implementation of this recommendation will need to be a carefully thought-out process that will include planning, engineering, obtaining inter-government agreements, and applying for and receiving grants and loans. The concerns of other programs and jurisdictions will have to be addressed (e.g., Water Resources Program concerns over changes in river flows due to changes in permitted discharge locations). The best solution must be found that addresses the problems identified in this study, anticipates future problems, and doesn't create any new problems.

No specific schedule is proposed here for implementation of the WLAs. A schedule should be established that allows steady, reasonable progress toward the goal of full implementation. It may be reasonable to allow a five-year watershed cycle for planning before actions are finalized. The final schedule will be arrived at after discussions with the permitted dischargers, public comment, and EPA approval.

A number of possible options may be available to meet the requirements of the TMDL and WLA. Alternative #1 assumes that Chehalis and Darigold will be able to remove their discharge for the dry season by industrial or agricultural reuse of the wastewater. Possible options available could include golf course irrigation, industrial supply water for the Chehalis Industrial Park, or cooling water for a recently proposed power plant.

Alternative #2 envisions a combined outfall for Centralia, Chehalis, and Darigold. The assumed location for this alternative was Borst Park, just downstream of the Skookumchuck River. This option takes advantage of the increased flows in this reach for mixing and dilution. Clearly other locations farther downstream may be more feasible, such as in the Fords Prairie area or combined with Grand Mound outfall. Other likely options can be modeled and a revised TMDL and allocations evaluated for additional alternatives.

7.2 LA Implementation

Table 7.1 summarizes the nonpoint sources in the Chehalis basin study area. The difference between existing conditions and the proposed LA for both ammonia and CBOD are calculated, as well as the associated percent reduction that each LA represents relative to existing conditions. Each tributary is identified for whether it is

Table 7.1 Nonpoint Load Reductions and Priorities

RM		Ammonia-N Loading (lb/day)				BOD5 Loading (lb/day)				DO-	
Code	Location	Total LA	Existing	Diff.	% Red.	Total LA	Existing	Diff.	% Red.	limited?	Priority
106.3	Chehalis R @ Pe Ell	0.54	1.40	0.86	61.4%	80.8	554.6	473.9	85.4%		10
100.2	Elk Creek	0.19	0.68	0.49	72.1%	28.3	130.1	101.8	78.3%		11
88.0	South Fork Chehalis R	0.19	1.24	1.05	84.7%	28.3	43.4	15.1	34.8%	suspect	13
84.4	Bunker Creek	0.00	0.03	0.03	91.0%	0.4	1.5	1.1	73.3%	limited	9
78.0	Stearns Creek	0.03	0.50	0.47	94.0%	4.1	8.9	4.9	54.5%	limited	8
97.9-77.6	Misc. Livestock Impact	Unknown			100.0%	Unknown			100.0%		7
75.2	Newaukum River	0.58	4.52	3.94	87.2%	86.9	110.0	23.2	21.0%	suspect	12
74.5	Dillenbaugh Creek	0.01	0.92	0.91	98.9%	1.2	10.8	9.6	88.8%	limited	4
70.7	Dairy North of Airport	0.00	5.21	5.21	100.0%	0.0	15.6	15.6	100.0%		3
69.2	Salzer Creek	0.00	3.62	3.62	99.9%	1.8	42.9	41.1	95.8%	limited	1
70.1-68.1	NFF/MWM GW	0.00	1.50	1.50	100.0%	0.0	16.9	16.9	100.0%		2
66.9	Skookumchuck R	1.23	6.15	4.92	80.0%	184.6	258.4	73.8	28.6%		14
77.6-66.5	Misc. Livestock Impact	Unknown			100.0%	Unknown			100.0%		5
74.5-66.5	Urban Stormwater	Unknown			100.0%	Unknown			100.0%		6
61.8	Lincoln Creek	0.18	0.18	0.00	0.0%	5.0	5.0	0.0	0.0%	limited	17
55.2	Scatter Creek	0.15	0.15	0.00	0.0%	5.9	5.9	0.0	0.0%	suspect	20
51.5	Independence Creek	0.10	0.10	0.00	0.0%	2.0	2.0	0.0	0.0%	limited	18
47.0	Black River	7.59	7.59	0.00	0.0%	177.7	177.7	0.0	0.0%	limited	15
44.9	Garrard Creek	0.27	0.27	0.00	0.0%	18.0	18.0	0.0	0.0%	limited	16
39.4	Rock Creek	0.04	0.04	0.00	0.0%	16.0	16.0	0.0	0.0%	suspect	21
39.5-33.8	Misc. Livestock Impact	7.44	7.44	0.00	0.0%	22.2	22.2	0.0	0.0%		19
38.8	Cedar Creek	0.32	0.32	0.00	0.0%	64.1	64.1	0.0	0.0%		22

listed as water quality-limited for DO on the draft 1994 Section 303(d) list, or whether it is suspected to be limited, but the data is inconclusive at this point. In the right-hand column the sources are given a priority for future control. The priority is based on the amount of loading, the percent reduction needed, the size of the basin and effort probably needed to achieve the reductions, the proximity of the sources to the Centralia reach, and whether the tributary itself is water quality-limited.

Implementation of the ammonia and CBOD LAs for the Chehalis River must be viewed as a long-term effort that will require the support of not just the Water Quality Program at Ecology, but also other programs at Ecology, other federal, state and local agencies, the Chehalis Tribe, dischargers, and citizens living in the basin. A number of activities are recommended below that are necessary and/or will help to implement the Chehalis River TMDL and allocations:

- National Frozen Foods, livestock operations near the river, and any other land waste application activities that could potentially affect ground water quality must ensure that their operations do not increase CBOD or ammonia levels in the ground water above background downgradient towards the river or its tributaries.

- The Centralia Landfill should conduct its clean-up to ensure that ammonia and BOD are not increasing above background in the ground water downgradient towards the river or Salzer Creek, and are not reaching the Chehalis River by stormwater runoff. Direct discharge of treated leachate should not be permitted from May through October.

- Stormwater runoff during the TMDL period of May through October should be provided BMPs. A stormwater permit for Centralia and Chehalis is recommended, and stormwater BMPs should be brought up to Puget Sound Stormwater Manual standards. The Washington State Department of Transportation has already committed to this level of treatment for I-5, to be implemented during the widening project. Other areas in the basin, especially along the mainstem and in the priority watersheds, should apply stormwater BMPs for construction sites and new development.

- Dairy farms and other livestock operations in the Chehalis River basin should provide Best Management Practices to control the discharge of ammonia and CBOD to the Chehalis River and its tributaries. These BMPs should include: agronomic rates of land application of waste; restricting or eliminating the access of livestock to the Chehalis River and tributaries; and eliminating overland flow of waste materials or leachate to the Chehalis River and tributaries.

- Septic systems should be inspected at residences that border the Chehalis River and its tributaries, and failing or inadequate systems should be brought up to current standards. These inspections should be made by county health department personnel as time and resources allow. This effort should follow the priorities presented in Table 7.1.

- Silvicultural, agricultural, and residential fertilization should be conducted with methods that prevent the application of fertilizer directly to surface waters. Fertilization should be done at agronomic rates that allow the full uptake of ammonia and minimize leaching to ground water near the Chehalis River or its tributaries.

- Wetland areas in the Chehalis basin should be protected, especially in the Centralia/Chehalis area. Natural wetlands should not be used as a substitute for proper stormwater controls.

- The Chehalis Basin Watershed Action Plan (Chehalis River Council, 1992) should be implemented as completely as possible. The Chehalis River Council should be supported and encouraged in their work on implementation of the Plan. The Plan should be revised to include the final TMDLs and LAs, to provide more specific timetables and priorities, and to describe available and reasonable BMPs for existing and new nonpoint sources.

- The Chehalis Fisheries Restoration Program (CFRP) provides an opportunity to integrate water quality improvements identified in this study with fisheries improvements. To the fullest extent possible, fishery improvement projects should be focused where CFRP priorities and the priorities of this TMDL overlap. Also, coordination should be encouraged between the activities of this TMDL and the work of the many entities involved with the CFRP, in particular the Chehalis Basin Fisheries Task Force.

- BMPs should be implemented through Shoreline Management Act permits for projects within the Act's jurisdiction. BMPs could be identified during the State Environmental Policy Act process, or in the permits themselves. To recognize the Chehalis River TMDLs and specify the BMPs for inclusion in Shoreline permits, modification of Shoreline Master Plans that affect the Chehalis River should be considered. Ecology and the local jurisdictions should work together to improve the quality of Shoreline permits and enforcement.

- To implement the phased TMDL for temperature, best management practices are recommended that increase shading on the mainstem Chehalis River and its tributaries. Projects that plant riparian shade trees should be encouraged, and existing riparian shade trees should be protected. The Chehalis Basin Watershed

Action Plan, the CFRP, and permits and enforcement through the Shoreline Management Act are key elements for implementing the temperature TMDL.

- Flow should be monitored during the summer low flow season and appropriate actions taken if flows are less than the minimum flows specified by regulation (Chapter 173-522 WAC). Water rights and existing withdrawals should be reviewed and actions taken as appropriate to maintain minimum flows. The Chehalis River and its tributaries in the study area, where open for consumptive appropriation, should be reviewed for possible closure. Top priority should be for the basin above Grand Mound (RM 59.9), and the priorities provided in Table 7.1 may also be used as a guideline.

7.3 Monitoring and Further Study

Long-term monitoring of the Chehalis River is necessary to assess the effectiveness of the TMDLs in protecting water quality. This monitoring could either be conducted by Ecology or by other agencies. The scope of monitoring is dependent on priorities and available resources. A number of strategies are suggested below:

- Permanent stations with monthly ambient monitoring should be continued or established at the key locations identified in the TMDL. Parameters should include temperature, pH, conductivity, turbidity, DO, ortho-phosphate, total phosphorus, ammonia nitrogen, nitrate/nitrite nitrogen, total persulfate nitrogen, BOD_5, and fecal coliform bacteria.

- Annual synoptic monitoring should be conducted in the Chehalis River twice a month in July, August, and September and monthly in May, June, and October. If resources do not allow this intensity of monitoring, monitoring could be less frequent, although monitoring should occur at least once in mid-August. An alternative to annual monitoring would be monitoring once every five years consistent with the Basin Approach of Ecology's Water Quality Program. However, due to the importance of nonpoint sources in the Chehalis basin, and based on the experience of the Rural Clean Water Program (Gale *et al.*, 1992), long-term monitoring (6-10 years) twice a month would be ideal to evaluate trends in water quality and the effectiveness of BMP implementation.

  Key locations for synoptic monitoring are the bridges over the Chehalis from Pe Ell downstream to Porter, the sites monitored in the Centralia reach during this study, and tributaries where the most significant BMP implementation effort will be focused. Parameters should include temperature, pH, conductivity, turbidity, DO, ortho-phosphate, total phosphorus, ammonia nitrogen, nitrate/nitrite nitrogen, total persulfate nitrogen, BOD_5, chlorophyll *a*, and fecal coliform bacteria.

Currently, the Chehalis Tribal Department of Natural Resources is conducting a monitoring program in the Chehalis basin. Monitoring is also being conducted on Dillenbaugh Creek, and the U.S. Fish and Wildlife Service is funding a position to evaluate water quality improvement projects. These efforts should be coordinated and supported by Ecology as much as possible. Receiving water monitoring by permitted dischargers is also an option that should be considered.

Three complex studies are suggested for consideration in future years, listed in order of relative priority:

1. A study of primary productivity from macrophyte and periphyton in Scatter Creek and in the mainstem Chehalis River from the Galvin Road bridge to Porter. The objective of the study would be to better understand the relationship of nutrient levels to biomass, productivity, and DO levels, with the goal of evaluating the need for a TMDL for eutrophication that could include nutrient criteria for the protection of DO levels and aesthetic standards.

2. A study of the interactions of ground water and pumping withdrawals with summertime base flow in the Chehalis River. Ground water makes up a significant portion of flow in the mainstem Chehalis River, and a significant portion of flow was estimated as being removed by pumping. The goal of the study would be to evaluate the extent to which both ground water and direct withdrawals are reducing base flows, and the extent to which pollutant concentrations in ground water are affecting river water quality.

3. A study of sediments in the Chehalis River, especially in the Centralia reach. The study could include a survey of the mainstem Chehalis River to make *in situ* SOD measurements, and measurements of benthic nutrient chemistry. This study would be best conducted after BMPs have been widely implemented and as the phased TMDL is being reassessed. The measured SOD levels and sediment chemistry could then be applied to modeling of the river, and perhaps to modeling of the sediments themselves, if that capability is available in the future.

8. Summary and Conclusions

8.1 General

- The Chehalis River in the study area is characterized by three distinct areas. The upper river from Pe Ell (RM 106.3) downstream to the Newaukum River (RM 75.2) takes about 5 hours to travel a mile and has low summer flows, about 15 cfs and above. The Centralia reach from the Newaukum River to the Skookumchuck River (RM 66.9) has flows of 60 cfs and up, but a travel time of 19 hours per mile. The lower stretch of the Chehalis River in the study area downstream of the Skookumchuck River to Porter (RM 33.8) has flows of 120 cfs and up, and the travel time is 2 hours per mile.

- The Chehalis River from Porter (RM 33.8) upstream has had a long history of dissolved oxygen falling below the 8.0 mg/L water quality criterion during the dry season. In particular, the Centralia reach, a sluggish, lake-like stretch in the Centralia/Chehalis area, has been observed to stratify and go anoxic in the deepest areas. The Chehalis River from the Newaukum River (RM 75.2) to Scammon Creek (RM 65.8), which includes the Centralia reach, has a Special Condition criterion for DO in the water quality standards: 5.0 mg/L from June 1 to September 15.

- A water quality study was conducted on the Chehalis River that included measurements of temperature, conductivity, pH, DO, Secchi depth and irradiance, and laboratory analysis of samples for BOD, nutrients, chlorophyll *a*, turbidity, TSS, conductivity, alkalinity, fecal coliform bacteria, and other parameters. Sampling and measurement included the mainstem Chehalis River, its major tributaries, and significant permitted point source dischargers. Additional sampling was conducted in some tributaries to aid in identifying loading sources.

8.2 Survey Results

- Sampling of the mainstem Chehalis River and its tributaries revealed that many areas were impaired by low DO, high temperatures, and high fecal coliform bacteria levels which violated the water quality standards for those parameters. These water bodies were recommended for listing on the 1994 Section 303(d) list for water quality-limited water bodies that require TMDLs.

  Three municipal WTPs (Pe Ell, Chehalis, and Centralia) and one industrial WTP (Darigold) discharge treated wastewater directly to the mainstem Chehalis River in the study area. A fourth municipal discharge has been proposed for the

Grand Mound area. Inadequate land treatment of food processing wastewater at state permitted facilities near the river was also identified as a contributor to low DO problems.

Comparison of data collected by the USFWS to data collected in this study revealed that loss of riparian canopy was a likely source of high temperatures, and livestock impacts the primary suspected nonpoint source of fecal coliform bacteria and pollutants that cause low DO. Samples of urban stormwater from a summer rain shower revealed very high BOD, ammonia, and fecal coliform bacteria.

A low-DO event in October 1991 was attributed to an upset at a permitted wastewater treatment facility at the head of the Centralia reach, and to nonpoint sources, most likely in the Stearns Creek basin or on the mainstem Chehalis River upstream of the Newaukum River and below Adna.

- The upper Chehalis River had problems with low DO from Ceres Road (RM 90.0) downstream, elevated temperature from Doty (RM 100.5) downstream, and high fecal coliform bacteria over the entire stretch. Most of the tributaries sampled shared these problems. The loss of riparian canopy was most likely the primary cause of high water temperatures. Livestock access and poor livestock waste handling practices were most likely the cause of low DO and high bacteria counts, although residential sources were also possible contributors, especially in the Pe Ell area. One or more pollutant sources are suspected in the basin between Ceres Road (RM 90.0) and Claquato (RM 77.6), and most likely downstream of Adna (RM 81.0), that have caused degradation of water quality in the Chehalis River downstream through the Centralia reach.

- The Centralia reach of the Chehalis River was characterized by stratified areas during the summer months in locations with deep pools. Temperatures at the surface were very high during July and August, near lethal levels for adult salmonids. The deep waters of the stratified areas at this time were cooler, but were mostly found to be anoxic, especially from RM 71.0 downstream. Some areas showed evidence of local pollutant inputs, in particular: the site north of the airport (RM 70.7), most likely from the nearby dairy farm; and the site below Salzer Creek (RM 69.1), most likely from pollutants originating in the Salzer Creek basin.

The Darigold and Chehalis WTPs have a great influence on the quality of the Chehalis River due to their location at the head of the Centralia reach. Any upsets at these plants are likely to cause major reductions in DO in the river, as was witnessed in the low DO event of October 1991. During the study, surface waters met the 5.0 mg/L special condition criterion, but DO did not meet the criterion of 8.0 mg/L from September 16 to early October, when the lower criterion is no longer in effect.

Dillenbaugh and Salzer Creeks are water bodies that were by themselves highly impacted, yet also had a strong influence on the Centralia reach. Dillenbaugh Creek is the object of a major restoration program which should be supported until completion. Dillenbaugh Creek has also been impacted by the American Crossarm and Conduit toxic site, where the proposed cleanup action should be completed if the creek is to be restored.

Salzer Creek was found to be heavily impacted from multiple sources including land application of wastewater by National Frozen Foods, a drainage sump at the Southwest Washington Fairgrounds, a failing on-site sewage system in the upper drainage (now corrected), urban and residential sources, livestock activities, and possibly other unidentified sources. The Centralia Landfill Superfund site may also be a contributor, although evidence could not confirm it as a significant source during the study. A significant effort of source identification and correction is needed to restore Salzer Creek. NFF land application to Field 1 on Salzer Creek should be strictly limited to agronomic rates, and ground water impacts evaluated with monitoring wells.

In addition to these sources, urban stormwater discharges to Dillenbaugh, Salzer, and China Creeks, and to stormwater drains near the Centralia WTP and below the Skookumchuck River. Urban stormwater runoff during the low flow season contained high levels of pollutants that likely degraded water quality in the Chehalis River. Implementation of stormwater controls in the Centralia/Chehalis area is strongly recommended, and coordination with the plans for stormwater improvements to I-5 may be an opportunity for reduced costs.

- The main problems in the lower stretch of the Chehalis River study area were high temperatures over the entire stretch and low DO from Scammon Creek (RM 65.8) to Prather Road (RM 59.9). Problems with low DO were found in Lincoln, Independence, and Garrard Creeks, and in the Black River. In addition, Lincoln Creek had elevated fecal coliform bacteria, and the Black River had high temperatures.

  Scatter Creek had high pH, temperature, and fecal coliform bacteria. High pH and DO in Scatter Creek indicate high levels of primary productivity. Productivity in Scatter Creek was probably stimulated by high nutrient loading, originating from the Global Aqua and Seafarm Washington aquaculture facilities that are essentially the source of the creek during the summer low flow period. A study of Scatter Creek should be conducted to evaluate minimum DO levels, determine the causes of high productivity, and recommend a TMDL to protect the creek from eutrophication.

- In general, problems due to nonpoint sources were found throughout the basin. Three areas are key to improving dry season water quality basin-wide: better livestock management practices, including riparian protection and implementation of farm plans; correction of inadequate or failing septic systems; and implementation of stormwater best management practices in urban areas where summer rainfall is generating runoff.

- Primary productivity in the study area was lowest in the upper Chehalis River, and highest in the downstream end of the Centralia reach and in the lower stretch of the river. Productivity in the upper river, the upper end of the Centralia reach, and in the lower river was dominated by periphyton and macrophytes. Phytoplankton production was found mostly in the lower Centralia reach. Measurements of Secchi depth and chlorophyll *a* classified conditions in the Centralia reach as oligotrophic to mesotrophic. The Centralia reach was potentially nitrogen-limited, but in the rest of the Chehalis River, from the SR 6 bridge near Chehalis (RM 74.6) upstream, and downstream of the Prather Road bridge (RM 59.9), phosphorus was the potentially limiting nutrient.

8.3 TMDL Analysis

- The water quality model WASP5 and its EUTRO component were used to simulate the water quality of the Chehalis River and determine its loading capacity. The model was calibrated with two sets of data collected in the summer of 1992, and verified with data from the summer of 1991. The river was then modeled with existing and background loading under critical low flow conditions, both for mid-summer and early fall conditions. Critical loading capacity was determined from further simulation under different loading scenarios.

- A phased TMDL is proposed for ammonia and CBOD, which would apply from May 1 to October 31 over the entire mainstem from Pe Ell downstream to Porter (WRIA 23). The specified TMDL period of May through October is recommended because it is the season when flows are lowest and temperatures highest.

  A key component of this recommended TMDL is that no loading capacity exists in the Centralia reach. Therefore, a WLA of zero is being recommended for this reach. This means the eventual removal of the existing City of Chehalis and Darigold WTP discharges during the specified TMDL period.

- Two alternatives for WLA/LAs under the TMDL are presented in the report. Alternative #1 is based on Chehalis and Darigold finding an alternative disposal method for their wastewater during the dry season, such as industrial or agricultural use. Alternative #2 is based on Centralia, Chehalis, and Darigold sighting a combined outfall below the Skookumchuck River. Other options may exist and can be modeled in the future as they are proposed and reviewed.

- Load allocations limited to background levels of ammonia and CBOD are recommended for nonpoint sources from the Skookumchuck River upstream. Nonpoint sources are prioritized for actions to reduce loading. High on the list are BMPs for livestock operations in the Centralia/Chehalis area, and ensuring that National Frozen Foods, Midway Meats, and the Centralia Landfill cause no surface runoff or ground water transport of pollutants into the Chehalis River or its tributaries.

- Loading capacity appears to exist to allow a WLA for the Pe Ell WTP and the proposed Grand Mound WTP. LAs based on current pollutant levels are recommended for nonpoint sources downstream of the Skookumchuck River, subject to all tributaries themselves meeting the water quality standards.

- No load allocations are recommended for future growth. As part of the phased TMDL, future growth allocations will be determined as the need arises, and after evaluation of the results of BMP implementation and research into nutrient enrichment, ground water/surface water interactions, and SOD.

- A phased TMDL for temperature is recommended for the Chehalis River and its tributaries. The temperature TMDL calls for riparian shade trees to be protected and replanted to the fullest extent possible along the Chehalis River and its tributaries, especially Scatter, Salzer, and Dillenbaugh Creeks, and the Black, Skookumchuck, Newaukum, and South Fork Chehalis Rivers.

- Implementation of LAs for tributaries of the Chehalis River are expected to correct problems that have resulted in exceedances of the water quality standards for DO and fecal coliform. Therefore the recommended TMDL for the mainstem Chehalis River encompasses phased TMDLs for those tributaries that were recommended for Section 303(d) listing.

- Implementation of the ammonia and CBOD WLAs will be primarily through permit modifications, administrative order, regional planning, and financial assistance through grants and loans. Implementation of the ammonia and CBOD LAs will be primarily through BMPs implemented by the combined effort of Ecology; other federal, state, tribal and local agencies; and local citizens. The Chehalis River Action Plan is a key element and the Chehalis River Council could play a crucial role in coordinating BMP implementation. Valuable BMP projects are also being funded through the Chehalis Fisheries Restoration Program. Use of Shoreline permits to implement BMPs is also potentially a helpful tool.

- Long-term monitoring is proposed to evaluate the effectiveness of the TMDL and WLA/LAs. Additional studies are proposed: to determine the causes and possible remedies of eutrophication and high primary productivity in Scatter Creek and the mainstem Chehalis River from Grand Mound to Porter (RM 59.9 to 33.8); to improve understanding of the effect of ground and surface water resource use on Chehalis River flow and quality; and to directly measure SOD and sediment chemistry to refine modeling in the next phase of the TMDL.

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Appendices

Appendix A. Details of Methods

A.1 Hydrodynamic and Channel Morphology Measurements

Flow and cross-section measurements were made in the main channels of the Chehalis River. These measurements were used to define channel geometry and to estimate time of travel for use in the model. Sites were selected that are representative of typical morphology for the river and logistically feasible. Measurements were either made by wading with tape measure, staff gage and velocity meter, or by boat with a standard USGS flow measurement apparatus (graduated transect cable and velocity meter with weighted probe). Marsh-McBirney® and Swoffer® velocity meters were used. A series of cross-sections were also made using a Lowrance® sonar sounding device for depth and a range-finder for width.

Flows were measured in the mainstem and tributaries during the intensive surveys of September 1991 and July and August 1992. In August 1991, the morphology of the river was surveyed, and several cross-section and flow measurements were made. Flows were also measured at selected sites in September and October 1991, and in June 1992.

As an alternative method to measure in-stream velocities and also measure time of travel in the Centralia reach, a drogue study was conducted. Drogue measurements were made by timing the passage of the drogue along a fixed distance. The drogue consisted of nylon vanes suspended to a depth of one meter below a shallow float.

An alternative estimate of travel time in the Chehalis River was developed using the discharge rates and cross-sectional areas measured in 1991. The method used is the "Occupied Channel Volume" method (Velz, 1970), where the travel time is calculated from the occupied channel volume of a segment divided by the discharge for each segment. Using a spreadsheet, the Chehalis River was divided into 0.1 mile segments, and based on field observations, a channel type was assigned to that segment. The observed cross-sections were used to estimate cross-sections for the different channel types, and observed flows were summed over the course of the river. Rough estimates of ground water inflows and outflows and surface withdrawals were made so that the summed flow balance equaled the observed flows. The segment area multiplied by segment length and divided by the flow gives the time of travel.

A.2 Physical and Chemical Field Measurements

Field measurements of the vertical profiles of water quality parameters were taken during eight separate weeks during 1991, and during nine separate weeks during 1992. This monitoring evaluated the development of stratification by the effects on temperature, conductivity, pH, and DO. These four parameters were measured in midchannel at one- or two-meter intervals of depth at selected stations. Appendix Table A.1 shows the sites and dates where vertical profiles were measured.

Measurements were made with a Hydrolab® Surveyor 2, which was calibrated at the EILS wet lab in Tumwater per the manufacturer's instructions and Watershed Assessment Section protocols. Temperature is factory calibrated. Conductivity was calibrated monthly with a 100 μmho/cm standard solution and the calibration confirmed with a 1,000 μmho/cm standard. Standard solutions at pH 7 and 10 were used for weekly pH calibration and post-calibration. Oxygen was calibrated and post-calibrated weekly in the laboratory with an air-saturated water bath using the modified Winkler iodometric azide method (Method 4500-O B, APHA, 1989). Field verification samples to be analyzed for DO using the Winkler method were taken at several sites where vertical profile measurements were taken.

Diurnal changes in water quality parameters were measured by deploying multi-parameter data-logging meters to record pH, temperature, DO, and conductivity over a 24-hour period. A Hydrolab® Datasonde 3 (DS3) was used, and calibrated by the same procedures as discussed above for the Surveyor 2. The DS3s were deployed near mid-channel at about one meter depth. Winkler DO field verification samples were taken at each DS3 deployment site at the beginning and end of the deployment period. Deployment sites were selected to evaluate various locations on the Chehalis River, with more intensive measurements in the slow middle reach. Meters were deployed in a number of locations in August and September 1991, and May through September 1992. Readings were made by the meters once per hour for at least 24 hours. A list of sites and dates of DS3 deployments is also in Appendix Table A.1.

Grab field measurements were made during intensive surveys at various mainstem and tributary sites. Orion meters, calibrated as per manufacturer's instructions, were used to measure pH. A mercury thermometer was used to measure temperature.

Light attenuation was measured with a KAHLSICO Underwater Irradiameter. Readings were made at the surface and at one-meter intervals of depth. Primary productivity in the mainstem Chehalis River was evaluated in 1991 by paired light/dark bottle experiments (Method No. 10200 J.2, APHA, 1989). This method uses paired bottles, one opaque and one clear, to measure the change in oxygen due to respiration and net primary productivity. The difference in DO between the two bottles is gross primary productivity. Morning and evening DO levels were measured by the Winkler method during the intensive surveys and also in an additional survey in late August 1992.

A.3 Chemical and Biological Sampling and Laboratory Analysis

Intensive sampling was conducted on August 27 and 28, 1991; September 10-12, 1991; July 21 and 22, 1992; and August 4 and 5, 1992. In each survey, multiple teams of two people each sampled and collected field measurements in the study area. The dates were chosen to fall within the season of lowest flow, highest temperatures, and maximum stratification.

Sampling stations were selected based on the following criteria:

1. The mainstem Chehalis River was sampled from Porter (RM 33.8) to Pe Ell (RM 106.3). On one occasion, an additional mainstem site was sampled upstream of Pe Ell at the City Water Intake (RM 108.2).

2. Loading sources were selected for sampling from those listed in Table 1.1 based on their proximity to the mainstem Chehalis River and their potential to discharge biochemical oxygen demand (BOD) or nutrients.

3. Major tributaries were sampled near the mouths, where access was possible and no backwater effects were observed. The sampling frequency for tributaries was based on watershed area and observed summer flow, with more samples taken from the largest tributaries. Additional samples were also collected at upstream sites on selected tributaries to aid in the identification of possible pollutant sources.

4. Mainstem stations in the Centralia reach were sampled by boat. Stations were chosen about one-half mile to one mile apart, based on river morphology and the location of possible pollutant inputs. Sonar was used to identify deeper areas where stratification was most likely, and some stations were placed in these locations. For the rest of the mainstem Chehalis River, stations were located approximately 2-10 miles apart. Stations were sighted at bridges and near boat launches, with additional wading stations selected where access was possible.

Sampling was conducted at six permitted point source discharges during intensive surveys. This sampling was conducted as Class II compliance inspections. The results of the point source sampling are reported in detail in Das (1993).

Key mainstem stations were sampled for selected parameters twice a day on each sampling date. Other stations and parameters were sampled under a schedule of one sample per day for one or more days, depending on laboratory costs and capacity, equipment logistics, and the importance of the parameter to meet study objectives. In addition, duplicate samples were taken for at least ten percent of parameters and stations.

Bridge and boat samples were collected with a Van Dorn® sampler, except for fecal coliform samples, which the boat team collected by hand and the bridge teams collected with a custom sampler. Sample bottles were rinsed before sample collection, except for bottles that were sterilized or contained preservatives. Samples were immediately labeled and stored on ice. Samples were transported by Ecology courier from the EILS Tumwater wet lab to Manchester Laboratory for analysis. All sampling, measurements, equipment calibration and Winkler method DO determinations were made by the protocols described in Ecology (1992b).

Laboratory sample containers and analyses were by EPA (1983b) or Standard Methods (APHA, 1989). Quality Assurance/Quality Control (QA/QC) measures were taken as specified by the Manchester Laboratory (Huntamer and Hyre, 1991). A list of the parameters selected for field measurements and laboratory analysis is presented in Appendix Table A.2.

Ultimate Carbonaceous BOD (UBOD) represents the theoretical "total" amount of carbonaceous BOD (CBOD) that would occur if the oxygen use of a sample were monitored for an indefinite amount of time. UBOD results are estimated from a first-order model using a time series of laboratory oxygen uptake measurements taken over a 30- to 60-day period. The program "BODFO" (NCASI, 1987b) was used for the first order fit.

Appendix Tables D.6 and F.5 show the five-day CBOD value ($CBOD_5$) taken from the time series, the ratio of UBOD to $CBOD_5$ (u/5 ratio), the first order rate coefficient "k", the sum of squares (SS) for the first order fit, the dilution used in the analysis, and the number of days used from the time series. The $CBOD_5$ value is based on essentially the same procedures as the standard BOD_5 laboratory analysis, except that the oxygen used by nitrification is subtracted. Since very little nitrification occurs in the first five days of the test, BOD_5 and $CBOD_5$ values can generally be considered equivalent. The u/5 ratio is typically between 1 and 2, although slightly higher values would not be of concern; values below 1 and extremely high values would signal some problem with fit of the model to the time series. A high SS ($> 1.00E+00$) indicates a relatively poor fit of the model to the data. UBOD results were based on 12 days if part of the time series had to be discarded due to an extremely poor fit of the full time series to the first order model.

In addition to the intensive surveys, sampling was also conducted on several other occasions: a set of samples was collected from the Chehalis River and several loading sources as part of an "emergency survey" during the oxygen sag event discovered in October 1991 (discussed in Section 3.6); two "mini surveys" were conducted in June and September 1992 to assess seasonal variation of parameters; special surveys were made of Salzer Creek in June and September 1992 and of Dillenbaugh Creek in July 1992 to aid in the evaluation of loading sources.

A summary of the sampling design used for the study can be found in Appendix Table A.3, which includes sites, parameters, dates, and frequency of sampling.

Appendix A
Table A.1 Vertical and Diurnal Monitoring Sites and Dates

V = Vertical Profile
D = Diel Time Series

		1991									1992								
		July	Aug				Sep		Oct		May		Jun	Jul		Aug		Sep	
Site Name	RM	22-24	1-2	14	19-23	27-28	10-12	24	8	10-14	7-8	28-29	16-17	6-7	22-23	3-4	20-21	8-9	30
CR @ Porter (Porter Rd Br)	33.8						D												
CR blw Oakville BL	42.1						D												
CR nr Independence	59.9						D												
CR blw Centralia BL	66.3		V	V	D			V	V		V,D	V,D	V	V	V	V	V	V	V
CR abv Skookumchuck R	67.0		V	V	V	V		V	V		V	V	V	V	V	V	V	V	V
CR @ Centralia (Mellen St)	67.5		V	V	V	V		V	V		V	V	V	V	V	V	V	V	V
CR abv Mellen St BR	67.6									V,D									
CR blw Midway Meats	68.0							V											
CR blw Midway Meats	68.2		V		V,D				V										
CR nr Midway Meats	68.5		V	V	V,D	V		V	V										
CR abv Midway Meats	68.6									V,D	V,D	V,D	V,D	V,D	V,D	V,D	V,D	V,D	V
CR blw Salzer Ck	69.1	V		V		V		V	V	V	V	V	V	V	V	V	V	V	V
CR blw Overhanging Tree	69.6		V	V		V		V	V	V,D	V,D	V,D	V,D	V,D	V,D	V,D	V,D	V,D	V
CR abv Overhanging Tree	70.0							V	V										
CR north of Airport	70.7		V	V	V,D	V		V	V			V	V	V	V	V	V	V	V
Cr blw Schueber Ditch	71.4							V	V										
CR blw Golf Course Intake	72.3												V,D	V,D	V,D	V,D	V,D	V,D	V
CR abv Golf Course Intake	72.5	V	V	V	V,D	V		V	V			V							
CR blw junk cars	73.1							V	V										
CR @ junk cars bend	73.6		V	V	V,D	V		V	V			V	V	V	V	V	V	V	V
CR blw Chehalis WTP	74.2							V	V										
CR @ SR 6 Br nr Chehalis	74.6	V	V	V	V	V		V	V		V	V	V	V	V	V	V	V	V
CR abv SR 6 Br nr Chehalis	74.9				V,D														
CR nr Goff Rd abv Claquato	77.6						D												
CR abv Ceres Rd Br	90.1				D		D												
CR @ Elk Ck Rd nr Doty	100.5				D		D												

Appendix A

Table A.2 Summary of Field and Laboratory Parameters and Methods

Parameter	Abbreviation used in text	Method of Analysis	Reference
FIELD PARAMETERS			
Temperature	TEMP	Field Meter (Thermistor)	NA
		Mercury Thermometer	NA
pH	PH	Field Meter (Electrode)	NA
Dissolved Oxygen	DO	Polarographic Probe	NA
		Winkler Modified Azide (EPA 360.2)	NA
LABORATORY PARAMETERS			
Specific Conductance	Cond	Conductivity bridge (EPA 120.1)	EPA (1983b)
Alkalinity	Alk	Low potentiometric titration (EPA 310.1)	EPA (1983b)
Turbidity	Turb	Nephelometer (EPA 180.1)	EPA (1983b)
Total Suspended Solids	TSS	Gravimetric (EPA 160.2)	EPA (1983b)
Total Dissolved Solids	TDS	Gravimetric (EPA 160.1)	EPA (1983b)
Total Iron	FE	ICP-AES (EPA 200.7)	EPA (1983b)
Dissolved Silica	SI	ICP-AES (EPA 200.7)	EPA (1983b)
5-day Carbonaceous BOD	BOD5	5-day incubation (EPA 405.1)	EPA (1983b)
Ultimate Carbonaceous BOD	UBOD	1st Order rate fit from 35 to 60 day incubation	NCASI (1987a)
Total Organic Carbon	TOC	Infrared detection (EPA 415.1)	EPA (1983b)
Chlorophyll a	CHLA	Fluorometer (Std Meth 17, No. 10200H.3)	APHA (1989)
		Spectrophotometer (Std Meth 17, No. 10200H.2)	APHA (1989)
Fecal Coliform	FC	Membrane Filter (Std Meth 17, No. 9222D)	APHA (1989)
% Klebsiella	KES	Manchester SOP	Huntamer and Hyre (1991)
Fecal Steptococci	FS	Membrane Filter (Std Meth 17, No. 9230C)	APHA (1989)
Total Ammonia N	NH3N	Phenate (EPA 350.1)	EPA (1983b)
Total Nitrate+Nitrite N	NO23N	Cadmium reduction (EPA 353.2)	EPA (1983b)
Total Persulfate N	TN	Persulfate reduction/Autoanalyzer	Valderrama (1981)
Soluble Reactive P (Ortho-P)	SRP	(EPA 365.3)	EPA (1983b)
Total Phosphorus	TP	Colorometric (EPA 365.3)	EPA (1983b)
		or Persulfate reduction/Autoanalyzer	Valderrama (1981)
Chloride	CL	Ion chromatography (EPA 300.0)	EPA (1983b)
Phytoplankton Identification	PHYID	Microscopic Identification and Enumeration	Sweet (1992)

Appendix A
Table A.3 Chehalis River Sampling Location and Frequency

INTENSIVE SURVEY: AUGUST 27, 1991		Parameters (See Table 2.3 for key to abbreviations)																	
STATION	RM	TEMP, PH,DO	TSS	TDS	TURB	COND	CL	ALK	SI	FE	TOC	BOD5	UBOD	NH3N NO23N	TP TN	SRP	CHLA	FC	PHYID
CR @ SR 6 nr Pe Ell	106.3	2	2	2	3	3	3				2		2	3	3	2	2	2	1
CR @ Elk Ck Rd nr Doty	100.5	2	2	2	2	2	2	1			1		1	2	2	2	2	2	
Elk Ck @ Elk Ck Rd Br	100.2005	1	1	1	1	1	1				1		1	1	1	1	1	1	
CR @ Ceres Rd Br	90.0	2	1	1	2	2	2				1		1	2	2	1	1	1	1
SF Chehalis R @ Boistfort Br	88.0059	1			1	1	1							1	1	1			
SF Chehalis R @ Tanker Intake	88.0007	1	1	1	1	1	1				1		1	1	1	1	1	1	1
Bunker Ck @ BR abv mouth	84.4006	1	1	1	1	1	1				1		1	1	1	1	1	1	
CR @ Adna (SR 6 Br)	81.0	2	1	1	2	2	2				1			2	2	1	1	1	
Stearns Ck @ Twin Oaks Rd	78.0004	1	1	1	1	1	1				1		1	1	1	1	1	1	
SF Newaukum R @ Forest	75.2111	1			1	1	1							1	1	1			
NF Newaukum R @ Forest	75.2109003	1			1	1	1							1	1	1			
Newaukum R @ mouth	75.20015	1	1	1	1	1	1				1		1	1	1	1	1	1	1
CR @ SR 6 Br nr Chehalis	74.6	2	2	2	3	3	3				2		2	3	3	2	2	2	2
Dillenbaugh Ck nr mouth	74.5001	1	1	1	1	1	1				1		1	1	1	1	1	1	
CR @ junk cars bend - Shallow	73.6	1			2	2	2	2						2	2	2			1
CR @ junk cars bend - Deep	73.6	1			1	1	1							1	1	1			
CR abv Golf Course intake - Shallow	72.5	1	1	1	1	1	1				1			1	1	1	1	1	
CR abv Golf Course intake - Deep	72.5	1			1	1	1							1	1				
Scheuber Drainage Ditch	71.6001	1			1	1	1							1	1	1			
CR north of Airport - Shallow	70.7	1	1	1	1	1	1	1			1		1	1	1	1	1	1	1
CR north of Airport - Deep	70.7	1	1	1	1	1	1	1			1		1	1	1	1	1	1	
CR blw Overhanging Tree - Shallow	69.6	1			1	1	1							1	1				
CR blw Overhanging Tree - Deep	69.6	1			1	1	1							1	1				
Salzer Ck @ Airport Road	69.2002	1	1	1	1	1	1				1		1	1	1	1	1	1	
CR blw Salzer Ck - Shallow	69.1	1			1	1	1				1			1	1				
CR blw Salzer Ck - Deep	69.1	1			1	1	1							1	1				
CR nr Midway Meats - Shallow	68.5	1	1	1	1	1	1				1			1	1	1	1		
CR nr Midway Meats - Deep	68.5	1			1	1	1							1	1				

Table A.3, page 2

CR @ Centralia (Mellen St) - Shallow	67.5	2	1	1	2	2	2				1		1	2	2	1	1	1	
CR @ Centralia (Mellen St) - Deep	67.5	1	1	1	1	1	1				1			1	1	1	1	1	
Stormdrain @ Centralia WTP	67.4002				1	1	1							1	1	1			
China Ck nr mouth	67.3001				1	1	1							1	1	1			
CR abv Skookumchuck R	67.0	1	1	1	1	1	1				1			1	1	1	1		
Skookumchuck R abv Hanaford	66.9045	1			1	1	1							1	1	1			
Hanaford Creek abv Skook R	66.903801	1			1	1	1							1	1	1			
Skookumchuck R nr mouth	66.9001	1	1	1	1	1	1				1		1	1	1	1	1	1	1
CR @ Riffle blw Centralia BL	66.0	1	2	2	2	2	2	2			2			2	2	2	2	2	1
CR @ Galvin (Galvin Rd Br)	64.2	2	1	1	2	2	2				1			2	2	1	1	1	
Lincoln Ck @ Lincoln Ck Rd	61.8001	1	1	1	1	1	1				1		1	1	1	1	1	1	
CR nr Grand Mound (Prather Rd)	59.9	2	1	1	3	3	3				1		1	3	3	1	1	1	1

INTENSIVE SURVEY: AUGUST 28, 1991		Parameters (See Table 2.3 for key to abbreviations)																	
		TEMP,												NH3N	TP				
STATION	RM	PH,DO	TSS	TDS	TURB	COND	CL	ALK	SI	FE	TOC	BOD5	UBOD	NO23N	TN	SRP	CHLA	FC	PHYID
CR @ SR 6 nr Pe Ell	106.3	2	2	2	3	3	3				2			3	3	2	2	2	1
CR @ Elk Ck Rd nr Doty	100.5	2	2	2	2	2	2	1			1			2	2	2	2	2	
Elk Ck @ Elk Ck Rd Br	100.2005	1	1	1	1	1	1				1			1	1	1	1	1	
CR @ Ceres Rd Br	90.0	2	1	1	2	2	2				1			2	2	1	1	1	1
SF Chehalis R @ Boistfort Br	88.0059	1			1	1	1							1	1	1			
SF Chehalis R @ Tanker Intake	88.0007	1	1	1	1	1	1				1			1	1	1	1	1	1
Bunker Ck @ BR abv mouth	84.4006	1	1	1	1	1	1				1			1	1	1	1	1	
CR @ Adna (SR 6 Br)	81.0	2	1	1	2	2	2				1			2	2	1	1	1	
Stearns Ck @ Twin Oaks Rd	78.0004	1	1	1	1	1	1				1			1	1	1	1	1	
SF Newaukum R @ Forest	75.2111	1			1	1	1							1	1	1			
NF Newaukum R @ Forest	75.2109003	1			1	1	1							1	1	1			
Newaukum R @ mouth	75.20015	1	1	1	1	1	1				1			1	1	1	1	1	1
CR @ SR 6 Br nr Chehalis	74.6	2	2	2	3	3	3				2			3	3	2	2	2	2
Dillenbaugh Ck nr mouth	74.5001	1	1	1	1	1	1				1			1	1	1	1	1	
CR @ junk cars bend - Shallow	73.6	1			2	2	2	2						2	2	2			
CR @ junk cars bend - Deep	73.6	1			1	1	1							1	1	1			
CR abv Golf Course intake - Shallow	72.5	1	1	1	1	1	1				1			1	1	1	1	1	
CR abv Golf Course intake - Deep	72.5	1			1	1	1							1	1				
Scheuber Drainage Ditch	71.6001	1			1	1	1							1	1	1			

Table A.3, page 3

CR north of Airport - Shallow	70.7	1	1	1	1	1	1	1			1		1	1	1	1	1	1	
CR north of Airport - Deep	70.7	1	1	1	1	1	1	1			1			1	1	1	1	1	
CR blw Overhanging Tree - Shallow	69.6	1			1	1	1							1	1				
CR blw Overhanging Tree - Deep	69.6	1			1	1	1							1	1				
Salzer Ck @ Airport Road	69.2002	1	1	1	1	1	1				1			1	1	1	1	1	
CR blw Salzer Ck - Shallow	69.1	1			1	1	1				1			1	1				
CR blw Salzer Ck - Deep	69.1	1			1	1	1				1			1	1				
CR nr Midway Meats - Shallow	68.5	1	1	1	1	1	1				1			1	1	1	1		
CR nr Midway Meats - Deep	68.5	1			1	1	1							1	1				
CR @ Centralia (Mellen St) - Shallow	67.5	2	1	1	2	2	2				1			2	2	1	1	1	
CR @ Centralia (Mellen St) - Deep	67.5	1	1	1	1	1	1				1			1	1	1	1	1	
Stormdrain @ Centralia WTP	67.4002				1	1	1							1	1				
China Ck nr mouth	67.3001				1	1	1							1	1				
CR abv Skookumchuck R	67.0	1	1	1	1	1	1				1			1	1	1	1		
Skookumchuck R abv Hanaford	66.9045	1			1	1	1							1	1	1			
Hanaford Creek abv Skook R	66.903801	1			1	1	1							1	1	1			
Skookumchuck R nr mouth	66.9001	1	1	1	1	1	1				1			1	1	1	1	1	
CR @ Riffle blw Centralia BL	66.0	1	2	2	2	2	2	2			2			2	2	2	2	2	
CR @ Galvin (Galvin Rd Br)	64.2	2	1	1	2	2	2				1			2	2	1	1	1	
Lincoln Ck @ Lincoln Ck Rd	61.8011	1	1	1	1	1	1				1			1	1	1	1	1	
CR nr Grand Mound (Prather Rd)	59.9	2	1	1	3	3	3				1			3	3	1	1	1	1

FACILITY SURVEY: AUGUST 26-28, 1991		Parameters (See Table 2.3 for key to abbreviations)																	
STATION	RM	TEMP, PH,DO	TSS	TDS	TURB	COND	CL	ALK	SI	FE	TOC	BOD5	UBOD	NH3N NO23N	TP TN	SRP	CHLA	FC	PHYID
Pe Ell WTP	105.001	2	4		4	4	4				4	2		4	4	2	4	3	
Chehalis WTP	74.3001	5	4		4	4	4				4	2	1	4	4	4	4	3	
Centralia WTP	67.4001	5	4		4	4	4				4	2	1	4	4	3	4	4	

INTENSIVE SURVEY: SEPTEMBER 10, 1991		Parameters (See Table 2.3 for key to abbreviations)																	
STATION	RM	TEMP, PH,DO	TSS	TDS	TURB	COND	CL	ALK	SI	FE	TOC	BOD5	UBOD	NH3N NO23N	TP TN	SRP	CHLA	FC	PHYID
CR nr Grand Mound (Prather Rd)	59.9	2	1	1	2	2	2				1		1	2	2	1	1	1	1
Blanksma Dairy Pump Springs	58.2001	1			1	1	1							1	1	1			
CR nr Blanksma Dairy Pump	58.2	1	2	2	2	2	2				2			2	2	2	2	2	

STATION	RM	TEMP, PH,DO	TSS	TDS	TURB	COND	CL	ALK	SI	FE	TOC	BOD5	UBOD	NH3N NO23N	TP TN	SRP	CHLA	FC	PHYID
Scatter Ck @ Br abv mouth	55.2007	1	1	1	1	1	1				1		1	1	1	1	1	1	
CR @ Independence Br	54.2	2	1	1	2	2	2				1		1	2	2	1	1	1	1
Independence Ck @ 201st St	51.5003	1			1	1	1							1	1	1			
Black R @ Howanut Rd Br	47.0012	2	1	1	3	3	3				1		1	3	3	1	1	1	1
Garrard Ck @ Mattson Rd	44.9009	1			1	1	1							1	1	1			
CR @ Sickman Ford Br	44.0	2	1	1	2	2	2				1			2	2	1	1	1	1
CR nr Oakville BL	42.2	1	1	1	1	1	1				1		1	1	1	1	1	1	
Rock Ck @ South Bank Rd	39.006	1			1	1	1							1	1	1			
Cedar Ck @ Elma-Gate Rd	38.8008	1	1	1	1	1	1				1		1	1	1	1	1	1	
CR @ Porter (Porter Rd Br)	33.8	3	2	2	3	3	3				2		2	3	3	2	2	2	1

INTENSIVE SURVEY: SEPTEMBER 11, 1991		Parameters (See Table 2.3 for key to abbreviations)																	
STATION	RM	TEMP, PH,DO	TSS	TDS	TURB	COND	CL	ALK	SI	FE	TOC	BOD5	UBOD	NH3N NO23N	TP TN	SRP	CHLA	FC	PHYID
CR nr Grand Mound (Prather Rd)	59.9	2	1	1	2	2	2				1			2	2	1	1	1	
Blanksma Dairy Pump Springs	58.2001	1			1	1	1							1	1	1			
CR nr Blanksma Dairy Pump	58.2	1	2	2	2	2	2				2			2	2	2	2	2	
Scatter Ck @ Br abv mouth	55.2007	1	1	1	1	1	1				1			1	1	1	1	1	
CR @ Independence Br	54.2	2	1	1	2	2	2				1			2	2	1	1	1	
Independence Ck @ 201st St	51.5003	1			1	1	1							1	1	1			
Black R @ Howanut Rd Br	47.0012	2	1	1	3	3	3				1			3	3	1	1	1	
Garrard Ck @ Mattson Rd	44.9009	1			1	1	1							1	1	1			
CR @ Sickman Ford Br	44.0	2	1	1	2	2	2				1			2	2	1	1	1	
CR nr Oakville BL	42.2	1	1	1	1	1	1				1			1	1	1	1	1	
Rock Ck @ South Bank Rd	39.4006	1			1	1	1							1	1	1			
Cedar Ck @ Elma-Gate Rd	38.8008	1	1	1	1	1	1				1			1	1	1	1	1	
CR @ Porter (Porter Rd Br)	33.8	3	2	2	3	3	3				2			3	3	2	2	2	

INTENSIVE SURVEY: SEPTEMBER 12, 1991		Parameters (See Table 2.3 for key to abbreviations)																	
STATION	RM	TEMP, PH,DO	TSS	TDS	TURB	COND	CL	ALK	SI	FE	TOC	BOD5	UBOD	NH3N NO23N	TP TN	SRP	CHLA	FC	PHYID
CR nr Grand Mound (Prather Rd)	59.9	2			2	2	2				1			2	2	1	1	1	
CR nr Blanksma Dairy Pump	58.2	1			2	2	2				2			2	2	2	2	2	
CR @ Independence Br	54.2	2			2	2	2				1			2	2	1	1	1	
Black R @ Howanut Rd Br	47.0012	2			3	3	3				1			3	3	1	1	1	

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STATION	RM	TEMP, PH,DO	TSS	TDS	TURB	COND	CL	ALK	SI	FE	TOC	BOD5	UBOD	NH3N NO23N	TP TN	SRP	CHLA	FC	PHYID
CR @ Sickman Ford Br	44.0	2			2	2	2				1			2	2	1	1	1	
CR nr Oakville BL	42.2	1			1	1	1				1			1	1	1	1	1	
Cedar Ck @ Elma-Gate Rd	38.8008	1			1	1	1				1			1	1	1	1	1	
CR @ Porter (Porter Rd Br)	33.8	3			3	3	3				2			3	3	2	2	2	

FACILITY SURVEY: SEPTEMBER 10-11, 1991		Parameters (See Table 2.3 for key to abbreviations)																	
		TEMP,												NH3N	TP				
STATION	RM	PH,DO	TSS	TDS	TURB	COND	CL	ALK	SI	FE	TOC	BOD5	UBOD	NO23N	TN	SRP	CHLA	FC	PHYID
Seafarm WA/Scatter Ck	55.208	2	2	2	2	2	2				2		1	2	2	2	2	2	
Global Aqua/Scatter Ck	55.206	2	2	2	2	2	2				2		1	2	2	2	2	2	

FACILITY SURVEY: DECEMBER 3-4, 1991		Parameters (See Table 2.3 for key to abbreviations)																	
		TEMP,												NH3N	TP				
STATION	RM	PH,DO	TSS	TDS	TURB	COND	CL	ALK	SI	FE	TOC	BOD5	UBOD	NO23N	TN	SRP	CHLA	FC	PHYID
Darigold WTP	74.4001	2	2		2	2	2	2			2	2	1	2	2	2		2	

SALZER CK SURVEY: JUNE 16, 1992		Parameters (See Table 2.3 for key to abbreviations)																	
		TEMP,												NH3N	TP				
STATION	RM	PH,DO	TSS	TDS	TURB	COND	CL	ALK	SI	FE	TOC	BOD5	UBOD	NO23N	TN	SRP	CHLA	FC	PHYID
Salzer Ck @ Fair St	69.2017	1	1		1	1	1				1	1		1	1			1	
Coal Ck @ National Ave	69.2008009	1	1		1	1	1				1	1		1	1			1	
Stormwater Ditch nr Fairgrounds	69.2006002		1		1	1	1				1	1		1	1			1	
Salzer Ck @ BN/UP Trestle	69.2006	1	2		2	2	2			2	2	2		2	2			2	
Salzer Ck @ Airport Rd	69.2002	1	1		1	1	1			1	1	1		1	1			1	

MINI SURVEY: JUNE 16-17, 1992		Parameters (See Table 2.3 for key to abbreviations)																	
		TEMP,												NH3N	TP				
STATION	RM	PH,DO	TSS	TDS	TURB	COND	CL	ALK	SI	FE	TOC	BOD5	UBOD	NO23N	TN	SRP	CHLA	FC	PHYID
CR @ SR 6 Br nr Chehalis	74.6	1			1		1		1		1			1	1	1	1		1
CR blw Golf Course intake - Shallow	72.3	1			1	1	1			1	1			1	1	1	1		
CR blw Overhanging Tree - Shallow	69.6	1			1	1	1			1	1			1	1	1	1		
CR @ Centralia (Mellen St) - Shallow	67.5	1			1		1		1	1	1			1	1	1	1		1
CR nr Grand Mound (Prather Rd)	59.9	1			1	1	1		1		1			1	1	1	1		1

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DILLENBAUGH CK SURVEY: JULY 7, 1992		Parameters (See Table 2.3 for key to abbreviations)																	
STATION	RM	TEMP, PH,DO	TSS	TDS	TURB	COND	CL	ALK	SI	FE	TOC	BOD5	UBOD	NH3N NO23N	TP TN	SRP	CHLA	FC	PHYID
Dillenbaugh Ck @ LaBree Rd	74.5034	1	2		2	2	2				2	2		2	2			1	
Berwick Ck at Hamilton Rd	74.5032005	1	1		1	1	1				1	1		1	1			2	
Chehalis Indust Pk Trib @ Bishop Rd	74.5023004	1	1		1	1	1				1	1		1	1			1	
Dillenbaugh Ck nr mouth	74.5001	1	1		1	1	1				1	1		1	1			1	

INTENSIVE SURVEY: JULY 21-22, 1992		Parameters (See Table 2.3 for key to abbreviations)																	
STATION	RM	TEMP, PH,DO	TSS	TDS	TURB	COND	CL	ALK	SI	FE	TOC	BOD5	UBOD	NH3N NO23N	TP TN	SRP	CHLA	FC	PHYID
CR @ Pe Ell Water Intake	108.2	1	1		1	1	1				1	1		1	1			1	
CR @ SR 6 nr Pe Ell	106.3	1	1	1	1	1	1	1			1	1		1	1	1	1	1	
CR @ Elk Ck Rd nr Doty	100.5	1					1							1	1	1			
Elk Ck blw Seven Ck	100.2028	1	1		1	1	1				1	1		1	1			1	
Elk Ck @ Elk Ck Rd Br	100.2005	2	2	1	2	2	2	2			2	2		2	2	2	1	2	
CR abv Ceres Rd Br	90.1	2	2	2	2	2	2	2			2	1	1	2	2	2	2	1	
SF Chehalis R @ Tanker Intake	88.0007	1					1				1			1	1	1			
Bunker Ck @ BR abv mouth	84.4006	1					1				1			1	1	1			
Stearns Ck @ Twin Oaks Rd	78.0004	1					1				1			1	1	1			
CR @ SR 603 Br nr Claquato	77.6	1					1							1	1	1			
Newaukum R @ mouth	75.20015	2	2	2	2	2	2	2			2	1	1	2	2	2	2	1	
CR @ SR 6 Br nr Chehalis	74.6	3	3	3	3	3	3	3	1		3	3	2	3	3	3	3	2	1
Dillenbaugh Ck nr mouth	74.5001	1	1	1	1	1	1	1			1		1	1	1	1	1	1	
CR @ junk cars bend	73.6	1					1							1	1	1			
CR blw Golf Course intake - Deep	72.5	1	1	1	1	1	1	1			1	1		1	1	1	1		
CR blw Golf Course intake - Shallow	72.5	1	1	1	1	1	1	1			1	1		1	1	1	1		
Golf Course Discharge Pipe	72.0001	1					1				1	1		1	1	1		1	
CR north of Airport - Deep	70.7	1					1							1	1	1			
CR north of Airport - Shallow	70.7	1					1							1	1	1			
CR blw Overhanging Tree - Deep	69.6	1	1	1	1	1	2	1		1	1	1		2	2	2	1		
CR blw Overhanging Tree - Shallow	69.6	1	2	2	2	2	2	2		1	2	1		2	2	2	2		
Salzer Ck @ Fair St	69.2017	1	1		1	1	2			2	2	1		2	2	2	2	2	
Coal Ck @ National Ave	69.2008009	1	1		1	1	1				1	1		1	1			1	

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STATION	RM	TEMP, PH,DO	TSS	TDS	TURB	COND	CL	ALK	SI	FE	TOC	BOD5	UBOD	NH3N NO23N	TP TN	SRP	CHLA	FC	PHYID
Stormwater Ditch nr Fairgrounds	69.2006002		1		1	1	1				1	1		1	1			1	
Salzer Ck @ BN/UP Trestle	69.2006	1	1		1	1	1			1	1	1		1	1			1	
Salzer Ck @ Airport Rd	69.2002	1	1		1	1	1	1		1	1	1		1	1	1	1	1	
CR blw Salzer Ck - Deep	69.1	1					1			1	1			1	1	1	1		
CR blw Salzer Ck - Shallow	69.1	1					1			1	1			1	1	1	1		
CR nr Midway Meats - Deep	68.5	1			1	1	1	1						1	1	1			
CR nr Midway Meats - Shallow	68.5	1			1	1	1	1						1	1	1			
CR @ Centralia (Mellen St)	67.5	2	2	2	2	2	2	2	1		2	1	1	2	2	2	2	1	1
CR abv Skookumchuck R	67.0	1					1							1	1	1			
Skookumchuck R nr mouth	66.9001	2	2	2	2	2	2	2			2	1	1	2	2	2	2	1	
CR blw Centralia BL	66.3	1			1		1							1	1	1			
CR @ Galvin (Galvin Rd Br)	64.2	1					1							1	1	1			
Lincoln Ck @ Lincoln Ck Rd	61.8011	1					1				1			1	1	1			
CR nr Grand Mound (Prather Rd)	59.9	2	2	2	2	2	2	2	1		2	1	1	2	2	2	2	1	1
Scatter Ck @ Br abv mouth	55.2007	1					1				1			1	1	1			
CR @ Independence Br	54.2	1					1							1	1	1			
CR abv Black River	49.2	1	1	1	1	1	1	1			1		1	1	1	1	1	1	
Black R @ Howanut Rd Br	47.0012	2	2	2	2	2	2	2			2	1	1	2	2	2	2	1	
Garrard Ck @ Mattson Rd	44.9009	1					1				1			1	1	1			
CR @ Sickman Ford Br	44.0	1	1	1	1	1	1	1			1		1	1	1	1	1	1	
Cedar Ck @ Elma-Gate Rd	38.8008	1					1				1			1	1	1			
CR @ Porter (Porter Rd Br)	33.8	2	2	2	2	2	2	2	1		2	1	1	2	2	2	2	1	1

FACILITY SURVEY: JULY 20-21, 1992		Parameters (See Table 2.3 for key to abbreviations)																	
STATION	RM	TEMP, PH,DO	TSS	TDS	TURB	COND	CL	ALK	SI	FE	TOC	BOD5	UBOD	NH3N NO23N	TP TN	SRP	CHLA	FC	PHYID
Darigold WTP	74.4001	2	5	3	3	3	3	3			3	4	1	3	3	3	3	2	
Chehalis WTP	74.3001	2	5	3	3	3	3	3			3	4	1	3	3	3	3	2	
Centralia WTP	67.4001	2	5	3	3	3	3	3			3	4	1	3	3	3	3	2	

INTENSIVE SURVEY: AUGUST 4-5, 1992		Parameters (See Table 2.3 for key to abbreviations)																	
STATION	RM	TEMP, PH,DO	TSS	TDS	TURB	COND	CL	ALK	SI	FE	TOC	BOD5	UBOD	NH3N NO23N	TP TN	SRP	CHLA	FC	PHYID
CR @ Pe Ell Water Intake	108.2	1	1		1	1	1				1	1		1	1			1	
CR @ SR 6 nr Pe Ell	106.3	1	1	1	1	1	1	1			1		1	1	1	1	1	1	

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STATION	RM	TEMP,												NH3N	TP				
		PH,DO	TSS	TDS	TURB	COND	CL	ALK	SI	FE	TOC	BOD5	UBOD	NO23N	TN	SRP	CHLA	FC	PHYID
CR @ Elk Ck Rd nr Doty	100.5	1					1							1	1	1			
Elk Ck blw Seven Ck	100.2028	1	1		1	1	1				1	1		1	1			1	
Elk Ck @ Elk Ck Rd Br	100.2005	2	2	2	2	2	2	2			2	2	2	2	2	2	2	2	
CR abv Ceres Rd Br	90.1	2	2	2	2	2	2	2			2	1	1	2	2	2	2	1	
SF Chehalis R @ Tanker Intake	88.0007	1					1				1			1	1	1			
Bunker Ck @ BR abv mouth	84.4006	1					1				1			1	1	1			
Stearns Ck @ Twin Oaks Rd	78.0004	1					1				1			1	1	1			
CR @ SR 603 Br nr Claquato	77.6	1					1							1	1	1			
Newaukum R @ mouth	75.20015	2	2	2	2	2	2	2			2	1	1	2	2	2	2	1	
CR @ SR 6 Br nr Chehalis	74.6	3	3	3	3	3	3	3	1		3	3	2	3	3	3	3	2	1
Dillenbaugh Ck @ LaBree Rd	74.5034	1	1		1	1	1				1	1		1	1			1	
Berwick Ck at Hamilton Rd	74.5032005	1	1		1	1	1				1	1		1	1			1	
Chehalis Indust Pk Trib @ Bishop Rd	74.5023004	1	1		1	1	1				1	1		1	1			1	
Dillenbaugh Ck nr mouth	74.5001	1	1	1	1	1	1				1	1		1	1	1		1	
CR @ junk cars bend	73.6	1					1							1	1	1			
CR blw Golf Course intake - Deep	72.5	1	1	1	1	1	1	1			1		1	1	1	1	1		
CR blw Golf Course intake - Shallow	72.5	1	1	1	1	1	1	1			1		1	1	1	1	1		
Golf Course Discharge Pipe	72.0001	1					1				1	1		1	1	1		1	
CR north of Airport - Deep	70.7	1					1							1	1	1			
CR north of Airport - Shallow	70.7	1					1							1	1	1			
CR blw Overhanging Tree - Deep	69.6	1	2	2	2	2	2	2			2		2	2	2	2	2		
CR blw Overhanging Tree - Shallow	69.6	1	1	1	1	1	2	1			1		1	2	2	2	1		
Salzer Ck @ Airport Rd	69.2002	1	1		1	1	1	1			1		1	1	1	1	1	1	
CR blw Salzer Ck - Deep	69.1	1			1	1	1	1			1			1	1	1	1		
CR blw Salzer Ck - Shallow	69.1	1			1	1	1	1			1			1	1	1	1		
CR nr Midway Meats - Deep	68.5	1			1	1	1	1						1	1	1			
CR nr Midway Meats - Shallow	68.5	1			1	1	1	1						1	1	1			
CR @ Centralia (Mellen St)	67.5	2	2	2	2	2	2	2	1		2	1	1	2	2	2	2	1	1
CR abv Skookumchuck R	67.0	1					1							1	1	1			
Skookumchuck R nr mouth	66.9001	2	2	2	2	2	2	2			2	1	1	2	2	2	2	1	
CR blw Centralia BL	66.3	1			1		1							1	1	1			
CR @ Galvin (Galvin Rd Br)	64.2	1					1							1	1	1			
Lincoln Ck @ Lincoln Ck Rd	61.8011	1					1				1			1	1	1			

CR nr Grand Mound (Prather Rd)	59.9	3	2	2	2	2	3	2	2		3	1	1	3	3	3	2	1	2
Scatter Ck @ Br abv mouth	55.2007	1					1				1			1	1	1			
CR @ Independence Br	54.2	1					1							1	1	1			
CR nr Independence	52.9						1							1	1	1			
CR abv Black River	49.2	1	1	1	1	1	1	1			1	1		1	1	1	1	1	
Black R @ Howanut Rd Br	47.0012	2	2	2	2	2	2	2			2	1	1	2	2	2	2	1	
Garrard Ck @ Mattson Rd	44.9009	1					1				1			1	1	1			
CR @ Sickman Ford Br	44.0	1	1	1	1	1	1	1			1	1		1	1	1	1	1	
Cedar Ck @ Elma-Gate Rd	38.8008	1					1				1			1	1	1			
CR @ Porter (Porter Rd Br)	33.8	2	2	2	2	2	2	2	1		2	1	1	2	2	2	2	1	1

FACILITY SURVEY: AUGUST 4-5, 1992		Parameters (See Table 2.3 for key to abbreviations)																	
STATION	RM	TEMP, PH,DO	TSS	TDS	TURB	COND	CL	ALK	SI	FE	TOC	BOD5	UBOD	NH3N NO23N	TP TN	SRP	CHLA	FC	PHYID
Darigold WTP	74.4001	3	5	3	3	3	3	3			3	4	1	3	3	3	3	2	
Chehalis WTP	74.3001	2	5	3	3	3	3	3			3	4	1	3	3	3	3	2	
Centralia WTP	67.4001	2	5	3	3	3	3	3			3	4	1	3	3	3	3	2	

SALZER CK SURVEY: SEPTEMBER 9, 1992		Parameters (See Table 2.3 for key to abbreviations)																	
STATION	RM	TEMP, PH,DO	TSS	TDS	TURB	COND	CL	ALK	SI	FE	TOC	BOD5	UBOD	NH3N NO23N	TP TN	SRP	CHLA	FC	PHYID
Coal Ck @ National Ave	69.2008009	1	1		1	1	1				1	1		1	1			1	
Stormwater Ditch nr Fairgrounds	69.2006002		1		1	1	1				1	1		1	1			1	
Salzer Ck @ BN/UP Trestle	69.2006	1	1		1	1	1			1	1	1		1	1			1	
Salzer Ck @ Airport Rd	69.2002	1	2		2	2	2			2	2	2		2	2			1	

MINI SURVEY: SEPTEMBER 30, 1992		Parameters (See Table 2.3 for key to abbreviations)																	
STATION	RM	TEMP, PH,DO	TSS	TDS	TURB	COND	CL	ALK	SI	FE	TOC	BOD5	UBOD	NH3N NO23N	TP TN	SRP	CHLA	FC	PHYID
CR @ SR 6 Br nr Chehalis	74.6	1			1		1		1	1	1	1		1	1	1	1		1
CR blw Golf Course intake - Shallow	72.3	1			1	1	1			1	1	1		1	1	1	1		
CR blw Overhanging Tree - Shallow	69.6	1			1	1	1			1	1	1		1	1	1	1		
CR @ Centralia (Mellen St) - Shallow	67.5	1			2		2		2		2	2		2	2	2	2		2
CR nr Grand Mound (Prather Rd)	59.9	1			1		1		1		1	1		1	1	1	1		1

Appendix B. Details of Quality Assurance/Quality Control

B.1 Flow Measurements

A subjective estimation of the quality of flow measurements made during this study is included in Appendix Table C.1. Measurements marked as "poor" were generally taken where velocities were near or below the minimum resolution of the velocity meters; the accuracy of these measurements are questionable. Locations were designated "fair" where velocities were high enough for good resolution, but the channel morphology and flow characteristics at the measurement site were less favorable to accurate measurement and likely resulted in greater variability of results. "Good" measurement sites had measurable velocities, straight channels with minimal turbulence, and allowed measurements of relatively good accuracy with low variability.

B.2 Field Measurements

All field monitoring meters were calibrated according to manufacturer's specifications. Temperature in Hydrolab meters is factory calibrated, with a manufacturer's specification of $\pm 0.15°C$. Hydrolab® Datasonde 3 (DS3) and Surveyor 2 (S2) meters were calibrated for DO and pH at least weekly, and for conductivity at least monthly, with a few exceptions. In 1991, conductivity for the S2 was not calibrated and for the DS3 calibrated only on September 9, 1991. All S2 calibrations were inadvertently not saved during August 1991; S2 data for this period were examined for measurement "drift" by evaluation of field verification and post-calibration information.

DS3 and S2 dissolved oxygen data were reviewed by comparison of meter readings and Winkler field verification measurements taken as replicate pairs. The manufacturer's specification for the meters is $\pm$ 0.2 mg/L DO. The RMSE between the meter and the field Winkler measurements was 0.33 mg/L. Although the variability of DO measurements with the meter were similar to the variability of the Winkler method, meter readings were often observed to produce measurements that were biased high or low over the sampling period between calibrations. Therefore, it was reasonable to adjust the meter data to reduce variability due to bias.

Several methods of systematic error correction for meter DO data were reviewed. The method of correction chosen was to use the Winkler field verification data to develop a correction factor. For each replicate pair of meter and Winkler field verification measurements, a replicate residual was calculated by subtracting the

Winkler value from the meter value. For each period between calibrations (typically one week) and for each meter, the average replicate residual was used as a correction factor that was subtracted from the raw field data. All DS3 and S2 dissolved oxygen data presented in this report have been corrected in this fashion. By this method, the RMSE was reduced to 0.12 mg/L for the DS3 measurements and 0.16 for the S2 measurements.

The Hydrolab manufacturer's specification for pH is ± 0.2 units. Post-calibration drift was reviewed for the meters, and with the exception of July and August 1991, the maximum difference between pre- and post- calibration pH values for any meter was 0.21 for the DS3's and 0.05 for the S2's. Because the pH data from July and August 1991 showed drift of significantly more than 0.2 units, the data for this period were corrected by subtracting from the raw data the drift at pH 7 for the sampling period between pre- and post-calibration. The drift was calculated by subtracting the post-calibration value from the pre-calibration value for the sampling period. All other pH data were acceptable and were not corrected.

The Hydrolab meter post-calibration data for conductivity indicate that precision was less than ± 5% for measurements near 100 μmhos/cm, and ±10% near 1000 μmhos/cm, with the exception that conductivity for the DS3's prior to August 9, 1991 showed a precision of ± 30%. Conductivity data have not been corrected.

B.3 Laboratory Sampling

All laboratory analyses were performed within specified holding times. Chlorophyll *a* data for week 35 in August 1991 are qualified due to absorbance ratios outside the normal range; data for week 37 in September 1991 are qualified due to poor precision; and data for week 32 in 1992 are qualified due to samples exceeding holding temperatures during transport. Total phosphorus data collected in 1991 with results less than 100 μg/L are qualified as reporting values that may be lower than the true value. Qualified data may be used with caution. All other data were reported by Ecology's Manchester Laboratory as usable without qualification.

The replicate precision of laboratory data can be measured in a number of ways, and two methods are used in this report. The root mean square error (RMSE) is calculated as the square root of the average squared difference between each pair of data. The root mean square coefficient of variation (RMS-CV) of paired readings is calculated as the square root of the average squared coefficient of variation of each pair of data, where the coefficient of variation is the standard deviation of the pair divided by the mean of the pair. These two methods were chosen because they are proven statistical tools recommended in the literature and used in other EILS studies (Reckhow, *et al.*, 1986; Ecology, 1992c), and because they are simple to use and understand.

The RMS-CV of field replicates was approximately 45% for chlorophyll *a* and 38% for phaeophyton-a; between 20 to 30% for fecal coliform and fecal streptococcus; between 10 to 20% for KES, total suspended solids and total dissolved solids; and less than 10% for all other parameters. These precision estimates reflect the variability and uncertainty of the data, and were taken into account in the data analysis leading to the recommendations of this report.

The replicate precision of field dissolved oxygen methods using the Winkler modified azide analytical method was less than 5% using RMS-CV of paired field replicates, and the RMSE of paired replicates was 0.33 mg/L.

Appendix C. Flow and Time of Travel

Appendix C

Table C.1 Chehalis River Flows

Mainstem Flows

RM Code	Site Description	Date	Time	Discharge (cfs)	Width (ft)	Area (ft2)	Avg vel (fps)	Data Quality
35.9	Sandy glide above Porter Ck	09/20/91	1450	371	154	778	0.48	Fair
38.4	Pool below Cedar Ck	09/20/91	1320	285	189	979	0.29	Fair
39.7	Glide above Rock Ck	09/20/91	1125	313	167	293	1.07	Fair
41.1	Run below Oakville Boat Launch	09/20/91	950	352	99	269	1.31	Good
42.2	CR nr Oakville BL	09/10/91	1225	447	133	179	2.50	Fair
42.2	CR nr Oakville BL	09/11/91	1204	419	130	173	2.43	Fair
42.2	CR nr Oakville BL	09/12/91	1200	373	131	171	2.18	Fair
45.1	Near Old Balch Bridge	08/21/91	1545	369	119	88	4.17	Fair
47.1	Pool above Black R	08/14/91	1820	220	120	638	0.34	Fair
48.4	Riffle above Black R	08/14/91	1715	285	62	105	2.73	Fair
51.1	Glide below Independence Ck	08/14/91	1610	288	168	272	1.06	Fair
52.9	CR nr Independence	09/10/91	815	308	176	304	1.02	Good
52.9	CR nr Independence	09/11/91	850	297	175	301	0.99	Good
52.9	CR nr Independence	09/12/91	830	300	174	305	0.98	Good
52.9	CR nr Independence	06/23/92	1115	297	160	383	0.77	Good
52.9	CR nr Independence	07/21/92	1430	213	178	269	0.79	Good
52.9	CR nr Independence	08/05/92	1200	143	167	271	0.53	Good
53.5	Riffle below Independence Br	08/14/91	1510	258	60	86	3.02	Fair
53.9	Pool below Independence Br	08/14/91	1410	211	221	627	0.34	Fair
58.0	Glide above Scatter Ck Island	08/13/91	1408	259	111	458	0.57	Good
61.5	Pool above Prather Rd Br	08/13/91	1604	203	182	811	0.25	Fair
63.2	Pool below Galvin Rd Br	08/13/91	1731	258	202	971	0.27	Fair
66.0	CR @ Riffle blw Centralia BL	08/22/91	1200	220	66	71	3.11	Fair
66.0	CR @ Riffle blw Centralia BL	08/28/91	1401	261	108	93	2.81	Fair
66.0	CR @ Riffle blw Centralia BL	10/10/91	1545	245	133	87	2.82	Fair
66.5	Sonar Cross-section	08/22/91			192	1004		
66.7	Above Centralia BL	06/24/92	1035	240	196	433	0.55	Good
66.7	Above Centralia BL	07/23/92	1055	173	196	394	0.44	Good
66.7	Above Centralia BL	08/03/92	1530	144	196	370	0.39	Good

Table C.1, page 2

RM Code	Site Description	Date	Time	Discharge (cfs)	Width (ft)	Area (ft2)	Avg vel (fps)	Data Quality
66.9	Sonar Cross-section	08/22/91			216	725		
67.4	Sonar Cross-section	08/22/91			197	1675		
67.9	Sonar Cross-section	08/22/91			177	1880		
68.4	Sonar Cross-section	08/21/91			233	2346		
68.9	Sonar Cross-section	08/21/91			157	1404		
69.4	Sonar Cross-section	08/21/91			149	1885		
69.9	Sonar Cross-section	08/21/91			161	1424		
70.4	Sonar Cross-section	08/21/91			185	1305		
70.9	Sonar Cross-section	08/21/91			180	1937		
71.4	Sonar Cross-section	08/21/91			144	1327		
71.9	Sonar Cross-section	08/21/91			108	903		
72.4	Sonar Cross-section	08/20/91			151	918		
72.9	Sonar Cross-section	08/20/91			141	922		
73.4	Sonar Cross-section	08/20/91			144	955		
73.9	Sonar Cross-section	08/20/91			108	860		
74.4	Sonar Cross-section	08/19/91			197	1602		
74.9	CR abv SR 6 Br nr Chehalis	08/19/91	1245	124	69	51	2.43	Fair
74.9	CR abv SR 6 Br nr Chehalis	08/27/91	1047	109	84	116	0.94	Fair
74.9	CR abv SR 6 Br nr Chehalis	08/28/91	1150	149	88	127	1.18	Fair
74.9	CR abv SR 6 Br nr Chehalis	10/10/91	1052	92	91	89	1.04	Fair
75.2	BSA Camp blw Newaukum	07/23/92	1300	105	71	104	1.01	Good
75.2	BSA Camp blw Newaukum	08/04/92	1110	68	68	89	0.76	Good
75.9	Pool above Newaukum	08/22/91	2000	33	83	639	0.05	Poor
77.5	Pool near Claquato	08/22/91	1845	37	86	327	0.11	Poor
78.5	Chute above Stearns Ck	08/22/91		44	46	88	0.49	Fair
78.8	Riffle above Stearns Ck	08/22/91		72	70	50	1.44	Fair
80.5	Pool below Adna bridge	08/22/91	1615	59	74	303	0.20	Fair
80.8	Glide below Adna bridge	08/22/91	1500	59	104	199	0.30	Fair
90.1	CR abv Ceres Rd Br	07/22/92	1450	54	73	33	1.67	Fair
90.1	CR abv Ceres Rd Br, 1st site	08/04/92	1340	28	66	140	0.20	Fair
90.1	CR abv Ceres Rd Br, 2nd site	08/04/92	1340	38	65	17	2.23	Fair
90.2	Above Ceres Rd Br	08/27/91	1145	58	89	105	0.55	Fair
90.2	Above Ceres Rd Br	08/28/91	1023	117	90	132	0.89	Fair

RM Code	Site Description	Date	Time	Discharge (cfs)	Width (ft)	Area (ft2)	Avg vel (fps)	Data Quality
90.2	Above Ceres Rd Br	06/23/92	950	68	89	115	0.59	Fair
94.6	Above Meskill Br	08/27/91		63	72	132	0.48	Good
94.6	Above Meskill Br	08/27/91		69	72	132	0.52	Good
94.6	Above Meskill Br	08/28/91	940	115	80	144	0.80	Good
100.5	CR @ Elk Ck Rd nr Doty	08/27/91	1417	34	93	108	0.31	Fair
100.5	CR @ Elk Ck Rd nr Doty	08/28/91	1259	42	99	125	0.34	Fair
106.3	CR @ SR 6 Br nr Pe Ell	08/27/91	1303	37	90	57	0.65	Good
106.3	CR @ SR 6 Br nr Pe Ell	08/28/91	1212	47	86	58	0.80	Good
106.3	CR @ SR 6 Br nr Pe Ell	07/22/92	1340	30	78	74	0.40	Good
106.3	CR @ SR 6 Br nr Pe Ell	08/04/92	1135	17	81	61	0.29	Good
Tributary Flows								
33.9002	Porter Ck @ RR Trestle	09/10/91	925	13.3		17.1	0.78	Good
33.9002	Porter Ck @ RR Trestle	09/11/91	845	11.8		14.2	0.83	Good
33.9002	Porter Ck @ RR Trestle	09/12/91	1000	13.2		14.7	0.90	Good
33.9002	Porter Ck @ RR Trestle	07/23/92	816	11.5		17.4	0.66	Good
33.9002	Porter Ck @ RR Trestle	08/05/92	915	8.7		9.2	0.95	Good
38.8008	Cedar Ck @ Elma-Gate Rd	09/10/91	1403	14.1		105.9	0.13	Good
38.8008	Cedar Ck @ Elma-Gate Rd	09/11/91	1330	13.8		64.9	0.21	Good
38.8008	Cedar Ck @ Elma-Gate Rd	09/12/91	1045	13.9		67.6	0.21	Good
38.8008	Cedar Ck @ Elma-Gate Rd	07/23/92	850	11.4		64.8	0.18	Good
38.8008	Cedar Ck @ Elma-Gate Rd	08/05/92	1000	12.0		61.7	0.19	Good
39.4006	Rock Ck @ South Bank Rd	09/10/91	1030	3.0		22.3	0.13	Fair
39.4006	Rock Ck @ South Bank Rd	09/11/91	945	2.2		22.3	0.10	Fair
44.9009	Garrard Ck @ Mattson Rd	09/10/91	1600	3.9		22.6	0.17	Good
44.9009	Garrard Ck @ Mattson Rd	09/11/91	1100	3.9		21.0	0.19	Good
44.9009	Garrard Ck @ Mattson Rd	07/23/92	930	3.2		7.7	0.42	Good
44.9009	Garrard Ck @ Mattson Rd	08/05/92	1045	1.8		2.7	0.69	Good
47.0012	Black R @ Howanut Rd Br	08/21/91	1300	66.6	86.1	160.0	0.42	Good
47.0012	Black R @ Howanut Rd Br	09/10/91	1250	64.7	85.5	188.4	0.34	Good
47.0012	Black R @ Howanut Rd Br	09/11/91	1350	68.6	85.5	208.7	0.33	Good
47.0012	Black R @ Howanut Rd Br	09/12/91	1325	65.8	88.5	195.6	0.34	Good
47.0012	Black R @ Howanut Rd Br	06/23/92	1311	74.5	84.5	179.1	0.42	Good
47.0012	Black R @ Howanut Rd Br	07/23/92	1000	51.0	82.0	149.3	0.34	Good

Table C.1, page 4

RM Code	Site Description	Date	Time	Discharge (cfs)	Width (ft)	Area (ft2)	Avg vel (fps)	Data Quality
47.0012	Black R @ Howanut Rd Br	08/05/92	1640	44.4	78.5	141.8	0.31	Good
51.5003	Independence Ck @ 123d St	09/10/91	930	0.6		2.9	0.19	Good
51.5003	Independence Ck @ 123d St	09/11/91	825	0.6		2.1	0.28	Good
55.2007	Scatter Ck @ Br abv mouth	09/10/91	1050	4.5		10.2	0.44	Fair
55.2007	Scatter Ck @ Br abv mouth	09/11/91	1140	3.6		9.4	0.38	Fair
55.2007	Scatter Ck @ Br abv mouth	07/21/92	1545	0.6		1.3	0.49	Fair
55.2007	Scatter Ck @ Br abv mouth	08/05/92	1402	0.8		5.0	0.15	Fair
55.2060	Global Aqua/Scatter Ck	09/10/91		1.7				Good
55.2080	Seafarm WA/Scatter Ck	09/10/91		5.8				Good
61.8011	Lincoln Ck @ Lincoln Ck Rd	08/27/91	1045	1.2		23.9	0.05	Poor
61.8011	Lincoln Ck @ Lincoln Ck Rd	08/28/91	1030	3.1		13.5	0.23	Poor
61.8011	Lincoln Ck @ Lincoln Ck Rd	07/21/92	1325	0.6		8.1	0.07	Poor
66.9001	Skookumchuck R nr mouth	08/27/91	1828	74.1		28.7	2.58	Fair
66.9001	Skookumchuck R nr mouth	08/28/91	1300	72.3		36.9	1.96	Fair
66.9001	Skookumchuck R nr mouth	10/10/91	1500	148.9		36.4	4.09	Fair
66.9001	Skookumchuck R nr mouth	07/23/92	1233	60.3		28.5	2.12	Fair
66.9001	Skookumchuck R nr mouth	08/03/92	1445	67.2		30.4	2.21	Fair
67.3001	China Ck nr mouth	08/28/91		2.3		5.1	0.46	Fair
67.4001	Centralia WTP	08/27/91		2.3				Good
67.4001	Centralia WTP	07/21/92		1.9				Good
67.4001	Centralia WTP	08/04/92		2.0				Good
69.2002	Salzer Ck @ Airport Rd	08/27/91	1300	3.6		20.4	0.17	Fair
69.2002	Salzer Ck @ Airport Rd	08/28/91	1215	2.0		14.4	0.14	Fair
69.2002	Salzer Ck @ Airport Rd	07/21/92	1140	0.5		3.7	0.14	Fair
69.2002	Salzer Ck @ Airport Rd	08/04/92	1430	0.1		1.0	0.14	Fair
69.2002	Salzer Ck @ Airport Rd	09/09/92	1155	0.5		3.6	0.14	Fair
69.2006	Salzer Ck @ BN/UP Trestle	09/09/92	1025	0.5		1.7	0.25	Fair
69.2008009	Coal Ck @ National Ave	09/09/92	935	0.3		1.4	0.23	Fair
74.3001	Chehalis WTP	08/27/91		1.9				Good
74.3001	Chehalis WTP	07/21/92		1.4				Good
74.3001	Chehalis WTP	08/04/92		1.3				Good
74.4001	Darigold WTP	12/04/91		0.7				Good
74.4001	Darigold WTP	07/21/92		0.7				Good

RM Code	Site Description	Date	Time	Discharge (cfs)	Width (ft)	Area (ft2)	Avg vel (fps)	Data Quality
74.4001	Darigold WTP	08/04/92		0.6				Good
74.5001	Dillenbaugh Ck	08/28/91	1225	1.4		2.3	0.63	Fair
74.5001	Dillenbaugh Ck nr mouth	07/22/92	1520	0.8		11.1	0.07	Poor
74.5001	Dillenbaugh Ck nr mouth	08/05/92	846	0.3		0.7	0.47	Fair
75.20015	Newaukum R @ mouth	08/27/91	1523	48.4		45.6	1.06	Good
75.20015	Newaukum R @ mouth	08/28/91	1359	72.0		53.5	1.35	Good
75.20015	Newaukum R @ mouth	07/23/92	1330	46.5		18.7	2.49	Good
75.20015	Newaukum R @ mouth	08/04/92	1205	26.6		26.6	1.00	Good
78.0004	Stearns Ck @ Twin Oaks Rd	08/27/91	1215	3.1		3.8	0.83	Fair
78.0004	Stearns Ck @ Twin Oaks Rd	08/28/91	1100	4.4		4.6	0.95	Fair
78.0004	Stearns Ck @ Twin Oaks Rd	07/23/92	1505	3.7		4.3	0.85	Fair
78.6004	Stearns Ck @ Twin Oaks Rd	08/04/92	1040	1.9		3.4	0.57	Fair
84.4006	Bunker Ck @ Br abv mouth	07/23/92	1430	0.3		4.1	0.08	Poor
84.4006	Bunker Ck abv mouth, 1st site	08/04/92	935	0.0		0.8	0.04	Poor
84.4006	Bunker Ck abv mouth, 2nd site	08/04/92	935	0.2		1.3	0.12	Fair
84.6006	Bunker Ck @ Br abv mouth	08/27/91	1115	1.3		16.3	0.08	Poor
84.6006	Bunker Ck @ Br abv mouth	08/28/91	1000	1.3		17.7	0.07	Poor
88.0007	SF Chehalis R @ Wyhsr Pump	08/27/91	1200	11.1		43.0	0.26	Good
88.0007	SF Chehalis R @ Wyhsr Pump	08/28/91	1121	18.7		64.3	0.29	Good
88.0007	SF Chehalis R @ Wyhsr Pump	07/22/92	935	14.8		32.5	0.46	Good
88.0007	SF Chehalis R @ Wyhsr Pump	08/04/92	850	9.3		3.6	2.57	Good
100.2005	Elk Ck @ Elk Ck Rd Br	08/27/91	901	35.0		29.4	1.19	Fair
100.2005	Elk Ck @ Elk Ck Rd Br	08/28/91	842	53.3		30.4	1.75	Fair
100.2005	Elk Ck @ Elk Ck Rd Br	07/22/92	1110	8.6		9.9	0.87	Fair
100.2005	Elk Ck @ Elk Ck Rd Br	08/04/92	1000	9.4		20.8	0.45	Fair
105.5001	Pe Ell WTP	08/27/91		0.2				Good

Appendix Table C.2 Prediction of Chehalis River Summer Low Flow below Newaukum River and above Skookumchuck River based on USGS Flow Gaging Stations.

Observed Flows

Date	RM Code	Station	Discharge
08/28/91	66.0	Chehalis River @ Riffle below Centralia Boat Launch	260.7
10/10/91			245.44
07/23/92	66.7	Chehalis River above Centralia Boat Launch	173.09
08/03/92			144.08
08/28/91	66.9001	Skookumchuck River near mouth	72.34
10/10/91			148.86
07/23/92			60.32
08/03/92			67.24
08/19/91	74.9	Chehalis River abv SR 6 Br nr Chehalis	123.91
10/10/91			92.25
07/23/92	75.2	Chehalis River @ BSA Camp blw Newaukum R	105.27
08/04/92			67.84
08/29/91	59.9	USGS Stn No. 12027500, Chehalis River near Grand Mound	356
10/11/91			241
07/24/92			187
08/04/92			147
08/27/91	66.9064	USGS Stn No. 12026400, Skookumchuck River near Bucoda	88
10/09/91			128
07/22/92			65
08/02/92			58
08/19/91	75.2041	USGS Stn No. 12025000, Newaukum River near Chehalis	46
08/27/91			46
08/28/91			69
10/10/91			36
07/23/92			48
08/04/92			33
08/18/91	101.8	USGS Stn No. 12020000, Chehalis River near Doty	35
08/26/91			32
08/27/91			38
10/09/91			24
07/22/92			30
08/03/92			23

Chehalis River above Skookumchuck River: Flow Estimates from Linear Regression

Date (t)	Grnd Mnd (t+1)	Skook (t-1)	GdMd -Skook	Abv Skook Observed	Abv Skook Estimated
08/28/91	356	88	268	188.4	2674
10/10/91	241	128	113	96.6	1132
07/23/92	187	65	122	112.8	1222
08/03/92	147	58	89	76.8	893

Regression Output (Linear):

Constant	30.674
Std Err of Y Est	8.4060
R Squared	0.9801
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	0.5943
Std Err of Coef.	0.0597
t	9.9445
t(.005,1,2)	9.925

Equation for Estimated Flows:

Q(CS) = {0.5943 * [Q(GM)-Q(SK)]+30.674}

where:
Q(CS) = Estimated Flows CR abv Skookumchuck for day 't'
Q(SK) = Gaged Flows Skookumchuck at Bucoda for day 't-1'
Q(GM) = Gaged Flows CR nr Grand Mound for day 't+1'

This regression assumes steady-state low flow conditions

Chehalis River below Newaukum River: Flow Estimates from Linear Regression

Date (t)	Doty (t-1)	Newauk (t)	Newauk +Doty	Abv Sr 6 Observed	Abv Sr 6 Estimated
08/19/91	35	46	81	123.9	566
08/27/91	32	46	78	109.0	546
08/28/91	38	69	107	149.2	745
10/10/91	24	36	60	92.3	422
07/23/92	30	48	78	105.3	546
08/04/92	23	33	56	67.8	394

Regression Output (Linear):

Constant	-4.208
Std Err of Y Est	8.6230
R Squared	0.9221
No. of Observations	6
Degrees of Freedom	4
X Coefficient(s)	1.4624
Std Err of Coef.	0.2124
t	6.8835
t(.0025,1,4)	5.598

Equation for Estimated Flows:

Q(CN) = {1.4624 * [Q(DY)+Q(NW)]-4.208}

where:
Q(CN) = Estimated Flows CR blw Newaukum for day 't'
Q(DY) = Gaged Flows Chehalis R near Doty for day 't-1'
Q(NW) = Gaged Flows Newaukum R near Chehalis for day 't'

This regression assumes steady-state low flow conditions

Appendix C
Table C.3 Chehalis River Time of Travel Estimate

All flows in cfs

All areas in sq. ft.

Morphology Types (T) and Cross-sectional Areas					
	Riffle/Chute	Swift Glide	Avg Glide	Slow Glide	Pool
RM	1	2	3	4	5
33.8 - 46.9	100	200	300	700	1000
47.0 - 59.8	100	200	300	500	700
59.9 - 66.9	100	300	500	800	1000
67.0 - 74.8	750	1000	1400	1900	2500
74.9 - 90.0	50	100	200	300	600
90.1 - 100.1	30	75	150	250	400
100.2 - 106.3	25	50	100	150	200

Groundwater Estimated Inflow and Outflow	
RM	Q (cfs/.1mi)
33.8	0.06
42.2	0.07
47.0	0.08
54.2	0.30
58.2	0.20
59.9	0.08
64.2	0.09
66.9	2.00
67.5	0.40
68.6	0.40
69.1	0.40
69.6	0.40
70.7	0.40
72.5	0.00
73.6	0.00
74.6	0.12
80.8	0.05
90.2	-0.12
94.6	0.12
100.5	0.17
101.8	0.07

Permitted Water Rights: River Withdrawals		
RM	Q	UseCoeff
33.8	14.38	0.30
42.2	1.43	0.30
47.0	2.02	0.30
54.2	1.03	0.30
58.2	0.45	0.30
59.9	6.73	0.30
64.2	2.26	0.30
66	1.12	0.30
67.5	1.34	0.30
68.6	1.00	0.30
69.1	0.00	0.30
69.6	1.75	0.30
70.7	6.07	0.30
72.5	0.94	0.30
73.6	0.40	0.30
74.6	32.48	0.30
80.8	17.20	0.90
90.2	3.90	0.90
94.6	4.20	0.90
100.5	0.50	0.70
101.8	3.78	0.70
106.4		

Table C.3, page 2

Early September 1991, Steady-state										
Name	RM	Minutes per .1mi	Days to mouth	QOb	QSm	QTr	QGw	QCu	T	Area
PORTER	33.8		0.000	412.0	412.6	12.75	0.06	-0.05	5	1000
Porter Ck	33.9	21	0.015		399.8		0.06	-0.05	5	1000
	34.0	22	0.030		399.8		0.06	-0.05	1	100
	34.1	2	0.032		399.8		0.06	-0.05	1	100
	34.2	2	0.033		399.8		0.06	-0.05	2	200
	34.3	4	0.036		399.8		0.06	-0.05	2	200
	34.4	4	0.039		399.7		0.06	-0.05	2	200
	34.5	4	0.042		399.7		0.06	-0.05	1	100
	34.6	2	0.044		399.7		0.06	-0.05	5	1000
	34.7	22	0.059		399.7		0.06	-0.05	5	1000
	34.8	22	0.074		399.7		0.06	-0.05	3	300
	34.9	7	0.079		399.7		0.06	-0.05	3	300
	35.0	7	0.084		399.7		0.06	-0.05	1	100
	35.1	2	0.085		399.7		0.06	-0.05	2	200
	35.2	4	0.088		399.7		0.06	-0.05	2	200
	35.3	4	0.091		399.7		0.06	-0.05	1	100
	35.4	2	0.093		399.7		0.06	-0.05	3	300
	35.5	7	0.097		399.7		0.06	-0.05	4	700
	35.6	15	0.108		399.6		0.06	-0.05	4	700
	35.7	15	0.119		399.6		0.06	-0.05	4	700
	35.8	15	0.129		399.6		0.06	-0.05	4	700
CR abv Porter Ck	35.9	15	0.140	370.8	399.6		0.06	-0.05	4	700
	36.0	15	0.151		399.6		0.06	-0.05	4	700
	36.1	15	0.162		399.6		0.06	-0.05	3	300
	36.2	7	0.166		399.6		0.06	-0.05	1	100
	36.3	2	0.168		399.6		0.06	-0.05	1	100
	36.4	2	0.169		399.6		0.06	-0.05	3	300
	36.5	7	0.174		399.6		0.06	-0.05	4	700
	36.6	15	0.185		399.6		0.06	-0.05	4	700
	36.7	15	0.195		399.5		0.06	-0.05	1	100
	36.8	2	0.197		399.5		0.06	-0.05	3	300
	36.9	7	0.201		399.5		0.06	-0.05	2	200
	37.0	4	0.204		399.5		0.06	-0.05	2	200
	37.1	4	0.207		399.5		0.06	-0.05	4	700
	37.2	15	0.218		399.5		0.06	-0.05	5	1000
Gibson Ck	37.3	22	0.233		399.5	2.5	0.06	-0.05	1	100
	37.4	2	0.235		397.0		0.06	-0.05	3	300
	37.5	7	0.240		397.0		0.06	-0.05	3	300
	37.6	7	0.244		397.0		0.06	-0.05	3	300
	37.7	7	0.249		397.0		0.06	-0.05	3	300
	37.8	7	0.253		397.0		0.06	-0.05	3	300
	37.9	7	0.258		397.0		0.06	-0.05	5	1000
	38.0	22	0.273		397.0		0.06	-0.05	5	1000
	38.1	22	0.289		397.0		0.06	-0.05	5	1000

Table C.3, page 3

Name	RM	Minutes per .1mi	Days to mouth	QOb	QSm	QTr	QGw	QCu	T	Area
	38.2	22	0.304		397.0		0.06	-0.05	5	1000
	38.3	22	0.320		397.0		0.06	-0.05	5	1000
Pool below Cedar Ck	38.4	22	0.335		397.0		0.06	-0.05	5	1000
	38.5	22	0.350		396.9		0.06	-0.05	2	200
	38.6	4	0.354		396.9		0.06	-0.05	2	200
	38.7	4	0.357		396.9		0.06	-0.05	2	200
Cedar Ck	38.8	4	0.360		396.9	13.9	0.06	-0.05	2	200
	38.9	4	0.363		383.0		0.06	-0.05	2	200
	39.0	5	0.366		383.0		0.06	-0.05	2	200
	39.1	5	0.369		383.0		0.06	-0.05	2	200
	39.2	5	0.372		383.0		0.06	-0.05	2	200
	39.3	5	0.376		383.0		0.06	-0.05	2	200
Rock Ck	39.4	5	0.379		383.0	2.6	0.06	-0.05	3	300
	39.5	7	0.384		380.3		0.06	-0.05	3	300
	39.6	7	0.388		380.3		0.06	-0.05	3	300
Glide above Rock Ck	39.7	7	0.393		380.3		0.06	-0.05	3	300
	39.8	7	0.398		380.3		0.06	-0.05	3	300
	39.9	7	0.403		380.3		0.06	-0.05	1	100
	40.0	2	0.404		380.3		0.06	-0.05	3	300
	40.1	7	0.409		380.3		0.06	-0.05	3	300
	40.2	7	0.414		380.3		0.06	-0.05	2	200
	40.3	5	0.417		380.3		0.06	-0.05	1	100
	40.4	2	0.419		380.3		0.06	-0.05	3	300
	40.5	7	0.424		380.3		0.06	-0.05	3	300
	40.6	7	0.429		380.3		0.06	-0.05	5	1000
	40.7	23	0.445		380.2		0.06	-0.05	1	100
	40.8	2	0.446		380.2		0.06	-0.05	5	1000
	40.9	23	0.462		380.2		0.06	-0.05	3	300
	41.0	7	0.467		380.2		0.06	-0.05	3	300
Run below Oakville BL	41.1	7	0.472		380.2		0.06	-0.05	3	300
	41.2	7	0.477		380.2		0.06	-0.05	3	300
	41.3	7	0.482		380.2		0.06	-0.05	3	300
	41.4	7	0.486		380.2		0.06	-0.05	3	300
	41.5	7	0.491		380.2		0.06	-0.05	3	300
	41.6	7	0.496		380.2		0.06	-0.05	3	300
	41.7	7	0.501		380.2		0.06	-0.05	5	1000
	41.8	23	0.517		380.1		0.06	-0.05	1	100
	41.9	2	0.519		380.1		0.06	-0.05	5	1000
CR blw Oakville BL	42.0	23	0.535		380.1		0.06	-0.05	3	300
	42.1	7	0.539		380.1		0.06	-0.05	3	300
Near Oakville BL	42.2	7	0.544	373.0	380.1		0.07	-0.01	2	200
	42.3	5	0.547		380.1		0.07	-0.01	2	200
	42.4	5	0.551		380.0		0.07	-0.01	2	200
	42.5	5	0.554		379.9		0.07	-0.01	2	200
Davis Ck	42.6	5	0.557		379.9	0.5	0.07	-0.01	2	200
	42.7	5	0.560		379.3		0.07	-0.01	3	300

Table C.3, page 4

Name	RM	Minutes per .1mi	Days to mouth	QOb	QSm	QTr	QGw	QCu	T	Area
	42.8	7	0.565		379.3		0.07	-0.01	3	300
	42.9	7	0.570		379.2		0.07	-0.01	5	1000
	43.0	23	0.586		379.1		0.07	-0.01	5	1000
	43.1	23	0.602		379.1		0.07	-0.01	3	300
	43.2	7	0.607		379.0		0.07	-0.01	3	300
	43.3	7	0.612		379.0		0.07	-0.01	1	100
	43.4	2	0.614		378.9		0.07	-0.01	5	1000
	43.5	23	0.630		378.8		0.07	-0.01	5	1000
	43.6	23	0.646		378.8		0.07	-0.01	2	200
	43.7	5	0.649		378.7		0.07	-0.01	2	200
	43.8	5	0.652		378.7		0.07	-0.01	2	200
	43.9	5	0.655		378.6		0.07	-0.01	2	200
Sickman Ford Bridge	44.0	5	0.659		378.5		0.07	-0.01	5	1000
	44.1	23	0.675		378.5		0.07	-0.01	5	1000
	44.2	23	0.691		378.4		0.07	-0.01	4	700
	44.3	16	0.702		378.3		0.07	-0.01	4	700
	44.4	16	0.714		378.3		0.07	-0.01	4	700
	44.5	16	0.725		378.2		0.07	-0.01	1	100
	44.6	2	0.727		378.2		0.07	-0.01	1	100
	44.7	2	0.728		378.1		0.07	-0.01	4	700
	44.8	16	0.739		378.0		0.07	-0.01	4	700
Garrard Ck	44.9	16	0.751		378.0	3.9	0.07	-0.01	4	700
	45.0	16	0.762		374.0		0.07	-0.01	4	700
Near Old Balch Bridge	45.1	16	0.774		373.9		0.07	-0.01	1	100
	45.2	2	0.775		373.9		0.07	-0.01	3	300
	45.3	7	0.780		373.8		0.07	-0.01	1	100
	45.4	2	0.782		373.7		0.07	-0.01	1	100
	45.5	2	0.783		373.7		0.07	-0.01	1	100
	45.6	2	0.785		373.6		0.07	-0.01	2	200
	45.7	5	0.788		373.6		0.07	-0.01	2	200
	45.8	5	0.792		373.5		0.07	-0.01	1	100
	45.9	2	0.793		373.4		0.07	-0.01	2	200
	46.0	5	0.796		373.4		0.07	-0.01	2	200
	46.1	5	0.800		373.3		0.07	-0.01	4	700
	46.2	17	0.811		373.3		0.07	-0.01	3	300
	46.3	7	0.816		373.2		0.07	-0.01	3	300
	46.4	7	0.821		373.1		0.07	-0.01	1	100
	46.5	2	0.823		373.1		0.07	-0.01	1	100
	46.6	2	0.824		373.0		0.07	-0.01	2	200
	46.7	5	0.828		372.9		0.07	-0.01	3	300
	46.8	7	0.832		372.9		0.07	-0.01	3	300
	46.9	7	0.837		372.8	66.4	0.07	-0.01	4	700
Black River	47.0	17	0.849		306.4		0.08	-0.01	4	500
Pool above Black R	47.1	14	0.859		306.3		0.08	-0.01	5	700
	47.2	20	0.873		306.2		0.08	-0.01	5	700
	47.3	20	0.887		306.2		0.08	-0.01	3	300

Name	RM	Minutes per .1mi	Days to mouth	QOb	QSm	QTr	QGw	QCu	T	Area
	47.4	9	0.893		306.1		0.08	-0.01	3	300
	47.5	9	0.899		306.0		0.08	-0.01	4	500
	47.6	14	0.909		305.9		0.08	-0.01	3	300
	47.7	9	0.915		305.9		0.08	-0.01	4	500
	47.8	14	0.925		305.8		0.08	-0.01	3	300
	47.9	9	0.931		305.7		0.08	-0.01	4	500
	48.0	14	0.941		305.7		0.08	-0.01	5	700
	48.1	20	0.955		305.6		0.08	-0.01	3	300
	48.2	9	0.961		305.5		0.08	-0.01	3	300
	48.3	9	0.967		305.4		0.08	-0.01	3	300
Riffle above Black R	48.4	9	0.973		305.4		0.08	-0.01	1	100
	48.5	3	0.975		305.3		0.08	-0.01	4	500
	48.6	14	0.985		305.2		0.08	-0.01	1	100
	48.7	3	0.987		305.1		0.08	-0.01	2	200
	48.8	6	0.991		305.1		0.08	-0.01	2	200
	48.9	6	0.995		305.0		0.08	-0.01	3	300
	49.0	9	1.001		304.9		0.08	-0.01	4	500
	49.1	14	1.011		304.9		0.08	-0.01	3	300
	49.2	9	1.017		304.8		0.08	-0.01	5	700
	49.3	20	1.031		304.7		0.08	-0.01	1	100
	49.4	3	1.033		304.6		0.08	-0.01	4	500
	49.5	14	1.043		304.6		0.08	-0.01	1	100
	49.6	3	1.045		304.5		0.08	-0.01	4	500
	49.7	14	1.055		304.4		0.08	-0.01	1	100
	49.8	3	1.057		304.4		0.08	-0.01	1	100
	49.9	3	1.059		304.3		0.08	-0.01	4	500
	50.0	14	1.069		304.2		0.08	-0.01	1	100
	50.1	3	1.071		304.1		0.08	-0.01	3	300
	50.2	9	1.077		304.1		0.08	-0.01	3	300
	50.3	9	1.083		304.0		0.08	-0.01	3	300
	50.4	9	1.089		303.9		0.08	-0.01	2	200
	50.5	6	1.093		303.9		0.08	-0.01	3	300
	50.6	9	1.099		303.8		0.08	-0.01	5	700
	50.7	20	1.113		303.7		0.08	-0.01	5	700
	50.8	20	1.127		303.6		0.08	-0.01	3	300
	50.9	9	1.133		303.6		0.08	-0.01	4	500
	51.0	14	1.143		303.5		0.08	-0.01	4	500
Glide blw Indy Ck	51.1	14	1.153		303.4		0.08	-0.01	3	300
	51.2	9	1.159		303.4		0.08	-0.01	2	200
	51.3	6	1.163		303.3		0.08	-0.01	3	300
	51.4	9	1.170		303.2		0.08	-0.01	2	200
Independence Ck	51.5	6	1.174		303.1	0.6	0.08	-0.01	5	700
	51.6	20	1.188		302.5		0.08	-0.01	4	500
	51.7	15	1.198		302.4		0.08	-0.01	2	200
	51.8	6	1.202		302.4		0.08	-0.01	1	100
	51.9	3	1.204		302.3		0.08	-0.01	2	200

Name	RM	Minutes per .1mi	Days to mouth	QOb	QSm	QTr	QGw	QCu	T	Area
	52.0	6	1.208		302.2		0.08	-0.01	3	300
	52.1	9	1.214		302.2		0.08	-0.01	3	300
	52.2	9	1.220		302.1		0.08	-0.01	5	700
	52.3	20	1.234		302.0		0.08	-0.01	2	200
	52.4	6	1.238		301.9		0.08	-0.01	2	200
	52.5	6	1.242		301.9		0.08	-0.01	4	500
	52.6	15	1.252		301.8		0.08	-0.01	4	500
	52.7	15	1.262		301.7		0.08	-0.01	3	300
	52.8	9	1.269		301.7		0.08	-0.01	3	300
Above Black R nr Indy	52.9	9	1.275	301.6	301.6		0.08	-0.01	3	300
	53.0	9	1.281		301.5		0.08	-0.01	1	100
	53.1	3	1.283		301.4		0.08	-0.01	3	300
	53.2	9	1.289		301.4		0.08	-0.01	5	700
	53.3	20	1.303		301.3		0.08	-0.01	3	300
	53.4	9	1.309		301.2		0.08	-0.01	3	300
Riffle blw Indy Br	53.5	9	1.315		301.2		0.08	-0.01	1	100
	53.6	3	1.317		301.1		0.08	-0.01	1	100
	53.7	3	1.319		301.0		0.08	-0.01	2	200
	53.8	6	1.323		300.9		0.08	-0.01	3	300
Pool blw Indy Br	53.9	9	1.329		300.9		0.08	-0.01	5	700
	54.0	20	1.344		300.8		0.08	-0.01	4	500
	54.1	15	1.354		300.7		0.08	-0.01	4	500
CR at Independence Br	54.2	15	1.364		300.7		0.30	-0.01	4	500
	54.3	15	1.374		300.4		0.30	-0.01	3	300
	54.4	9	1.380		300.1		0.30	-0.01	3	300
	54.5	9	1.386		299.8		0.30	-0.01	3	300
	54.6	9	1.392		299.5		0.30	-0.01	1	100
	54.7	3	1.394		299.2		0.30	-0.01	3	300
	54.8	9	1.401		298.9		0.30	-0.01	4	500
	54.9	15	1.411		298.6		0.30	-0.01	3	300
	55.0	9	1.417		298.3		0.30	-0.01	3	300
	55.1	9	1.423		298.0		0.30	-0.01	5	700
Scatter Ck	55.2	21	1.437		297.7	4.0	0.30	-0.01	1	100
	55.3	3	1.440		293.4		0.30	-0.01	2	200
	55.4	6	1.444		293.1		0.30	-0.01	3	300
	55.5	9	1.450		292.8		0.30	-0.01	1	100
	55.6	3	1.452		292.5		0.30	-0.01	4	500
	55.7	15	1.462		292.2		0.30	-0.01	4	500
	55.8	15	1.473		291.9		0.30	-0.01	1	100
	55.9	3	1.475		291.7		0.30	-0.01	3	300
	56.0	9	1.481		291.4		0.30	-0.01	1	100
	56.1	3	1.483		291.1		0.30	-0.01	4	500
	56.2	15	1.494		290.8		0.30	-0.01	3	300
	56.3	9	1.500		290.5		0.30	-0.01	3	300
	56.4	9	1.507		290.2		0.30	-0.01	3	300
	56.5	9	1.513		289.9		0.30	-0.01	1	100

Table C.3, page 7

Name	RM	Minutes per .1mi	Days to mouth	QOb	QSm	QTr	QGw	QCu	T	Area
	56.6	3	1.515		289.6		0.30	-0.01	3	300
	56.7	9	1.521		289.3		0.30	-0.01	4	500
	56.8	15	1.532		289.0		0.30	-0.01	3	300
	56.9	9	1.538		288.7		0.30	-0.01	3	300
	57.0	9	1.545		288.4		0.30	-0.01	5	700
	57.1	21	1.559		288.1		0.30	-0.01	1	100
	57.2	3	1.561		287.9		0.30	-0.01	2	200
	57.3	6	1.566		287.6		0.30	-0.01	3	300
	57.4	9	1.572		287.3		0.30	-0.01	1	100
	57.5	3	1.574		287.0		0.30	-0.01	4	500
	57.6	15	1.585		286.7		0.30	-0.01	4	500
	57.7	15	1.596		286.4		0.30	-0.01	1	100
	57.8	3	1.598		286.1		0.30	-0.01	3	300
	57.9	9	1.604		285.8		0.30	-0.01	1	100
Glide abv Scatter Ck Is	58.0	3	1.606		285.5		0.30	-0.01	4	500
	58.1	15	1.617		285.2		0.30	-0.01	3	300
Springs at Blanskma's	58.2	9	1.623		284.9		0.20	-0.01	3	300
Prarie Creek	58.3	9	1.630		284.7		0.20	-0.01	4	500
	58.4	15	1.641		284.5		0.20	-0.01	4	500
	58.5	15	1.651		284.4		0.20	-0.01	1	100
	58.6	3	1.653		284.2		0.20	-0.01	5	700
	58.7	22	1.668		284.0		0.20	-0.01	2	200
	58.8	6	1.673		283.8		0.20	-0.01	3	300
	58.9	9	1.679		283.6		0.20	-0.01	4	500
Maple Lane School	59.0	16	1.690		283.4		0.20	-0.01	4	500
	59.1	16	1.701		283.2		0.20	-0.01	2	200
	59.2	6	1.705		283.0		0.20	-0.01	1	100
	59.3	3	1.707		282.8		0.20	-0.01	3	300
	59.4	9	1.714		282.6		0.20	-0.01	4	500
	59.5	16	1.725		282.4		0.20	-0.01	4	500
	59.6	16	1.735		282.2		0.20	-0.01	1	100
	59.7	3	1.738		282.1		0.20	-0.01	4	500
	59.8	16	1.748		281.9		0.20	-0.01	5	700
GRAND MOUND	59.9	22	1.764	281.7	281.7					
Late August 1991, Steady-state										
Name	RM	Minutes per .1mi	Days to mouth	QOb	QSm	QTr	QGw	QCu	T	Area
GRAND MOUND	59.9		1.764	224.0	224.3		0.08	-0.0	5	1000
	60.0	39	1.791		224.3		0.08	-0.0	5	1000
	60.1	39	1.818		224.3		0.08	-0.0	4	800
	60.2	31	1.840		224.2		0.08	-0.0	4	800
	60.3	31	1.862		224.2		0.08	-0.0	1	100
	60.4	4	1.864		224.2		0.08	-0.0	3	500
	60.5	20	1.878		224.1		0.08	-0.0	3	500
	60.6	20	1.892		224.1		0.08	-0.0	1	100

Table C.3, page 8

Name	RM	Minutes per .1mi	Days to mouth	QOb	QSm	QTr	QGw	QCu	T	Area
	60.7	4	1.894		224.1		0.08	-0.0	5	1000
	60.8	39	1.922		224.0		0.08	-0.0	4	800
	60.9	31	1.943		224.0		0.08	-0.0	3	500
	61.0	20	1.957		224.0		0.08	-0.0	4	800
	61.1	31	1.979		224.0		0.08	-0.0	3	500
	61.2	20	1.993		223.9		0.08	-0.0	3	500
	61.3	20	2.006		223.9		0.08	-0.0	1	100
	61.4	4	2.009		223.9		0.08	-0.0	1	100
Pool above Prather Rd	61.5	4	2.012		223.8		0.08	-0.0	4	800
	61.6	31	2.033		223.8		0.08	-0.0	5	1000
	61.7	39	2.061		223.8		0.08	-0.0	5	1000
Lincoln Ck	61.8	39	2.088		223.7	1.2	0.08	-0.0	3	500
	61.9	20	2.102		222.5		0.08	-0.0	3	500
	62.0	20	2.115		222.5		0.08	-0.0	1	100
	62.1	4	2.118		222.5		0.08	-0.0	4	800
	62.2	32	2.140		222.4		0.08	-0.0	4	800
	62.3	32	2.162		222.4		0.08	-0.0	1	100
	62.4	4	2.165		222.4		0.08	-0.0	4	800
	62.5	32	2.187		222.3		0.08	-0.0	3	500
	62.6	20	2.201		222.3		0.08	-0.0	4	800
	62.7	32	2.223		222.3		0.08	-0.0	5	1000
	62.8	40	2.250		222.2		0.08	-0.0	4	800
	62.9	32	2.272		222.2		0.08	-0.0	4	800
	63.0	32	2.294		222.2		0.08	-0.0	3	500
	63.1	20	2.308		222.1		0.08	-0.0	4	800
Pool below Galvin Rd	63.2	32	2.330		222.1		0.08	-0.0	5	1000
	63.3	40	2.357		222.1		0.08	-0.0	1	100
	63.4	4	2.360		222.0		0.08	-0.0	4	800
	63.5	32	2.382		222.0		0.08	-0.0	1	100
	63.6	4	2.385		222.0		0.08	-0.0	4	800
	63.7	32	2.407		221.9		0.08	-0.0	1	100
	63.8	4	2.410		221.9		0.08	-0.0	4	800
	63.9	32	2.432		221.9		0.08	-0.0	4	800
	64.0	32	2.454		221.8		0.08	-0.0	3	500
	64.1	20	2.468		221.8		0.08	-0.0	4	800
Galvin Rd Bridge	64.2	32	2.490		221.8		0.09	-0.0	4	800
	64.3	32	2.512		221.7		0.09	-0.0	3	500
	64.4	20	2.525		221.7		0.09	-0.0	4	800
	64.5	32	2.547		221.6		0.09	-0.0	4	800
	64.6	32	2.570		221.6		0.09	-0.0	5	1000
	64.7	40	2.597		221.5		0.09	-0.0	5	1000
	64.8	40	2.625		221.5		0.09	-0.0	2	300
	64.9	12	2.633		221.4		0.09	-0.0	2	300
	65.0	12	2.641		221.4		0.09	-0.0	1	100
	65.1	4	2.644		221.3		0.09	-0.0	4	800
	65.2	32	2.666		221.3		0.09	-0.0	4	800

Table C.3, page 9

Name	RM	Minutes per .1mi	Days to mouth	QOb	QSm	QTr	QGw	QCu	T	Area
	65.3	32	2.688		221.2		0.09	-0.0	1	100
	65.4	4	2.691		221.1		0.09	-0.0	3	500
	65.5	20	2.705		221.1		0.09	-0.0	2	300
	65.6	12	2.713		221.0		0.09	-0.0	4	800
	65.7	32	2.735		221.0		0.09	-0.0	2	300
Scammon Ck	65.8	12	2.744		220.9	0.1	0.09	-0.0	4	800
	65.9	32	2.766		220.7		0.09	-0.0	1	100
Riffle blw Centralia BL	66.0	4	2.768	220.5	220.7		0.09	-0.0	1	100
	66.1	4	2.771		220.6		0.09	-0.0	4	800
	66.2	32	2.793		220.6		0.09	-0.0	4	800
	66.3	32	2.816		220.5		0.09	-0.0	3	500
	66.4	20	2.829		220.4		0.09	-0.0	4	800
	66.5	32	2.852		220.4		0.09	-0.0	5	1000
	66.6	40	2.879		220.3		0.09	-0.0	4	800
	66.7	32	2.901		220.2		0.09	-0.0	4	800
	66.8	32	2.924		220.2		0.09	-0.0	3	500
Skookumchuck R	66.9	20	2.938		220.1	74.1	2.00	-0.0	4	800
	67.0	32	2.960		144.0		2.00	-0.0	1	750
	67.1	46	2.992		142.0		2.00	-0.0	2	1000
	67.2	62	3.035		140.1		2.00	-0.0	3	1400
China Ck	67.3	88	3.096		138.1		2.00	-0.0	3	1400
Centralia WTP	67.4	89	3.158		136.1	2.3	2.00	-0.0	4	1900
Mellen Street Bridge	67.5	123	3.243		131.9		0.40	-0.0	4	1900
	67.6	127	3.331		131.5		0.40	-0.0	4	1900
	67.7	127	3.419		131.1		0.40	-0.0	4	1900
	67.8	128	3.508		130.8		0.40	-0.0	3	1400
	67.9	94	3.573		130.4		0.40	-0.0	4	1900
	68.0	128	3.662		130.0		0.40	-0.0	4	1900
	68.1	129	3.752		129.7		0.40	-0.0	4	1900
	68.2	129	3.841		129.3		0.40	-0.0	4	1900
	68.3	129	3.931		128.9		0.40	-0.0	3	1400
	68.4	96	3.997		128.6		0.40	-0.0	5	2500
	68.5	171	4.116		128.2		0.40	-0.0	4	1900
Pool abv Midway Meat	68.6	130	4.207		127.9		0.40	-0.1	6	2500
	68.7	172	4.326		127.5		0.40	-0.1	4	1900
	68.8	131	4.417		127.2		0.40	-0.1	3	1400
	68.9	97	4.485		126.8		0.40	-0.1	3	1400
	69.0	97	4.552		126.5		0.40	-0.1	3	1400
blw Salzer Ck	69.1	97	4.620		126.2		0.40	0.0	5	2500
Salzer Ck	69.2	174	4.741		125.8	2.8	0.40	0.0	4	1900
	69.3	133	4.833		122.5		0.40	0.0	3	1400
	69.4	101	4.903		122.1		0.40	0.0	4	1900
	69.5	137	4.998		121.7		0.40	0.0	3	1400
blw Overhanging Tree	69.6	101	5.068		121.3		0.40	-0.0	5	2500
	69.7	181	5.194		121.0		0.40	-0.0	4	1900
	69.8	138	5.290		120.6		0.40	-0.0	3	1400

Name	RM	Minutes per .1mi	Days to mouth	QOb	QSm	QTr	QGw	QCu	T	Area
	69.9	102	5.361		120.3		0.40	-0.0	3	1400
	70.0	102	5.432		119.9		0.40	-0.0	3	1400
	70.1	103	5.504		119.6		0.40	-0.0	3	1400
	70.2	103	5.575		119.2		0.40	-0.0	4	1900
	70.3	140	5.673		118.8		0.40	-0.0	3	1400
	70.4	104	5.745		118.5		0.40	-0.0	3	1400
	70.5	104	5.817		118.1		0.40	-0.0	3	1400
	70.6	104	5.889		117.8		0.40	-0.0	4	1900
Pool North of Airport	70.7	142	5.988		117.4		0.40	-0.1	5	2500
	70.8	187	6.118		117.1		0.40	-0.1	3	1400
	70.9	105	6.191		116.8		0.40	-0.1	4	1900
	71.0	143	6.290		116.5		0.40	-0.1	3	1400
	71.1	106	6.364		116.2		0.40	-0.1	4	1900
Seeps on right bank	71.2	144	6.464		115.9		0.40	-0.1	4	1900
	71.3	144	6.564		115.6		0.40	-0.1	3	1400
	71.4	107	6.638		115.3		0.40	-0.1	3	1400
	71.5	107	6.712		115.0		0.40	-0.1	2	1000
Scheuber Ditch	71.6	76	6.765		114.7		0.40	-0.1	6	2500
	71.7	192	6.898		114.4		0.40	-0.1	3	1400
	71.8	108	6.973		114.2		0.40	-0.1	2	1000
	71.9	77	7.026		113.9		0.40	-0.1	2	1000
	72.0	77	7.080		113.6		0.40	-0.1	2	1000
	72.1	77	7.134		113.3		0.40	-0.1	3	1400
	72.2	109	7.210		113.0		0.40	-0.1	2	1000
	72.3	78	7.264		112.7		0.40	-0.1	2	1000
	72.4	78	7.318		112.4		0.40	-0.1	2	1000
Pool abv Golf Course	72.5	78	7.372		112.1		0.00	-0.0	5	2500
	72.6	196	7.509		112.1		0.00	-0.0	2	1000
	72.7	79	7.563		112.1		0.00	-0.0	3	1400
	72.8	110	7.639		112.1		0.00	-0.0	2	1000
	72.9	78	7.694		112.2		0.00	-0.0	2	1000
	73.0	78	7.748		112.2		0.00	-0.0	5	2500
	73.1	196	7.885		112.2		0.00	-0.0	2	1000
	73.2	78	7.939		112.2		0.00	-0.0	4	1900
	73.3	149	8.042		112.3		0.00	-0.0	2	1000
	73.4	78	8.097		112.3		0.00	-0.0	2	1000
	73.5	78	8.151		112.3		0.00	-0.0	2	1000
Pool at junk cars bend	73.6	78	8.206		112.3		0.00	-0.0	4	1900
	73.7	149	8.309		112.4		0.00	-0.0	3	1400
	73.8	110	8.385		112.4		0.00	-0.0	2	1000
	73.9	78	8.440		112.4		0.00	-0.0	2	1000
	74.0	78	8.494		112.4		0.00	-0.0	2	1000
	74.1	78	8.548		112.4		0.00	-0.0	4	1900
	74.2	149	8.652		112.4		0.00	-0.0	2	1000
Chehalis WTP	74.3	78	8.706		112.4	1.9	0.00	-0.0	3	1400
Darigold WTP	74.4	110	8.782		110.5	0.4	0.00	-0.0	3	1400

Name	RM	Minutes per .1mi	Days to mouth	QOb	QSm	QTr	QGw	QCu	T	Area
Dillenbaugh Ck	74.5	111	8.860		110.2	1.4	0.00	-0.0	4	1900
SR 6 Br nr Chehalis	74.6	152	8.965		108.8		0.12	-0.2	3	1400
	74.7	113	9.044		108.8		0.12	-0.2	1	750
	74.8	61	9.086		108.9		0.12	-0.2	2	1000
Above SR 6 nr Chehalis	74.9	81	9.142	109.0	108.9		0.12	-0.2	2	100
	75.0	8	9.147		108.9		0.12	-0.2	2	100
	75.1	8	9.153		109.0		0.12	-0.2	1	50
Newaukum R	75.2	4	9.156		109.0	48.4	0.12	-0.2	4	300
	75.3	24	9.173		60.7		0.12	-0.2	5	600
	75.4	87	9.233		60.7		0.12	-0.2	2	100
	75.5	14	9.243		60.8		0.12	-0.2	3	200
	75.6	29	9.263		60.8		0.12	-0.2	4	300
	75.7	43	9.293		60.8		0.12	-0.2	4	300
	75.8	43	9.324		60.9		0.12	-0.2	3	200
Pool above Newaukum	75.9	29	9.344		60.9		0.12	-0.2	5	600
	76.0	87	9.404		61.0		0.12	-0.2	4	300
	76.1	43	9.434		61.0		0.12	-0.2	2	100
	76.2	14	9.444		61.0		0.12	-0.2	4	300
	76.3	43	9.474		61.1		0.12	-0.2	4	300
	76.4	43	9.504		61.1		0.12	-0.2	2	100
	76.5	14	9.514		61.1		0.12	-0.2	4	300
	76.6	43	9.544		61.2		0.12	-0.2	4	300
	76.7	43	9.574		61.2		0.12	-0.2	2	100
	76.8	14	9.584		61.2		0.12	-0.2	4	300
	76.9	43	9.614		61.3		0.12	-0.2	4	300
	77.0	43	9.644		61.3		0.12	-0.2	2	100
	77.1	14	9.654		61.4		0.12	-0.2	2	100
	77.2	14	9.664		61.4		0.12	-0.2	4	300
	77.3	43	9.694		61.4		0.12	-0.2	4	300
	77.4	43	9.723		61.5		0.12	-0.2	5	600
Pool near Claquato	77.5	86	9.783		61.5		0.12	-0.2	4	300
SR 603 Br nr Claquato	77.6	43	9.813		61.5		0.12	-0.2	3	200
Mill Ck	77.7	29	9.833		61.6	0.2	0.12	-0.2	3	200
	77.8	29	9.853		61.4		0.12	-0.2	1	50
	77.9	7	9.858		61.4		0.12	-0.2	5	600
Stearns Ck	78.0	86	9.917		61.5	3.1	0.12	-0.2	1	50
	78.1	7	9.922		58.4		0.12	-0.2	5	600
	78.2	90	9.985		58.4		0.12	-0.2	3	200
	78.3	30	10.006		58.5		0.12	-0.2	5	600
	78.4	90	10.069		58.5		0.12	-0.2	3	200
Chute abv Stearns Ck	78.5	30	10.090		58.5		0.12	-0.2	2	100
	78.6	15	10.100		58.6		0.12	-0.2	5	600
	78.7	90	10.163		58.6		0.12	-0.2	4	300
Riffle abv Stearns Ck	78.8	45	10.194		58.6		0.12	-0.2	2	100
	78.9	15	10.204		58.7		0.12	-0.2	1	50
	79.0	7	10.210		58.7		0.12	-0.2	5	600

Name	RM	Minutes per .1mi	Days to mouth	QOb	QSm	QTr	QGw	QCu	T	Area
	79.1	90	10.272		58.7		0.12	-0.2	3	200
	79.2	30	10.293		58.8		0.12	-0.2	3	200
	79.3	30	10.314		58.8		0.12	-0.2	3	200
	79.4	30	10.334		58.9		0.12	-0.2	5	600
	79.5	90	10.397		58.9		0.12	-0.2	3	200
	79.6	30	10.417		58.9		0.12	-0.2	3	200
	79.7	30	10.438		59.0		0.12	-0.2	4	300
	79.8	45	10.469		59.0		0.12	-0.2	5	600
	79.9	89	10.531		59.0		0.12	-0.2	4	300
	80.0	45	10.562		59.1		0.12	-0.2	1	50
	80.1	7	10.568		59.1		0.12	-0.2	5	600
	80.2	89	10.630		59.2		0.12	-0.2	2	100
	80.3	15	10.640		59.2		0.12	-0.2	1	50
	80.4	7	10.645		59.2		0.12	-0.2	3	200
Pool below Adna Br	80.5	30	10.666		59.3		0.12	-0.2	4	300
	80.6	45	10.697		59.3		0.12	-0.2	5	600
	80.7	89	10.759		59.3		0.12	-0.2	1	50
Glide below Adna Br	80.8	7	10.764	59.30	59.4		0.05	-0.2	3	200
	80.9	30	10.784		59.5		0.05	-0.2	3	200
SR 6 Bridge nr Adna	81.0	30	10.805		59.6		0.05	-0.2	1	50
	81.1	7	10.810		59.7		0.05	-0.2	3	200
	81.2	29	10.830		59.8		0.05	-0.2	2	100
	81.3	15	10.841		60.0		0.05	-0.2	1	50
	81.4	7	10.846		60.1		0.05	-0.2	4	300
	81.5	44	10.876		60.2		0.05	-0.2	4	300
	81.6	44	10.907		60.3		0.05	-0.2	3	200
	81.7	29	10.927		60.4		0.05	-0.2	3	200
	81.8	29	10.947		60.5		0.05	-0.2	1	50
	81.9	7	10.952		60.6		0.05	-0.2	5	600
	82.0	87	11.013		60.8		0.05	-0.2	1	50
	82.1	7	11.018		60.9		0.05	-0.2	5	600
	82.2	87	11.078		61.0		0.05	-0.2	3	200
	82.3	29	11.098		61.1		0.05	-0.2	5	600
	82.4	86	11.158		61.2		0.05	-0.2	3	200
	82.5	29	11.178		61.3		0.05	-0.2	2	100
	82.6	14	11.188		61.4		0.05	-0.2	5	600
	82.7	86	11.248		61.6		0.05	-0.2	4	300
	82.8	43	11.277		61.7		0.05	-0.2	2	100
	82.9	14	11.287		61.8		0.05	-0.2	1	50
	83.0	7	11.292		61.9		0.05	-0.2	5	600
	83.1	85	11.351		62.0		0.05	-0.2	3	200
	83.2	28	11.371		62.1		0.05	-0.2	3	200
	83.3	28	11.391		62.2		0.05	-0.2	3	200
	83.4	28	11.410		62.4		0.05	-0.2	5	600
	83.5	85	11.469		62.5		0.05	-0.2	3	200
	83.6	28	11.489		62.6		0.05	-0.2	3	200

Name	RM	Minutes per .1mi	Days to mouth	QOb	QSm	QTr	QGw	QCu	T	Area
	83.7	28	11.508		62.7		0.05	-0.2	4	300
	83.8	42	11.538		62.8		0.05	-0.2	5	600
	83.9	84	11.596		62.9		0.05	-0.2	4	300
	84.0	42	11.625		63.0		0.05	-0.2	1	50
	84.1	7	11.630		63.2		0.05	-0.2	5	600
	84.2	84	11.688		63.3		0.05	-0.2	2	100
	84.3	14	11.698		63.4		0.05	-0.2	1	50
Bunker Ck	84.4	7	11.702		63.5	1.3	0.05	-0.2	3	200
	84.5	28	11.722		62.3		0.05	-0.2	4	300
	84.6	42	11.751		62.4		0.05	-0.2	5	600
	84.7	85	11.810		62.5		0.05	-0.2	1	50
	84.8	7	11.815		62.7		0.05	-0.2	2	100
	84.9	14	11.825		62.8		0.05	-0.2	3	200
	85.0	28	11.844		62.9		0.05	-0.2	3	200
	85.1	28	11.863		63.0		0.05	-0.2	3	200
	85.2	28	11.883		63.1		0.05	-0.2	2	100
	85.3	14	11.893		63.2		0.05	-0.2	1	50
	85.4	7	11.897		63.3		0.05	-0.2	4	300
	85.5	42	11.926		63.5		0.05	-0.2	4	300
	85.6	42	11.955		63.6		0.05	-0.2	3	200
	85.7	28	11.974		63.7		0.05	-0.2	3	200
	85.8	28	11.994		63.8		0.05	-0.2	1	50
	85.9	7	11.998		63.9		0.05	-0.2	5	600
	86.0	83	12.056		64.0		0.05	-0.2	1	50
	86.1	7	12.061		64.1		0.05	-0.2	5	600
	86.2	82	12.118		64.3		0.05	-0.2	3	200
	86.3	27	12.137		64.4		0.05	-0.2	5	600
	86.4	82	12.194		64.5		0.05	-0.2	3	200
	86.5	27	12.213		64.6		0.05	-0.2	2	100
	86.6	14	12.222		64.7		0.05	-0.2	5	600
	86.7	82	12.279		64.8		0.05	-0.2	4	300
	86.8	41	12.307		64.9		0.05	-0.2	2	100
	86.9	14	12.316		65.1		0.05	-0.2	1	50
	87.0	7	12.321		65.2		0.05	-0.2	5	600
	87.1	81	12.377		65.3		0.05	-0.2	3	200
	87.2	27	12.396		65.4		0.05	-0.2	3	200
	87.3	27	12.415		65.5		0.05	-0.2	3	200
	87.4	27	12.433		65.6		0.05	-0.2	5	600
	87.5	80	12.489		65.8		0.05	-0.2	3	200
	87.6	27	12.508		65.9		0.05	-0.2	3	200
	87.7	27	12.526		66.0		0.05	-0.2	4	300
	87.8	40	12.554		66.1		0.05	-0.2	5	600
	87.9	80	12.610		66.2		0.05	-0.2	4	300
South Fork Chehalis R	88.0	40	12.637		66.3	11.1	0.05	-0.2	1	50
	88.1	7	12.642		55.4		0.05	-0.2	5	600
Above SF mouth	88.2	95	12.708		55.5		0.05	-0.2	2	100

Name	RM	Minutes per .1mi	Days to mouth	QOb	QSm	QTr	QGw	QCu	T	Area
	88.3	16	12.719		55.6		0.05	-0.2	1	50
	88.4	8	12.725		55.7		0.05	-0.2	3	200
	88.5	32	12.747		55.8		0.05	-0.2	4	300
	88.6	47	12.780		55.9		0.05	-0.2	5	600
	88.7	94	12.845		56.0		0.05	-0.2	1	50
	88.8	8	12.851		56.2		0.05	-0.2	2	100
	88.9	16	12.861		56.3		0.05	-0.2	3	200
	89.0	31	12.883		56.4		0.05	-0.2	3	200
	89.1	31	12.905		56.5		0.05	-0.2	3	200
	89.2	31	12.926		56.6		0.05	-0.2	2	100
	89.3	16	12.937		56.7		0.05	-0.2	1	50
	89.4	8	12.943		56.8		0.05	-0.2	4	300
	89.5	46	12.975		57.0		0.05	-0.2	4	300
	89.6	46	13.007		57.1		0.05	-0.2	3	200
	89.7	31	13.028		57.2		0.05	-0.2	3	200
	89.8	31	13.050		57.3		0.05	-0.2	1	50
	89.9	8	13.055		57.4		0.05	-0.2	4	300
Ceres Rd Bridge	90.0	46	13.087		57.5		0.05	-0.2	1	50
	90.1	8	13.092		57.7		0.05	-0.2	3	150
Above Ceres Rd Br	90.2	23	13.108	57.9	57.8		-0.12	-0.1	1	30
	90.3	5	13.111		58.0		-0.12	-0.1	5	400
	90.4	61	13.154		58.2		-0.12	-0.1	1	30
	90.5	5	13.157		58.4		-0.12	-0.1	4	250
	90.6	38	13.183		58.6		-0.12	-0.1	3	150
	90.7	23	13.199		58.8		-0.12	-0.1	5	400
	90.8	60	13.240		59.0		-0.12	-0.1	3	150
	90.9	22	13.256		59.2		-0.12	-0.1	2	75
	91.0	11	13.264		59.4		-0.12	-0.1	5	400
	91.1	59	13.305		59.6		-0.12	-0.1	4	250
	91.2	37	13.330		59.8		-0.12	-0.1	2	75
	91.3	11	13.338		60.0		-0.12	-0.1	1	30
	91.4	4	13.341		60.2		-0.12	-0.1	5	400
	91.5	59	13.382		60.4		-0.12	-0.1	3	150
	91.6	22	13.397		60.6		-0.12	-0.1	3	150
	91.7	22	13.412		60.8		-0.12	-0.1	3	150
	91.8	22	13.427		61.0		-0.12	-0.1	5	400
	91.9	58	13.467		61.2		-0.12	-0.1	3	150
	92.0	22	13.482		61.4		-0.12	-0.1	3	150
	92.1	22	13.497		61.6		-0.12	-0.1	4	250
	92.2	36	13.522		61.8		-0.12	-0.1	5	400
	92.3	57	13.562		62.0		-0.12	-0.1	4	250
	92.4	36	13.586		62.2		-0.12	-0.1	1	30
	92.5	4	13.589		62.4		-0.12	-0.1	5	400
	92.6	56	13.628		62.6		-0.12	-0.1	2	75
	92.7	11	13.636		62.8		-0.12	-0.1	1	30
	92.8	4	13.639		63.0		-0.12	-0.1	3	150

Name	RM	Minutes per .1mi	Days to mouth	QOb	QSm	QTr	QGw	QCu	T	Area
	92.9	21	13.653		63.2		-0.12	-0.1	4	250
	93.0	35	13.677		63.4		-0.12	-0.1	5	400
	93.1	56	13.716		63.6		-0.12	-0.1	1	30
	93.2	4	13.719		63.8		-0.12	-0.1	2	75
	93.3	10	13.726		64.0		-0.12	-0.1	3	150
	93.4	21	13.740		64.2		-0.12	-0.1	3	150
	93.5	21	13.755		64.4		-0.12	-0.1	3	150
	93.6	21	13.769		64.6		-0.12	-0.1	2	75
	93.7	10	13.776		64.8		-0.12	-0.1	1	30
	93.8	4	13.779		65.0		-0.12	-0.1	4	250
	93.9	34	13.802		65.2		-0.12	-0.1	4	250
	94.0	34	13.826		65.4		-0.12	-0.1	3	150
	94.1	20	13.840		65.6		-0.12	-0.1	3	150
	94.2	20	13.854		65.8		-0.12	-0.1	1	30
	94.3	4	13.857		66.0		-0.12	-0.1	4	250
Meskill Bridge	94.4	33	13.880		66.2		-0.12	-0.1	1	30
	94.5	4	13.882		66.4		-0.12	-0.1	4	250
Above Meskill Br	94.6	33	13.905	66.4	66.6		0.12	-0.1	2	75
	94.7	10	13.912		66.5		0.12	-0.1	3	150
Hope Ck	94.8	20	13.926		66.4	0.5	0.12	-0.1	5	400
	94.9	53	13.963		65.9		0.12	-0.1	3	150
	95.0	20	13.977		65.8		0.12	-0.1	2	75
	95.1	10	13.984		65.8		0.12	-0.1	5	400
	95.2	54	14.021		65.7		0.12	-0.1	4	250
	95.3	33	14.044		65.6		0.12	-0.1	2	75
	95.4	10	14.051		65.6		0.12	-0.1	1	30
	95.5	4	14.054		65.5		0.12	-0.1	5	400
	95.6	54	14.091		65.5		0.12	-0.1	3	150
	95.7	20	14.105		65.4		0.12	-0.1	3	150
	95.8	20	14.119		65.4		0.12	-0.1	3	150
	95.9	20	14.133		65.3		0.12	-0.1	5	400
	96.0	54	14.171		65.3		0.12	-0.1	3	150
	96.1	20	14.185		65.2		0.12	-0.1	3	150
	96.2	20	14.199		65.1		0.12	-0.1	4	250
	96.3	34	14.222		65.1		0.12	-0.1	5	400
	96.4	54	14.260		65.0		0.12	-0.1	4	250
	96.5	34	14.283		65.0		0.12	-0.1	1	30
	96.6	4	14.286		64.9		0.12	-0.1	5	400
	96.7	54	14.324		64.9		0.12	-0.1	2	75
	96.8	10	14.331		64.8		0.12	-0.1	1	30
	96.9	4	14.334		64.7		0.12	-0.1	3	150
	97.0	20	14.348		64.7		0.12	-0.1	4	250
	97.1	34	14.372		64.6		0.12	-0.1	5	400
	97.2	54	14.409		64.6		0.12	-0.1	1	30
	97.3	4	14.412		64.5		0.12	-0.1	2	75
	97.4	10	14.419		64.5		0.12	-0.1	3	150

Name	RM	Minutes per .1mi	Days to mouth	QOb	QSm	QTr	QGw	QCu	T	Area
	97.5	20	14.434		64.4		0.12	-0.1	3	150
	97.6	20	14.448		64.4		0.12	-0.1	3	150
	97.7	21	14.462		64.3		0.12	-0.1	2	75
	97.8	10	14.469		64.2		0.12	-0.1	1	30
	97.9	4	14.472		64.2		0.12	-0.1	4	250
	98.0	34	14.496		64.1		0.12	-0.1	4	250
	98.1	34	14.520		64.1		0.12	-0.1	3	150
	98.2	21	14.534		64.0		0.12	-0.1	3	150
	98.3	21	14.548		64.0		0.12	-0.1	1	30
	98.4	4	14.551		63.9		0.12	-0.1	4	250
	98.5	34	14.575		63.9		0.12	-0.1	1	30
	98.6	4	14.578		63.8		0.12	-0.1	4	250
	98.7	34	14.602		63.7		0.12	-0.1	3	150
	98.8	21	14.616		63.7		0.12	-0.1	4	250
	98.9	35	14.640		63.6		0.12	-0.1	5	400
	99.0	55	14.679		63.6		0.12	-0.1	1	30
	99.1	4	14.681		63.5		0.12	-0.1	2	75
	99.2	10	14.689		63.5		0.12	-0.1	3	150
	99.3	21	14.703		63.4		0.12	-0.1	3	150
	99.4	21	14.718		63.4		0.12	-0.1	3	150
	99.5	21	14.732		63.3		0.12	-0.1	2	75
	99.6	10	14.739		63.2		0.12	-0.1	1	30
	99.7	4	14.742		63.2		0.12	-0.1	4	250
	99.8	35	14.766		63.1		0.12	-0.1	4	250
	99.9	35	14.791		63.1		0.12	-0.1	3	150
	100.0	21	14.805		63.0		0.12	-0.1	3	150
	100.1	21	14.820		63.0		0.12	-0.1	1	30
Elk Ck	100.2	4	14.823		62.9	29.0	0.12	-0.1	4	150
	100.3	21	14.837		33.9		0.12	-0.1	1	25
	100.4	6	14.842		33.8		0.12	-0.1	4	150
County Rd Br nr Doty	100.5	39	14.869	33.9	33.8		0.17	-0.0	3	100
	100.6	26	14.887		33.6		0.17	-0.0	5	200
	100.7	52	14.923		33.5		0.17	-0.0	3	100
	100.8	26	14.941		33.3		0.17	-0.0	2	50
	100.9	13	14.951		33.2		0.17	-0.0	5	200
	101.0	53	14.987		33.0		0.17	-0.0	4	150
	101.1	40	15.015		32.9		0.17	-0.0	2	50
	101.2	13	15.024		32.8		0.17	-0.0	1	25
	101.3	7	15.029		32.6		0.17	-0.0	5	200
	101.4	54	15.067		32.5		0.17	-0.0	3	100
	101.5	27	15.085		32.3		0.17	-0.0	3	100
	101.6	27	15.104		32.2		0.17	-0.0	3	100
	101.7	27	15.123		32.0		0.17	-0.0	5	200
DOTY	101.8	55	15.161	32.0	31.9		0.07	-0.1	3	100
	101.9	28	15.181		31.9		0.07	-0.1	3	100
	102.0	28	15.200		31.9		0.07	-0.1	4	150

Name	RM	Minutes per .1mi	Days to mouth	QOb	QSm	QTr	QGw	QCu	T	Area
	102.1	41	15.229		31.9		0.07	-0.1	5	200
	102.2	55	15.267		31.9		0.07	-0.1	4	150
	102.3	41	15.296		31.8		0.07	-0.1	1	25
	102.4	7	15.300		31.8		0.07	-0.1	5	200
	102.5	55	15.339		31.8		0.07	-0.1	2	50
	102.6	14	15.348		31.8		0.07	-0.1	1	25
	102.7	7	15.353		31.8		0.07	-0.1	3	100
Robinson Ck	102.8	28	15.372		31.8		0.07	-0.1	4	150
	102.9	42	15.401		31.8		0.07	-0.1	5	200
	103.0	55	15.440		31.8		0.07	-0.1	1	25
	103.1	7	15.445		31.7		0.07	-0.1	2	50
	103.2	14	15.454		31.7		0.07	-0.1	3	100
	103.3	28	15.473		31.7		0.07	-0.1	3	100
	103.4	28	15.493		31.7		0.07	-0.1	3	100
	103.5	28	15.512		31.7		0.07	-0.1	2	50
	103.6	14	15.522		31.7		0.07	-0.1	1	25
Jones Ck	103.7	7	15.526		31.7		0.07	-0.1	4	150
	103.8	42	15.555		31.7		0.07	-0.1	4	150
	103.9	42	15.584		31.6		0.07	-0.1	3	100
	104.0	28	15.604		31.6		0.07	-0.1	3	100
	104.1	28	15.623		31.6		0.07	-0.1	1	25
	104.2	7	15.628		31.6		0.07	-0.1	4	150
Shields Ck	104.3	42	15.657		31.6		0.07	-0.1	1	25
	104.4	7	15.662		31.6		0.07	-0.1	4	150
	104.5	42	15.691		31.6		0.07	-0.1	3	100
	104.6	28	15.710		31.6		0.07	-0.1	4	150
	104.7	42	15.739		31.5		0.07	-0.1	5	200
	104.8	56	15.778		31.5		0.07	-0.1	1	25
	104.9	7	15.783		31.5		0.07	-0.1	2	50
	105.0	14	15.792		31.5		0.07	-0.1	3	100
Cannonball Ck	105.1	28	15.812		31.5		0.07	-0.1	3	100
	105.2	28	15.831		31.5		0.07	-0.1	3	100
	105.3	28	15.851		31.5		0.07	-0.1	2	50
	105.4	14	15.860		31.5		0.07	-0.1	1	25
Pe Ell WTP	105.5	7	15.865		31.4	0.2	0.07	-0.1	4	150
	105.6	42	15.894		31.2		0.07	-0.1	4	150
	105.7	42	15.924		31.2		0.07	-0.1	3	100
	105.8	28	15.943		31.2		0.07	-0.1	3	100
	105.9	28	15.963		31.2		0.07	-0.1	1	25
	106.0	7	15.968		31.2		0.07	-0.1	4	150
	106.1	42	15.997		31.2		0.07	-0.1	1	25
	106.2	7	16.002		31.2		0.07	-0.1	4	150
SR 6 Bridge @ Pe Ell	106.3	42	16.031	31.2	31.2				2	50
	106.4	14	16.041							

Appendix D. Mainstem Survey Results

D.1 Details of Phytoplankton Identification Results

In the Chehalis River, samples were collected and the algal units were counted, measured, and identified (Sweet, 1992). Biovolume and algal density for the whole sample and for the most common species were reported.

The algal species found in the Chehalis River were somewhat variable. Diatoms were common (*Cymbella minuta, Achnanthes minutissima, Cocconeis placentula, Achnanthes linearis, Stephanodiscus hantzschii*, and *Melosira distans*). These species are typical of low to moderate nutrient waters and are mostly periphytic. Cryptophytes (*Cryptomonas erosa* and *Rhodomonas minuta*) were also common at times, especially in the Centralia reach. These cryptophytes are flagellate, facultative heterotrophs. They are found in a wide range of conditions, but are generally associated with slow-moving waters which are nutrient- or organic-enriched.

Table D.5 summarizes total algal biovolume and density, and lists dominant taxa at sites and times sampled. Algae populations were highest in the spring, lowest in the summer, and somewhat higher in the fall. Seasonal variability of species varied from site to site. At the SR 6 bridge near Chehalis (RM 74.6) species composition was relatively constant. At Mellen St (RM 67.5) algal species changed significantly between each sampling period. The community composition at Prather Road (RM 59.9) changed from June to July and from August to late September, but showed little change between July and August.

Spatially, species variability reflected the hydrologic and quality characteristics of the river. Species composition showed little variability between Pe Ell and the Ceres Road site (RM 106.3 and 90.0). The greatest changes in algal species occurred from Ceres Road to the SR 6 Bridge near Chehalis (RM 74.6), and between the SR 6 bridge and Mellen Street (RM 67.5). From Mellen Street to Prather Road (RM 59.9) a small change was observed, and the species composition at four stations from Prather Road to Porter (RM 33.8) were all fairly similar.

The relationship between chlorophyll *a* measurements and algal biovolume and density is very poor. Possible explanations for the lack of a good correlation are the large amounts of non-algal chlorophyll-containing debris found in some samples, the poor analytical precision indicated by the high replicate variability of the chlorophyll *a* analyses, the variability of biovolume measurements, and the variability of chlorophyll *a* content in the organism as a function of species and environmental conditions.

D.2 Details of Fecal Coliform Sources

Most of the fecal coliform exceedances found during the TMDL study occurred during the intensive sampling on August 27 and 28, 1991, which took place during a period of significant rain (1.44 inches recorded at Olympia from August 26 to 28). Local nonpoint sources are suspected for these increases:

- Residential sources in Pe Ell were a likely source for the high levels at RM 106.3. Also, the USFWS habitat degradation survey (Wampler *et al.*, 1993) identified pollutant inputs and livestock access along Rock Creek and McCormick Creek, which are possible sources upstream of the sampling site.

- The elevated bacteria levels above Elk Creek (RM 100.5) could have been from Pe Ell's stormwater, sources on Rock Creek, and/or from other agricultural sources along the mainstem. The USFWS survey identified livestock bank impacts upstream of the sampling site. The effluent from the Pe Ell treatment plant showed very low levels of fecal coliform bacteria.

- The Ceres Road sample may have resulted from high fecal coliform levels in Elk Creek.

- Since both the Chehalis River at Adna and the Newaukum River had relatively low fecal coliform levels, the high values at RM 74.6 were likely from high bacteria levels in Stearns Creek and/or from sources along the mainstem below Adna. The USFWS survey identified livestock riverbank impacts on the mainstem below Adna, and a number of dairies have been identified in that area.

- Field observations in this study identified an extensive area of cattle access across the river and upstream from the Golf Course, which was a likely cause of the elevated fecal coliform value at RM 72.5. Also, high bacteria levels were detected in Dillenbaugh Creek. The Discharge Monitoring Reports (DMRs) for Darigold show no detection of fecal coliform on August 26, 1991 and the sampling at Chehalis WTP (Das, 1993) showed very low levels of fecal coliform, which removes these dischargers from consideration as sources.

- The high fecal coliform values at Mellen Street (RM 67.5) were most likely a result of high levels in Salzer Creek, although other mainstem sources may have contributed to the levels observed. However, due to the long travel time in the Centralia reach, a source within two to three miles of the Mellen Street bridge was most likely.

- High levels below the boat launch at Centralia and at the Galvin Road bridge (RM 66.0 and 64.2) may have reflected upstream levels. Urban stormwater from the Centralia area may have also contributed to the high levels, since stormwater was observed to be actively discharging during the survey.

The tributaries mentioned here are discussed in more detail in Appendix F.

Additional high fecal coliform values were observed at the Route 6 bridges near Pe Ell and Chehalis (RM 106.3 and 74.6) during the July 1992 intensive sampling survey. Although rainfall was trace at the Olympia, showers fell during the survey in the upper Chehalis River basin. The sources mentioned above are again suspect.

D.3 Details of Nutrient Results

Results for parameters discussed in this section - ammonia nitrogen (NH3N), nitrate/nitrite nitrogen (NO23N), total persulfate nitrogen (TN), total phosphorus (TN), soluble reactive phosphorus (SRP), and chlorides - are presented for mainstem Chehalis River sampling sites in Appendix Table D.4.

From upstream to downstream, NH3N concentrations varied widely between the upper river, the Centralia reach, and the lower river in the study area. From Pe Ell to the SR 6 bridge near Chehalis (RM 106.3 to 74.6), ammonia was less than 0.05 mg/L and often below detection. In the surface waters of the Centralia reach (RM 73.6 to 67.0), NH3N concentrations were between 0.08 and 0.54 mg/L. This increase resulted mostly from the Chehalis and Darigold WTPs. In the deep waters north of the airport, below the overhanging tree, and below Salzer Creek (RM 70.7, 69.6, and 69.1), the maximum NH3N levels detected were 0.675, 0.217, and 1.290 mg/L, respectively. Below the Skookumchuck River, NH3N concentrations began to fall, and from Prather Road to Porter (RM 59.9 to 33.8), NH3N ranged from less than 0.07 mg/L to below detection. The NH3N concentrations measured in the Chehalis River appear to be below toxicity criteria, although the maximum concentration below Salzer Creek was close to the chronic toxicity criterion for the observed conditions of temperature and pH.

NO23N levels showed a general pattern of steady increase from upstream to downstream. Above Adna (RM 81.0), NO23N concentrations ranged as low as below the detection level of 0.01 mg/L. From the Skookumchuck River downstream to Porter (RM 33.8), NO23N was detected at levels as high as 0.66 mg/L. The association of increasing nitrate with decreasing ammonia suggests that nitrification is a partial cause of the pattern. The three STPs clearly increased nitrate concentrations, and ground water inflows were also likely sources of relatively high NO23N inputs.

The deep areas north of the airport and below Salzer Creek showed unusually low NO23N concentrations - near or below detection for most samples. This was likely a result of anoxic reducing conditions causing denitrification and preventing nitrification.

TN concentrations were lowest at the upstream end, ranging generally between 0.1 and 0.2 mg/L above Adna. Maximum levels were found the downstream end of the Centralia reach, exceeding 1.2 mg/L at Mellen Street and above the Skookumchuck River (RM 67.5 and 67.0). Organic nitrogen, calculated as TN-(NO23N+NH3N), made up a relatively high proportion of TN in the Centralia reach and upper river. Below the Skookumchuck River, NO23N concentrations were between 0.5 and 0.9 mg/L, and the fraction of organic nitrogen was relatively small. Again, the deep areas north of the airport and below Salzer Creek had unusually high TN, as high as 1.06 and 1.66 mg/L, respectively, and made up almost entirely of ammonia and organic nitrogen.

TP levels were less than detection at the upstream end of the study area, and increased gradually downstream to the SR 6 bridge near Chehalis (RM 74.6), with levels remaining below 0.03 mg/L. The fraction of TP that was orthophosphate in this stretch varied widely. TP increased dramatically in Centralia reach surface waters, with concentrations mostly falling between 0.1 and 0.5 mg/L and orthophosphate making up a large fraction of the TP. From the Skookumchuck River to Porter (RM 66.9 to 33.8), TP dropped steadily from upstream maximum levels well over 0.1 mg/L to downstream levels of 0.05 mg/L and below. Over half the TP in this stretch was orthophosphate.

Again, the deep areas north of the airport and below Salzer Creek (RM 70.7 and 69.1) had unusually high TP levels. North of the airport, the highest detected concentration was 0.444 mg/L, twice the level at the surface and almost all in the organic form. Below Salzer Creek a high level of 1.60 mg/L was detected in deep samples, which was five to six times the surface level and mostly in the organic form.

Appendix D
Table D.1 Mainstem Field Measurement Data

RM Code	Site Description	Date	Time	Depth (m)	TEMP meter (°C)	TEMP Hg (°C)	pH (s.u.)	COND (µho/cm)	DO meter (mg/L)	DO Winkler (mg/L)
108.2	CR @ Pe Ell Water Intake	07/22/92	1305	0.0		16.4	8.0			10.7
		08/04/92	1240	0.0	17.7	17.0	8.1			9.4
106.3	CR @ SR 6 Br nr Pe Ell	07/25/91	1200	0.3	16.6		7.2	69	9.9	
		08/27/91	809	0.0	15.3		7.5			9.2
		08/27/91	1333	0.0						10.2
		08/27/91	1333	0.0	15.1		7.9			10.1
		08/28/91	802	0.0	14.4		7.2			9.6
		08/28/91	1212	0.0						10.4
		08/28/91	1212	0.0	14.7		7.8			10.3
		07/22/92	1340	0.0		17.0	8.2			10.8
		08/04/92	1135	0.0	18.1	17.5	8.0			9.8
100.5	CR @ Elk Ck Rd nr Doty	07/25/91	1220	0.5	17.9		7.1	77	9.6	
		08/20/91	705	0.0	19.6		6.9	81	8.3	
		08/22/91	1440	0.0	22.0		7.5	79	10.2	
		08/27/91	830	0.0	15.7		7.6			8.8
		08/27/91	1423	0.0	16.2		7.4			9.8
		08/28/91	825	0.0	15.4		7.4			9.0
		08/28/91	1259	0.0	15.4		7.5			9.4
		09/10/91	1320	0.0						10.5
		09/10/91	1320	0.0						10.6
		09/11/91	925	0.0						9.6
		07/22/92	1045	0.0		17.4	7.7			9.7
		08/04/92	940	0.0	18.1	18.7	7.7			8.6
97.9	CR @ Dryad	07/25/91	1240	0.5	17.8		7.0	76	9.4	
		07/25/91	1240	1.5	17.8		6.9	76	9.4	
		08/25/92	1703	0.5						10.3
		08/26/92	700	0.5						8.5
		08/26/92	700	0.5						8.6
94.4	CR @ Meskill Br	07/25/91	1300	0.0	18.1		6.8	60	9.3	
		07/25/91	1300	2.0	18.2		6.7	75	9.3	
90.1	CR abv Ceres Rd Br	07/22/92	910	0.0		18.0	7.4			8.1
		07/22/92	1450	0.0		18.4	7.8			9.0
		08/04/92	820	0.0		19.9	7.4			7.5
		08/04/92	1340	0.0	20.1	19.0	7.6			8.2
90.0	CR @ Ceres Rd Br	07/25/91	1320	0.0	19.3		6.7	75	8.8	
		07/25/91	1320	2.0	19.2		6.7	75	8.8	
		08/20/91	735	0.0	20.3		6.7	81	7.7	
		08/20/91	735	1.0	20.3		6.7	81	7.6	
		08/20/91	735	1.7	20.3		6.7	82	7.5	
		08/22/91	1500	0.0	22.5		7.0	77	9.3	
		08/22/91	1500	1.0	21.9		7.0	79	8.9	
		08/22/91	1500	1.7	21.1		6.9	81	8.3	
		08/27/91	740	0.0	16.7		6.3			8.2
		08/27/91	1415	0.0	17.0		7.5			8.7
		08/28/91	730	0.0	16.0		7.1			8.6
		08/28/91	1400	0.0	15.8		7.4			8.8
		09/10/91	1345	0.0						9.8
		09/10/91	1345	0.0						9.8
		09/11/91	1005	0.0						9.1
		10/10/91	1755	0.0	14.1		6.7	93	8.8	
		10/10/91	1755	1.0	14.1		6.6	94	8.7	
		10/10/91	1755	2.0	14.1		6.6	93	8.7	
		08/25/92	1720	0.5						9.0
		08/26/92	730	0.5						8.4
81.0	CR @ Adna (SR 6 Br)	07/25/91	1416	0.0	20.3		6.6	85	8.2	
		07/25/91	1416	1.5	20.3		6.6	85	8.2	
		08/27/91	810	0.0	17.7		6.9			8.1
		08/27/91	1500	0.0	18.1		6.6			8.7

RM Code	Site Description	Date	Time	Depth (m)	TEMP meter (˚C)	TEMP Hg (˚C)	pH (s.u.)	COND (µho/cm)	DO meter (mg/L)	DO Winkler (mg/L)
81.0	CR @ Adna (SR 6 Br)	08/28/91	800	0.0	16.8		6.8			8.3
		08/28/91	1430	0.0	16.6		7.4			8.8
79.8	CR nr Goff Rd abv Claquato	09/10/91	1405	0.0						10.0
		09/10/91	1405	0.0						10.0
		09/11/91	1025	0.0						8.7
77.6	CR @ SR 603 Br nr Claquato	07/22/92	1255	0.0		19.9	7.5			7.7
		08/04/92	1115	0.0		21.2	7.7	84		7.3
		08/25/92	1750	0.0						9.0
		08/25/92	1750	0.0						9.1
		08/26/92	750	0.0						8.0
75.1	CR @ Old Riverside Rd Br	10/10/91	1846	0.0	14.1		6.8	97	5.7	
		10/10/91	1846	1.0	14.1		6.6	96	5.4	
		10/10/91	1846	2.0	14.1		6.6	96	5.4	
		10/10/91	1846	3.0	14.0		6.5	96	5.4	
74.9	CR abv SR 6 Br nr Chehalis	08/19/91	1315	0.0						8.3
		08/19/91	1315	0.0	23.4			96	8.6	8.3
		08/19/91	1315	0.5	23.4			97	8.5	
		08/19/91	1315	1.0	23.4			97	8.5	
		08/19/91	1315	1.5	23.4			98	8.5	
		08/19/91	1315	2.0	23.4			98	8.5	
		08/19/91	1315	2.5	23.4			98	8.5	
		08/20/91	1205	0.0						8.2
		08/20/91	1205	0.0	22.6		6.7	95	8.3	8.2
		08/20/91	1205	1.0	22.6		6.7	95	8.2	
		08/20/91	1205	2.0	22.7		6.7	97	8.2	
74.6	CR @ SR 6 Br nr Chehalis	07/24/91	1213	0.0	22.3		6.8	83	7.3	
		07/24/91	1213	1.5	22.4		6.8	89	7.2	
		08/01/91	1220	0.5	22.1		6.7	90	8.0	
		08/01/91	1220	2.5	22.1		6.7	91	8.0	
		08/02/91	1150	0.0	21.3		6.6	89	7.9	8.0
		08/02/91	1150	1.0	21.3		6.6	88	7.9	
		08/14/91	1045	0.0	20.6		6.8	93	8.0	8.2
		08/14/91	1045	1.0	20.6		6.7	93	8.0	
		08/14/91	1045	2.0	20.6		6.7	94	8.1	
		08/20/91	800	0.0	21.7		6.6	96	7.6	
		08/20/91	800	1.0	21.8		6.6	97	7.5	
		08/20/91	800	2.0	21.8		6.6	97	7.5	
		08/20/91	800	2.2	21.7		6.6	98	7.5	
		08/22/91	1520	0.0	23.9		6.8	94	8.7	
		08/22/91	1520	1.0	23.8		6.8	96	8.7	
		08/22/91	1520	2.0	23.8		6.7	96	8.7	
		08/22/91	1520	2.2	23.8		6.7	96	8.7	
		08/27/91	830	0.0	17.2		7.3			8.1
		08/27/91	1600	0.0						8.7
		08/27/91	1600	0.0	17.8		6.6			8.7
		08/28/91	820	0.0	16.8		7.2			8.2
		08/28/91	1310	0.0						8.4
		08/28/91	1310	0.0	16.8		7.2			8.4
		09/24/91	1030	0.0	15.7		6.9	97	9.3	9.2
		09/24/91	1030	1.0	15.7		6.9	97	9.3	
		09/24/91	1030	2.0	15.6		6.9	97	9.3	
		10/08/91	1135	0.0	12.9		6.5	99	5.4	
		10/08/91	1135	1.0	12.9		6.5	99	5.5	
		10/08/91	1135	2.0	12.9		6.5	99	5.5	5.9
		10/10/91	1040	0.0	12.3		6.5	99	5.7	5.5
		10/14/91	1415	0.0	14.1		6.6	97	6.3	6.4
		05/28/92	1100	0.0	17.0		7.0	72	9.1	9.1
		05/28/92	1100	1.0	17.0		7.1	73	9.1	
		06/16/92	1325	0.0	17.3		7.1	84	9.3	9.7
		06/16/92	1325	1.5	17.3		7.1	84	9.3	
		07/07/92	1324	0.0	18.6		6.9	88	8.8	
		07/07/92	1324	1.5	18.6		7.0	88	8.8	

Table D.1, page 3

RM Code	Site Description	Date	Time	Depth (m)	TEMP meter (˚C)	TEMP Hg (˚C)	pH (s.u.)	COND (µho/cm)	DO meter (mg/L)	DO Winkler (mg/L)
74.6	CR @ SR 6 Br nr Chehalis	07/22/92	905	0.0		19.8	7.0			7.3
		07/22/92	1425	0.0		19.6	7.2			8.3
		07/22/92	1445	0.0		19.8	7.1			7.9
		08/04/92	837	0.0		21.0	7.2	102		7.3
		08/04/92	1350	0.0		21.2	7.7	79		8.2
		08/20/92	1245	0.0	21.5		7.0	107	8.9	
		08/20/92	1245	1.0	21.5		7.0	107	8.9	
		08/20/92	1247	0.0						8.7
		08/25/92	1800	1.0						9.7
		08/26/92	800	1.0						8.0
		09/09/92	850	0.0	15.0		7.3	101	9.0	
		09/09/92	850	1.0	15.0		7.3	101	9.0	
		09/09/92	850	2.0	15.0		7.3	102	9.1	
		09/30/92	830	0.0	14.3		7.1	84	9.2	
		09/30/92	830	1.0	14.3		7.0	84	9.2	
		09/30/92	830	2.0	14.3		7.0	84	9.2	
74.2	CR blw Chehalis WTP	09/24/91	1055	0.0	15.7		6.9	125	9.0	
		09/24/91	1055	1.0	15.6		6.9	124	9.0	
		10/08/91	1145	0.0	13.3		6.5	123	4.9	
		10/08/91	1145	1.0	13.3		6.5	123	4.8	
73.6	CR @ junk cars bend	08/02/91	1226	0.0	21.9		6.5	100	7.2	
		08/02/91	1226	1.0	21.7		6.5	100	7.2	
		08/02/91	1226	2.0	21.3		6.5	101	7.2	
		08/02/91	1226	3.0	21.3		6.5	101	7.2	
		08/02/91	1226	4.0	21.2		6.5	102	7.1	
		08/02/91	1226	5.0	21.2		6.5	103	7.1	
		08/02/91	1226	6.0	21.2		6.5	104	7.1	
		08/14/91	1140	0.0	21.5		6.7	115	7.4	
		08/14/91	1140	1.0	21.0		6.7	115	7.3	
		08/14/91	1140	2.0	21.0		6.7	117	7.3	
		08/14/91	1140	3.0	20.9		6.7	117	7.3	
		08/14/91	1140	4.0	20.9		6.7	118	7.3	
		08/14/91	1140	5.0	20.9		6.7	118	6.6	
		08/19/91	1505	0.0						7.7
		08/19/91	1505	0.0	25.5			110	7.6	7.5
		08/19/91	1505	1.0	23.7			111	7.3	
		08/19/91	1505	2.0	23.3			112	7.4	
		08/19/91	1505	3.0	23.0			114	7.3	
		08/19/91	1505	4.0	23.0			115	7.2	
		08/19/91	1505	4.5	23.0			116	7.2	
		08/20/91	1225	0.0						7.3
		08/20/91	1225	0.0	23.9		6.7	113	7.4	7.3
		08/20/91	1225	1.0	23.0		6.6	115	7.2	
		08/20/91	1225	2.0	22.8		6.6	115	7.2	
		08/20/91	1225	3.0	22.8		6.6	117	7.2	
		08/20/91	1225	4.0	22.8		6.6	119	7.1	
		08/20/91	1225	4.5	22.8		6.6	119	7.0	
		08/27/91	1220	0.0						8.1
		08/27/91	1220	0.0	18.6		6.8	113		8.1
		08/27/91	1220	1.0	18.6		6.8	114		
		08/27/91	1220	2.0	18.6		6.8	114		
		08/27/91	1220	3.0	18.6		6.8	114	8.8	
		08/27/91	1220	4.0	18.6		6.8	115	8.8	
		08/27/91	1220	5.0	18.6		6.8	116	8.8	8.2
		08/28/91	1250	0.0	17.4		6.7	108	8.9	8.2
		08/28/91	1250	2.0	17.4		6.7	109	8.7	
		08/28/91	1250	4.0	17.4		6.7	109	8.7	

RM Code	Site Description	Date	Time	Depth (m)	TEMP meter (°C)	TEMP Hg (°C)	pH (s.u.)	COND (µho/cm)	DO meter (mg/L)	DO Winkler (mg/L)
73.6	CR @ junk cars bend	09/24/91	1110	0.0	16.2		6.9	118	9.0	
		09/24/91	1110	1.0	16.2		6.9	118	9.0	
		09/24/91	1110	2.0	16.1		6.9	120	8.9	
		09/24/91	1110	3.0	16.1		6.9	120	9.0	
		09/24/91	1110	4.0	16.1		6.9	119	8.9	
		10/08/91	1205	0.0	13.7		6.5	119	3.9	4.1
		10/08/91	1205	1.0	13.7		6.5	119	3.9	
		10/08/91	1205	2.0	13.7		6.5	119	3.9	
		10/08/91	1205	3.0	13.7		6.4	119	3.9	
		10/08/91	1205	4.0	13.7		6.4	119	3.9	
		10/08/91	1205	5.0	13.7		6.4	118	3.9	
		10/10/91	1019	0.0	13.1		6.4	116	4.6	
		10/10/91	1214	0.0	13.8		6.5	119	4.5	4.3
		10/14/91	1405	0.0	14.6		6.6	113	5.5	
		05/28/92	1135	0.0	17.2		7.1	76	9.0	
		05/28/92	1135	2.0	17.2		7.1	76	9.0	
		05/28/92	1135	4.0	17.2		7.1	77	9.0	
		06/16/92	1400	0.0	17.2		7.1	93	9.3	
		06/16/92	1400	2.0	17.2		7.0	93	9.3	
		06/16/92	1400	4.0	17.2		7.0	93	9.2	
		07/07/92	1302	0.0	18.9		6.9	99	8.0	
		07/07/92	1302	2.0	18.8		6.9	99	8.0	
		07/07/92	1302	4.0	18.8		6.9	99	8.0	
		07/22/92	1250	0.0	20.5		6.9	136	7.0	
		07/22/92	1250	1.0	20.4		6.9	137	6.8	
		07/22/92	1250	2.0	20.5		6.9	137	6.8	
		07/22/92	1250	3.0	20.5		6.9	136	6.8	
		07/22/92	1250	4.0	20.4		6.9	138	6.8	
		07/22/92	1250	5.0	20.4		6.9	138	6.8	
		07/22/92	1308	0.0						7.0
		08/04/92	1442	0.0	22.3		7.0	129	7.6	
		08/04/92	1442	1.0	22.3		7.0	130	7.4	
		08/04/92	1442	1.0	22.3		7.0	130	7.4	
		08/04/92	1442	2.0	22.2		6.9	130	7.2	
		08/04/92	1442	3.0	22.2		6.9	130	7.1	
		08/04/92	1442	4.0	22.2		6.9	129	7.1	
		08/04/92	1442	5.0	18.2		6.6	229	0.1	
		08/20/92	1308	0.0	23.2		7.0	129	8.1	
		08/20/92	1308	1.0	22.4		7.0	129	8.0	
		08/20/92	1308	2.0	22.2		7.0	129	8.0	
		08/20/92	1308	3.0	22.1		7.0	130	7.7	
		08/20/92	1308	4.0	22.1		7.0	131	7.5	
		08/20/92	1308	5.0	18.6		6.6	213	0.5	
		09/09/92	1535	0.0	17.0		7.1	116	8.7	
		09/09/92	1535	1.0	16.6		7.1	116	8.6	
		09/09/92	1535	2.0	16.1		7.1	114	8.6	
		09/09/92	1535	3.0	16.1		7.1	114	8.6	
		09/09/92	1535	4.0	16.0		7.1	102	8.6	
		09/30/92	1025	0.0	14.4		7.0	100	8.8	8.6
		09/30/92	1025	1.0	14.4		7.0	100	8.8	
		09/30/92	1025	2.0	14.3		7.0	100	8.8	
		09/30/92	1025	3.0	14.3		7.0	100	8.8	
73.1	CR blw junk cars	09/24/91	1125	0.0	16.1		6.9	112	9.0	
		09/24/91	1125	1.0	16.0		6.9	112	9.0	
		09/24/91	1125	2.0	16.0		6.9	111	9.0	
		09/24/91	1125	3.0	15.9		6.9	111	9.0	
		09/24/91	1125	4.0	15.8		6.9	112	8.8	
		10/08/91	1220	0.0	14.2		6.4	118	3.3	
		10/08/91	1220	1.0	13.8		6.4	117	3.4	
		10/08/91	1220	2.0	13.7		6.4	117	3.4	
		10/08/91	1220	3.0	13.7		6.4	116	3.4	

RM Code	Site Description	Date	Time	Depth (m)	TEMP meter (˚C)	TEMP Hg (˚C)	pH (s.u.)	COND (µho/cm)	DO meter (mg/L)	DO Winkler (mg/L)
72.5	CR abv Golf Course intake	07/22/91	1245	0.0	20.8				7.7	
		07/22/91	1245	2.0	20.7				7.7	
		07/22/91	1245	4.0	20.5				7.7	
		07/22/91	1245	6.0	20.5				7.5	
		08/02/91	1250	0.0	22.5		6.5	97	7.4	
		08/02/91	1250	1.0	22.4		6.5	98	7.4	
		08/02/91	1250	2.0	22.4		6.5	99	7.4	
		08/02/91	1250	3.0	22.2		6.5	100	7.4	
		08/02/91	1250	4.0	22.2		6.5	101	7.4	
		08/02/91	1250	5.0	21.9		6.5	101	7.4	
		08/02/91	1250	6.0	21.8		6.5	102	7.0	
		08/14/91	1205	0.0	21.6		6.7	101	7.6	
		08/14/91	1205	1.0	21.3		6.7	102	7.5	
		08/14/91	1205	2.0	20.9		6.6	103	7.5	
		08/14/91	1205	3.0	20.7		6.6	105	7.5	
		08/14/91	1205	4.0	20.7		6.6	107	7.5	
		08/14/91	1205	5.0	20.5		6.6	109	7.3	
		08/14/91	1205	6.0	20.5		6.6	110	7.2	
		08/19/91	1525	0.0						7.9
		08/19/91	1525	0.0	25.7			105	8.0	7.9
		08/19/91	1525	1.0	23.9			105	7.8	
		08/19/91	1525	2.0	23.3			105	7.8	
		08/19/91	1525	2.6	23.2			107	7.8	
		08/20/91	1010	0.0						7.0
		08/20/91	1010	0.0						7.0
		08/20/91	1030	0.0	22.4		6.5	110	7.0	
		08/20/91	1030	1.0	22.4		6.5	111	7.0	
		08/20/91	1030	2.0	22.4		6.5	112	6.9	
		08/20/91	1030	3.0	22.4		6.5	113	6.9	
		08/21/91	1220	0.0	23.4		7.0	110	7.3	
		08/21/91	1220	1.0	23.0		7.0	111	7.2	
		08/21/91	1220	2.0	22.7		6.9	112	7.1	
		08/21/91	1220	2.5	22.7		6.9	113	7.0	
		08/27/91	1320	0.0	18.4		6.7	114	8.9	
		08/27/91	1320	1.0	18.4		6.7	114	8.8	
		08/27/91	1320	2.0	18.4		6.7	114	8.8	
		08/27/91	1320	3.0	18.4		6.7	114	8.7	
		08/27/91	1320	4.0	18.4		6.7	114	8.7	
		08/27/91	1320	5.0	18.4		6.7	114	8.6	
		08/28/91	1325	0.0	17.9		6.7	118	8.4	
		08/28/91	1325	2.0	17.9		6.7	119	8.3	
		08/28/91	1325	4.0	17.9		6.7	119	8.3	
		08/28/91	1325	6.0	17.9		6.6	118	8.2	
		09/24/91	1145	0.0	16.3		6.9	118	8.7	
		09/24/91	1145	1.0	16.1		6.9	118	8.7	
		09/24/91	1145	2.0	16.1		6.9	119	8.6	
		09/24/91	1145	3.0	16.0		6.9	119	8.6	
		09/24/91	1145	4.0	16.0		6.9	118	8.6	
		10/08/91	1235	0.0	14.4		6.4	118	2.5	
		10/08/91	1235	1.0	14.0		6.4	119	2.4	
		10/08/91	1235	2.0	13.9		6.4	117	2.3	
		10/08/91	1235	3.0	13.8		6.3	117	2.3	
		10/08/91	1235	4.0	13.8		6.3	118	2.3	
		10/10/91	1007	0.0	13.3		6.4	119	3.8	
		10/14/91	1355	0.0	14.7		6.5	112	4.9	
		05/28/92	1145	0.0	17.4		7.1	77	8.7	
		05/28/92	1145	2.0	17.4		7.1	78	8.7	
		05/28/92	1145	4.0	17.4		7.1	77	8.7	
		05/28/92	1145	6.0	17.4		7.1	78	8.7	
		05/28/92	1145	7.2	17.4		7.1	78	8.7	

RM Code	Site Description	Date	Time	Depth (m)	TEMP meter (°C)	TEMP Hg (°C)	pH (s.u.)	COND (µho/cm)	DO meter (mg/L)	DO Winkler (mg/L)
72.3	CR blw Golf Course Intake	06/16/92	1420	0.0	17.4		7.1	93	9.0	9.0
		06/16/92	1420	2.0	17.4		7.0	93	9.0	
		06/16/92	1420	4.0	17.4		7.0	93	9.0	
		06/17/92	1600	0.0						8.8
		06/17/92	1600	0.0						8.9
		07/06/92	1630	0.0						8.0
		07/07/92	1241	0.0						8.3
		07/07/92	1241	0.0	19.3		6.9	100	8.0	7.9
		07/07/92	1241	2.0	19.3		6.9	100	8.0	
		07/07/92	1241	4.0	19.3		6.9	100	8.0	
		07/07/92	1402	0.0						8.2
		07/22/92	1325	0.0	21.0		6.9	133	6.3	
		07/22/92	1325	1.0	21.0		6.8	133	6.2	
		07/22/92	1325	2.0	21.0		6.8	133	6.2	
		07/22/92	1325	3.0	21.0		6.8	133	6.2	
		07/22/92	1325	4.0	21.0		6.8	133	6.1	
		07/22/92	1328	0.0						6.4
		07/23/92	1357	0.0						6.7
		08/03/92	1255	0.0						7.3
		08/04/92	1358	0.0						6.9
		08/04/92	1405	0.0	22.0		6.9	132	7.0	
		08/04/92	1405	1.0	22.0		6.9	132	6.9	
		08/04/92	1405	2.0	22.0		6.9	132	6.8	
		08/04/92	1405	3.0	22.0		6.8	132	6.8	
		08/04/92	1405	4.0	22.0		6.8	132	6.7	
		08/20/92	1345	0.0						7.8
		08/20/92	1350	0.0	23.4		7.0	136	7.9	
		08/20/92	1350	1.0	22.9		6.9	135	7.8	
		08/20/92	1350	2.0	22.6		6.9	134	7.5	
		08/20/92	1350	3.0	22.4		6.9	135	7.1	
		08/20/92	1350	3.5	22.4		6.9	136	6.9	
		08/21/92	1200	0.0						7.0
		08/21/92	1200	0.0						7.1
		09/08/92	1400	0.0						8.0
		09/08/92	1453	0.0						8.0
		09/09/92	1508	0.0						8.1
		09/09/92	1508	0.0						8.2
		09/09/92	1515	0.0	17.4		7.0	124	8.2	
		09/09/92	1515	1.0	17.1		7.0	123	8.1	
		09/09/92	1515	2.0	17.1		7.0	124	8.1	
		09/09/92	1515	3.0	17.1		7.0	124	8.0	
		09/09/92	1515	4.0	17.0		7.0	124	8.0	
		09/09/92	1515	4.8	16.9		7.0	124	8.0	
		09/30/92	1050	0.0	14.4		7.0	96	8.6	
		09/30/92	1050	1.0	14.3		6.9	96	8.7	
		09/30/92	1050	2.0	14.2		6.9	96	8.7	
		09/30/92	1050	3.0	14.2		7.0	96	8.7	
		09/30/92	1050	4.0	14.2		7.0	96	8.7	
71.4	CR blw Schueber Ditch	09/24/91	1200	0.0	16.9		6.9	115	8.5	
		09/24/91	1200	1.0	16.8		6.9	115	8.5	
		09/24/91	1200	2.0	16.6		6.9	114	8.5	
		09/24/91	1200	3.0	16.5		6.9	114	8.5	
		09/24/91	1200	4.0	16.5		6.9	114	8.5	
		10/08/91	1255	0.0	14.6		6.4	121	0.7	0.8
		10/08/91	1255	1.0	14.2		6.4	122	0.5	
		10/08/91	1255	2.0	14.1		6.3	122	0.5	
		10/08/91	1255	3.0	14.1		6.3	122	0.5	
		10/08/91	1255	4.0	14.1		6.3	122	0.5	
		10/10/91	956	0.0	13.6		6.3	122	3.2	
		10/14/91	1345	0.0	14.6		6.4	111	4.5	

RM Code	Site Description	Date	Time	Depth (m)	TEMP meter (°C)	TEMP Hg (°C)	pH (s.u.)	COND (µho/cm)	DO meter (mg/L)	DO Winkler (mg/L)
70.7	CR north of Airport	08/02/91	1345	0.0	23.6		6.5	103	7.0	7.3
		08/02/91	1345	1.0	23.0		6.5	104	7.0	
		08/02/91	1345	2.0	22.4		6.5	104	7.0	
		08/02/91	1345	3.0	22.3		6.5	105	6.9	
		08/02/91	1345	4.0	22.3		6.5	106	6.8	
		08/02/91	1345	5.0	20.7		6.2	110	4.2	
		08/02/91	1345	6.0	19.7		6.1	113	3.8	
		08/02/91	1345	7.0	18.6		6.0	125	2.5	
		08/02/91	1345	8.0	17.6		5.9	151	0.9	
		08/14/91	1245	0.0	23.1		6.7	102	7.4	
		08/14/91	1245	1.0	21.3		6.6	102	7.3	
		08/14/91	1245	2.0	21.0		6.6	104	7.3	
		08/14/91	1245	3.0	20.8		6.6	104	7.2	
		08/14/91	1245	4.0	20.8		6.6	106	7.2	
		08/14/91	1245	5.0	20.3		6.4	115	6.1	
		08/14/91	1245	6.0	19.2		6.1	133	1.3	
		08/20/91	1520	0.0						8.6
		08/20/91	1520	0.0	25.9		7.0	104	8.6	8.6
		08/20/91	1520	1.0	23.9		6.7	105	7.8	
		08/20/91	1520	2.0	23.4		6.6	106	7.1	
		08/20/91	1520	3.0	23.1		6.5	109	6.7	
		08/20/91	1520	3.7	21.7		6.2	130	3.4	
		08/27/91	1448	0.0	19.1		6.7	111	8.4	
		08/27/91	1448	1.0	19.1		6.7	112	8.4	
		08/27/91	1448	2.0	19.1		6.7	112	8.4	
		08/27/91	1448	3.0	19.1		6.7	112	8.3	
		08/27/91	1448	4.0	19.1		6.7	112	8.3	
		08/27/91	1448	5.0	17.6		6.1	151	0.4	
		08/27/91	1448	6.0	16.7		6.1	168	0.2	
		08/27/91	1448	7.0	15.9		6.1	225	0.2	
		08/27/91	1448	8.0	15.5		6.1	302	0.2	
		08/28/91	1433	0.0	18.1		6.7	112	8.4	7.8
		08/28/91	1433	2.0	18.1		6.6	113	8.3	
		08/28/91	1433	4.0	18.1		6.6	113	8.3	
		08/28/91	1433	5.0	18.1		6.5	115	8.2	
		08/28/91	1433	6.0	16.7		6.1	170	0.4	4.6
		09/24/91	1225	0.0	17.8		6.9	115	8.2	
		09/24/91	1225	1.0	16.9		6.9	115	8.1	
		09/24/91	1225	2.0	16.9		6.9	114	8.1	
		09/24/91	1225	3.0	16.8		6.9	114	8.0	
		09/24/91	1225	4.0	16.7		6.8	116	7.9	
		09/24/91	1225	5.0	16.7		6.8	116	7.9	
		09/24/91	1225	6.0	16.7		6.8	116	7.8	
		09/24/91	1225	7.0	16.7		6.8	115	7.8	
		09/24/91	1225	8.0	16.7		6.8	120	7.7	
		09/24/91	1225	9.0	15.8		6.6	498	0.2	
		10/08/91	1320	0.0	14.6		6.4	118	1.2	
		10/08/91	1320	1.0	14.4		6.3	117	1.1	
		10/08/91	1320	2.0	14.3		6.3	117	1.0	
		10/08/91	1320	3.0	14.3		6.3	117	1.0	
		10/08/91	1320	4.0	14.2		6.3	117	1.0	
		10/08/91	1320	5.0	14.2		6.3	117	1.0	
		10/08/91	1320	6.0	14.2		6.3	117	0.9	
		10/08/91	1320	7.0	14.2		6.3	117	0.9	
		10/08/91	1320	8.0	14.2		6.3	117	0.9	
		10/10/91	948	0.0	13.8		6.3	119	2.4	
		10/10/91	1252	0.0	15.6		6.5	119	2.9	2.7
		10/14/91	1335	0.0	15.0		6.4	112	3.7	
		10/14/91	1445	0.0	15.4		6.5	111	4.0	

RM Code	Site Description	Date	Time	Depth (m)	TEMP meter (˚C)	TEMP Hg (˚C)	pH (s.u.)	COND (μho/cm)	DO meter (mg/L)	DO Winkler (mg/L)
70.7	CR north of Airport	05/28/92	1203	0.0	17.9		7.1	80	8.4	
		05/28/92	1203	2.0	17.9		7.0	80	8.4	
		05/28/92	1203	4.0	17.9		7.0	80	8.4	
		05/28/92	1203	6.0	17.9		7.0	80	8.3	
		06/16/92	1440	0.0	17.3		7.0	92	9.1	
		06/16/92	1440	2.0	17.3		7.0	92	9.1	
		06/16/92	1440	4.0	17.2		7.0	92	9.0	
		07/07/92	1217	0.0	19.3		6.8	99	7.2	
		07/07/92	1217	2.0	19.3		6.8	99	7.3	
		07/07/92	1217	4.0	19.2		6.8	100	7.2	
		07/07/92	1217	6.0	19.2		6.8	101	7.1	
		07/07/92	1217	6.5	18.3		6.6	116	4.4	
		07/07/92	1217	7.0	15.4		6.5	191	0.2	
		07/07/92	1217	8.0	15.4		6.5	244	0.3	
		07/22/92	1415	0.0	21.6		6.8	132	5.8	
		07/22/92	1415	1.0	21.7		6.8	132	5.6	
		07/22/92	1415	2.0	21.6		6.8	131	5.6	
		07/22/92	1415	3.0	21.6		6.8	132	5.6	
		07/22/92	1415	4.0	19.7		6.5	133	1.9	
		07/22/92	1415	5.0	18.1		6.5	158	0.1	
		07/22/92	1415	6.0	17.2		6.4	170	0.1	
		07/22/92	1415	7.0	16.1		6.4	243	0.1	
		07/22/92	1415	8.0	15.3		6.5	368	0.1	
		08/04/92	1300	0.0	22.6		6.9	134	7.3	
		08/04/92	1300	1.0	22.6		6.9	134	7.2	
		08/04/92	1300	2.0	22.6		6.9	134	6.9	
		08/04/92	1300	3.0	21.5		6.7	133	4.5	
		08/04/92	1300	4.0	18.7		6.5	165	0.1	
		08/04/92	1300	5.0	17.2		6.4	188	0.0	
		08/04/92	1300	6.0	15.9		6.5	244	0.0	
		08/04/92	1300	7.0	15.5		6.5	388	0.0	
		08/04/92	1300	8.0	15.2		6.6	406	0.1	
		08/04/92	1311	1.7						7.1
		08/04/92	1319	6.8						0.1
		08/20/92	1404	0.0	23.8		7.0	131	8.0	
		08/20/92	1404	1.0	22.9		6.9	131	7.6	
		08/20/92	1404	2.0	22.7		6.8	131	7.2	
		08/20/92	1404	3.0	22.4		6.8	131	5.7	
		08/20/92	1404	4.0	19.7		6.4	177	1.2	
		08/20/92	1404	5.0	17.8		6.4	193	0.5	
		09/09/92	1445	0.0	20.0		7.1	123	7.6	
		09/09/92	1445	1.0	17.7		7.0	122	7.3	
		09/09/92	1445	2.0	17.3		7.0	122	7.2	
		09/09/92	1445	3.0	17.3		6.9	123	7.1	
		09/09/92	1445	4.0	17.3		6.9	125	7.0	
		09/09/92	1445	5.0	17.2		6.9	127	6.7	
		09/09/92	1445	6.0	15.5		6.6	275	0.0	
		09/09/92	1445	7.0	14.6		6.6	374	0.0	
		09/09/92	1445	8.0	14.3		6.7	484	0.0	
		09/09/92	1445	9.0	14.0		6.7	744	0.0	
		09/30/92	1120	0.0	15.4		6.9	94	8.2	
		09/30/92	1120	1.0	14.7		6.9	94	8.2	
		09/30/92	1120	2.0	14.6		6.9	94	8.3	
		09/30/92	1120	3.0	14.6		6.9	94	8.2	
		09/30/92	1120	4.0	14.6		6.9	94	8.2	
		09/30/92	1120	5.0	14.6		7.0	94	8.2	
		09/30/92	1120	6.0	14.6		7.0	94	8.2	
		09/30/92	1120	7.0	14.6		7.0	94	8.2	
		09/30/92	1120	8.0	14.6		7.0	94	7.1	

RM Code	Site Description	Date	Time	Depth (m)	TEMP meter (˚C)	TEMP Hg (˚C)	pH (s.u.)	COND (µho/cm)	DO meter (mg/L)	DO Winkler (mg/L)
70.0	CR abv Overhanging Tree	09/24/91	1255	0.0						7.6
		09/24/91	1255	0.0	18.1		6.9	121	8.0	7.7
		09/24/91	1255	1.0	17.5		6.8	121	7.7	
		09/24/91	1255	2.0	17.2		6.8	120	7.7	
		10/08/91	1345	0.0	15.3		6.5	121	3.7	
		10/08/91	1345	1.0	14.8		6.4	121	3.8	
		10/08/91	1345	2.0	14.6		6.4	121	3.7	
		10/08/91	1345	3.0	14.6		6.4	121	3.6	
		10/08/91	1345	4.0	14.6		6.4	122	3.6	
		10/08/91	1345	5.0	14.6		6.3	122	3.6	
		10/08/91	1345	6.0	14.6		6.3	122	3.5	
		10/08/91	1345	7.0	14.6		6.3	122	3.5	
		10/08/91	1345	8.0	14.5		6.4	145	3.4	
		10/10/91	939	0.0	13.9		6.3	121	1.4	
		10/10/91	1307	0.0	15.0		6.4	121	1.8	
69.8	CR abv Overhanging Tree	10/10/91	1313	0.0	15.4		6.4	119	1.7	
69.6	CR blw Overhanging Tree	08/02/91	1410	0.0	23.8		6.5	103	7.0	
		08/02/91	1410	1.0	22.4		6.5	104	7.1	
		08/02/91	1410	2.0	22.2		6.5	106	6.9	
		08/02/91	1410	3.0	22.1		6.4	107	6.7	
		08/02/91	1410	4.0	22.0		6.4	108	6.6	
		08/02/91	1410	5.0	22.0		6.4	108	6.6	
		08/02/91	1410	6.0	21.4		6.3	109	5.1	
		08/02/91	1410	7.0	20.6		6.2	111	4.2	
		08/02/91	1410	8.0	20.1		6.2	127	3.3	
		08/14/91	1315	0.0	24.4		6.6	102	7.2	7.5
		08/14/91	1315	1.0	21.4		6.6	103	7.2	
		08/14/91	1315	2.0	21.1		6.6	105	7.2	
		08/14/91	1315	3.0	20.9		6.6	105	6.5	
		08/14/91	1315	4.0	20.9		6.5	107	6.1	
		08/14/91	1315	5.0	20.9		6.5	108	6.2	
		08/14/91	1315	6.0	20.8		6.5	109	5.5	
		08/14/91	1315	7.0	20.7		6.5	112	5.3	
		08/14/91	1315	8.0	19.9		6.4	165	3.2	
		08/14/91	1315	9.0	16.2		6.4	373	0.3	
		08/27/91	1553	0.0	19.8		6.6	120	8.0	7.6
		08/27/91	1553	1.0	19.9		6.6	120	7.9	
		08/27/91	1553	2.0	20.0		6.6	120	7.8	
		08/27/91	1553	3.0	19.9		6.6	120	7.9	
		08/27/91	1553	4.0	19.9		6.6	121	7.9	
		08/27/91	1553	5.0	19.9		6.6	122	7.9	
		08/27/91	1553	6.0	19.9		6.6	122	7.8	
		08/27/91	1553	7.0	19.9		6.6	125	7.1	
		08/27/91	1553	8.0	17.2		6.3	280	0.3	
		08/28/91	1527	0.0	18.7		6.6	117	7.7	
		08/28/91	1527	2.0	18.7		6.6	117	7.6	
		08/28/91	1527	4.0	18.8		6.6	117	7.6	
		08/28/91	1527	6.0	18.8		6.6	117	7.6	
		08/28/91	1527	8.0	18.7		6.6	117	7.6	
		09/24/91	1310	0.0	19.4		6.9	123	7.4	
		09/24/91	1310	1.0	17.8		6.8	122	7.6	
		09/24/91	1310	2.0	17.7		6.8	123	7.5	
		09/24/91	1310	3.0	17.6		6.8	123	7.3	
		09/24/91	1310	4.0	17.5		6.8	123	7.3	
		09/24/91	1310	5.0	17.5		6.8	123	7.3	
		09/24/91	1310	6.0	17.5		6.8	123	7.3	
		09/24/91	1310	7.0	17.5		6.8	122	7.4	
		09/24/91	1310	8.0	17.5		6.8	122	7.4	
		09/24/91	1310	9.0	15.7		6.8	374	0.2	

RM Code	Site Description	Date	Time	Depth (m)	TEMP meter (°C)	TEMP Hg (°C)	pH (s.u.)	COND (µho/cm)	DO meter (mg/L)	DO Winkler (mg/L)
69.6	CR blw Overhanging Tree	10/08/91	1400	0.0	15.8		6.5	124	5.9	
		10/08/91	1400	1.0	14.9		6.5	125	5.5	
		10/08/91	1400	2.0	14.8		6.5	124	5.3	
		10/08/91	1400	3.0	14.8		6.4	125	5.3	
		10/08/91	1400	4.0	14.7		6.4	125	5.1	
		10/08/91	1400	5.0	14.7		6.4	125	5.0	
		10/08/91	1400	6.0	14.7		6.4	125	5.0	
		10/08/91	1400	7.0	14.7		6.4	125	5.0	
		10/08/91	1400	8.0	14.7		6.4	125	5.0	
		10/10/91	926	0.0	14.0		6.3	121	1.1	
		10/10/91	926	0.0	14.2		6.3	120	1.0	1.5
		10/10/91	926	0.0	14.2		6.4	120	1.1	
		10/10/91	926	5.0	14.1		6.3	121	1.0	
		10/10/91	1318	0.0						2.0
		10/10/91	1318	0.0	15.0		6.4	121	1.3	2.2
		10/10/91	1346	0.0	15.2		6.4	119	1.5	
		10/14/91	1325	0.0	15.2		6.5	126	3.3	3.7
		10/14/91	1500	0.0	15.6		6.4	126	3.4	4.1
		10/14/91	1500	1.0	14.6		6.3	126	3.3	
		10/14/91	1500	2.0	14.1		6.3	126	3.1	
		10/14/91	1500	3.0	14.0		6.3	126	3.1	
		10/14/91	1500	4.0	14.0		6.3	125	3.0	
		10/14/91	1500	5.0	13.9		6.3	125	3.0	
		10/14/91	1500	6.0	13.9		6.3	125	3.0	
		10/14/91	1500	7.0	13.9		6.3	125	3.0	
		05/07/92	1250	0.0						8.9
		05/07/92	1250	0.0	18.0		7.1	70	8.8	8.9
		05/07/92	1250	1.0	17.9		7.0	71	8.8	
		05/07/92	1250	2.0	17.9		7.0	71	8.8	
		05/07/92	1250	3.0	17.9		7.0	71	8.8	
		05/07/92	1250	4.0	17.8		6.9	71	8.8	
		05/07/92	1250	5.0	17.8		6.9	71	8.8	
		05/07/92	1250	6.0	17.8		6.9	71	8.8	
		05/08/92	1118	0.0						8.9
		05/28/92	1225	0.0						8.1
		05/28/92	1225	0.0	18.3		7.1	79	8.1	8.1
		05/28/92	1225	2.0	18.3		7.0	79	8.2	
		05/28/92	1225	4.0	18.3		7.0	79	8.1	
		05/28/92	1225	6.0	18.3		7.0	79	8.1	
		05/29/92	1025							8.3
		06/16/92	1500	0.0						8.8
		06/16/92	1500	0.0	17.4		7.0	93	8.9	8.7
		06/16/92	1500	2.0	17.4		7.0	93	8.9	
		06/16/92	1500	4.0	17.4		6.9	93	8.9	
		06/16/92	1500	6.0	17.4		6.9	94	8.9	
		06/17/92	1530	0.0						9.1
		07/06/92	1605	0.0						6.3
		07/06/92	1605	0.0						6.4
		07/07/92	1147	0.0	19.6		6.8	102	6.8	6.7
		07/07/92	1147	2.0	19.6		6.8	103	6.8	
		07/07/92	1147	4.0	19.6		6.8	103	6.7	
		07/07/92	1147	6.0	19.6		6.8	104	6.6	
		07/07/92	1147	7.0	19.6		6.8	106	6.6	
		07/22/92	1455	0.0	22.0		6.7	126	5.5	
		07/22/92	1455	1.0	22.1		6.7	128	5.4	
		07/22/92	1455	2.0	22.1		6.7	129	5.4	
		07/22/92	1455	3.0	22.1		6.7	129	5.3	
		07/22/92	1455	4.0	22.0		6.7	126	5.0	
		07/22/92	1455	5.0	19.6		6.6	122	2.3	
		07/22/92	1455	6.0	18.9		6.5	136	0.8	
		07/22/92	1455	7.0	18.3		6.5	157	0.2	
		07/22/92	1505	0.0						5.5

RM Code	Site Description	Date	Time	Depth (m)	TEMP meter (˚C)	TEMP Hg (˚C)	pH (s.u.)	COND (µho/cm)	DO meter (mg/L)	DO Winkler (mg/L)
69.6	CR blw Overhanging Tree	07/23/92	1330	0.0						5.2
		08/03/92	1338	0.0						8.7
		08/04/92	1145	0.0	23.1		7.0	127	8.4	
		08/04/92	1145	1.0	23.1		7.0	127	8.4	
		08/04/92	1145	2.0	23.0		6.9	127	7.9	
		08/04/92	1145	3.0	22.7		6.9	128	6.9	
		08/04/92	1145	4.0	20.8		6.7	126	4.2	
		08/04/92	1145	5.0	19.8		6.6	136	2.2	
		08/04/92	1145	6.0	18.7		6.6	169	0.1	
		08/04/92	1158	0.0						8.2
		08/04/92	1158	0.0						8.3
		08/20/92	1430	0.0						8.6
		08/20/92	1430	0.0	24.3		7.0	133	8.5	
		08/20/92	1430	1.0	23.5		7.0	132	8.5	
		08/20/92	1430	2.0	23.1		6.9	132	7.7	
		08/20/92	1430	3.0	22.9		6.9	133	7.0	
		08/20/92	1430	4.0	21.4		6.7	116	4.0	
		08/20/92	1430	5.0	20.0		6.6	124	2.7	
		08/20/92	1430	6.0	19.3		6.6	140	0.7	
		08/20/92	1430	7.0	18.1		6.6	230	0.5	
		08/21/92	1131	0.0						7.2
		09/08/92	1522	0.0						6.3
		09/09/92	1412	0.0						6.1
		09/09/92	1415	0.0	19.5		6.9	146	6.2	
		09/09/92	1415	1.0	18.2		6.9	148	5.9	
		09/09/92	1415	2.0	17.9		6.9	149	5.9	
		09/09/92	1415	3.0	17.8		6.8	149	5.8	
		09/09/92	1415	4.0	17.8		6.8	149	5.7	
		09/09/92	1415	5.0	17.7		6.8	149	5.8	
		09/09/92	1415	6.0	17.7		6.8	150	5.7	
		09/09/92	1415	7.0	17.6		6.8	158	5.5	
		09/09/92	1415	8.0	15.3		6.8	0	0.0	
		09/30/92	1150	0.0	14.9		6.9	90	7.9	
		09/30/92	1150	1.0	14.7		6.9	90	7.9	
		09/30/92	1150	2.0	14.6		6.9	90	7.9	
		09/30/92	1150	3.0	14.6		6.9	90	7.8	
		09/30/92	1150	4.0	14.6		6.9	90	7.8	
		09/30/92	1150	5.0	14.6		6.9	90	7.8	
		09/30/92	1150	6.0	14.5		6.9	90	7.8	
		09/30/92	1150	7.0	14.5		6.9	90	7.8	
69.1	CR blw Salzer Ck	07/22/91	1400	0.0	20.3				7.5	
		07/22/91	1400	2.0	19.9				7.4	
		07/22/91	1400	4.0	19.0				7.0	
		07/22/91	1400	6.0	18.3				4.2	
		07/22/91	1400	8.0	17.0				1.3	
		08/14/91	1350	0.0	23.2		6.7	102	7.9	
		08/14/91	1350	1.0	21.9		6.7	101	7.9	
		08/14/91	1350	2.0	21.4		6.7	103	7.9	
		08/14/91	1350	3.0	21.1		6.6	104	7.1	
		08/14/91	1350	4.0	21.0		6.6	108	6.2	
		08/14/91	1350	5.0	20.4		5.9	179	0.1	
		08/27/91	1630	0.0	20.1		6.6	119	7.5	
		08/27/91	1630	1.0	20.2		6.6	119	7.5	
		08/27/91	1630	2.0	20.2		6.6	119	7.5	
		08/27/91	1630	3.0	20.0		6.6	122	5.1	
		08/27/91	1630	4.0	19.5		6.4	198	0.9	
		08/27/91	1630	5.0	19.2		6.4	247	0.6	
		08/27/91	1630	6.0	18.4		6.1	219	0.2	
		08/27/91	1630	7.0	16.0		6.4	249	0.2	0.0

RM Code	Site Description	Date	Time	Depth (m)	TEMP meter (°C)	TEMP Hg (°C)	pH (s.u.)	COND (μho/cm)	DO meter (mg/L)	DO Winkler (mg/L)
69.1	CR blw Salzer Ck	08/28/91	1550	0.0	19.0		6.6	122	7.4	
		08/28/91	1550	2.0	19.0		6.6	123	7.2	
		08/28/91	1550	4.0	18.9		6.5	161	4.9	
		08/28/91	1550	6.0	18.5		6.2	215	0.3	
		08/28/91	1550	8.0	13.6		6.6	294	0.2	
		09/24/91	1335	0.0	18.7		6.8	125	7.4	
		09/24/91	1335	1.0	18.0		6.8	124	7.5	
		09/24/91	1335	2.0	17.9		6.8	125	7.4	
		09/24/91	1335	3.0	17.8		6.8	124	7.3	
		09/24/91	1335	4.0	17.6		6.7	125	6.6	
		09/24/91	1335	5.0	17.1		6.5	158	0.2	
		09/24/91	1335	6.0	17.0		6.5	158	0.1	
		09/24/91	1335	7.0	16.9		6.5	158	0.1	
		09/24/91	1335	8.0	15.2		6.8	282	0.1	
		09/24/91	1335	9.0	13.5		7.0	308	0.1	
		10/08/91	1420	0.0	16.0		6.6	123	6.5	
		10/08/91	1420	1.0	15.2		6.5	122	6.5	
		10/08/91	1420	2.0	15.1		6.5	122	6.5	
		10/08/91	1420	3.0	15.0		6.5	122	6.2	
		10/08/91	1420	4.0	14.9		6.5	123	6.0	
		10/08/91	1420	5.0	14.8		6.3	138	3.1	
		10/08/91	1420	6.0	14.8		6.3	137	3.4	
		10/08/91	1420	7.0	14.7		6.3	133	4.1	
		10/10/91	919	0.0	14.1		6.3	120	1.6	
		05/07/92	1315	0.0	17.9		7.2	72	8.8	
		05/07/92	1315	2.0	17.8		7.1	72	8.8	
		05/07/92	1315	4.0	17.8		7.0	72	8.8	
		05/07/92	1315	6.0	17.8		7.0	72	8.8	
		05/07/92	1315	8.0	17.8		7.0	72	8.8	
		05/28/92	1242	0.0	18.5		7.1	80	8.0	
		05/28/92	1242	2.0	18.6		7.0	80	8.0	
		05/28/92	1242	4.0	18.6		7.0	80	8.1	
		05/28/92	1242	6.0	18.5		7.0	81	8.0	
		05/28/92	1242	8.0	18.5		7.0	81	8.0	
		05/28/92	1242	9.0	18.5		7.0	81	8.0	
		06/16/92	1520	0.0	17.4		7.0	94	9.0	
		06/16/92	1520	2.0	17.4		6.9	95	9.0	
		06/16/92	1520	4.0	17.4		6.9	95	9.0	
		06/16/92	1520	6.0	17.4		6.9	95	9.0	
		06/16/92	1520	8.0	17.4		6.9	97	8.9	
		07/07/92	1126	0.0	19.8		6.8	108	6.3	
		07/07/92	1126	2.0	19.8		6.8	109	6.3	
		07/07/92	1126	4.0	19.7		6.8	110	6.2	
		07/07/92	1126	5.0	19.7		6.8	110	6.2	
		07/07/92	1126	6.0	19.6		6.8	129	1.8	
		07/07/92	1126	7.0	17.2		6.6	168	0.2	
		07/07/92	1126	8.0	15.2		6.8	269	0.2	
		07/07/92	1126	9.0	13.9		7.0	299	0.2	
		07/22/92	1555	0.0	22.0		6.8	124	5.7	
		07/22/92	1555	1.0	22.1		6.8	124	5.6	
		07/22/92	1555	2.0	22.1		6.8	124	5.6	
		07/22/92	1555	3.0	22.1		6.8	125	5.6	
		07/22/92	1555	4.0	21.2		6.7	206	4.1	
		07/22/92	1555	5.0	19.8		6.7	185	2.2	
		07/22/92	1555	6.0	18.6		6.6	203	0.2	
		07/22/92	1555	7.0	16.3		6.7	240	0.1	
		07/22/92	1555	8.0	13.9		7.0	318	0.1	
		07/22/92	1555	9.0	13.3		7.1	320	0.1	

RM Code	Site Description	Date	Time	Depth (m)	TEMP meter (°C)	TEMP Hg (°C)	pH (s.u.)	COND (µho/cm)	DO meter (mg/L)	DO Winkler (mg/L)
69.1	CR blw Salzer Ck	08/04/92	1115	0.0	22.6		6.9	128	8.1	
		08/04/92	1115	1.0	22.7		6.9	128	8.1	
		08/04/92	1115	2.0	22.7		6.9	128	8.1	
		08/04/92	1115	3.0	22.7		6.9	132	7.7	
		08/04/92	1115	4.0	20.9		6.8	165	3.7	
		08/04/92	1115	5.0	19.4		6.6	202	0.1	
		08/04/92	1115	6.0	17.8		6.6	227	0.0	
		08/04/92	1115	7.0	15.6		6.8	298	0.0	
		08/04/92	1115	8.0	13.5		7.0	325	0.1	
		08/20/92	1455	0.0	24.4		7.0	133	8.8	
		08/20/92	1455	1.0	23.3		7.0	133	8.7	
		08/20/92	1455	2.0	23.0		7.0	133	8.1	
		08/20/92	1455	3.0	22.9		6.9	133	7.7	
		08/20/92	1455	4.0	21.0		6.7	128	2.4	
		08/20/92	1455	5.0	19.6		6.6	158	0.7	
		08/20/92	1455	6.0	17.9		6.6	240	0.5	
		08/20/92	1455	7.0	15.6		6.8	292	0.5	
		08/20/92	1455	8.0	13.6		7.1	318	0.5	
		08/20/92	1455	8.5	13.1		7.2	316	0.4	
		09/09/92	1355	0.0	19.1		6.8	143	6.0	
		09/09/92	1355	1.0	18.4		6.8	143	5.9	
		09/09/92	1355	2.0	18.3		6.8	143	5.9	
		09/09/92	1355	3.0	18.0		6.8	143	5.6	
		09/09/92	1355	4.0	18.0		6.8	144	5.6	
		09/09/92	1355	5.0	17.9		6.8	144	5.4	
		09/09/92	1355	6.0	17.6		6.8	186	1.7	
		09/09/92	1355	7.0	14.9		6.9	299	0.0	
		09/09/92	1355	8.0	13.1		7.1	308	0.0	
		09/09/92	1355	9.0	12.7		7.1	324	1.5	
		09/30/92	1220	0.0						7.5
		09/30/92	1220	0.0	15.4		6.9	90	7.7	7.6
		09/30/92	1220	1.0	15.2		6.9	90	7.7	
		09/30/92	1220	2.0	15.0		6.9	90	7.7	
		09/30/92	1220	3.0	14.8		6.9	90	7.7	
		09/30/92	1220	4.0	14.8		6.9	90	7.7	
		09/30/92	1220	5.0	14.8		6.9	90	7.7	
		09/30/92	1220	6.0	14.8		6.9	90	7.7	
		09/30/92	1220	7.0	14.8		6.9	90	7.6	
68.6	CR abv Midway Meats	10/10/91	912	0.0	14.4		6.4	122	2.9	
		10/10/91	1355	0.0	16.0		6.5	123	3.4	3.5
		10/14/91	1315	0.0	14.6		6.4	125	3.7	4.0
		10/14/91	1520	0.0	15.3		6.4	125	4.1	4.3
		10/14/91	1520	1.0	15.1		6.4	124	4.1	
		10/14/91	1520	2.0	14.7		6.3	125	3.8	
		10/14/91	1520	3.0	14.6		6.3	125	3.6	
		10/14/91	1520	4.0	14.1		6.3	126	3.1	
		05/07/92	1330	0.0	17.9		7.2	72	8.7	8.9
		05/07/92	1330	2.0	17.6		7.1	72	8.8	
		05/07/92	1330	4.0	17.6		7.1	72	8.8	
		05/07/92	1330	6.0	17.6		7.0	73	8.8	
		05/08/92	1101	0.0						8.7
		05/08/92	1101	0.0						8.8
		05/28/92	1300	0.0	18.7		7.0	81	8.0	8.0
		05/28/92	1300	2.0	18.7		7.0	81	7.9	
		05/28/92	1300	4.0	18.7		7.0	81	7.9	
		05/29/92	1007							7.9
		05/29/92	1007							8.0
		06/16/92	1535	0.0	17.4		7.0	95	9.0	8.8
		06/16/92	1535	2.0	17.4		6.9	96	8.9	
		06/16/92	1535	4.0	17.3		6.9	96	8.8	
		06/17/92	1525	0.0						8.7

RM Code	Site Description	Date	Time	Depth (m)	TEMP meter (˚C)	TEMP Hg (˚C)	pH (s.u.)	COND (µho/cm)	DO meter (mg/L)	DO Winkler (mg/L)
68.6	CR abv Midway Meats	07/06/92	1555	0.0						7.9
		07/06/92	1709	0.0						7.1
		07/07/92	1112	0.0	20.0		6.8	117	5.8	5.9
		07/07/92	1112	2.0	20.1		6.8	116	5.7	
		07/07/92	1112	4.0	20.0		6.8	116	5.8	
		07/22/92	1644	0.0	21.9		6.8	128	5.9	
		07/22/92	1644	1.0	22.0		6.7	128	5.7	
		07/22/92	1644	2.0	22.0		6.7	129	5.5	
		07/22/92	1644	3.0	22.0		6.7	130	5.4	
		07/22/92	1644	3.7	21.9		6.7	130	5.4	
		07/22/92	1657	0.0						5.7
		07/23/92	1317	0.0						5.2
		08/03/92	1347	0.0						8.3
		08/03/92	1347	0.0						8.6
		08/04/92	1038	0.0						8.2
		08/04/92	1043	0.0	22.7		7.0	128	8.3	
		08/04/92	1043	1.0	22.7		7.0	128	8.2	
		08/04/92	1043	2.0	22.7		7.0	130	7.5	
		08/04/92	1043	3.0	22.2		6.8	137	5.5	
		08/04/92	1059	0.0						8.2
		08/20/92	1515	0.0	24.4		7.1	133	9.9	
		08/20/92	1515	1.0	23.2		7.1	132	9.3	
		08/20/92	1515	2.0	22.9		7.0	132	7.8	
		08/20/92	1515	3.0	22.6		6.8	131	5.4	
		08/20/92	1515	3.9	20.6		6.6	123	2.6	
		08/20/92	1522	0.0						10.0
		08/21/92	1122	0.0						8.0
		09/08/92	1304	0.0						6.3
		09/08/92	1304	0.0						6.6
		09/09/92	1340	0.0	18.8		6.8	145	6.0	
		09/09/92	1340	1.0	18.6		6.8	145	5.7	
		09/09/92	1340	2.0	18.0		6.8	148	6.7	
		09/09/92	1340	3.0	17.9		6.8	148	6.7	
		09/09/92	1347	0.0						6.2
		09/30/92	1240	0.0	15.9		6.9	91	7.3	
		09/30/92	1240	1.0	15.2		6.9	91	7.5	
		09/30/92	1240	2.0	14.9		6.8	91	7.5	
		09/30/92	1240	3.0	14.9		6.8	91	7.5	
		09/30/92	1240	4.0	14.9		6.9	91	7.5	
68.5	CR nr Midway Meats	07/22/91	1045	0.0	19.5				7.5	
		08/02/91	1445	0.0	23.8		6.7	100	9.0	
		08/02/91	1445	1.0	23.0		6.7	102	8.4	
		08/02/91	1445	2.0	22.5		6.6	103	8.0	
		08/02/91	1445	3.0	22.3		6.5	103	7.3	
		08/02/91	1445	4.0	22.2		6.5	104	7.1	
		08/02/91	1445	5.0	22.2		6.5	104	7.0	
		08/02/91	1445	6.0	21.0		6.3	105	4.4	
		08/02/91	1445	7.0	19.7		6.1	120	2.2	
		08/14/91	1430	0.0	22.7		6.8	102	7.5	
		08/14/91	1430	1.0	22.0		6.7	104	7.7	
		08/14/91	1430	2.0	21.5		6.6	106	6.2	
		08/14/91	1430	3.0	21.2		6.5	108	5.5	
		08/14/91	1430	4.0	21.1		6.5	109	5.5	
		08/14/91	1430	5.0	21.1		6.4	111	5.3	
		08/14/91	1430	6.0	21.0		6.4	112	5.2	
		08/14/91	1430	7.0	19.4		6.0	137	0.4	

RM Code	Site Description	Date	Time	Depth (m)	TEMP meter (˚C)	TEMP Hg (˚C)	pH (s.u.)	COND (µho/cm)	DO meter (mg/L)	DO Winkler (mg/L)
68.5	CR nr Midway Meats	08/21/91	1507	0.0						9.4
		08/21/91	1507	0.0	25.8		7.2	108	9.3	9.1
		08/21/91	1507	1.0	24.0		7.2	107	9.7	
		08/21/91	1507	2.0	23.6		7.1	109	7.5	
		08/21/91	1507	3.0	23.1		6.9	118	5.8	
		08/21/91	1507	4.0	22.1		6.7	132	2.8	
		08/21/91	1507	5.0	20.8		6.4	170	0.6	
		08/21/91	1507	5.8	20.2		6.3	223	0.1	
		08/23/91	1005	0.0						7.5
		08/23/91	1005	0.0	22.6		7.0	114	7.6	7.5
		08/23/91	1005	1.0	22.7		6.9	115	7.5	
		08/23/91	1005	2.0	22.7		6.9	116	7.5	
		08/23/91	1005	3.0	22.7		6.9	118	7.2	
		08/23/91	1005	4.0	21.9		6.7	146	1.8	
		08/23/91	1005	5.0	20.3		6.3	185	0.1	
		08/23/91	1005	5.8	19.8		6.1	339	0.0	
		08/27/91	1708	0.0	20.3		6.5	122	6.6	
		08/27/91	1708	1.0	20.4		6.5	122	6.6	
		08/27/91	1708	2.0	20.4		6.5	123	6.6	
		08/27/91	1708	3.0	20.4		6.5	122	6.6	
		08/27/91	1708	4.0	20.4		6.5	123	6.6	
		08/27/91	1708	5.0	20.4		6.5	122	6.6	
		08/27/91	1708	6.0	18.4		6.1	146	0.3	
		08/27/91	1708	7.0	16.1		6.0	177	0.2	
		08/28/91	1620	0.0	19.2		6.5	134	6.4	
		08/28/91	1620	2.0	19.2		6.5	134	6.3	
		08/28/91	1620	4.0	19.3		6.5	133	6.4	
		08/28/91	1620	6.0	19.2		6.5	133	6.4	
		09/24/91	1400	0.0	18.5		6.8	127	7.0	
		09/24/91	1400	1.0	18.2		6.8	127	6.8	
		09/24/91	1400	2.0	17.9		6.8	127	6.5	
		09/24/91	1400	3.0	17.8		6.7	127	6.5	
		09/24/91	1400	4.0	17.8		6.7	126	6.4	
		09/24/91	1400	5.0	17.6		6.7	126	6.2	
		09/24/91	1400	6.0	17.6		6.7	126	6.2	
		10/08/91	1435	0.0	16.6		6.6	124	6.6	
		10/08/91	1435	1.0	15.4		6.5	124	6.7	
		10/08/91	1435	2.0	15.2		6.5	125	6.4	
		10/08/91	1435	3.0	15.0		6.5	125	6.2	
		10/08/91	1435	4.0	15.0		6.5	124	6.1	
		10/08/91	1435	5.0	15.0		6.4	124	6.0	
		10/08/91	1435	6.0	15.0		6.4	124	6.0	
68.2	CR blw Midway Meats	08/02/91	1500	0.0	23.8		6.8	99	9.5	
		08/02/91	1500	1.0	23.0		6.7	101	8.9	
		08/02/91	1500	2.0	22.3		6.6	101	7.5	
		08/20/91	1550	0.0						9.4
		08/20/91	1550	0.0	25.8		6.8	108	9.6	9.5
		08/20/91	1550	1.0	23.6		6.7	109	9.1	
		08/20/91	1550	2.0	23.2		6.5	112	7.0	
		08/20/91	1550	3.0	23.1		6.5	123	5.3	
		08/21/91	955	0.0						8.0
		08/21/91	955	0.0						8.0
		08/21/91	1015	0.0	23.3		6.7	109	8.2	
		08/21/91	1015	1.0	23.1		6.7	110	7.9	
		08/21/91	1015	2.0	23.0		6.8	113	7.3	
		08/21/91	1015	3.0	22.7		6.7	120	5.9	
		08/21/91	1015	4.0	22.1		6.6	132	3.4	
		08/23/91	1020	0.0						7.6
		08/23/91	1020	0.0	22.6		6.7	114	7.7	7.6
		08/23/91	1020	1.0	22.7		6.7	115	7.7	
		08/23/91	1020	2.0	22.7		6.6	115	7.6	
		08/23/91	1020	3.0	22.7		6.6	117	7.2	

RM Code	Site Description	Date	Time	Depth (m)	TEMP meter (˚C)	TEMP Hg (˚C)	pH (s.u.)	COND (µho/cm)	DO meter (mg/L)	DO Winkler (mg/L)
68.2	CR blw Midway Meats	10/08/91	1450	0.0	16.6		6.5	123	6.5	
		10/08/91	1450	1.0	15.5		6.5	123	6.5	
		10/08/91	1450	2.0	15.3		6.5	123	6.2	
		10/08/91	1450	3.0	15.3		6.5	123	6.1	
		10/08/91	1450	4.0	15.2		6.4	124	6.0	
		10/08/91	1450	5.0	15.3		6.4	124	5.9	
		10/10/91	906	0.0	14.5		6.5	125	4.7	
68.0	CR blw Midway Meats	09/24/91	1415	0.0	18.7		6.8	126	7.4	
		09/24/91	1415	1.0	18.3		6.8	125	7.3	
		09/24/91	1415	2.0	18.0		6.8	126	6.9	
		09/24/91	1415	3.0	17.9		6.8	126	6.6	
		09/24/91	1415	4.0	17.8		6.7	127	6.5	
		09/24/91	1415	5.0	17.8		6.7	128	6.4	
67.6	CR abv Mellen St Br	10/10/91	1425	0.0	16.7		6.5	126	6.1	6.1
		10/14/91	1305	0.0	15.4		6.4	123	3.4	3.9
		10/14/91	1540	0.0	15.9		6.4	124	4.3	4.4
		10/14/91	1540	1.0	15.3		6.4	124	3.8	
		10/14/91	1540	2.0	14.9		6.3	124	3.8	
		10/14/91	1540	3.0	14.3		6.3	124	3.1	
67.5	CR @ Centralia (Mellen St Br)	07/22/91	1030	0.0	19.5					
		07/22/91	1500	0.0	20.3				4.3	
		08/01/91	1330	0.5	23.3		6.8	100	10.3	
		08/01/91	1330	2.0	22.1		6.5	102	7.7	
		08/01/91	1330	3.5	21.2		6.4	181	4.6	
		08/02/91	1515	0.0	24.0		6.8	100	9.6	
		08/02/91	1515	1.0	22.8		6.8	101	9.8	
		08/02/91	1515	2.0	22.2		6.6	104	7.6	
		08/02/91	1515	3.0	22.0		6.5	109	6.8	
		08/14/91	1510	0.0	23.1		6.7	107	6.8	
		08/14/91	1510	1.0	22.5		6.6	109	6.7	
		08/14/91	1510	2.0	21.4		6.5	111	5.6	
		08/14/91	1510	3.0	21.0		6.4	136	4.4	
		08/14/91	1510	4.0	20.3		6.5	229	3.8	
		08/20/91	820	0.0	22.4		7.1	115	8.1	
		08/20/91	820	1.0	22.6		6.6	115	8.1	
		08/20/91	820	2.0	22.5		6.4	117	5.7	
		08/20/91	820	2.5	22.0		6.3	130	4.4	
		08/20/91	820	3.0	20.8		6.4	221	3.0	
		08/20/91	820	3.9	20.4		6.3	278	0.2	
		08/22/91	1545	0.0	26.2		7.3	115	9.3	
		08/22/91	1545	1.0	24.0		6.8	112	8.4	
		08/22/91	1545	2.0	23.3		6.6	116	7.1	
		08/22/91	1545	3.0	22.0		6.4	226	2.4	
		08/22/91	1545	3.9	20.7		6.3	292	0.1	
		08/27/91	800	0.0	18.9	19.3	7.1			
		08/27/91	800	0.7	18.9	19.3	7.1			6.0
		08/27/91	1550	0.7	19.6	20.0	7.1			5.8
		08/27/91	1615	2.5	19.4	19.7	7.1			5.7
		08/28/91	755	0.7	18.7	19.0	7.1			5.2
		08/28/91	1420	0.7	18.7	19.0	7.1			5.5
		08/28/91	1445	2.5	18.9	19.2	6.5			5.2
		09/24/91	1425	0.0	18.8		6.8	125	7.6	
		09/24/91	1425	1.0	18.5		6.8	125	7.5	
		09/24/91	1425	2.0	17.9		6.8	126	6.7	
		09/24/91	1425	3.0	17.8		6.7	125	6.5	
		09/24/91	1425	4.0	17.8		6.7	125	6.4	
		10/08/91	1505	0.0						5.4
		10/08/91	1505	0.0	16.4		6.5	125	5.2	5.2
		10/08/91	1505	1.0	15.6		6.5	124	5.4	
		10/08/91	1505	2.0	15.4		6.4	124	4.6	
		10/08/91	1505	3.0	15.4		6.4	125	4.6	

RM Code	Site Description	Date	Time	Depth (m)	TEMP meter (°C)	TEMP Hg (°C)	pH (s.u.)	COND (µho/cm)	DO meter (mg/L)	DO Winkler (mg/L)
67.5	CR @ Centralia (Mellen St Br)	10/10/91	858	0.0	14.7		6.6	126	5.8	
		10/10/91	1445	0.0	17.7		6.5	129	6.1	6.2
		05/07/92	1350	0.0	17.5		7.3	72	8.7	
		05/07/92	1350	2.0	17.4		7.1	73	8.7	
		05/07/92	1350	4.0	17.4		7.0	73	8.7	
		05/28/92	1320	0.0	18.8		7.0	82	7.7	
		05/28/92	1320	2.0	18.7		7.0	82	7.7	
		05/28/92	1320	3.5	18.7		7.0	82	7.7	
		06/16/92	1555	0.0	17.7		7.0	99	8.5	
		06/16/92	1555	2.0	17.5		6.9	99	8.4	
		06/16/92	1555	4.0	17.5		6.9	99	8.4	
		07/07/92	1100	0.0	20.3		6.8	115	6.1	
		07/07/92	1100	2.0	20.3		6.8	115	6.1	
		07/07/92	1100	3.0	20.3		6.8	115	6.0	
		07/22/92	1710	0.0	21.8		6.8	123	6.3	
		07/22/92	1710	1.0	21.8		6.8	124	6.1	
		07/22/92	1710	2.0	21.8		6.7	127	5.8	
		07/22/92	1710	3.0	21.2		6.7	302	0.9	
		08/04/92	1000	0.0	22.2		6.9	132	7.8	
		08/04/92	1000	1.0	22.3		6.9	131	7.8	
		08/04/92	1000	2.0	22.3		6.9	136	7.7	
		08/04/92	1000	3.0	20.9		6.8	368	0.2	
		08/04/92	1620	0.0	22.6		7.0	130	8.8	
		08/04/92	1620	1.0	22.7		7.0	131	7.8	
		08/04/92	1620	2.0	22.5		7.0	132	7.0	
		08/04/92	1634	2.0						8.3
		08/20/92	1534	0.0	23.7		7.1	128	9.7	
		08/20/92	1534	1.0	23.0		7.1	129	9.2	
		08/20/92	1534	2.0	22.6		7.0	133	8.2	
		08/20/92	1534	3.0	21.7		6.9	312	2.5	
		09/09/92	1325	0.0	18.9		6.8	144	6.1	
		09/09/92	1325	1.0	18.6		6.8	144	5.8	
		09/09/92	1325	2.0	18.2		6.8	144	5.7	
		09/09/92	1325	3.0	18.1		6.8	144	5.5	
		09/09/92	1325	4.0	18.0		6.8	145	5.3	
		09/30/92	1305	0.0	17.3		6.8	92	7.3	
		09/30/92	1305	1.0	15.2		6.8	91	7.0	
		09/30/92	1305	2.0	15.1		6.8	91	7.0	
		09/30/92	1305	3.0	15.0		6.8	91	7.0	
67.0	CR abv Skookumchuck R	08/02/91	1530	0.0	22.8		6.9	100	10.4	
		08/02/91	1530	1.0	22.6		6.9	101	10.5	
		08/02/91	1530	1.5	22.5		6.9	101	10.2	
		08/14/91	1540	0.0	22.8		6.7	109	6.8	
		08/14/91	1540	1.0	22.0		6.6	111	6.3	
		08/14/91	1540	2.0	21.7		6.6	111	6.0	
		08/21/91	1400	0.0						8.7
		08/21/91	1400	0.0	24.2		6.9	110	8.5	8.4
		08/21/91	1400	1.0	23.6		7.0	113	8.4	
		08/21/91	1400	2.0	21.5		6.9	116	6.7	
		08/22/91	915	0.0						7.2
		08/23/91	1050	0.0						7.2
		08/23/91	1050	0.0	22.4		6.6	119	7.3	7.2
		08/23/91	1050	1.0	22.3		6.6	120	7.2	
		08/23/91	1050	2.0	22.2		6.6	121	6.7	
		08/23/91	1050	2.5	13.4		6.5	150	3.2	
		08/27/91	1758	0.0	20.1		6.5	134	6.3	
		08/27/91	1758	1.0	20.2		6.5	134	6.2	
		08/27/91	1758	2.0	20.2		6.5	134	6.2	
		08/28/91	1730	0.0	19.6		6.5	138	5.7	
		08/28/91	1730	2.0	19.5		6.5	139	5.5	

RM Code	Site Description	Date	Time	Depth (m)	TEMP meter (˚C)	TEMP Hg (˚C)	pH (s.u.)	COND (µho/cm)	DO meter (mg/L)	DO Winkler (mg/L)
67.0	CR abv Skookumchuck R	09/24/91	1440	0.0	18.8		6.8	133	7.5	
		09/24/91	1440	1.0	18.3		6.8	133	7.3	
		09/24/91	1440	2.0	18.0		6.8	133	7.3	
		10/08/91	1520	0.0	16.4		6.6	132	5.7	
		10/08/91	1520	1.0	15.9		6.5	132	5.2	
		10/08/91	1520	2.0	15.7		6.5	132	4.9	
		10/10/91	852	0.0	14.7		6.6	127	6.0	
		10/14/91	1255	0.0	14.8		6.3	128	2.8	3.5
		05/07/92	1400	0.0	17.4		7.2	74	8.7	
		05/07/92	1400	2.0	17.5		7.1	74	8.7	
		05/28/92	1332	0.0	18.8		7.0	84	7.8	
		05/28/92	1332	2.0	18.8		7.0	84	7.7	
		06/16/92	1608	0.0	17.7		6.9	105	8.5	
		06/16/92	1608	2.0	17.7		6.9	107	8.5	
		07/07/92	1045	0.0	20.2		6.9	117	6.3	
		07/07/92	1045	2.0	20.2		6.8	117	6.3	
		07/22/92	1742	0.0	21.6		6.8	123	6.2	
		07/22/92	1742	1.0	21.6		6.8	124	6.3	
		07/22/92	1742	2.0	19.2		6.7	127	3.8	
		07/22/92	1742	2.5	13.5		6.4	302	3.2	
		08/04/92	940	0.0	22.1		7.0	133	8.0	
		08/04/92	940	1.0	22.2		6.9	132	7.9	
		08/04/92	940	2.0	14.5		6.7	140	6.1	
		08/20/92	1547	0.0	23.9		7.1	134	9.2	
		08/20/92	1547	1.0	23.3		7.1	133	8.9	
		08/20/92	1547	2.0	17.4		6.8	135	5.7	
		08/20/92	1547	2.5	16.6		6.7	139	5.8	
		09/09/92	1310	0.0	18.4		6.9	152	5.8	
		09/09/92	1310	1.0	18.4		6.9	152	5.9	
		09/09/92	1310	2.0	18.4		6.9	151	5.9	
		09/09/92	1310	3.0	17.7		6.8	147	5.2	
		09/30/92	1345	0.0	16.3		6.9	101	7.1	
		09/30/92	1345	1.0	15.7		6.8	100	7.0	
		09/30/92	1345	2.0	15.5		6.8	99	7.0	
66.3	CR blw Centralia BL	08/02/91	1610	0.0	22.7		6.9	90	10.2	10.5
		08/02/91	1610	1.0	22.2		6.9	92	10.1	
		08/02/91	1610	1.5	22.2		6.9	92	10.1	
		08/14/91	1550	0.0	22.2		6.7	96	7.9	8.1
		08/14/91	1550	1.0	21.4		6.7	97	8.0	
		08/14/91	1550	2.0	21.3		6.7	98	7.9	
		09/24/91	1450	0.0	17.8		6.9	96	9.1	9.2
		09/24/91	1450	1.0	17.2		6.9	97	9.1	
		09/24/91	1450	2.0	17.1		6.9	98	9.1	
		10/08/91	1530	0.0	15.0		6.7	95	8.1	8.1
		10/08/91	1530	1.0	14.4		6.6	95	8.1	
		10/08/91	1530	2.0	14.3		6.6	96	8.1	
		10/10/91	842	0.0	13.2		6.7	96	8.3	
		10/14/91	1245	0.0	14.2		6.5	95	7.1	7.3
		05/07/92	1415	0.0						9.4
		05/07/92	1415	0.0	17.7		7.3	76	9.3	9.4
		05/07/92	1415	2.0	17.6		7.1	76	9.3	
		05/08/92	1042	0.0						8.7
		05/28/92	911	0.0						8.3
		05/28/92	1350	0.0	18.0		7.2	79	9.1	8.9
		05/28/92	1350	1.3	18.0		7.1	79	9.1	
		05/29/92	932							8.5
		06/16/92	1620	0.0	17.2		7.1	98	9.5	
		06/16/92	1620	2.0	17.2		7.0	98	9.5	
		07/07/92	1030	0.0	19.2		6.9	105	7.0	
		07/07/92	1030	0.0	19.2		6.9	106	6.9	6.8

RM Code	Site Description	Date	Time	Depth (m)	TEMP meter (˚C)	TEMP Hg (˚C)	pH (s.u.)	COND (µho/cm)	DO meter (mg/L)	DO Winkler (mg/L)
66.3	CR blw Centralia BL	07/22/92	1834	0.0	20.1		6.9	113	7.3	
		07/22/92	1834	1.0	20.2		6.9	113	7.3	
		07/22/92	1834	2.0	20.2		6.9	113	7.4	
		07/22/92	1838	0.0						7.3
		08/04/92	851	0.0	20.7		7.0	114	7.9	7.8
		08/04/92	851	1.0	20.7		7.0	114	7.9	
		08/04/92	851	2.0	20.7		7.0	114	7.9	
		08/20/92	1600	0.0	22.5		7.1	110	9.3	
		08/20/92	1600	1.0	21.7		7.1	111	9.2	
		08/20/92	1600	1.5	21.6		7.1	111	9.1	
		09/09/92	1253	0.0	17.1		7.0	112	7.8	
		09/09/92	1253	1.0	16.7		7.0	112	7.7	
		09/09/92	1253	1.7	16.7		7.0	112	7.6	
		09/30/92	1400	0.0	15.2		7.0	87	8.3	8.5
		09/30/92	1400	1.0	14.9		6.9	87	8.3	
		09/30/92	1400	2.0	14.9		6.9	87	8.3	
66.0	CR @ Riffle blw Centralia BL	08/27/91	1951	0.0	18.3		6.7	102	8.0	
		08/28/91	1817	0.0						7.9
		08/28/91	1817	0.0	18.1		6.6	112	7.3	6.8
64.2	CR @ Galvin (Galvin Rd Br)	08/01/91	1425	0.5	21.7		6.8	91	9.2	
		08/01/91	1425	2.0	21.1		6.8	92	8.7	
		08/27/91	900	0.5	17.6	17.9	7.1			7.2
		08/27/91	1730	0.2	18.1	18.4	7.2			7.8
		08/28/91	835	0.2	17.1	17.4	7.1			6.6
		08/28/91	1545	0.2	17.5	17.8	7.1			8.0
		07/21/92	1255	0.0		22.2	7.3			7.3
		08/05/92	1110	0.0	20.4	19.0	6.9			7.6
		08/25/92	1820	1.0						9.3
		08/26/92	820	1.0						7.5
60.3	CR @ Riffle abv Prather Rd	08/12/91	1300	0.0	21.6		7.0	107	9.1	
60.0	CR @ Cable abv Prather Rd	08/12/91	1400	0.0	21.4		6.9	108	8.6	
		08/12/91	1400	1.0	21.2		6.9	108	8.6	
		08/12/91	1400	2.0	21.0		6.9	108	8.6	
59.9	CR nr Grand Mound (Prather Rd)	08/01/91	1450	0.5	22.2		7.0	92	9.9	
		08/01/91	1450	1.5	22.1		7.0	92	9.9	
		08/01/91	1450	2.5	21.9		6.9	94	9.8	
		08/21/91	815	0.0	21.1		6.9	99	6.9	
		08/21/91	815	1.0	21.0		6.9	100	6.9	
		08/21/91	815	2.0	21.0		6.8	102	6.8	
		08/21/91	815	2.5	20.9		6.8	104	6.3	
		08/22/91	1620	0.0	23.2		7.0	97	9.8	
		08/22/91	1620	1.0	23.2		7.0	97	9.7	
		08/22/91	1620	2.0	22.4		6.9	100	10.0	
		08/22/91	1620	2.7	21.9		6.7	104	9.4	
		08/27/91	929	0.5						7.4
		08/27/91	929	0.5	17.4	17.8	7.1			7.5
		08/27/91	1820	0.2	18.0	18.3	7.4			9.3
		08/28/91	905	0.2						7.1
		08/28/91	905	0.2	17.2	17.5	7.3			7.0
		08/28/91	1630	0.2	17.3	17.6	7.3			8.6
		09/10/91	710	0.0	15.9		7.0			8.5
		09/10/91	1230	0.0	18.2		7.2			9.2
		09/11/91	740	0.0	16.6		7.0			7.8
		09/11/91	1305	0.0	18.1		7.1			9.2
		09/12/91	740	0.0	16.6		7.0			7.9
		09/12/91	1130	0.0	17.0		7.1			8.2
		06/17/92	1255	0.0	17.2		7.1	98	9.5	
		06/17/92	1255	2.0	17.1		7.1	98	9.4	
		07/21/92	816	0.0		19.9	7.2			7.1
		07/21/92	1615	0.0		20.8	7.3			8.3

RM Code	Site Description	Date	Time	Depth (m)	TEMP meter (°C)	TEMP Hg (°C)	pH (s.u.)	COND (µho/cm)	DO meter (mg/L)	DO Winkler (mg/L)
59.9	CR nr Grand Mound (Prather Rd)	08/05/92	740	0.0	18.3	17.0	6.8			7.7
		08/05/92	1504	0.0	22.9	21.0	7.5			9.2
		08/05/92	1518	0.0	22.9	21.0	7.2			9.2
		08/25/92	1837	1.0						10.4
		08/26/92	835	1.0						7.9
		09/30/92	1450	0.0	16.4		7.0	87	9.1	
		09/30/92	1450	1.0	16.0		7.0	88	9.1	
		09/30/92	1450	2.0	15.7		7.0	87	8.8	
58.2	CR nr Blanksma Dairy Pump	08/12/91	1600	0.0	21.5		7.0	106	10.1	
		09/10/91	1135	0.0						9.7
		09/10/91	1135	0.0	17.7		7.5			9.7
		09/11/91	1220	0.0						9.3
		09/11/91	1220	0.0	17.3		7.1			9.2
		09/12/91	1045	0.0						8.5
		09/12/91	1045	0.0	16.9		7.1			8.5
54.2	CR @ Independence Br	08/01/91	1545	0.5	21.3		7.0	98	9.6	
		08/01/91	1545	2.5	21.3		7.0	100	9.6	
		09/10/91	745	0.0	15.8		7.1			9.1
		09/10/91	1305	0.0	18.3		7.3			10.2
		09/11/91	810	0.0	16.3		7.0			8.5
		09/11/91	1355	0.0	17.9		7.1			9.4
		09/12/91	805	0.0	16.3		7.0			8.3
		09/12/91	1150	0.0	16.8		7.2			8.8
		07/21/92	1505	0.0		19.9	7.2			8.6
		08/05/92	1340	0.0	20.8	20.0	7.3			9.2
		08/24/92	1820	0.5						12.0
		08/25/92	710	0.5						8.5
52.9	CR nr Independence	09/12/91	1505	0.0						10.6
49.2	CR abv Black River	07/21/92	1140	0.0		19.0	7.0			8.3
		08/05/92	1205	0.0		19.3	7.6	111		10.3
44.0	CR @ Sickman Ford Br	08/01/91	1810	0.5	21.9		7.6	99	10.5	
		08/01/91	1810	3.5	21.9		7.6	102	10.4	
		08/01/91	1810	5.0	21.9		7.6	102	10.5	
		08/21/91	650	0.0	21.1		7.1	104	8.6	
		08/21/91	650	1.0	21.1		7.1	105	8.6	
		08/21/91	650	2.0	21.1		7.1	106	8.6	
		08/21/91	650	3.0	21.1		7.0	107	8.6	
		08/21/91	650	4.0	21.1		7.1	108	8.5	
		08/21/91	650	5.0	21.1		7.1	109	8.5	
		08/22/91	1655	0.0	22.5		7.8	102	11.5	
		08/22/91	1655	1.0	22.4		7.8	103	11.4	
		08/22/91	1655	2.0	22.4		7.8	104	11.4	
		08/22/91	1655	3.0	22.2		7.7	105	10.9	
		08/22/91	1655	4.0	21.9		7.5	107	10.3	
		08/22/91	1655	4.8	21.4		7.2	109	8.8	
		09/10/91	750	0.0	15.7	15.9	7.3	99		8.7
		09/10/91	1645	0.0	19.3	19.5	8.0	117		11.5
		09/11/91	735	0.0	16.6	16.8	6.8	104		8.6
		09/11/91	1450	0.0	18.8	18.8	7.5	91		10.2
		09/12/91	810	0.0	16.4	16.6	6.7	88		8.6
		09/12/91	1350	0.0	18.1	18.1	6.7	110		9.9
		07/21/92	1100	0.0		19.4	7.0			8.1
		08/05/92	1120	0.0		19.5	7.3	102		8.8
42.2	CR nr Oakville BL	08/12/91	1800	0.0	21.1		7.8	105	10.7	
		09/10/91	1255	0.0	18.6	18.8	7.7	110		10.6
		09/11/91	1235	0.0	17.5	17.7	7.5	110		9.7
		09/12/91	1235	0.0	17.9	17.8	7.2	103		10.0
42.1	CR blw Oakville BL	08/25/92	800	0.0						9.4
		08/25/92	800	0.0						9.5
33.8	CR @ Porter (Porter Rd Br)	09/10/91	840	0.0	16.3	16.4	7.3	108		9.1
		09/10/91	1815	0.0						11.2
		09/10/91	1815	0.0	19.5	19.8	8.0	110		11.2

RM Code	Site Description	Date	Time	Depth (m)	TEMP meter (˚C)	TEMP Hg (˚C)	pH (s.u.)	COND (µho/cm)	DO meter (mg/L)	DO Winkler (mg/L)
33.8	CR @ Porter (Porter Rd Br)	09/11/91	825	0.0	17.1	17.4	6.9	109		9.1
		09/11/91	1225	0.0						9.6
		09/11/91	1550	0.0						10.5
		09/11/91	1550	0.0	19.3	19.4	7.2	111		10.6
		09/12/91	855	0.0	17.3	17.3	6.7	106		9.0
		09/12/91	1405	1.5						10.0
		09/12/91	1455	0.0						10.6
		09/12/91	1455	0.0	18.8	18.7	7.2	99		10.6
		07/21/92	930	0.0		19.8	7.1			7.9
		07/21/92	1535	0.0		20.0	7.4			9.7
		08/05/92	900	0.0		19.7	7.1	100		8.8
		08/05/92	1750	0.0		21.2	8.3	100		10.9
		08/24/92	1940	1.0						11.3
		08/25/92	818	1.0						9.1

Appendix D

Table D.2 Mainstem Laboratory Results: Conventional Parameters and Metals

RM Code	Site Description	Lab #	Date	Time	Depth	COND (µmho/cm)	ALK (mg/L)	TURB (NTU)	TSS (mg/L)	TDS (mg/L)	FE (µg/L)	SI (µg/L)
108.2	CR @ Pe Ell Water Intake	308562	07/22/92	1305	0.0	81		0.7	1			
		328547	08/04/92	1240	0.0	82		0.7	3 B			
106.3	CR @ SR 6 Br nr Pe Ell	358340	08/27/91	809	0.0	77		0.5				
		358345	08/27/91	1333	0.0	77		0.6	1	78		
		358346	08/27/91	1333	0.0	77		1.0	2	68		
		358440	08/28/91	755	0.0	77		0.6				
		358445	08/28/91	1210	0.0	76		0.4	1	42		
		358446	08/28/91	1210	0.0	76		0.4	1	34		
		308561	07/22/92	1340	0.0	82	33.1	0.8	2	89		
		328546	08/04/92	1135	0.0	82	33.0	0.5	2 B	84		
100.5	CR @ Elk Ck Rd nr Doty	358341	08/27/91	830	0.0	82	32.5	0.6	2	123		
		358347	08/27/91	1423	0.0	81		0.6	2	77		
		358441	08/28/91	820	0.0	82	32.7	0.6	1	39		
		358447	08/28/91	1255	0.0	83		0.9	2	86		
		308557	07/22/92	1045	0.0							
		328542	08/04/92	940	0.0							
90.1	CR abv Ceres Rd Br	308555	07/22/92	910	0.0	87	33.4	1.4	3	62		
		308564	07/22/92	1450	0.0	86	32.8	1.2	2	64		
		328540	08/04/92	820	0.0	88	33.5	1.1	1 B	249		
		328549	08/04/92	1340	0.0	88	33.7	1.0	3 B	94		
90.0	CR @ Ceres Rd Br	358320	08/27/91	740	0.0	82		1.5				
		358328	08/27/91	1415	0.0	81		2.3	5	67		
		358420	08/28/91	730	0.0	81		2.4				
		358428	08/28/91	1400	0.0	81		2.1	1	31		
81.0	CR @ Adna (SR 6 Br)	358321	08/27/91	810	0.0	96		1.5				
		358329	08/27/91	1500	0.0	96		1.3	4	65		
		358421	08/28/91	800	0.0	95		1.5				
		358429	08/28/91	1430	0.0	93		1.3	2	46		
77.6	CR @ SR 603 Br nr Claquato	418030	10/10/91	1755	0.0	104		1.9	4			
		308590	07/22/92	1255	0.5							
		328574	08/04/92	1115	0.0							
74.6	CR @ SR 6 Br nr Chehalis	358322	08/27/91	830	0.0	101		2.0				
		358330	08/27/91	1600	0.0	101		2.2	2	72		
		358331	08/27/91	1600	0.0	101		2.2	3	70		
		358422	08/28/91	820	0.0	102		2.5				
		358430	08/28/91	1310	0.0	101		2.2	3	53		
		358431	08/28/91	1310	0.0	101		2.1	4	41		
		418020	10/10/91	1040	0.0	108		2.1	4			
		418028	10/10/91	1741	0.0							
		258111	06/16/92	1325	0.0	91		1.1				6830

Table D.2, page 2

RM Code	Site Description	Lab #	Date	Time	Depth	COND (µmho/cm)	ALK (mg/L)	TURB (NTU)	TSS (mg/L)	TDS (mg/L)	FE (µg/L)	SI (µg/L)
74.6	CR @ SR 6 Br nr Chehalis	308586	07/22/92	905	0.5	107	40.0	1.6	3	99		
		308592	07/22/92	1424	0.5							
		308592	07/22/92	1424	0.5	106	39.3	1.0	1 U	71		7730
		308593	07/22/92	1445	0.5	107	39.5	1.3	1	90		
		328571	08/04/92	837	0.5	112	40.7	1.4	2 B	90		
		328576	08/04/92	1350	0.5							
		328576	08/04/92	1350	0.5	111	40.6	1.1	2 B	93		
		328577	08/04/92	1350	0.5	111	40.7	1.6	2 B	87		
		408080	09/30/92	845	1.0			4.2				7110
73.6	CR @ junk cars bend	358301	08/27/91	1220	1.1	125	42.7	2.6				
		358302	08/27/91	1220	1.1	125	42.4	2.5				
		358303	08/27/91	1220	4.2	128		2.5				
		358401	08/28/91	1255	1.0	118	41.7	2.2				
		358402	08/28/91	1255	1.0	118	41.3	2.3				
		358403	08/28/91	1255	4.1	118		2.2				
		418023	10/10/91	1214	0.0	131		2.4	3			
		308521	07/22/92	1304	3.1					82		
		328501	08/04/92	1451	3.1							
72.5	CR abv Golf Course intake	358304	08/27/91	1320	1.1	123		2.3	5	100		
		358305	08/27/91	1320	4.2							
		358404	08/28/91	1325	1.3	128		2.3	5	70		
		358405	08/28/91	1325	5.3	127		2.8				
72.3	CR blw Golf Course intake	258112	06/16/92	1420	0.0	100		1.4			362	
		308522	07/22/92	1334	0.9	135	46.0	1.5	6	133		
		308523	07/22/92	1343	3.8	135	46.1	2.6	11			
		328502	08/04/92	1410	0.9	133	46.0	1.2	2 B	118		
		328503	08/04/92	1417	3.7	133	45.8	1.5	1 B	139		
		408081	09/30/92	1100	2.7	109		5.9			460	
70.7	CR north of Airport	358308	08/27/91	1448	1.6	121	42.1	1.9	6	102		
		358309	08/27/91	1448	6.6	211	81.9	13.0	17	145		
		358408	08/28/91	1433	1.3	122	42.2	1.8	2	48		
		358409	08/28/91	1433	6.0	162	62.9	10.0	6	79		
		418024	10/10/91	1252	0.0	132		2.1	3			
		308524	07/22/92	1425	1.7							
		308525	07/22/92	1429	6.6							
		328504	08/04/92	1311	1.7							
		328505	08/04/92	1319	6.8							
69.6	CR blw Overhanging Tree	358310	08/27/91	1553	1.7	132		1.9				
		358311	08/27/91	1553	6.9	134		1.8				
		358410	08/28/91	1527	1.8	127		1.8				
		358411	08/28/91	1527	7.0	127		2.1				
		418025	10/10/91	1318	0.0	133		1.6	2			
		418026	10/10/91	1318	0.0	133		1.6	3			
		258113	06/16/92	1500	0.0	101		1.2			384	

RM Code	Site Description	Lab #	Date	Time	Depth	COND (µmho/cm)	ALK (mg/L)	TURB (NTU)	TSS (mg/L)	TDS (mg/L)	FE (µg/L)	SI (µg/L)
69.6	CR blw Overhanging Tree	308526	07/22/92	1510	1.6	129	44.8	1.3	4	84	340	
		308527	07/22/92	1510	1.6	129	44.8	1.2	4	105		
		308528	07/22/92	1535	6.2	137	49.8	1.6	5	85	498	
		308529	07/22/92	1535	6.2							
		328506	08/04/92	1210	1.4	128	44.2	1.0	2 B	139		
		328507	08/04/92	1210	1.4	126	44.4	1.3	3 B	112		
		328508	08/04/92	1225	5.5	136	50.2	1.3	2 B	131		
		328509	08/04/92	1225	5.5							
		408082	09/30/92	1200	4.4	102		3.3			478	
69.1	CR blw Salzer Ck	358312	08/27/91	1630	1.5	130		1.6				
		358313	08/27/91	1630	6.2	225		4.8				
		358412	08/28/91	1550	1.8	133		1.6				
		358413	08/28/91	1550	7.4	290		11.0				
		308530	07/22/92	1608	1.9	126	43.5	1.4			337	
		308531	07/22/92	1613	7.7	287	143.0	8.5			3720	
		328510	08/04/92	1124	1.7	128	44.4	1.3				
		328511	08/04/92	1131	6.7	224	97.6	3.2				
68.6	CR abv Midway Meats	418027	10/10/91	1355	0.0	136		3.8	4			
		308532	07/22/92	1644	0.8	132	44.2	1.2				
		308533	07/22/92	1646	3.1	131	43.8	1.5				
		328512	08/04/92	1052	0.7	129	44.3	1.8				
		328513	08/04/92	1054	2.8	134	44.4	1.8				
68.5	CR nr Midway Meats	358314	08/27/91	1708	1.4	133		2.0	4	109		
		358315	08/27/91	1708	5.7	133		1.9				
		358414	08/28/91	1620	1.4	146		1.8	2	74		
		358415	08/28/91	1620	5.8	143		1.7				
67.5	CR @ Centralia (Mellen St Br)	358350	08/27/91	800	0.7	140		1.8				
		358358	08/27/91	1550	0.7	145		2.4	3	82		
		358358	08/27/91	1550	0.7	145		2.4	3	82		
		358359	08/27/91	1615	2.5	148		2.1	2	91		
		358450	08/28/91	755	0.7	141	48.4	2.1				
		358458	08/28/91	1420	0.7	143	48.5	2.1	5	74		
		358459	08/28/91	1445	2.5	148	49.9	2.2	3	73		
		418029	10/10/91	1445	0.0	143		3.5	4			
		258114	06/16/92	1555	0.0	106		1.2			441	7020
		308541	07/22/92	1158	1.9	136	45.4	1.4	7	96		
		308553	07/22/92	1725	1.9	130	44.5	1.5	5	106		7810
		328565	08/04/92	1010	2.0	133	44.8	2.5	6 B	114		
		328556	08/04/92	1620	2.0	130	44.1	1.5	4 B	149		
		408083	09/30/92	1320	2.0			3.5				7870
		408084	09/30/92	1320	2.0			1.9				7300
67.0	CR abv Skookumchuck R	358316	08/27/91	1758	1.4	146		2.2	4	126		
		358416	08/28/91	1730	1.4	150		2.1	4	74		
		308534	07/22/92	1755	1.6							
		328514	08/04/92	947	1.3							

Table D.2, page 4

RM Code	Site Description	Lab #	Date	Time	Depth	COND (µmho/cm)	ALK (mg/L)	TURB (NTU)	TSS (mg/L)	TDS (mg/L)	FE (µg/L)	SI (µg/L)
66.3	CR blw Centralia BL	308536	07/22/92	1836	1.4			1.8				
		328516	08/04/92	905	1.3			1.6				
66.0	CR @ riffle blw Centralia BL	358318	08/27/91	1951	0.0	112	38.4	2.5	4	102		
		358319	08/27/91	1951	0.0							
		358319	08/27/91	1951	0.0	112	38.2	2.5	6	123		
		358418	08/28/91	1817	0.0	121	40.9	2.6	3	67		
		358419	08/28/91	1817	0.0							
		358419	08/28/91	1817	0.0	121	40.9	2.5	3	61		
64.2	CR @ Galvin (Galvin Rd Br)	358351	08/27/91	900	0.5	112		2.7				
		358360	08/27/91	1730	0.2	110		2.6	2	65		
		358451	08/28/91	835	0.0	116	39.7	3.0				
		358460	08/28/91	1545	0.0	117	39.9	2.5	2	58		
		308552	07/21/92	1255	0.0							
		328567	08/05/92	1110	0.0							
59.9	CR nr Grand Mound (Prather Rd)	358352	08/27/91	929	0.5	112		1.5				
		358353	08/27/91	929	0.5	112		1.5				
		358361	08/27/91	1820	0.2	112		1.5	1	69		
		358452	08/28/91	905	0.0	112	38.5	1.8				
		358453	08/28/91	905	0.0	113	38.3	1.9				
		358461	08/28/91	1630	0.0	112	38.0	2.1	1	63		
		378340	09/10/91	710	0.0	98		2.0				
		378348	09/10/91	1230	0.0	96		2.0	3	62		
		378440	09/11/91	740	0.0	97		1.9				
		378448	09/11/91	1305	0.0	98		1.7	3	99		
		378540	09/12/91	740	0.0	99		2.0				
		378548	09/12/91	1130	0.0	99		1.9				
		258115	06/17/92	1255	0.0	107		1.2				6260
		308540	07/21/92	816	0.0	112	37.8	1.0	3	80		
		308551	07/21/92	1615	0.0	111	37.3	1.1	1	73		7110
		328555	08/05/92	740	0.0	111	38.4	1.0	1	82		
		328564	08/05/92	1530	0.0	113	38.5	1.0	1 U	85		
		328566	08/05/92	1530	0.0							
		408085	09/30/92	1500	1.7			1.4				7090
58.2	CR nr Blanksma Dairy Pump	378342	09/10/91	1135	0.0	99		1.8	2	62		
		378343	09/10/91	1140	0.0							
		378343	09/10/91	1140	0.0	99		1.8	1	69		
		378442	09/11/91	1220	0.0	98		1.6	2	108		
		378443	09/11/91	1220	0.0							
		378443	09/11/91	1220	0.0	98		1.5	2	106		
		378542	09/12/91	1045	0.0	101		1.8				
		378543	09/12/91	1045	0.0	101		1.6				
54.2	CR @ Independence Bridge	378341	09/10/91	745	0.0	103		1.9				
		378349	09/10/91	1305	0.0	103		1.8	3	66		
		378441	09/11/91	810	0.0	101		1.5				
		378449	09/11/91	1335	0.0	101		1.3	3	118		

Table D.2, page 5

RM Code	Site Description	Lab #	Date	Time	Depth	COND (µmho/cm)	ALK (mg/L)	TURB (NTU)	TSS (mg/L)	TDS (mg/L)	FE (µg/L)	SI (µg/L)
54.2	CR @ Independence Bridge	378541	09/12/91	805	0.0	103		2.0				
		378549	09/12/91	1150	0.0	103		1.6				
		308550	07/21/92	1505	0.0							
		328563	08/05/92	1340	0.0							
52.9	CR nr Independence	328568	08/05/92	1200	0.0							
49.2	CR abv Black River	308575	07/21/92	1140	0.0	115	39.1	1.1	2	57		
		328590	08/05/92	1205	0.0	113	39.4	1.5	1 U	87		
44.0	CR @ Sickman Ford Br	378355	09/10/91	750	0.0	105	36.5	1.0				
		378362	09/10/91	1645	0.0	104	36.5	1.1	2	68		
		378455	09/11/91	735	0.0	105	36.3	1.2				
		378462	09/11/91	1450	0.0	105	36.5	1.2		83		
		378555	09/12/91	810	0.0	104	36.8	1.5				
		378562	09/12/91	1350	0.0	104	36.5	1.3				
		308574	07/21/92	1100	0.5	115	40.8	1.5	2	80		
		328589	08/05/92	1120	0.5	115	41.1	1.5	2	93		
42.2	CR nr Oakville BL	378359	09/10/91	1255	0.0	104	36.0	1.2	1	63		
		378459	09/11/91	1235	0.0	105	36.6	1.3		104		
		378559	09/12/91	1235	0.0	104	36.9	1.0				
33.8	CR nr Porter (Porter Rd Br)	378356	09/10/91	840	0.0	103	37.2	1.6				
		378363	09/10/91	1815	0.0	103	37.0	1.0	2	77		
		378364	09/10/91	1815	0.0	104	37.9	1.2	1	55		
		378456	09/11/91	825	0.0	103	36.8	1.5				
		378463	09/11/91	1550	0.0	106	36.9	1.3		101		
		378464	09/11/91	1550	0.0	106	36.9	1.4		100		
		378556	09/12/91	855	0.0	104	37.0	1.4				
		378563	09/12/91	1455	0.0							
		378563	09/12/91	1455	0.0	104	36.8	1.2				
		378564	09/12/91	1455	0.0	104	36.5	1.3				
		308571	07/21/92	930	0.5	111	40.2	2.2	4	70		
		308582	07/21/92	1535	0.5	111	40.2	1.3	1 U	71		8070
		328586	08/05/92	900	0.5	111	41.3	2.1	3	86		
		328597	08/05/92	1750	0.5	111		1.3	5	81		

Appendix D

Table D.3 Mainstem Laboratory Results: Biological Parameters

RM Code	Site Description	Lab #	Date	Time	Depth (m)	BOD5 (mg/L)	BOD5 (mg/L)	TOC (mg/L)	CHLA (µg/L)	FC (#/100mL)	KES (%)	FS (#/100mL)
108.2	CR @ City Water Intake	308562	07/22/92	1305	0.0	2.0 U	2.0 U	1.1		35		
108.2	CR @ City Water Intake	328547	08/04/92	1240	0.0	2.0 U	2.0 U	1.2		8		
106.3	CR @ Pe Ell Bridge	358340	08/27/91	809	0.0							
106.3	CR @ Pe Ell Bridge	358345	08/27/91	1333	0.0			9.2	1.5	690 B		
106.3	CR @ Pe Ell Bridge	358346	08/27/91	1333	0.0			8.5	1.0 U	510		
106.3	CR @ Pe Ell Bridge	358440	08/28/91	755	0.0							
106.3	CR @ Pe Ell Bridge	358445	08/28/91	1210	0.0			3.1	1.0 U	88 B		
106.3	CR @ Pe Ell Bridge	358446	08/28/91	1210	0.0			3.1	1.0 U	170 B		
106.3	CR @ Pe Ell Bridge	308561	07/22/92	1340	0.0	2.0 U	2.0 U	1.5	0.9	120		
106.3	CR @ Pe Ell Bridge	328546	08/04/92	1135	0.0			1.4	1.6	40		
100.5	CR @ Elk Ck Rd near Doty	358341	08/27/91	830	0.0				1.5	230 B		
100.5	CR @ Elk Ck Rd near Doty	358347	08/27/91	1423	0.0			5.0	1.0 U	330 B		
100.5	CR @ Elk Ck Rd near Doty	358441	08/28/91	820	0.0				1.5	270		
100.5	CR @ Elk Ck Rd near Doty	358447	08/28/91	1255	0.0			3.9	1.0 U	210 B		
100.5	CR @ Elk Ck Rd near Doty	308557	07/22/92	1045	0.0							
100.5	CR @ Elk Ck Rd near Doty	328542	08/04/92	940	0.0							
90.1	CR @ Ceres Rd Bridge	308555	07/22/92	910	0.0	2.0 U	2.0 U	3.0	0.0			
90.1	CR @ Ceres Rd Bridge	308564	07/22/92	1450	0.0			2.9	0.0	45		
90.1	CR @ Ceres Rd Bridge	328540	08/04/92	820	0.0	2.0 U	2.0 U	2.8	0.0			
90.1	CR @ Ceres Rd Bridge	328549	08/04/92	1340	0.0			2.8	0.0	44		
90.0	CR @ Ceres Rd Bridge	358320	08/27/91	740	0.0							
90.0	CR @ Ceres Rd Bridge	358328	08/27/91	1415	0.0			4.9	1.0 U	61		
90.0	CR @ Ceres Rd Bridge	358420	08/28/91	730	0.0							
90.0	CR @ Ceres Rd Bridge	358428	08/28/91	1400	0.0			4.8	1.5	200		
81.0	CR @ SR 6 Bridge near Adna	358321	08/27/91	810	0.0							
81.0	CR @ SR 6 Bridge near Adna	358329	08/27/91	1500	0.0			3.2	1.6	44		
81.0	CR @ SR 6 Bridge near Adna	358421	08/28/91	800	0.0							
81.0	CR @ SR 6 Bridge near Adna	358429	08/28/91	1430	0.0			3.7	1.0 U	57		
77.6	CR @ SR 603 Bridge nr Claquato	418030	10/10/91	1755	0.0	12.0		7.2				
77.6	CR @ SR 603 Bridge nr Claquato	308590	07/22/92	1255	0.5			U				
77.6	CR @ SR 603 Bridge nr Claquato	328574	08/04/92	1115	0.0							
74.6	CR @ SR 6 Bridge nr Chehalis	358322	08/27/91	830	0.0							
74.6	CR @ SR 6 Bridge nr Chehalis	358330	08/27/91	1600	0.0			3.1	1.0 U	63		
74.6	CR @ SR 6 Bridge nr Chehalis	358331	08/27/91	1600	0.0			3.0	1.0 U	110		
74.6	CR @ SR 6 Bridge nr Chehalis	358422	08/28/91	820	0.0							
74.6	CR @ SR 6 Bridge nr Chehalis	358430	08/28/91	1310	0.0			3.2	1.5	65		
74.6	CR @ SR 6 Bridge nr Chehalis	358431	08/28/91	1310	0.0			3.2	1.0 U	230		
74.6	CR @ SR 6 Bridge nr Chehalis	418020	10/10/91	1040	0.0	2.0		3.4				
74.6	CR @ SR 6 Bridge nr Chehalis	418028	10/10/91	1741	0.0					3	67	5
74.6	CR @ SR 6 Bridge nr Chehalis	258111	06/16/92	1325	0.0			2.2				

RM Code	Site Description	Lab #	Date	Time	Depth (m)	BOD5 (mg/L)	BOD5 (mg/L)	TOC (mg/L)	CHLA (µg/L)	FC (#/100mL)	KES (%)	FS (#/100mL)
74.6	CR @ SR 6 Bridge nr Chehalis	308586	07/22/92	905	0.5	2.0 U	2.0 U	2.6	0.0			
74.6	CR @ SR 6 Bridge nr Chehalis	308592	07/22/92	1424	0.5				0.0			
74.6	CR @ SR 6 Bridge nr Chehalis	308592	07/22/92	1424	0.5	2.0 U	2.0 U	2.6	1.0	120		
74.6	CR @ SR 6 Bridge nr Chehalis	308593	07/22/92	1445	0.5	2.0 U	2.0 U	2.9	2.8	200		
74.6	CR @ SR 6 Bridge nr Chehalis	328571	08/04/92	837	0.5	2.0 U	2.0 U	2.6	0.0			
74.6	CR @ SR 6 Bridge nr Chehalis	328576	08/04/92	1350	0.5				1.8			
74.6	CR @ SR 6 Bridge nr Chehalis	328576	08/04/92	1350	0.5	2.0 U	2.0 U	2.6	3.6	14		
74.6	CR @ SR 6 Bridge nr Chehalis	328577	08/04/92	1350	0.5	2.0 U	2.0 U	2.6	1.7	17		
74.6	CR @ SR 6 Bridge nr Chehalis	408080	09/30/92	845	1.0	2.0 U	2.0 U	3.3	0.5			
73.6	CR at Junk Cars bend	358301	08/27/91	1220	1.1							
73.6	CR at Junk Cars bend	358302	08/27/91	1220	1.1							
73.6	CR at Junk Cars bend	358303	08/27/91	1220	4.2							
73.6	CR at Junk Cars bend	358401	08/28/91	1255	1.0							
73.6	CR at Junk Cars bend	358402	08/28/91	1255	1.0							
73.6	CR at Junk Cars bend	358403	08/28/91	1255	4.1							
73.6	CR at Junk Cars bend	418023	10/10/91	1214	0.0			3.3				
73.6	CR at Junk Cars bend	308521	07/22/92	1304	3.1							
73.6	CR at Junk Cars bend	328501	08/04/92	1451	3.1							
72.5	CR above Golf Course intake	358304	08/27/91	1320	1.1			3.2	1.6	37		
72.5	CR above Golf Course intake	358305	08/27/91	1320	4.2							
72.5	CR above Golf Course intake	358404	08/28/91	1325	1.3			3.8	1.5	140 B		
72.5	CR above Golf Course intake	358405	08/28/91	1325	5.3							
72.3	CR below Golf Course intake	258112	06/16/92	1420	0.0			2.3				
72.3	CR below Golf Course intake	308522	07/22/92	1334	0.9	2.6	2.4	3.2	0.9			
72.3	CR below Golf Course intake	308523	07/22/92	1343	3.8	3.0	3.0	3.2	0.8			
72.3	CR below Golf Course intake	328502	08/04/92	1410	0.9			2.8	0.9			
72.3	CR below Golf Course intake	328503	08/04/92	1417	3.7			2.7	3.4			
72.3	CR below Golf Course intake	408081	09/30/92	1100	2.7	2.0 U	2.0 U	4.0	0.7			
70.7	CR north of the Airport	358308	08/27/91	1448	1.6			3.3	4.8	39 B		
70.7	CR north of the Airport	358309	08/27/91	1448	6.6			3.9	4.8			
70.7	CR north of the Airport	358408	08/28/91	1433	1.3			3.4	1.0 U			
70.7	CR north of the Airport	358409	08/28/91	1433	6.0			3.6	1.0 U			
70.7	CR north of the Airport	418024	10/10/91	1252	0.0			3.1		1 U	N	8
70.7	CR north of the Airport	308524	07/22/92	1425	1.7							
70.7	CR north of the Airport	308525	07/22/92	1429	6.6							
70.7	CR north of the Airport	328504	08/04/92	1311	1.7							
70.7	CR north of the Airport	328505	08/04/92	1319	6.8							
69.6	CR below Overhanging Tree	358310	08/27/91	1553	1.7							
69.6	CR below Overhanging Tree	358311	08/27/91	1553	6.9							
69.6	CR below Overhanging Tree	358410	08/28/91	1527	1.8							
69.6	CR below Overhanging Tree	358411	08/28/91	1527	7.0							
69.6	CR below Overhanging Tree	418025	10/10/91	1318	0.0			3.0		7	43	3
69.6	CR below Overhanging Tree	418026	10/10/91	1318	0.0			3.0		5	60	5
69.6	CR below Overhanging Tree	258113	06/16/92	1500	0.0			2.2				

Table D.3, page 3

RM Code	Site Description	Lab #	Date	Time	Depth (m)	BOD5 (mg/L)	BOD5 (mg/L)	TOC (mg/L)	CHLA (µg/L)	FC (#/100mL)	KES (%)	FS (#/100mL)
69.6	CR below Overhanging Tree	308526	07/22/92	1510	1.6	3.4	2.8	3.1	2.5			
69.6	CR below Overhanging Tree	308527	07/22/92	1510	1.6			3.1	1.6			
69.6	CR below Overhanging Tree	308528	07/22/92	1535	6.2	2.0 U	2.0 U	3.1	0.0			
69.6	CR below Overhanging Tree	308529	07/22/92	1535	6.2							
69.6	CR below Overhanging Tree	328506	08/04/92	1210	1.4			2.7	5.7			
69.6	CR below Overhanging Tree	328507	08/04/92	1210	1.4			2.8	5.3			
69.6	CR below Overhanging Tree	328508	08/04/92	1225	5.5			2.6	3.4			
69.6	CR below Overhanging Tree	328509	08/04/92	1225	5.5							
69.6	CR below Overhanging Tree	408082	09/30/92	1200	4.4	2.0 U	2.0 U	4.3				
69.1	CR below Salzer Ck	358312	08/27/91	1630	1.5			3.4				
69.1	CR below Salzer Ck	358313	08/27/91	1630	6.2							
69.1	CR below Salzer Ck	358412	08/28/91	1550	1.8			3.6				
69.1	CR below Salzer Ck	358413	08/28/91	1550	7.4							
69.1	CR below Salzer Ck	308530	07/22/92	1608	1.9			3.1	0.7			
69.1	CR below Salzer Ck	308531	07/22/92	1613	7.7			5.5	0.9			
69.1	CR below Salzer Ck	328510	08/04/92	1124	1.7			2.7	4.7			
69.1	CR below Salzer Ck	328511	08/04/92	1131	6.7			4.0	4.5			
68.6	CR above Midway Meats	418027	10/10/91	1355	0.0			2.6		14	21	76
68.6	CR above Midway Meats	308532	07/22/92	1644	0.8							
68.6	CR above Midway Meats	308533	07/22/92	1646	3.1							
68.6	CR above Midway Meats	328512	08/04/92	1052	0.7							
68.6	CR above Midway Meats	328513	08/04/92	1054	2.8							
68.5	CR above Midway Meats	358314	08/27/91	1708	1.4			3.3	3.2			
68.5	CR above Midway Meats	358315	08/27/91	1708	5.7							
68.5	CR above Midway Meats	358414	08/28/91	1620	1.4			3.8	1.0 U			
68.5	CR above Midway Meats	358415	08/28/91	1620	5.8							
67.5	CR @ Mellen Street Bridge	358350	08/27/91	800	0.7							
67.5	CR @ Mellen Street Bridge	358358	08/27/91	1550	0.7					120		
67.5	CR @ Mellen Street Bridge	358358	08/27/91	1550	0.7			4.9	1.4	120		
67.5	CR @ Mellen Street Bridge	358359	08/27/91	1615	2.5			5.3	1.5	190		
67.5	CR @ Mellen Street Bridge	358450	08/28/91	755	0.7							
67.5	CR @ Mellen Street Bridge	358458	08/28/91	1420	0.7			4.9	1.5	460		
67.5	CR @ Mellen Street Bridge	358459	08/28/91	1445	2.5			3.7	1.0 U	55		
67.5	CR @ Mellen Street Bridge	418029	10/10/91	1445	0.0	3.0		2.5		3	33	43
67.5	CR @ Mellen Street Bridge	258114	06/16/92	1555	0.0			2.2				
67.5	CR @ Mellen Street Bridge	308541	07/22/92	1158	1.9	3.4	3.6	3.2	0.0			
67.5	CR @ Mellen Street Bridge	308553	07/22/92	1725	1.9			3.1	0.0	19 S		
67.5	CR @ Mellen Street Bridge	328565	08/04/92	1010	2.0			3.0	7.4	11		
67.5	CR @ Mellen Street Bridge	328556	08/04/92	1620	2.0	2.0 U	2.0 U	2.9	6.9			
67.5	CR @ Mellen Street Bridge	408083	09/30/92	1320	2.0	2.0 U	2.0 U	4.4	0.8			
67.5	CR @ Mellen Street Bridge	408084	09/30/92	1320	2.0	2.0 U	2.0 U	4.4	1.0			
67.0	CR above Skookumchuck R	358316	08/27/91	1758	1.4			3.9	3.2			
67.0	CR above Skookumchuck R	358416	08/28/91	1730	1.4			4.2	1.0 U			
67.0	CR above Skookumchuck R	308534	07/22/92	1755	1.6							
67.0	CR above Skookumchuck R	328514	08/04/92	947	1.3							

Table D.3, page 4

RM Code	Site Description	Lab #	Date	Time	Depth (m)	BOD5 (mg/L)	BOD5 (mg/L)	TOC (mg/L)	CHLA (µg/L)	FC (#/100mL)	KES (%)	FS (#/100mL)
66.3	CR blw Centralia BL	308536	07/22/92	1836	1.4							
66.3	CR blw Centralia BL	328516	08/04/92	905	1.3							
66.0	CR @ riffle blw Centralia BL	358318	08/27/91	1951	0.0			3.3	6.5	160		
66.0	CR @ riffle blw Centralia BL	358319	08/27/91	1951	0.0				1.0 U			
66.0	CR @ riffle blw Centralia BL	358319	08/27/91	1951	0.0			3.3	1.0 U	220 B		
66.0	CR @ riffle blw Centralia BL	358418	08/28/91	1817	0.0			3.6	1.5	150		
66.0	CR @ riffle blw Centralia BL	358419	08/28/91	1817	0.0				1.5			
66.0	CR @ riffle blw Centralia BL	358419	08/28/91	1817	0.0			3.6	1.0 U	96		
64.2	CR @ Galvin Rd Bridge	358351	08/27/91	900	0.5							
64.2	CR @ Galvin Rd Bridge	358360	08/27/91	1730	0.2			4.6	1.0 U	47		
64.2	CR @ Galvin Rd Bridge	358451	08/28/91	835	0.0							
64.2	CR @ Galvin Rd Bridge	358460	08/28/91	1545	0.0			4.6	2.8	140		
64.2	CR @ Galvin Rd Bridge	308552	07/21/92	1255	0.0							
64.2	CR @ Galvin Rd Bridge	328567	08/05/92	1110	0.0							
59.9	CR @ Prather Rd Bridge	358352	08/27/91	929	0.5							
59.9	CR @ Prather Rd Bridge	358353	08/27/91	929	0.5							
59.9	CR @ Prather Rd Bridge	358361	08/27/91	1820	0.2			3.9	1.0 U	35		
59.9	CR @ Prather Rd Bridge	358452	08/28/91	905	0.0							
59.9	CR @ Prather Rd Bridge	358453	08/28/91	905	0.0							
59.9	CR @ Prather Rd Bridge	358461	08/28/91	1630	0.0			4.1	1.0 U	28		
59.9	CR @ Prather Rd Bridge	378340	09/10/91	710	0.0							
59.9	CR @ Prather Rd Bridge	378348	09/10/91	1230	0.0			2.4	0.7	5 B		
59.9	CR @ Prather Rd Bridge	378440	09/11/91	740	0.0							
59.9	CR @ Prather Rd Bridge	378448	09/11/91	1305	0.0			3.4	1.2	6		
59.9	CR @ Prather Rd Bridge	378540	09/12/91	740	0.0							
59.9	CR @ Prather Rd Bridge	378548	09/12/91	1130	0.0			3.2	1.0	4		
59.9	CR @ Prather Rd Bridge	258115	06/17/92	1255	0.0			2.3				
59.9	CR @ Prather Rd Bridge	308540	07/21/92	816	0.0	2.0 U	2.0 U	2.9	2.3			
59.9	CR @ Prather Rd Bridge	308551	07/21/92	1615	0.0			3.0	2.2	7 S		
59.9	CR @ Prather Rd Bridge	328555	08/05/92	740	0.0	2.0	2.8	2.5	1.2			
59.9	CR @ Prather Rd Bridge	328564	08/05/92	1530	0.0			2.7	0.0	11 B		
59.9	CR @ Prather Rd Bridge	328566	08/05/92	1530	0.0			2.5				
59.9	CR @ Prather Rd Bridge	408085	09/30/92	1500	1.7	2.0 U	2.0 U	3.5	0.8			
58.2	CR nr Blanksma Dairy Pump	378342	09/10/91	1135	0.0			3.6	0.5	10 B		
58.2	CR nr Blanksma Dairy Pump	378343	09/10/91	1140	0.0				1.5			
58.2	CR nr Blanksma Dairy Pump	378343	09/10/91	1140	0.0			4.1	0.7	6		
58.2	CR nr Blanksma Dairy Pump	378442	09/11/91	1220	0.0			3.2	1.7	7		
58.2	CR nr Blanksma Dairy Pump	378443	09/11/91	1220	0.0				2.2			
58.2	CR nr Blanksma Dairy Pump	378443	09/11/91	1220	0.0			3.2	2.5	9		
58.2	CR nr Blanksma Dairy Pump	378542	09/12/91	1045	0.0			3.3	1.8	18		
58.2	CR nr Blanksma Dairy Pump	378543	09/12/91	1045	0.0			3.4	1.4	11 B		
54.2	CR @ Independence Bridge	378341	09/10/91	745	0.0							
54.2	CR @ Independence Bridge	378349	09/10/91	1305	0.0			2.1	1.0	15		
54.2	CR @ Independence Bridge	378441	09/11/91	810	0.0							
54.2	CR @ Independence Bridge	378449	09/11/91	1335	0.0			3.1	1.6	9		

Table D.3, page 5

RM Code	Site Description	Lab #	Date	Time	Depth (m)	BOD5 (mg/L)	BOD5 (mg/L)	TOC (mg/L)	CHLA (µg/L)	FC (#/100mL)	KES (%)	FS (#/100mL)
54.2	CR @ Independence Bridge	378541	09/12/91	805	0.0							
54.2	CR @ Independence Bridge	378549	09/12/91	1150	0.0			3.4	1.0	12		
54.2	CR @ Independence Bridge	308550	07/21/92	1505	0.0							
54.2	CR @ Independence Bridge	328563	08/05/92	1340	0.0							
52.9	CR nr Independence	328568	08/05/92	1200	0.0							
49.2	CR abv Black River	308575	07/21/92	1140	0.0			2.3	2.6	18		
49.2	CR abv Black River	328590	08/05/92	1205	0.0	2.0 U	2.0 U	2.6	3.5	11		
44.0	CR @ Sickman Ford Br	378355	09/10/91	750	0.0							
44.0	CR @ Sickman Ford Br	378362	09/10/91	1645	0.0			2.6	0.9	5		
44.0	CR @ Sickman Ford Br	378455	09/11/91	735	0.0							
44.0	CR @ Sickman Ford Br	378462	09/11/91	1450	0.0			4.1	1.8	6		
44.0	CR @ Sickman Ford Br	378555	09/12/91	810	0.0							
44.0	CR @ Sickman Ford Br	378562	09/12/91	1350	0.0			3.5	2.3	4		
44.0	CR @ Sickman Ford Br	308574	07/21/92	1100	0.5			3.0	0.0	4		
44.0	CR @ Sickman Ford Br	328589	08/05/92	1120	0.5	2.0 U	2.0 U	2.5	0.0	10		
42.2	CR nr Oakville BL	378359	09/10/91	1255	0.0			3.6	0.6	5		
42.2	CR nr Oakville BL	378459	09/11/91	1235	0.0			3.0	0.7	6		
42.2	CR nr Oakville BL	378559	09/12/91	1235	0.0			3.1	0.4	6		
33.8	CR nr PORTER (Porter Rd Br)	378356	09/10/91	840	0.0							
33.8	CR nr PORTER (Porter Rd Br)	378363	09/10/91	1815	0.0			3.9	1.7	6		
33.8	CR nr PORTER (Porter Rd Br)	378364	09/10/91	1815	0.0			4.4	0.9	4		
33.8	CR nr PORTER (Porter Rd Br)	378456	09/11/91	825	0.0							
33.8	CR nr PORTER (Porter Rd Br)	378463	09/11/91	1550	0.0			3.7	2.7	7 B		
33.8	CR nr PORTER (Porter Rd Br)	378464	09/11/91	1550	0.0			3.5	2.7	5		
33.8	CR nr PORTER (Porter Rd Br)	378556	09/12/91	855	0.0							
33.8	CR nr PORTER (Porter Rd Br)	378563	09/12/91	1455	0.0				0.5			
33.8	CR nr PORTER (Porter Rd Br)	378563	09/12/91	1455	0.0			3.1	0.2	11		
33.8	CR nr PORTER (Porter Rd Br)	378564	09/12/91	1455	0.0			3.1	2.4	18		
33.8	CR nr PORTER (Porter Rd Br)	308571	07/21/92	930	0.5	2.0 U	2.0 U	2.5	0.0			
33.8	CR nr PORTER (Porter Rd Br)	308582	07/21/92	1535	0.5			2.4	1.4	12		
33.8	CR nr PORTER (Porter Rd Br)	328586	08/05/92	900	0.5	2.0 U	2.0 U	2.2	0.0			
33.8	CR nr PORTER (Porter Rd Br)	328597	08/05/92	1750	0.5			2.4	0.0	15		

Appendix D

Table D.4 Mainstem Laboratory Results: Nutrients and Chloride

RM Code	Site Description	Lab #	Date	Time	Depth (m)	NH3N (mg/L)	NO23N (mg/L)	TN (mg/L)	SRP (mg/L)	TP (mg/L)	CL (mg/L)
108.2	CR @ City Water Intake	308562	07/22/92	1305	0.0	0.012	0.090	0.138		0.010 U	3.3
108.2	CR @ City Water Intake	328547	08/04/92	1240	0.0	0.010	0.080	0.187		0.010 U	3.5
106.3	CR @ Pe Ell Bridge	358340	08/27/91	809	0.0	0.010 U	0.070	0.110		0.010 U	3.8
106.3	CR @ Pe Ell Bridge	358345	08/27/91	1333	0.0	0.010 U	0.064	0.134	0.003 U	0.010 U	3.9
106.3	CR @ Pe Ell Bridge	358346	08/27/91	1333	0.0	0.010 U	0.063	0.138	0.003 U	0.010 U	3.8
106.3	CR @ Pe Ell Bridge	358440	08/28/91	755	0.0	0.010 U	0.038	0.139		0.010 U	3.7
106.3	CR @ Pe Ell Bridge	358445	08/28/91	1210	0.0	0.010 U	0.036	0.133	0.003 U	0.010 U	3.8
106.3	CR @ Pe Ell Bridge	358446	08/28/91	1210	0.0	0.010 U	0.037	0.131	0.003 U	0.010 U	3.8
106.3	CR @ Pe Ell Bridge	308561	07/22/92	1340	0.0	0.013	0.090	0.151	0.010 U	0.010 U	3.6
106.3	CR @ Pe Ell Bridge	328546	08/04/92	1135	0.0	0.010	0.074	0.218	0.010 U	0.010 U	3.8
100.5	CR @ Elk Ck Rd near Doty	358341	08/27/91	830	0.0	0.010 U	0.023	0.076	0.003 U	0.010 U	4.4
100.5	CR @ Elk Ck Rd near Doty	358347	08/27/91	1423	0.0	0.010 U	0.010 U	0.148	0.003 U	0.014 L	4.7
100.5	CR @ Elk Ck Rd near Doty	358441	08/28/91	820	0.0	0.010 U	0.010 U	0.148	0.003 U	0.013 L	4.4
100.5	CR @ Elk Ck Rd near Doty	358447	08/28/91	1255	0.0	0.010 U	0.010 U	0.144	0.003 U	0.013 L	4.5
100.5	CR @ Elk Ck Rd near Doty	308557	07/22/92	1045	0.0	0.021	0.053	0.157	0.010 U	0.012	4.4
100.5	CR @ Elk Ck Rd near Doty	328542	08/04/92	940	0.0	0.017	0.035	0.184	0.010 U	0.010 U	4.6
90.1	CR @ Ceres Rd Bridge	308555	07/22/92	910	0.0	0.021	0.030	0.157	0.010 U	0.016	4.9
90.1	CR @ Ceres Rd Bridge	308564	07/22/92	1450	0.0	0.017	0.028	0.183	0.010 U	0.012	4.9
90.1	CR @ Ceres Rd Bridge	328540	08/04/92	820	0.0	0.020	0.027	0.216	0.011	0.011	5.1
90.1	CR @ Ceres Rd Bridge	328549	08/04/92	1340	0.0	0.016	0.023	0.226	0.011	0.010 U	5.2
90.0	CR @ Ceres Rd Bridge	358320	08/27/91	740	0.0	0.010 U	0.015	0.126		0.010 U	5.2
90.0	CR @ Ceres Rd Bridge	358328	08/27/91	1415	0.0	0.010 U	0.011	0.137	0.003 U	0.017 L	4.8
90.0	CR @ Ceres Rd Bridge	358420	08/28/91	730	0.0	0.010 U	0.013	0.196		0.019 L	4.8
90.0	CR @ Ceres Rd Bridge	358428	08/28/91	1400	0.0	0.010 U	0.010 U	0.197	0.003 U	0.018 L	4.9
81.0	CR @ SR 6 Bridge near Adna	358321	08/27/91	810	0.0	0.010 U	0.148	0.266		0.010 U	6.8
81.0	CR @ SR 6 Bridge near Adna	358329	08/27/91	1500	0.0	0.010 U	0.145	0.268	0.004	0.010 U	6.8
81.0	CR @ SR 6 Bridge near Adna	358421	08/28/91	800	0.0	0.010 U	0.128	0.306		0.016 L	6.1
81.0	CR @ SR 6 Bridge near Adna	358429	08/28/91	1430	0.0	0.010 U	0.139	0.296	0.003	0.012 L	6.1
77.6	CR @ SR 603 Bridge nr Claquato	418030	10/10/91	1755	0.0	0.248	0.056	0.476	0.061	0.091 L	7.2
77.6	CR @ SR 603 Bridge nr Claquato	308590	07/22/92	1255	0.5	0.033	0.178	0.349	0.015	0.024	6.6
77.6	CR @ SR 603 Bridge nr Claquato	328574	08/04/92	1115	0.0	0.032	0.179	0.474	0.018	0.021	6.4
74.6	CR @ SR 6 Bridge nr Chehalis	358322	08/27/91	830	0.0	0.010 U	0.077	0.179		0.015 L	7.3
74.6	CR @ SR 6 Bridge nr Chehalis	358330	08/27/91	1600	0.0	0.010 U	0.083	0.210	0.009	0.012 L	7.5
74.6	CR @ SR 6 Bridge nr Chehalis	358331	08/27/91	1600	0.0	0.010 U	0.081	0.196	0.009	0.012 L	7.5
74.6	CR @ SR 6 Bridge nr Chehalis	358422	08/28/91	820	0.0	0.010 U	0.090	0.254		0.023 L	7.1
74.6	CR @ SR 6 Bridge nr Chehalis	358430	08/28/91	1310	0.0	0.018	0.100	0.262	0.010	0.020 L	7.1
74.6	CR @ SR 6 Bridge nr Chehalis	358431	08/28/91	1310	0.0	0.021	0.095	0.263	0.009	0.022 L	7.0
74.6	CR @ SR 6 Bridge nr Chehalis	418020	10/10/91	1040	0.0	0.010 U	0.010	0.364	0.022	0.060 L	8.5
74.6	CR @ SR 6 Bridge nr Chehalis	418028	10/10/91	1741	0.0						
74.6	CR @ SR 6 Bridge nr Chehalis	258111	06/16/92	1325	0.0	0.020	0.083	0.222	0.010 U	0.010 U	5.9

Table D.4, page 2

RM Code	Site Description	Lab #	Date	Time	Depth (m)	NH3N (mg/L)	NO23N (mg/L)	TN (mg/L)	SRP (mg/L)	TP (mg/L)	CL (mg/L)
74.6	CR @ SR 6 Bridge nr Chehalis	308586	07/22/92	905	0.5	0.046	0.089	0.839	0.014	0.030	7.7
74.6	CR @ SR 6 Bridge nr Chehalis	308592	07/22/92	1424	0.5						
74.6	CR @ SR 6 Bridge nr Chehalis	308592	07/22/92	1424	0.5	0.032	0.085	0.237	0.013	0.021	7.7
74.6	CR @ SR 6 Bridge nr Chehalis	308593	07/22/92	1445	0.5	0.030	0.084	0.254	0.013	0.021	7.7
74.6	CR @ SR 6 Bridge nr Chehalis	328571	08/04/92	837	0.5	0.019	0.088	0.303	0.018	0.015	8.1
74.6	CR @ SR 6 Bridge nr Chehalis	328576	08/04/92	1350	0.5						
74.6	CR @ SR 6 Bridge nr Chehalis	328576	08/04/92	1350	0.5	0.016	0.083	0.292	0.015	0.014	8.1
74.6	CR @ SR 6 Bridge nr Chehalis	328577	08/04/92	1350	0.5	0.016	0.082	0.330	0.016	0.015	8.1
74.6	CR @ SR 6 Bridge nr Chehalis	408080	09/30/92	845	1.0	0.026	0.230	0.394		0.024	7.0
73.6	CR at Junk Cars bend	358301	08/27/91	1220	1.1	0.292	0.226	0.729	0.255	0.348	9.9
73.6	CR at Junk Cars bend	358302	08/27/91	1220	1.1	0.293	0.222	0.739	0.253	0.307	10.0
73.6	CR at Junk Cars bend	358303	08/27/91	1220	4.2	0.302	0.230	0.751	0.271	0.385	10.7
73.6	CR at Junk Cars bend	358401	08/28/91	1255	1.0	0.096	0.149	0.422	0.195	0.225	11.8
73.6	CR at Junk Cars bend	358402	08/28/91	1255	1.0	0.096	0.141	0.420	0.200	0.227	11.9
73.6	CR at Junk Cars bend	358403	08/28/91	1255	4.1	0.093	0.140	0.419	0.195	0.224	11.8
73.6	CR at Junk Cars bend	418023	10/10/91	1214	0.0	0.177	0.104	0.668	0.314	0.325	12.7
73.6	CR at Junk Cars bend	308521	07/22/92	1304	3.1	0.253	0.124	0.598	0.238	0.256	12.3
73.6	CR at Junk Cars bend	328501	08/04/92	1451	3.1	0.405	0.157	0.969	0.145	0.170	10.7
72.5	CR above Golf Course intake	358304	08/27/91	1320	1.1	0.142	0.242	0.565	0.247	0.248	10.0
72.5	CR above Golf Course intake	358305	08/27/91	1320	4.2	0.157	0.254	0.590		0.226	
72.5	CR above Golf Course intake	358404	08/28/91	1325	1.3	0.235	0.226	0.712	0.299	0.369	12.8
72.5	CR above Golf Course intake	358405	08/28/91	1325	5.3	0.231	0.230	0.710		0.362	13.0
72.3	CR below Golf Course intake	258112	06/16/92	1420	0.0	0.098	0.120	0.360	0.080	0.078	6.8
72.3	CR below Golf Course intake	308522	07/22/92	1334	0.9	0.234	0.145	0.568	0.205	0.218	12.0
72.3	CR below Golf Course intake	308523	07/22/92	1343	3.8	0.234	0.144	0.562	0.202	0.224	11.9
72.3	CR below Golf Course intake	328502	08/04/92	1410	0.9	0.170	0.200	0.616	0.208	0.246	11.1
72.3	CR below Golf Course intake	328503	08/04/92	1417	3.7	0.165	0.195	0.678	0.203	0.243	11.1
72.3	CR below Golf Course intake	408081	09/30/92	1100	2.7	0.185	0.305	0.728		0.127	8.7
70.7	CR north of the Airport	358308	08/27/91	1448	1.6	0.080	0.214	0.463	0.142	0.213	10.2
70.7	CR north of the Airport	358309	08/27/91	1448	6.6	0.339	0.014	0.516	0.026	0.090 L	17.4
70.7	CR north of the Airport	358408	08/28/91	1433	1.3	0.127	0.252	0.586	0.223	0.252	10.0
70.7	CR north of the Airport	358409	08/28/91	1433	6.0	0.197	0.152	0.556	0.023	0.205	12.0
70.7	CR north of the Airport	418024	10/10/91	1252	0.0	0.208	0.138	0.652	0.248	0.286	12.5
70.7	CR north of the Airport	308524	07/22/92	1425	1.7	0.183	0.173	0.549	0.268	0.278	11.3
70.7	CR north of the Airport	308525	07/22/92	1429	6.6	0.394	0.010 U	0.591	0.034	0.159	16.3
70.7	CR north of the Airport	328504	08/04/92	1311	1.7	0.147	0.222	0.662	0.198	0.264	10.8
70.7	CR north of the Airport	328505	08/04/92	1319	6.8	0.675	0.010 U	1.060	0.042	0.444	37.2
69.6	CR below Overhanging Tree	358310	08/27/91	1553	1.7	0.059	0.214	0.460		0.295	11.7
69.6	CR below Overhanging Tree	358311	08/27/91	1553	6.9	0.066	0.220	0.442		0.344	12.5
69.6	CR below Overhanging Tree	358410	08/28/91	1527	1.8	0.094	0.235	0.523		0.209	10.8
69.6	CR below Overhanging Tree	358411	08/28/91	1527	7.0	0.103	0.237	0.528		0.217	11.0
69.6	CR below Overhanging Tree	418025	10/10/91	1318	0.0	0.208	0.111	0.666	0.277	0.309	11.6
69.6	CR below Overhanging Tree	418026	10/10/91	1318	0.0	0.182	0.114	0.623	0.278	0.307	11.4
69.6	CR below Overhanging Tree	258113	06/16/92	1500	0.0	0.069	0.148	0.324	0.063	0.063	6.9

Table D.4, page 3

RM Code	Site Description	Lab #	Date	Time	Depth (m)	NH3N (mg/L)	NO23N (mg/L)	TN (mg/L)	SRP (mg/L)	TP (mg/L)	CL (mg/L)
69.6	CR below Overhanging Tree	308526	07/22/92	1510	1.6	0.169	0.188	0.511	0.230	0.243	10.4
69.6	CR below Overhanging Tree	308527	07/22/92	1510	1.6	0.168	0.188	0.508	0.227	0.244	10.5
69.6	CR below Overhanging Tree	308528	07/22/92	1535	6.2	0.217	0.169	0.516	0.080	0.112	10.1
69.6	CR below Overhanging Tree	308529	07/22/92	1535	6.2	0.213	0.174	0.507	0.079	0.106	10.1
69.6	CR below Overhanging Tree	328506	08/04/92	1210	1.4	0.083	0.206	0.564	0.146	0.192	9.7
69.6	CR below Overhanging Tree	328507	08/04/92	1210	1.4	0.085	0.207	0.563	0.149	0.187	9.7
69.6	CR below Overhanging Tree	328508	08/04/92	1225	5.5	0.224	0.182	0.602	0.089	0.127	10.6
69.6	CR below Overhanging Tree	328509	08/04/92	1225	5.5	0.212	0.189	0.601	0.088	0.118	10.7
69.6	CR below Overhanging Tree	408082	09/30/92	1200	4.4	0.107	0.348	0.647		0.095	7.6
69.1	CR below Salzer Ck	358312	08/27/91	1630	1.5	0.043	0.218	0.451		0.337	11.8
69.1	CR below Salzer Ck	358313	08/27/91	1630	6.2	0.627	0.010 U	0.990		0.279	20.1
69.1	CR below Salzer Ck	358412	08/28/91	1550	1.8	0.093	0.231	0.515		0.261	12.1
69.1	CR below Salzer Ck	358413	08/28/91	1550	7.4	1.290	0.011	1.660		1.600	9.5
69.1	CR below Salzer Ck	308530	07/22/92	1608	1.9	0.179	0.189	0.520	0.198	0.215	9.9
69.1	CR below Salzer Ck	308531	07/22/92	1613	7.7	1.070	0.010 U	1.240	0.585	1.530	7.8
69.1	CR below Salzer Ck	328510	08/04/92	1124	1.7	0.080	0.196	0.579	0.142	0.174	9.9
69.1	CR below Salzer Ck	328511	08/04/92	1131	6.7	0.482	0.010 U	0.826	0.176	0.369	13.0
68.6	CR above Midway Meats	418027	10/10/91	1355	0.0	0.185	0.170	0.670	0.278	0.310	11.6
68.6	CR above Midway Meats	308532	07/22/92	1644	0.8	0.152	0.182	0.522	0.212	0.232	10.9
68.6	CR above Midway Meats	308533	07/22/92	1646	3.1	0.163	0.183	0.509	0.205	0.220	N
68.6	CR above Midway Meats	328512	08/04/92	1052	0.7	0.061	0.179	0.499	0.139	0.175	10.3
68.6	CR above Midway Meats	328513	08/04/92	1054	2.8	0.068	0.180	0.545	0.130	0.165	11.9
68.5	CR above Midway Meats	358314	08/27/91	1708	1.4	0.055	0.208	0.443	0.171	0.308	12.5
68.5	CR above Midway Meats	358315	08/27/91	1708	5.7	0.055	0.212	0.437		0.314	11.4
68.5	CR above Midway Meats	358414	08/28/91	1620	1.4	0.082	0.199	0.514	0.204	0.342	14.0
68.5	CR above Midway Meats	358415	08/28/91	1620	5.8	0.083	0.210	0.519		0.331	14.1
67.5	CR @ Mellen Street Bridge	358350	08/27/91	800	0.7	0.343	0.285	0.906		0.336	11.6
67.5	CR @ Mellen Street Bridge	358358	08/27/91	1550	0.7						
67.5	CR @ Mellen Street Bridge	358358	08/27/91	1550	0.7	0.454	0.284	1.040	0.322	0.351	13.0
67.5	CR @ Mellen Street Bridge	358359	08/27/91	1615	2.5	0.576	0.332	1.210	0.323	0.405	6.1
67.5	CR @ Mellen Street Bridge	358450	08/28/91	755	0.7	0.308	0.251	0.856		0.368	11.8
67.5	CR @ Mellen Street Bridge	358458	08/28/91	1420	0.7	0.290	0.239	0.806	0.242	0.411	12.6
67.5	CR @ Mellen Street Bridge	358459	08/28/91	1445	2.5	0.392	0.281	0.941	0.281	0.439	12.7
67.5	CR @ Mellen Street Bridge	418029	10/10/91	1445	0.0	0.214	0.264	0.781	0.250	0.290	13.1
67.5	CR @ Mellen Street Bridge	258114	06/16/92	1555	0.0	0.085	0.159	0.384	0.069	0.073	7.7
67.5	CR @ Mellen Street Bridge	308541	07/22/92	1158	1.9	0.302	0.230	0.718	0.216	0.228	11.0
67.5	CR @ Mellen Street Bridge	308553	07/22/92	1725	1.9	0.264	0.215	0.649	0.191	0.209	10.4
67.5	CR @ Mellen Street Bridge	328565	08/04/92	1010	2.0	0.142	0.185	0.652	0.136	0.176	11.3
67.5	CR @ Mellen Street Bridge	328556	08/04/92	1620	2.0	0.087	0.175	0.546	0.131	0.165	11.0
67.5	CR @ Mellen Street Bridge	408083	09/30/92	1320	2.0	0.129	0.387	0.495		0.101	7.8
67.5	CR @ Mellen Street Bridge	408084	09/30/92	1320	2.0	0.124	0.382	0.687		0.092	7.8
67.0	CR above Skookumchuck R	358316	08/27/91	1758	1.4	0.510	0.370	1.160	0.304	0.361	10.9
67.0	CR above Skookumchuck R	358416	08/28/91	1730	1.4	0.534	0.358	1.220	0.323	0.470	11.9
67.0	CR above Skookumchuck R	308534	07/22/92	1755	1.6	0.221	0.320	0.700	0.175	0.199	9.9
67.0	CR above Skookumchuck R	328514	08/04/92	947	1.3	0.118	0.195	0.599	0.131	0.167	10.7

Table D.4, page 4

RM Code	Site Description	Lab #	Date	Time	Depth (m)	NH3N (mg/L)	NO23N (mg/L)	TN (mg/L)	SRP (mg/L)	TP (mg/L)	CL (mg/L)
66.3	CR blw Centralia BL	308536	07/22/92	1836	1.4	0.240	0.302	0.706	0.159	0.174	8.5
66.3	CR blw Centralia BL	328516	08/04/92	905	1.3	0.076	0.248	0.605	0.087	0.115	8.4
66.0	CR @ riffle blw Centralia BL	358318	08/27/91	1951	0.0	0.162	0.323	0.658	0.099	0.152	7.6
66.0	CR @ riffle blw Centralia BL	358319	08/27/91	1951	0.0						
66.0	CR @ riffle blw Centralia BL	358319	08/27/91	1951	0.0	0.164	0.324	0.660	0.116	0.185	7.6
66.0	CR @ riffle blw Centralia BL	358418	08/28/91	1817	0.0	0.279	0.351	0.860	0.193	0.269	8.8
66.0	CR @ riffle blw Centralia BL	358419	08/28/91	1817	0.0						
66.0	CR @ riffle blw Centralia BL	358419	08/28/91	1817	0.0	0.284	0.350	0.863	0.195	0.271	9.4
64.2	CR @ Galvin Rd Bridge	358351	08/27/91	900	0.5	0.113	0.318	0.630		0.170	8.1
64.2	CR @ Galvin Rd Bridge	358360	08/27/91	1730	0.2	0.076	0.297	0.528	0.116	0.144	7.9
64.2	CR @ Galvin Rd Bridge	358451	08/28/91	835	0.0	0.237	0.399	0.866		0.225	8.4
64.2	CR @ Galvin Rd Bridge	358460	08/28/91	1545	0.0	0.250	0.400	0.872	0.178	0.240	8.3
64.2	CR @ Galvin Rd Bridge	308552	07/21/92	1255	0.0	0.091	0.262	0.511	0.105	0.109	8.0
64.2	CR @ Galvin Rd Bridge	328567	08/05/92	1110	0.0	0.068	0.273	0.537	0.092	0.118	8.8
59.9	CR @ Prather Rd Bridge	358352	08/27/91	929	0.5	0.036	0.431	0.612		0.142	8.4
59.9	CR @ Prather Rd Bridge	358353	08/27/91	929	0.5	0.034	0.434	0.643		0.147	8.2
59.9	CR @ Prather Rd Bridge	358361	08/27/91	1820	0.2	0.035	0.412	0.607	0.117	0.140	8.3
59.9	CR @ Prather Rd Bridge	358452	08/28/91	905	0.0	0.054	0.446	0.653		0.154	6.1
59.9	CR @ Prather Rd Bridge	358453	08/28/91	905	0.0	0.066	0.448	0.662		0.145	8.0
59.9	CR @ Prather Rd Bridge	358461	08/28/91	1630	0.0	0.068	0.428	0.685	0.109	0.147	7.7
59.9	CR @ Prather Rd Bridge	378340	09/10/91	710	0.0	0.048	0.460	0.659		0.099 L	6.3
59.9	CR @ Prather Rd Bridge	378348	09/10/91	1230	0.0	0.036	0.437	0.623	0.072	0.097 L	6.3
59.9	CR @ Prather Rd Bridge	378440	09/11/91	740	0.0	0.038	0.443	0.634		0.086 L	6.4
59.9	CR @ Prather Rd Bridge	378448	09/11/91	1305	0.0	0.037	0.426	0.617	0.066	0.082 L	6.4
59.9	CR @ Prather Rd Bridge	378540	09/12/91	740	0.0	0.043	0.448	0.629		0.085 L	6.7
59.9	CR @ Prather Rd Bridge	378548	09/12/91	1130	0.0	0.033	0.437	0.617	0.065	0.083 L	6.6
59.9	CR @ Prather Rd Bridge	258115	06/17/92	1255	0.0	0.058	0.324	0.530	0.059	0.070	6.9
59.9	CR @ Prather Rd Bridge	308540	07/21/92	816	0.0	0.026	0.298	0.527	0.066	0.064	8.1
59.9	CR @ Prather Rd Bridge	308551	07/21/92	1615	0.0	0.024	0.313	0.464	0.072	0.069	7.9
59.9	CR @ Prather Rd Bridge	328555	08/05/92	740	0.0	0.027	0.327	0.529	0.069	0.080	8.0
59.9	CR @ Prather Rd Bridge	328564	08/05/92	1530	0.0	0.021	0.347	0.550	0.066	0.081	8.3
59.9	CR @ Prather Rd Bridge	328566	08/05/92	1530	0.0	0.022	0.342	0.522	0.069	0.081	8.4
59.9	CR @ Prather Rd Bridge	408085	09/30/92	1500	1.7	0.049	0.466	0.484		0.082	6.5
58.2	CR nr Blanksma Dairy Pump	378342	09/10/91	1135	0.0	0.029	0.499	0.671	0.069	0.096 L	6.1
58.2	CR nr Blanksma Dairy Pump	378343	09/10/91	1140	0.0						
58.2	CR nr Blanksma Dairy Pump	378343	09/10/91	1140	0.0	0.025	0.500	0.680	0.069	0.102	6.6
58.2	CR nr Blanksma Dairy Pump	378442	09/11/91	1220	0.0	0.021	0.492	0.668	0.065	0.089 L	6.5
58.2	CR nr Blanksma Dairy Pump	378443	09/11/91	1220	0.0						
58.2	CR nr Blanksma Dairy Pump	378443	09/11/91	1220	0.0	0.028	0.492	0.707	0.067	0.094 L	6.2
58.2	CR nr Blanksma Dairy Pump	378542	09/12/91	1045	0.0	0.028	0.509	0.671	0.067	0.086 L	6.8
58.2	CR nr Blanksma Dairy Pump	378543	09/12/91	1045	0.0	0.026	0.509	0.668	0.067	0.089 L	6.6
54.2	CR @ Independence Bridge	378341	09/10/91	745	0.0	0.015	0.631	0.791		0.083 L	6.4
54.2	CR @ Independence Bridge	378349	09/10/91	1305	0.0	0.010 U	0.641	0.792	0.061	0.086 L	6.2
54.2	CR @ Independence Bridge	378441	09/11/91	810	0.0	0.011	0.662	0.815		0.081 L	6.1
54.2	CR @ Independence Bridge	378449	09/11/91	1335	0.0	0.011	0.660	0.811	0.062	0.078 L	6.4

Table D.4, page 5

RM Code	Site Description	Lab #	Date	Time	Depth (m)	NH3N (mg/L)	NO23N (mg/L)	TN (mg/L)	SRP (mg/L)	TP (mg/L)	CL (mg/L)
54.2	CR @ Independence Bridge	378541	09/12/91	805	0.0	0.012	0.652	0.796		0.073 L	6.4
54.2	CR @ Independence Bridge	378549	09/12/91	1150	0.0	0.012	0.653	0.803	0.056	0.075 L	6.8
54.2	CR @ Independence Bridge	308550	07/21/92	1505	0.0			0.755			8.1
54.2	CR @ Independence Bridge	328563	08/05/92	1340	0.0	0.018	0.621	0.805	0.048	0.057	7.8
52.9	CR nr Independence	328568	08/05/92	1200	0.0	0.019	0.549	0.732	0.046	0.054	7.8
49.2	CR abv Black River	308575	07/21/92	1140	0.0	0.010 U	0.541	0.657	0.041	0.043	7.9
49.2	CR abv Black River	328590	08/05/92	1205	0.0	0.013	0.485	0.649	0.041	0.048	7.9
44.0	CR @ Sickman Ford Br	378355	09/10/91	750	0.0	0.010 U	0.588	0.731		0.063 L	6.3
44.0	CR @ Sickman Ford Br	378362	09/10/91	1645	0.0	0.010 U	0.571	0.727	0.047	0.065 L	6.2
44.0	CR @ Sickman Ford Br	378455	09/11/91	735	0.0	0.010 U	0.610	0.784		0.059 L	5.9
44.0	CR @ Sickman Ford Br	378462	09/11/91	1450	0.0	0.010 U	0.595	0.748	0.048	0.064 L	6.1
44.0	CR @ Sickman Ford Br	378555	09/12/91	810	0.0	0.010 U	0.623	0.756		0.060 L	6.1
44.0	CR @ Sickman Ford Br	378562	09/12/91	1350	0.0	0.010 U	0.612	0.749	0.047	0.061 L	6.1
44.0	CR @ Sickman Ford Br	308574	07/21/92	1100	0.5	0.026	0.521	0.664	0.027	0.033	7.0
44.0	CR @ Sickman Ford Br	328589	08/05/92	1120	0.5	0.025	0.434	0.675	0.028	0.045	7.4
42.2	CR nr Oakville BL	378359	09/10/91	1255	0.0	0.014	0.543	0.705	0.041	0.061 L	6.2
42.2	CR nr Oakville BL	378459	09/11/91	1235	0.0	0.010 U	0.580	0.723	0.044	0.059 L	6.0
42.2	CR nr Oakville BL	378559	09/12/91	1235	0.0	0.010 U	0.589	0.722	0.003	0.058 L	6.1
33.8	CR nr PORTER (Porter Rd Br)	378356	09/10/91	840	0.0	0.010 U	0.506	0.698		0.054 L	6.5
33.8	CR nr PORTER (Porter Rd Br)	378363	09/10/91	1815	0.0	0.010 U	0.491	0.667	0.037	0.054 L	6.3
33.8	CR nr PORTER (Porter Rd Br)	378364	09/10/91	1815	0.0	0.010 U	0.491	0.667	0.037	0.048 L	6.1
33.8	CR nr PORTER (Porter Rd Br)	378456	09/11/91	825	0.0	0.010 U	0.494	0.660		0.057 L	5.9
33.8	CR nr PORTER (Porter Rd Br)	378463	09/11/91	1550	0.0	0.010 U	0.495	0.684	0.038	0.056 L	6.8
33.8	CR nr PORTER (Porter Rd Br)	378464	09/11/91	1550	0.0	0.010 U	0.495	0.685	0.039	0.055 L	6.7
33.8	CR nr PORTER (Porter Rd Br)	378556	09/12/91	855	0.0	0.017	0.522	0.668		0.052 L	6.0
33.8	CR nr PORTER (Porter Rd Br)	378563	09/12/91	1455	0.0						
33.8	CR nr PORTER (Porter Rd Br)	378563	09/12/91	1455	0.0	0.010 U	0.508	0.647	0.038	0.052 L	6.0
33.8	CR nr PORTER (Porter Rd Br)	378564	09/12/91	1455	0.0	0.010 U	0.508	0.636	0.038	0.049 L	6.2
33.8	CR nr PORTER (Porter Rd Br)	308571	07/21/92	930	0.5	0.030	0.408	0.688	0.022	0.022	7.0
33.8	CR nr PORTER (Porter Rd Br)	308582	07/21/92	1535	0.5	0.019	0.403	0.593	0.019	0.024	7.0
33.8	CR nr PORTER (Porter Rd Br)	328586	08/05/92	900	0.5	0.019	0.288	0.512	0.022	0.032	7.6
33.8	CR nr PORTER (Porter Rd Br)	328597	08/05/92	1750	0.5	0.010	0.268	0.543	0.024	0.010	7.3

Appendix D
Table D.5 Summary of Phytoplankton Identification Results

ALGAL DENSITIES (#/mL)

RM Code	08/27/91	08/28/91	09/10/91	06/16/92 06/17/92	07/21/92 07/22/92	08/04/92 08/05/92	09/30/92
Chehalis R							
33.8			554		155	117	
44.0			521				
54.2			529				
59.9	397	398	277	666	108	90;104	319
66.0	429						
67.5				663;726	169	72	368;452
70.7	1590						
73.6	1575						
74.6	508;471	484;424		266	105	86	
90.0	611	599					
106.3	426	476					
Tributaries							
66.9001	421						
75.20015	312	316					
88.0007	390	384					

ALGAL BIOVOLUMES (um3 x 1000 per mL)

RM Code	08/27/91	08/28/91	09/10/91	06/16/92 06/17/92	07/21/92 07/22/92	08/04/92 08/05/92	09/30/92
Chehalis R							
33.8			284		60	54	
44.0			140				
54.2			164				
59.9	164	117	130	173	32	30;35	74
66.0	136						
67.5				108;102	25	28	118;122
70.7	655						
73.6	328						
74.6	172;135	132;85		71	33	23	
90.0	161	154					
106.3	138	166					
Tributaries							
66.9001	197						
75.20015	99	101					
88.0007	124	172					

DOMINANT SPECIES

RM Code	08/27/91	08/28/91	09/10/91	06/16/92 06/17/92	07/21/92 07/22/92	08/04/92 08/05/92	09/30/92
Chehalis R							
33.8			D		D	D	
44.0			D				
54.2			D				
59.9	D	D	D	C	D	D	D
66.0	C						
67.5				C	D	D	D,K,C
70.7	C						
73.6	C						
74.6	C	C		D	D	D	
90.0	D	D					
106.3	D	D					
Tributaries							
66.9001	D,C						
75.20015	D	D					
88.0007	C,D	D					

D = Diatoms C = Cryptophytes K = Chrysophytes

Appendix D

Table D.6 Ultimate CBOD Analysis Summary - Mainstem

RM Code	Site Description	Lab #	Date	Time	Depth (m)	BOD5 (mg/L)	UBOD (mg/L)	u/5 (n.d.)	k (1/day)	SS	Dltn (n.d.)	Days
106.3	CR @ SR 6 Br nr Pe Ell	358345	8/27/91	1333	0.0	4.8	9.9	2.08	0.1323	1.2E-01	1	29
		358346	8/27/91	1333	0.0	5.3	10.3	1.96	0.1365	3.8E-01	1	29
		328546	8/4/92	1135	0.0	0.6	1.9	2.85	0.1037	3.7E-02	1	34
100.5	CR Elk Ck Rd nr Doty	358341	8/27/91	830	0.0	0.9	3.1	3.35	0.1217	4.6E-01	1	29
90.1	CR abv Ceres Rd Br	308564	7/22/92	1450	0.0	1.1	2.0	1.83	0.1191	2.4E-01	1	34
		328549	8/4/92	1340	0.0	0.8	2.0	2.63	0.1196	1.4E-01	1	34
90.0	CR @ Ceres Rd Br	358328	8/27/91	1415	0.0	3.8	11.7	3.07	0.0839	1.9E-01	1	29
74.6	CR @ SR 6 Br nr Chehalis	358330	8/27/91	1600	0.0	1.0	2.7	2.76	0.13	3.0E-01	1	29
		358331	8/27/91	1600	0.0	0.8	2.7	3.47	0.1104	3.4E-01	1	29
		308592	7/22/92	1424	0.5	0.7	1.6	2.42	0.096	3.2E-01	1	34
		308593	7/22/92	1445	0.5	0.8	1.7	2.16	0.0986	1.8E-01	1	34
		308593R	7/22/92	1445	0.5	0.8	1.6	1.88	0.1192	2.8E-01	1	34
		328576	8/4/92	1350	0.5	0.6	2.0	3.51	0.0794	2.6E-02	1	34
		328577	8/4/92	1350	0.5	0.7	2.0	2.85	0.1009	2.0E-02	1	34
		328577R	8/4/92	1350	0.5	0.7	2.0	2.90	0.0989	3.1E-02	1	34
72.3	CR blw Golf Course intake	328502	8/4/92	1410	0.9	0.9	2.3	2.65	0.0642	4.4E-01	1	34
		328503	8/4/92	1417	3.7	0.8	2.1	2.61	0.0721	3.1E-01	1	34
70.7	CR north of Airport	358308	8/27/91	1448	1.6	1.0	2.0	2.09	0.1418	7.1E-02	1	29
		358408	8/28/91	1433	1.3	1.8	2.2	1.18	0.3106	2.5E-01	1	29
		358309	8/27/91	1448	6.6	1.5	2.3	1.55	0.2079	1.3E-01	1	29
69.6	CR blw Overhanging Tree	418025	10/10/91			1.5	3.4	2.23	0.1253	1.6E-01	1	32
		418025R	10/10/91			1.3	3.6	2.77	0.1090	2.4E-01	1	32
		328506	8/4/92	1210	1.4	1.0	2.1	2.00	0.1067	4.5E-01	1	34
		328507	8/4/92	1210	1.4	1.0	2.2	2.09	0.1142	1.8E-01	1	34
		328508	8/4/92	1225	5.5	0.3	0.9	2.54	0.0714	2.8E-01	1	34
67.5	CR @ Centralia (Mellen St Br)	358358	8/27/91	1550	0.7	1.4	3.7	2.67	0.1176	4.3E-01	1	29
		358358R	8/27/91	1550	0.7	1.8	3.6	1.98	0.1782	1.0E+00	1	29
		308553	7/22/92	1725	1.9	0.9	1.6	1.73	0.1281	1.5E-01	1	34
		328565	8/4/92			1.1	2.1	1.90	0.1697	1.8E-01	1	34
59.9	CR nr Grand Mound (Prather Rd)	358361	8/27/91	1820	0.2	1.0	1.9	1.96	0.1914	1.7E-02	1	29
		378348	9/10/91	1230	0.0	0.6	1.7	2.87	0.1267	1.7E-01	1	29
		308551	7/21/92	1615	0.0	0.8	2.1	2.50	0.0885	1.9E-01	1	34
		328564	8/5/92	1530	0.0	0.5	2.5	5.23	0.0716	3.9E-01	1	34
54.2	CR @ Independence Bridge	378349	9/10/91	1305	0.0	0.4	1.7	4.16	0.0603	1.8E-01	1	29
49.2	CR abv Black R	308575	7/21/92	1140	0.0	0.9	2.0	2.15	0.1303	1.2E-01	1	34
44.0	CR @ Sickman Ford Br	308574	7/21/92	1100	0.5	0.7	2.0	2.72	0.1022	2.3E-01	1	34
42.2	CR nr Oakville BL	378359	9/10/91	1255	0.0	0.5	2.4	4.73	0.0549	2.1E-01	1	60
33.8	CR @ Porter (Porter Rd Br)	378363	9/10/91	1815	0.0	0.8	2.7	3.57	0.0640	5.0E-01	1	60
		378364	9/10/91			0.8	2.3	2.82	0.0967	2.0E-01	1	60
		378364R	9/10/91			1.1	2.9	2.53	0.0809	5.8E-01	1	60
		308582	7/21/92	1535	0.5	0.9	2.1	2.25	0.0099	5.9E-02	1	34
		308582R	7/21/92	1535	0.5	1.2	2.1	1.79	0.1318	1.2E-01	1	34
		328597	8/5/92	1750	0.5	0.6	2.5	3.90	0.0878	2.1E-01	1	34
		328597R	8/5/92	1750	0.5	0.0	2.0	75.88	0.0788	6.6E-01	1	34

u/5 = UBOD/CBOD5; k = bottle deoxygenation rate; SS = Residual sum of squares for 1st-order fit; Dltn = dilution used; Days = # of days used in 1st-order fit.

Appendix E. Diurnal Field Measurements

Appendix E

Table E.1 Summary of Diurnal DS3 Measurements

RM Code	Date	N		TEMP °C	PH S.U.	COND µmho/cm	DO %Sat	DO mg/L
33.8	9/11/91-9/12/91	24	min	17.2	7.3	93	89	9.0
			avg	17.6	7.5	94	98	9.8
			max	18.2	8.0	94	110	10.8
			range	1.0	0.6	1	21	1.8
42.1	9/11/91-9/12/91	24	min	16.9	7.2	93	90	8.9
			avg	17.5	7.5	93	102	9.9
			max	18.2	7.9	94	115	11.0
			range	1.3	0.7	1	25	2.2
52.9	9/11/91-9/12/91	24	min	16.9	7.2	93	90	8.9
			avg	17.5	7.5	93	102	9.9
			max	18.2	7.9	94	115	11.0
			range	1.3	0.7	1	25	2.2
66.3	5/7/92-5/8/92	23	min	16.6	7.0	0	85	8.6
			avg	17.3	7.0	0	89	8.9
			max	17.8	7.1	0	94	9.3
			range	1.2	0.1	0	9	0.7
66.3	5/28/92-5/29/92	23	min	17.5	7.0	82	77	7.5
			avg	17.8	7.0	83	86	8.4
			max	18.0	7.2	84	96	9.3
			range	0.5	0.2	2	19	1.7
67.0	8/21/91-8/22/91	24	min	22.8	7.0	126	81	7.2
			avg	23.3	7.0	128	90	7.9
			max	23.7	7.1	130	101	8.8
			range	1.0	0.1	4	20	1.6
67.6	10/10/91-10/14/91	96	min	14.0	6.7	126	22	2.6
			avg	14.8	6.8	127	36	4.1
			max	15.5	7.2	130	63	7.0
			range	1.5	0.5	4	41	4.4
68.5	8/20/91-8/22/91	48	min	23.2	7.0	132	89	7.7
			avg	23.7	7.2	134	103	8.9
			max	24.4	7.6	137	124	10.6
			range	1.3	0.6	5	35	2.9
68.6	8/21/91-8/22/91	24	min	22.6	7.0	137	87	7.5
			avg	23.6	7.3	139	110	9.4
			max	24.5	7.6	145	128	10.9
			range	1.8	0.6	8	42	3.4
68.6	10/10/91-10/14/91	96	min	13.8	6.8	119	13	1.6
			avg	14.4	6.8	120	28	3.2
			max	15.2	6.9	124	39	4.4
			range	1.4	0.1	5	25	2.8
68.6	5/7/92-5/8/92	23	min	16.7	6.9	68	92	8.7
			avg	17.3	6.9	69	94	8.7
			max	17.9	7.0	70	96	8.9
			range	1.2	0.1	1	3	0.2

N = number of hours monitored. Measurements were recorded hourly.

Table E.1, page 2

RM Code	Date	N		TEMP °C	PH S.U.	COND µmho/cm	DO %Sat	DO mg/L
68.6	5/28/92-5/29/92	24	min	18.0	7.0	82	87	7.9
			avg	18.5	7.0	83	88	7.9
			max	18.9	7.2	84	90	8.0
			range	0.9	0.1	2	2	0.1
68.6	6/16/92-6/17/92	24	min	17.1	7.0	95	85	8.5
			avg	17.3	7.0	95	87	8.7
			max	17.5	7.1	96	90	8.9
			range	0.4	0.1	1	5	0.5
68.6	7/6/92-7/7/92	23	min	20.0	6.9	115	69	6.0
			avg	20.4	6.9	119	73	6.4
			max	21.0	7.2	122	81	7.0
			range	1.1	0.3	7	13	1.0
68.6	7/22/92-7/23/92	24	min	21.7	6.9	123	59	5.1
			avg	22.0	6.9	124	64	5.6
			max	22.2	7.0	129	68	5.9
			range	0.5	0.1	6	9	0.8
68.6	8/3/92-8/4/92	24	min	22.9	7.0	121	96	8.2
			avg	23.5	7.1	122	100	8.5
			max	24.5	7.4	124	105	8.8
			range	1.6	0.4	2	9	0.5
68.6	8/20/92-8/21/92	24	min	22.5	7.0	131	90	7.9
			avg	23.2	7.1	132	100	8.6
			max	24.3	7.3	133	119	10.1
			range	1.8	0.4	2	29	2.2
68.6	9/8/92-9/9/92	24	min	18.0	6.9	143	60	6.2
			avg	18.6	7.0	145	67	6.8
			max	19.3	7.1	148	77	7.6
			range	1.3	0.2	6	16	1.4
69.6	10/10/91-10/14/91	96	min	13.8	6.7	114	14	2.1
			avg	14.2	6.8	117	28	3.6
			max	14.8	6.9	121	36	4.6
			range	1.0	0.1	7	23	2.5
69.6	5/7/92-5/8/92	23	min	16.9	7.0	0	92	8.7
			avg	17.4	7.0	0	93	8.8
			max	18.0	7.1	0	95	8.9
			range	1.0	0.1	0	3	0.2
69.6	5/28/92-5/29/92	24	min	17.6	--	88	88	8.1
			avg	18.0	--	89	88	8.1
			max	18.4	--	90	89	8.2
			range	0.8	--	2	1	0.1
69.6	6/16/92-6/17/92	24	min	17.0	7.0	96	93	8.7
			avg	17.2	7.1	97	94	8.8
			max	17.7	7.1	99	95	8.9
			range	0.7	0.1	4	2	0.2

N = number of hours monitored. Measurements were recorded hourly.

Table E.1, page 3

RM Code	Date	N		TEMP °C	PH S.U.	COND µmho/cm	DO %Sat	DO mg/L
69.6	7/6/92-7/7/92	22	min	19.6	6.9	102	68	6.1
			avg	20.0	6.9	108	71	6.3
			max	20.8	7.0	111	75	6.8
			range	1.1	0.1	9	7	0.7
69.6	7/22/92-7/23/92	24	min	21.4	6.8	120	59	5.2
			avg	21.9	6.8	126	62	5.4
			max	22.2	6.9	130	65	5.6
			range	0.8	0.2	9	6	0.4
69.6	8/3/92-8/4/92	24	min	23.2	7.0	122	97	8.2
			avg	23.5	7.1	122	101	8.6
			max	23.8	7.1	123	109	9.3
			range	0.5	0.1	1	12	1.0
69.6	8/20/92-8/21/92	24	min	22.6	6.9	130	77	7.2
			avg	23.1	7.0	131	87	8.0
			max	23.6	7.2	131	100	9.1
			range	1.0	0.3	2	23	1.9
69.6	9/8/92-9/9/92	18	min	17.9	6.7	149	64	5.8
			avg	18.0	6.7	150	66	6.0
			max	18.3	6.7	154	68	6.2
			range	0.4	0.0	6	4	0.4
70.7	8/20/91-8/21/91	23	min	22.9	7.0	133	80	7.0
			avg	23.3	7.0	135	87	7.6
			max	23.8	7.1	138	96	8.3
			range	0.9	0.1	5	16	1.3
72.3	6/16/92-6/17/92	24	min	16.9	7.2	91	92	8.8
			avg	17.2	7.2	94	93	8.9
			max	17.6	7.5	97	95	9.0
			range	0.6	0.3	6	3	0.2
72.3	7/6/92-7/7/92	22	min	19.1	7.2	99	86	7.8
			avg	19.3	7.2	100	87	8.0
			max	19.8	7.2	101	90	8.2
			range	0.7	0.0	2	4	0.4
72.3	7/22/92-7/23/92	24	min	20.1	7.0	122	69	6.2
			avg	20.6	7.0	125	70	6.4
			max	21.1	7.1	129	72	6.6
			range	1.0	0.2	7	2	0.3
72.3	8/3/92-8/4/92	24	min	22.2	7.0	128	80	6.7
			avg	23.1	7.1	131	90	7.4
			max	24.0	7.2	134	101	8.3
			range	1.9	0.2	6	21	1.5
72.3	8/20/92-8/21/92	24	min	21.7	6.9	135	74	6.9
			avg	22.5	7.0	141	84	7.7
			max	23.5	7.2	144	101	8.9
			range	1.8	0.3	9	27	2.0

N = number of hours monitored. Measurements were recorded hourly.

Table E.1, page 4

RM Code	Date	N		TEMP °C	PH S.U.	COND µmho/cm	DO %Sat	DO mg/L
72.3	9/8/92-9/9/92	24	min	16.1	7.0	123	82	7.8
			avg	17.0	7.0	127	86	8.1
			max	18.1	7.2	130	93	8.6
			range	2.0	0.3	7	11	0.8
72.5	8/19/91-8/21/91	48	min	22.5	7.0	116	78	6.9
			avg	23.3	7.0	121	85	7.4
			max	25.1	7.2	126	96	8.0
			range	2.6	0.2	9	17	1.1
73.6	8/19/91-8/20/91	24	min	22.9	7.0	134	84	7.5
			avg	23.2	7.1	137	88	7.7
			max	23.5	7.1	144	91	8.0
			range	0.6	0.1	10	7	0.5
74.9	8/19/91-8/20/91	24	min	22.0	7.1	115	85	7.4
			avg	23.1	7.2	116	92	7.9
			max	24.5	7.4	116	101	8.5
			range	2.5	0.3	1	16	1.0
79.8	9/10/91-9/11/91	23	min	17.5	7.2	80	90	8.6
			avg	18.0	7.3	80	95	9.0
			max	19.0	7.4	81	100	9.4
			range	1.5	0.2	1	10	0.7
90.1	9/10/91-9/11/91	24	min	15.2	7.2	70	88	8.8
			avg	16.8	7.3	71	96	9.4
			max	18.9	7.5	71	108	10.1
			range	3.7	0.3	1	20	1.3
100.5	9/10/91-9/11/91	24	min	14.2	7.4	73	88	9.2
			avg	16.1	7.7	74	96	9.8
			max	17.3	7.9	74	106	10.6
			range	3.1	0.5	1	17	1.4

N = number of hours monitored. Measurements were recorded hourly.

Appendix E
Table E.2 Full Results of DS3 Measurements

DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch100
Setup Date (MMDDYY) : 091091
Setup Time (HHMMSS) : 091443
Starting Date (MMDDYY) : 091091
Starting Time (HHMMSS) : 100000
Stopping Date (MMDDYY) : 091391
Stopping Time (HHMMSS) : 140000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 34
Stn ID: County Rd Br @ Doty
RM: Chehalis River 100.5

Temp (F,mx/av/mn): 79/60/44
Precip (in): 0
Wind (mph,avg): 3.8
Clouds(0-10): 0-9-1
Description: Sunny, warm

Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND mmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
91091	100000	14.2	7.6	0.073	93	9.8	10.0	
91091	110000	14.6	7.6	0.073	96	10.0	10.2	
91091	120000	15.3	7.6	0.073	99	10.2	10.3	
91091	130000	16.0	7.7	0.073	102	10.3	10.5	
91091	132000					[10.4]		10.5
91091	140000	16.7	7.8	0.074	105	10.4	10.6	
91091	150000	17.1	7.9	0.074	106	10.4	10.6	
91091	160000	17.1	7.9	0.074	105	10.3	10.5	
91091	170000	16.9	7.9	0.074	103	10.2	10.4	
91091	180000	16.7	7.9	0.074	101	10.1	10.2	
91091	190000	16.8	7.8	0.074	100	9.9	10.1	
91091	200000	16.9	7.8	0.074	98	9.7	9.9	
91091	210000	17.2	7.8	0.074	96	9.5	9.7	
91091	220000	17.3	7.8	0.074	95	9.4	9.5	
91091	230000	17.2	7.8	0.074	94	9.3	9.4	
91191	0	16.9	7.7	0.074	93	9.2	9.4	
91191	10000	16.6	7.6	0.074	93	9.2	9.4	
91191	20000	16.2	7.6	0.074	92	9.2	9.4	
91191	30000	15.9	7.5	0.074	91	9.2	9.3	
91191	40000	15.6	7.5	0.074	90	9.1	9.3	
91191	50000	15.5	7.5	0.074	89	9.1	9.3	
91191	60000	15.4	7.4	0.074	89	9.1	9.2	
91191	70000	15.3	7.4	0.074	88	9.0	9.2	
91191	80000	15.2	7.4	0.074	89	9.1	9.3	
91191	90000	15.1	7.4	0.074	90	9.3	9.4	
91191	92500					[9.4]		9.6

Appendix E Table E.2, page 2	DO/corr = Corrected DO Measurement DO/mtr = DO measurement by DS3 meter DO/Wink = DO measurement by Winkler method

Log File Name : ch90
Setup Date (MMDDYY) : 091091
Setup Time (HHMMSS) : 091951
Starting Date (MMDDYY) : 091091
Starting Time (HHMMSS) : 100000
Stopping Date (MMDDYY) : 091391
Stopping Time (HHMMSS) : 140000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 35
Stn ID: Above Ceres Rd Bridge
RM: Chehalis River 90.0

Temp (F,mx/av/mn): 79/60/44
Precip (in): 0
Wind (mph,avg): 3.8
Clouds(0-10): 0-9-1
Description: Sunny, warm

Date MMDDYY	Time HHMMSS	TEMP ˚C	PH s.u.	COND mmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
91091	110000	15.2	7.4	0.070	92	9.4	9.3	
91091	120000	15.7	7.3	0.070	94	9.6	9.4	
91091	130000	16.3	7.3	0.070	97	9.8	9.6	
91091	134500					[9.9]		9.8
91091	140000	17.0	7.4	0.071	101	10.0	9.8	
91091	150000	17.8	7.4	0.071	104	10.1	10.0	
91091	160000	18.4	7.4	0.071	107	10.2	10.1	
91091	170000	18.8	7.5	0.071	108	10.3	10.1	
91091	180000	18.9	7.5	0.071	107	10.2	10.1	
91091	190000	18.6	7.5	0.071	105	10.1	9.9	
91091	200000	18.1	7.5	0.071	102	9.9	9.7	
91091	210000	17.7	7.4	0.071	100	9.7	9.6	
91091	220000	17.3	7.4	0.071	98	9.6	9.4	
91091	230000	17.1	7.4	0.071	97	9.5	9.4	
91191	0	17.0	7.4	0.071	95	9.4	9.3	
91191	10000	17.0	7.3	0.071	94	9.3	9.1	
91191	20000	16.8	7.3	0.071	93	9.2	9.0	
91191	30000	16.6	7.3	0.071	91	9.1	9.0	
91191	40000	16.3	7.3	0.071	90	9.1	8.9	
91191	50000	16.1	7.3	0.071	89	9.0	8.9	
91191	60000	15.8	7.2	0.071	89	9.0	8.8	
91191	70000	15.6	7.2	0.071	88	9.0	8.8	
91191	80000	15.4	7.2	0.071	88	9.0	8.9	
91191	90000	15.4	7.2	0.071	89	9.1	8.9	
91191	100000	15.4	7.2	0.071	90	9.2	9.1	
91191	100500					[9.2]		9.1

Appendix E
Table E.2, page 3

DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch79
Setup Date (MMDDYY) : 091091
Setup Time (HHMMSS) : 092203
Starting Date (MMDDYY) : 091091
Starting Time (HHMMSS) : 100000
Stopping Date (MMDDYY) : 091391
Stopping Time (HHMMSS) : 140000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 36
Stn ID: Above Claquato nr Goff Rd
RM: Chehalis River 79

Temp (F,mx/av/mn): 79/60/44
Precip (in): 0
Wind (mph,avg): 3.8
Clouds(0-10): 0-9-1
Description: Sunny, warm

Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND mmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
91091	120000	17.8	7.4	0.080	94	9.1	9.0	
91091	130000	18.4	7.3	0.080	96	9.3	9.1	
91091	140000	18.8	7.3	0.080	98	9.4	9.2	
91091	150000	19.0	7.3	0.080	100	9.4	9.3	
91091	160000	19.0	7.3	0.081	100	9.5	9.3	
91091	170000	18.8	7.3	0.081	100	9.5	9.4	
91091	180000	18.5	7.3	0.081	99	9.5	9.4	
91091	190000	18.2	7.3	0.081	98	9.5	9.3	
91091	200000	18.0	7.3	0.080	97	9.4	9.3	
91091	210000	17.9	7.3	0.080	96	9.4	9.2	
91091	220000	17.9	7.3	0.080	96	9.3	9.2	
91091	230000	18.0	7.3	0.080	95	9.2	9.1	
91191	0	18.0	7.3	0.080	95	9.2	9.1	
91191	10000	17.9	7.3	0.080	94	9.2	9.0	
91191	20000	17.8	7.3	0.080	94	9.1	9.0	
91191	30000	17.7	7.3	0.080	93	9.1	8.9	
91191	40000	17.6	7.2	0.080	92	9.0	8.9	
91191	50000	17.5	7.2	0.080	91	8.9	8.8	
91191	60000	17.5	7.2	0.080	91	8.9	8.7	
91191	70000	17.5	7.2	0.080	90	8.8	8.7	
91191	80000	17.6	7.2	0.080	90	8.8	8.6	
91191	90000	17.7	7.2	0.080	90	8.8	8.6	
91191	100000	17.8	7.2	0.080	91	8.8	8.7	
91191	102500					[8.8]		8.7

Appendix E
Table E.2, page 4

DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch74
Setup Date (MMDDYY) : 081991
Setup Time (HHMMSS) : 090318
Starting Date (MMDDYY) : 081991
Starting Time (HHMMSS) : 100000
Stopping Date (MMDDYY) : 082491
Stopping Time (HHMMSS) : 140000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 36
Stn ID: Above SR 6 Br near Chehalis
RM: Chehalis River 74.9

Temp (F,mx/av/mn): 86/70/50
Precip (in): 0
Wind (mph,avg): 4.8
Clouds(0-10): 2-3
Description: Sunny, warm, clear

Date MMDDYY	Time HHMMSS	TEMP ˚C	PH s.u.	COND mmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
81991	120000	22.8	7.4	0.115	94	8.2	8.1	
81991	130000	23.2	7.2	0.115	97	8.4	8.3	
81991	131500					[8.4]		8.3
81991	140000	23.6	7.2	0.115	99	8.5	8.4	
81991	150000	24.0	7.2	0.115	100	8.5	8.4	
81991	160000	24.3	7.2	0.115	101	8.6	8.5	
81991	170000	24.4	7.2	0.116	101	8.5	8.4	
81991	180000	24.5	7.2	0.116	99	8.4	8.3	
81991	190000	24.4	7.2	0.116	98	8.3	8.2	
81991	200000	24.2	7.2	0.116	96	8.1	8.0	
81991	210000	24.0	7.2	0.116	94	8.0	7.9	
81991	220000	23.7	7.2	0.116	92	7.9	7.8	
81991	230000	23.5	7.1	0.116	90	7.8	7.7	
82091	0	23.3	7.1	0.116	89	7.7	7.6	
82091	10000	23.1	7.1	0.116	88	7.6	7.5	
82091	20000	22.9	7.1	0.116	87	7.6	7.5	
82091	30000	22.6	7.1	0.116	86	7.6	7.5	
82091	40000	22.4	7.1	0.116	86	7.6	7.5	
82091	50000	22.3	7.1	0.116	86	7.5	7.4	
82091	60000	22.1	7.1	0.116	85	7.5	7.4	
82091	70000	22.0	7.1	0.116	85	7.5	7.4	
82091	80000	22.0	7.1	0.116	86	7.6	7.5	
82091	90000	22.0	7.1	0.115	87	7.7	7.6	
82091	100000	22.0	7.1	0.115	89	7.9	7.8	
82091	110000	22.3	7.2	0.115	92	8.1	8.0	
82091	120000	22.7	7.2	0.115	94	8.2	8.1	
82091	120500					[8.2]		8.2

Appendix E
Table E.2, page 5

DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch73
Setup Date (MMDDYY) : 081991
Setup Time (HHMMSS) : 085935
Starting Date (MMDDYY) : 081991
Starting Time (HHMMSS) : 100000
Stopping Date (MMDDYY) : 082491
Stopping Time (HHMMSS) : 140000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 35
Stn ID: Junk Cars Pool
RM: Chehalis River 73.6

Temp (F,mx/av/mn): 86/70/50
Precip (in): 0
Wind (mph,avg): 4.8
Clouds(0-10): 2-3
Description: Sunny, warm, clear

Date MMDDYY	Time HHMMSS	TEMP ˚C	PH s.u.	COND mmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
81991	120000	23.0	7.1	0.136	86	7.5	7.6	
81991	130000	22.9	7.0	0.138	85	7.4	7.5	
81991	140000	23.1	7.0	0.138	85	7.3	7.5	
81991	150000	22.9	7.0	0.139	84	7.3	7.5	
81991	150500					[7.3]		7.6
81991	160000	23.3	7.0	0.139	87	7.5	7.6	
81991	170000	23.1	7.1	0.139	86	7.5	7.6	
81991	180000	23.3	7.1	0.138	87	7.6	7.7	
81991	190000	23.5	7.1	0.139	90	7.7	7.8	
81991	200000	23.4	7.1	0.139	90	7.7	7.8	
81991	210000	23.2	7.1	0.138	89	7.7	7.8	
81991	220000	23.2	7.1	0.138	88	7.7	7.8	
81991	230000	23.2	7.1	0.137	89	7.7	7.8	
82091	0	23.2	7.1	0.136	90	7.8	7.9	
82091	10000	23.3	7.1	0.136	91	7.8	8.0	
82091	20000	23.3	7.1	0.136	91	7.8	8.0	
82091	30000	23.3	7.1	0.135	91	7.9	8.0	
82091	40000	23.2	7.1	0.135	91	7.8	8.0	
82091	50000	23.2	7.1	0.134	90	7.8	7.9	
82091	60000	23.2	7.1	0.134	89	7.7	7.9	
82091	70000	23.1	7.1	0.134	88	7.7	7.8	
82091	80000	23.1	7.1	0.135	88	7.6	7.7	
82091	90000	23.0	7.1	0.137	87	7.6	7.7	
82091	100000	22.9	7.1	0.139	86	7.5	7.6	
82091	110000	22.9	7.0	0.144	85	7.4	7.5	
82091	120000	22.9	7.0	0.144	84	7.3	7.5	
82091	122500					[7.3]		7.3

Appendix E Table E.2, page 6	DO/corr = Corrected DO Measurement DO/mtr = DO measurement by DS3 meter DO/Wink = DO measurement by Winkler method

Log File Name : ch72
Setup Date (MMDDYY) : 081991
Setup Time (HHMMSS) : 085340
Starting Date (MMDDYY) : 081991
Starting Time (HHMMSS) : 100000
Stopping Date (MMDDYY) : 082491
Stopping Time (HHMMSS) : 140000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 34
Stn ID: Above Golf Course Intake
RM: Chehalis River 72.5

Temp (F,mx/av/mn): 89/70/50
Precip (in): 0
Wind (mph,avg): 4.4
Clouds(0-10): 2-3-2-0
Description: Sunny, warm, clear

Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND mmho/cm	DO %Sat	DO/raw mg/l	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
81991	120000	22.7	7.1	0.117	83	7.2	7.3	7.3	
81991	130000	22.9	7.0	0.117	85	7.4	7.4	7.5	
81991	140000	23.1	7.1	0.117	87	7.5	7.5	7.6	
81991	150000	23.6	7.1	0.116	90	7.7	7.8	7.8	
81991	152500						[7.77}		7.9
81991	160000	23.7	7.1	0.116	91	7.7	7.8	7.8	
81991	170000	23.9	7.1	0.116	92	7.8	7.8	7.9	
81991	180000	24.1	7.1	0.116	92	7.8	7.8	7.9	
81991	190000	24.9	7.2	0.116	93	7.7	7.8	7.8	
81991	200000	24.6	7.1	0.117	95	7.9	8.0	8.0	
81991	210000	24.1	7.1	0.117	91	7.7	7.8	7.8	
81991	220000	23.8	7.1	0.118	89	7.5	7.6	7.6	
81991	230000	23.5	7.1	0.118	87	7.4	7.4	7.5	
82091	0	23.4	7.1	0.119	85	7.2	7.3	7.4	
82091	10000	23.3	7.0	0.119	83	7.1	7.2	7.3	
82091	20000	23.2	7.0	0.120	83	7.1	7.2	7.2	
82091	30000	23.1	7.0	0.120	82	7.0	7.1	7.1	
82091	40000	23.0	7.0	0.121	81	6.9	7.0	7.1	
82091	50000	22.9	7.0	0.121	81	7.0	7.0	7.1	
82091	60000	22.8	7.0	0.122	80	6.9	7.0	7.0	
82091	70000	22.7	7.0	0.122	79	6.9	6.9	7.0	
82091	80000	22.6	7.0	0.122	79	6.9	6.9	7.0	
82091	90000	22.5	7.0	0.122	79	6.9	6.9	7.0	
82091	100000	22.5	7.0	0.122	79	6.9	6.9	7.0	
82091	101000						[6.9]		7.0
82091	110000	22.5	7.0	0.122	80	6.9	7.0	7.0	
82091	120000	22.7	7.0	0.122	81	7.0	7.0	7.1	

Appendix E

Table E.2, page 7

(continued from page 6)

Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND mmho/cm	DO %Sat	DO/raw mg/l	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
82091	130000	23.0	7.0	0.121	83	7.2	7.2	7.3	
82091	140000	23.2	7.1	0.121	86	7.4	7.4	7.5	
82091	150000	23.5	7.1	0.120	88	7.5	7.6	7.7	
82091	160000	23.9	7.1	0.119	90	7.6	7.7	7.8	
82091	170000	24.0	7.1	0.119	91	7.7	7.8	7.8	
82091	180000	24.1	7.1	0.119	91	7.7	7.8	7.8	
82091	190000	25.1	7.2	0.119	96	7.9	8.0	8.0	
82091	200000	24.7	7.2	0.119	95	7.9	8.0	8.0	
82091	210000	24.2	7.1	0.120	92	7.7	7.8	7.8	
82091	220000	23.9	7.1	0.121	90	7.6	7.7	7.7	
82091	230000	23.6	7.1	0.122	87	7.4	7.4	7.5	
82191	0	23.5	7.0	0.122	85	7.2	7.3	7.3	
82191	10000	23.3	7.0	0.123	84	7.1	7.2	7.3	
82191	20000	23.2	7.0	0.124	82	7.1	7.1	7.2	
82191	30000	23.1	7.0	0.125	81	7.0	7.0	7.1	
82191	40000	23.0	7.0	0.125	81	6.9	7.0	7.1	
82191	50000	22.9	7.0	0.126	80	6.9	6.9	7.0	
82191	60000	22.8	7.0	0.125	80	6.9	7.0	7.0	
82191	70000	22.7	7.0	0.125	79	6.8	6.9	6.9	
82191	80000	22.6	7.0	0.125	78	6.8	6.9	6.9	
82191	90000	22.6	7.0	0.125	78	6.8	6.9	6.9	
82191	100000	22.6	7.0	0.125	78	6.8	6.9	6.9	
82191	110000	22.7	7.0	0.125	80	6.9	7.0	7.0	
82191	120000	22.8	7.0	0.124	81	7.0	7.1	7.1	
82191	122000						[7.1]		

Appendix E
Table E.2, page 8

DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch616
Setup Date (MMDDYY) : 061692
Setup Time (HHMMSS) : 083528
Starting Date (MMDDYY) : 061692
Starting Time (HHMMSS) : 110000
Stopping Date (MMDDYY) : 061792
Stopping Time (HHMMSS) : 180000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 36
Stn ID: Below Golf Course Intake
RM: Chehalis River 72.3

Temp (F,mx/av/mn): 72/58/45
Precip (in): 0
Wind (mph,avg): 5.7
Clouds(0-10): 10-7
Description: Cloudy w/ drizzle - partly cloudy,warm

Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND µmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
61692	130000	17.6	7.5	94	94	9.0	8.9	
61692	140000	17.5	7.3	93	95	9.1	9.0	
61692	142000					[9.1]		9.0
61692	150000	17.5	7.2	93	95	9.1	9.0	
61692	160000	17.4	7.2	92	94	9.0	9.0	
61692	170000	17.4	7.2	92	95	9.1	9.0	
61692	180000	17.4	7.2	92	95	9.1	9.0	
61692	190000	17.4	7.2	91	95	9.1	9.0	
61692	200000	17.3	7.2	91	95	9.1	9.0	
61692	210000	17.3	7.2	92	94	9.1	9.0	
61692	220000	17.2	7.2	92	94	9.0	9.0	
61692	230000	17.2	7.2	92	94	9.0	9.0	
61792	0	17.2	7.2	93	93	9.0	8.9	
61792	10000	17.1	7.2	94	93	9.0	8.9	
61792	20000	17.1	7.2	95	93	9.0	8.9	
61792	30000	17.1	7.2	95	93	8.9	8.9	
61792	40000	17.0	7.2	95	92	8.9	8.9	
61792	50000	17.0	7.2	95	92	8.9	8.8	
61792	60000	17.0	7.2	96	92	8.9	8.8	
61792	70000	16.9	7.2	96	92	8.9	8.8	
61792	80000	17.0	7.2	95	92	8.9	8.8	
61792	90000	17.0	7.2	96	92	8.9	8.8	
61792	100000	17.0	7.2	96	92	8.9	8.8	
61792	110000	17.1	7.2	96	92	8.9	8.8	
61792	120000	17.1	7.2	97	92	8.9	8.8	
61792	130000	17.3	7.2	97	93	9.0	8.9	
61792	140000	17.4	7.2	98	93	8.9	8.9	
61792	150000	17.5	7.2	98	93	8.9	8.9	
61792	160000	17.6	7.2	98	93	8.9	8.9	8.9

Appendix E
Table E.2, page 9

DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch706
Setup Date (MMDDYY) : 070692
Setup Time (HHMMSS) : 083501
Starting Date (MMDDYY) : 070692
Starting Time (HHMMSS) : 140000
Stopping Date (MMDDYY) : 070792
Stopping Time (HHMMSS) : 180000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 36
Stn ID: Below Golf Course Intake
RM: Chehalis River 72.3

Temp (F,mx/av/mn): 73/61/48
Precip (in): 0
Wind (mph,avg): 7
Clouds(0-10): 9
Description: Overcast, warm - cloudy,cool

Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND µmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
70692	163000					[7.9]		8.0
70692	170000	19.8	7.2	99	87	7.9	7.9	
70692	180000	19.8	7.2	99	87	7.9	7.9	
70692	190000	19.7	7.2	99	87	7.9	7.9	
70692	200000	19.6	7.2	99	87	7.9	7.9	
70692	210000	19.5	7.2	99	86	7.9	7.9	
70692	220000	19.5	7.2	99	86	7.9	7.8	
70692	230000	19.4	7.2	99	86	7.9	7.9	
70792	0	19.3	7.2	100	86	7.9	7.9	
70792	10000	19.2	7.2	100	86	7.9	7.9	
70792	20000	19.2	7.2	101	86	7.9	7.9	
70792	30000	19.1	7.2	101	86	7.9	7.9	
70792	40000	19.1	7.2	101	86	7.9	7.9	
70792	50000	19.1	7.2	101	86	8.0	7.9	
70792	60000	19.1	7.2	100	87	8.0	8.0	
70792	70000	19.1	7.2	100	87	8.1	8.0	
70792	80000	19.1	7.2	100	88	8.1	8.1	
70792	90000	19.2	7.2	100	88	8.1	8.1	
70792	100000	19.2	7.2	100	89	8.2	8.1	
70792	110000	19.3	7.2	101	89	8.2	8.2	
70792	120000	19.3	7.2	101	89	8.2	8.2	
70792	124100					[8.2]		8.1
70792	130000	19.4	7.2	101	90	8.2	8.2	
70792	140000	19.4	7.2	101	90	8.2	8.2	8.2

Appendix E
Table E.2, page 10

DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch722
Setup Date (MMDDYY) : 072092
Setup Time (HHMMSS) : 084620
Starting Date (MMDDYY) : 072292
Starting Time (HHMMSS) : 080000
Stopping Date (MMDDYY) : 072392
Stopping Time (HHMMSS) : 180000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 34
Stn ID: Below Golf Course Intake
RM: Chehalis River 72.3

Temp (F,mx/av/mn): 72/65/56
Precip (in): 0.01
Wind (mph,avg): 6.4
Clouds(0-10): 10
Description: cloudy, warm

Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND µmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
72292	120000	21.1	7.1	129	69	6.2	6.2	
72292	130000	21.1	7.1	128	70	6.2	6.3	
72292	132800					[6.2]		6.4
72292	140000	21.0	7.0	127	71	6.3	6.4	
72292	150000	21.0	7.0	127	71	6.3	6.4	
72292	160000	21.0	7.0	126	71	6.3	6.4	
72292	170000	20.9	7.0	126	71	6.3	6.4	
72292	180000	20.8	7.0	125	71	6.3	6.4	
72292	190000	20.8	7.0	125	71	6.3	6.4	
72292	200000	20.7	7.0	124	71	6.4	6.4	
72292	210000	20.7	7.0	123	71	6.4	6.4	
72292	220000	20.6	7.0	123	71	6.4	6.4	
72292	230000	20.6	7.0	122	71	6.4	6.4	
72392	0	20.5	7.0	122	71	6.4	6.4	
72392	10000	20.5	7.0	122	71	6.4	6.4	
72392	20000	20.4	7.0	122	71	6.4	6.4	
72392	30000	20.4	7.0	122	70	6.4	6.4	
72392	40000	20.3	7.0	123	70	6.3	6.4	
72392	50000	20.2	7.0	123	70	6.3	6.4	
72392	60000	20.2	7.0	124	70	6.3	6.4	
72392	70000	20.1	7.0	125	69	6.3	6.3	
72392	80000	20.1	7.0	127	69	6.3	6.3	
72392	90000	20.1	7.0	128	70	6.3	6.4	
72392	100000	20.1	7.0	129	70	6.4	6.4	
72392	110000	20.1	7.0	129	72	6.5	6.6	
72392	120000	20.1	7.0	129	72	6.5	6.6	
72392	130000	20.1	7.0	129	73	6.6	6.7	
72392	135700					[6.7]		6.7
72392	140000	20.0	7.0	128	74	6.7	6.7	

Appendix E
Table E.2, page 11

DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch803
Setup Date (MMDDYY) : 080392
Setup Time (HHMMSS) : 081001
Starting Date (MMDDYY) : 080392
Starting Time (HHMMSS) : 110000
Stopping Date (MMDDYY) : 080492
Stopping Time (HHMMSS) : 190000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 36
Stn ID: Below Golf Course Intake
RM: Chehalis River 72.3

Temp (F,mx/av/mn): 84/63/51
Precip (in): 0
Wind (mph,avg): 6.5
Clouds(0-10): 0-10
Description: warm, clear - cool, cloudy

Date MMDDYY	Time HHMMSS	TEMP ˚C	PH s.u.	COND µmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
80392	125500					[7.5]		7.3
80392	130000	23.2	7.1	134	89	7.6	7.3	
80392	140000	23.4	7.1	133	90	7.6	7.4	
80392	150000	23.7	7.1	133	90	7.7	7.4	
80392	160000	23.9	7.1	133	92	7.7	7.5	
80392	170000	23.5	7.1	134	95	8.1	7.8	
80392	180000	23.6	7.1	134	98	8.3	8.1	
80392	190000	24.0	7.2	134	99	8.3	8.1	
80392	200000	24.0	7.2	134	101	8.5	8.3	
80392	210000	24.0	7.2	134	99	8.4	8.1	
80392	220000	23.7	7.2	133	98	8.3	8.0	
80392	230000	23.4	7.2	132	96	8.1	7.9	
80492	0	23.2	7.1	132	94	8.0	7.7	
80492	10000	23.1	7.1	131	92	7.9	7.6	
80492	20000	22.9	7.1	131	90	7.7	7.5	
80492	30000	22.8	7.1	131	88	7.6	7.3	
80492	40000	22.7	7.1	131	87	7.5	7.2	
80492	50000	22.6	7.0	131	85	7.3	7.1	
80492	60000	22.5	7.0	130	83	7.2	6.9	
80492	70000	22.4	7.0	130	82	7.1	6.9	
80492	80000	22.4	7.0	129	81	7.0	6.8	
80492	90000	22.3	7.0	129	81	7.0	6.8	
80492	100000	22.2	7.0	128	80	7.0	6.7	
80492	110000	22.2	7.0	128	80	7.0	6.7	
80492	120000	22.2	7.0	128	80	7.0	6.7	
80492	130000	22.1	7.0	128	81	7.1	6.8	
80492	140000	22.2	7.0	128	82	7.1	6.9	6.9
80492	150000	22.2	7.0	128	83	7.2	6.9	

Appendix E
Table E.2, page 12

DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch0820
Setup Date (MMDDYY) : 081792
Setup Time (HHMMSS) : 083756
Starting Date (MMDDYY) : 082092
Starting Time (HHMMSS) : 080000
Stopping Date (MMDDYY) : 082192
Stopping Time (HHMMSS) : 120000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 35
Stn ID: Below Golf Course Intake
RM: Chehalis River 72.3

Temp (F,mx/av/mn): 79/61/44
Precip (in): 0
Wind (mph,avg): 6.9
Clouds(0-10): 1-8
Description: warm, clear - mild, cloudy

Date MMDDYY	Time HHMMSS	TEMP ˚C	PH s.u.	COND µmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
82092	130000	22.7	7.0	135	84	7.3	7.6	
82092	134500					[7.4]		7.8
82092	140000	22.9	7.0	135	86	7.4	7.8	
82092	150000	23.1	7.0	136	87	7.4	7.8	
82092	160000	23.2	7.0	136	87	7.5	7.8	
82092	170000	23.4	7.0	136	94	8.0	8.3	
82092	180000	23.5	7.1	139	95	8.1	8.5	
82092	190000	23.4	7.2	139	101	8.6	8.9	
82092	200000	23.2	7.2	139	98	8.4	8.7	
82092	210000	22.9	7.1	140	94	8.0	8.4	
82092	220000	22.8	7.1	141	91	7.8	8.2	
82092	230000	22.7	7.0	141	88	7.6	8.0	
82192	0	22.6	7.0	142	86	7.4	7.8	
82192	10000	22.5	7.0	142	85	7.3	7.7	
82192	20000	22.4	7.0	143	83	7.2	7.6	
82192	30000	22.3	7.0	143	81	7.0	7.4	
82192	40000	22.1	7.0	143	79	6.9	7.3	
82192	50000	22.0	7.0	143	78	6.8	7.1	
82192	60000	22.0	7.0	143	77	6.7	7.1	
82192	70000	21.8	6.9	144	75	6.6	6.9	
82192	80000	21.7	6.9	144	74	6.5	6.9	
82192	90000	21.7	6.9	144	75	6.6	6.9	
82192	100000	21.7	6.9	143	76	6.7	7.0	
82192	110000	21.7	6.9	143	76	6.7	7.1	
82192	120000	21.7	6.9	142	77	6.7	7.1	7.1

Appendix E
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DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch0908
Setup Date (MMDDYY) : 090892
Setup Time (HHMMSS) : 103732
Starting Date (MMDDYY) : 090892
Starting Time (HHMMSS) : 110000
Stopping Date (MMDDYY) : 090992
Stopping Time (HHMMSS) : 160000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 35
Stn ID: Below Golf Course Intake
RM: Chehalis River 72.3

Temp (F,mx/av/mn): 76/58/38
Precip (in): 0
Wind (mph,avg): 7
Clouds(0-10): 1-4-1
Description: Rain prev nt - Ptly cloudy, mild - foggy, cool - sunny after 915

Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND µmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
90892	140000	17.5	7.2	123	87	8.3	8.0	8.0
90892	145300					[8.4]		8.0
90892	150000	17.8	7.1	123	89	8.5	8.2	
90892	160000	17.8	7.0	123	90	8.5	8.3	
90892	170000	17.7	7.0	123	89	8.5	8.2	
90892	180000	18.1	7.1	125	93	8.8	8.5	
90892	190000	17.9	7.1	127	93	8.8	8.6	
90892	200000	17.7	7.1	126	93	8.8	8.6	
90892	210000	17.5	7.1	127	91	8.7	8.4	
90892	220000	17.3	7.1	127	88	8.5	8.2	
90892	230000	17.2	7.1	128	87	8.4	8.1	
90992	0	17.1	7.1	128	87	8.4	8.1	
90992	10000	17.0	7.0	129	86	8.3	8.0	
90992	20000	16.8	7.0	129	85	8.2	7.9	
90992	30000	16.7	7.0	129	84	8.1	7.9	
90992	40000	16.5	7.0	130	83	8.1	7.8	
90992	50000	16.4	7.0	129	83	8.1	7.8	
90992	60000	16.3	7.0	129	82	8.1	7.8	
90992	70000	16.2	7.0	128	82	8.1	7.8	
90992	80000	16.1	7.0	128	82	8.1	7.8	
90992	90000	16.1	7.0	128	82	8.1	7.8	
90992	100000	16.2	7.0	127	83	8.1	7.9	
90992	110000	16.3	7.0	128	84	8.2	7.9	
90992	120000	16.4	7.0	128	84	8.2	8.0	
90992	130000	16.6	7.0	128	85	8.3	8.0	
90992	140000	16.7	7.0	129	85	8.3	8.0	
90992	150000	16.9	7.0	129	86	8.4	8.1	
90992	150800					[8.4]		8.2

Appendix E
Table E.2, page 14

DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/S2 = DO measurement by S2 meter

Log File Name : ch70
Setup Date (MMDDYY) : 081991
Setup Time (HHMMSS) : 085935
Starting Date (MMDDYY) : 081991
Starting Time (HHMMSS) : 100000
Stopping Date (MMDDYY) : 082491
Stopping Time (HHMMSS) : 140000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: DS 35
Stn ID: North of Airport
RM: Chehalis River 70.7

Temp (F,mx/av/mn): 86/69/51
Precip (in): 0
Wind (mph,avg): 4.2
Clouds(0-10): 2-0-1
Description: Sunny, warm, clear

No Winkler Field verification data available

Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND mmho/cm	DO %Sat	DO/mtr mg/l	DO/S2 mg/l
82091	140000	23.2	7.0	0.133	89	7.7	
82091	150000	23.4	7.0	0.133	92	7.9	
82091	152000					[7.9	7.9
82091	160000	23.4	7.0	0.133	92	7.9	
82091	170000	23.5	7.1	0.133	96	8.3	
82091	180000	23.7	7.1	0.133	94	8.1	
82091	190000	23.5	7.0	0.134	93	8.0	
82091	200000	23.5	7.0	0.134	90	7.8	
82091	210000	23.5	7.0	0.134	89	7.6	
82091	220000	23.5	7.0	0.134	88	7.6	
82091	230000	23.8	7.1	0.135	95	8.1	
82191	0	23.6	7.1	0.135	91	7.9	
82191	10000	23.4	7.0	0.135	88	7.6	
82191	20000	23.3	7.0	0.136	86	7.5	
82191	30000	23.2	7.0	0.136	85	7.3	
82191	40000	23.1	7.0	0.136	84	7.3	
82191	50000	23.1	7.0	0.136	83	7.2	
82191	60000	23.0	7.0	0.137	82	7.1	
82191	70000	22.9	7.0	0.137	81	7.1	
82191	80000	22.9	7.0	0.137	81	7.0	
82191	90000	22.9	7.0	0.137	80	7.0	
82191	100000	22.9	7.0	0.137	82	7.1	
82191	110000	23.0	7.0	0.138	84	7.3	
82191	120000	23.5	7.0	0.138	87	7.5	

Appendix E
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DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch36	Unit #:	36	
Setup Date (MMDDYY) : 100991	Stn ID:	Below Overhanging Tree	
Setup Time (HHMMSS) : 152937	RM:	Chehalis River 69.6	
Starting Date (MMDDYY) : 101091			
Starting Time (HHMMSS) : 080000	Temp (F,mx/av/mn):		86/57/35
Stopping Date (MMDDYY) : 101491	Precip (in):		0
Stopping Time (HHMMSS) : 170000	Wind (mph,avg):		3.9
Interval (HHMMSS) : 010000	Clouds(0-10):		0-2-1-7-4-2-0
Warmup : Enable	Description:		n/a

Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND mmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
101091	131800					[1.4]		2.1
101091	140000	14.4	6.9	0.114	14	1.5	2.1	
101091	150000	14.5	6.8	0.114	15	1.7	2.2	
101091	160000	14.5	6.8	0.114	18	2.0	2.5	
101091	170000	14.4	6.8	0.114	18	1.9	2.5	
101091	180000	14.5	6.8	0.115	18	2.0	2.5	
101091	190000	14.4	6.8	0.115	16	1.7	2.3	
101091	200000	14.7	6.8	0.115	18	1.9	2.5	
101091	210000	14.6	6.8	0.114	19	2.1	2.6	
101091	220000	14.7	6.8	0.114	18	2.0	2.5	
101091	230000	14.8	6.8	0.114	20	2.2	2.7	
101191	0	14.8	6.8	0.114	21	2.3	2.8	
101191	10000	14.7	6.8	0.114	23	2.5	3.0	
101191	20000	14.6	6.8	0.114	22	2.5	3.0	
101191	30000	14.5	6.8	0.114	23	2.5	3.0	
101191	40000	14.4	6.8	0.114	26	2.9	3.4	
101191	50000	14.2	6.8	0.114	26	2.9	3.4	
101191	60000	14.2	6.8	0.114	24	2.6	3.2	
101191	70000	14.1	6.8	0.114	23	2.5	3.0	
101191	80000	14.0	6.8	0.114	21	2.3	2.9	
101191	90000	14.0	6.8	0.115	19	2.1	2.7	
101191	100000	14.0	6.7	0.115	19	2.1	2.6	
101191	110000	14.0	6.7	0.115	20	2.2	2.7	
101191	120000	14.0	6.7	0.115	20	2.3	2.8	
101191	130000	14.0	6.7	0.115	22	2.4	3.0	
101191	140000	14.1	6.7	0.115	24	2.7	3.2	

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(continued from page 15)

Date MMDDYY	Time HHMMSS	TEMP ˚C	PH s.u.	COND mmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
101191	150000	14.2	6.7	0.115	25	2.8	3.3	
101191	160000	14.3	6.8	0.115	26	2.9	3.4	
101191	170000	14.4	6.8	0.116	27	2.9	3.5	
101191	180000	14.3	6.8	0.116	26	2.9	3.4	
101191	190000	14.3	6.8	0.116	25	2.8	3.3	
101191	200000	14.4	6.8	0.116	26	2.9	3.4	
101191	210000	14.2	6.8	0.116	26	2.9	3.4	
101191	220000	14.2	6.8	0.115	27	2.9	3.5	
101191	230000	14.5	6.8	0.115	28	3.1	3.6	
101291	0	14.2	6.8	0.115	27	3.0	3.5	
101291	10000	14.2	6.8	0.115	27	3.0	3.5	
101291	20000	14.3	6.8	0.115	28	3.2	3.7	
101291	30000	14.2	6.8	0.115	28	3.1	3.6	
101291	40000	14.4	6.8	0.115	33	3.6	4.1	
101291	50000	14.3	6.8	0.115	34	3.8	4.3	
101291	60000	14.2	6.8	0.115	33	3.6	4.1	
101291	70000	14.2	6.8	0.115	32	3.6	4.1	
101291	80000	14.1	6.8	0.115	32	3.6	4.1	
101291	90000	14.1	6.8	0.115	32	3.5	4.0	
101291	100000	14.1	6.8	0.115	31	3.4	4.0	
101291	110000	14.1	6.8	0.115	31	3.4	3.9	
101291	120000	14.1	6.8	0.115	31	3.4	3.9	
101291	130000	14.1	6.8	0.115	30	3.3	3.8	
101291	140000	14.2	6.8	0.115	31	3.5	4.0	
101291	150000	14.5	6.8	0.116	31	3.5	4.0	
101291	160000	14.5	6.8	0.115	31	3.4	3.9	
101291	170000	14.4	6.8	0.116	33	3.6	4.1	
101291	180000	14.3	6.8	0.116	31	3.4	4.0	
101291	190000	14.3	6.8	0.116	31	3.4	3.9	
101291	200000	14.3	6.8	0.117	30	3.4	3.9	
101291	210000	14.3	6.8	0.117	30	3.3	3.9	
101291	220000	14.3	6.8	0.117	31	3.4	3.9	
101291	230000	14.5	6.8	0.118	32	3.6	4.1	
101391	0	14.5	6.8	0.117	31	3.5	4.0	
101391	10000	14.6	6.8	0.117	35	3.8	4.3	
101391	20000	14.4	6.8	0.117	36	4.0	4.5	
101391	30000	14.3	6.8	0.117	36	4.0	4.6	
101391	40000	14.2	6.8	0.117	35	3.9	4.4	
101391	50000	14.1	6.8	0.117	35	3.9	4.4	
101391	60000	14.0	6.8	0.118	34	3.8	4.3	
101391	70000	14.0	6.8	0.118	32	3.6	4.1	
101391	80000	13.9	6.8	0.118	32	3.6	4.1	
101391	90000	13.9	6.8	0.118	30	3.3	3.8	

Appendix E
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(continued from page 16)

Date MMDDYY	Time HHMMSS	TEMP ˚C	PH s.u.	COND mmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
101391	100000	13.9	6.8	0.118	29	3.3	3.8	
101391	110000	13.9	6.8	0.118	30	3.3	3.8	
101391	120000	13.9	6.8	0.119	30	3.3	3.8	
101391	130000	14.0	6.8	0.119	30	3.4	3.9	
101391	140000	14.1	6.8	0.119	32	3.5	4.1	
101391	150000	14.0	6.8	0.119	32	3.6	4.1	
101391	160000	14.1	6.8	0.119	32	3.6	4.1	
101391	170000	14.2	6.8	0.119	33	3.7	4.2	
101391	180000	14.2	6.8	0.120	32	3.6	4.1	
101391	190000	14.1	6.8	0.120	32	3.5	4.0	
101391	200000	14.2	6.8	0.120	32	3.6	4.1	
101391	210000	14.2	6.8	0.120	32	3.6	4.1	
101391	220000	14.3	6.8	0.120	33	3.7	4.2	
101391	230000	14.2	6.8	0.120	35	3.9	4.4	
101491	0	14.2	6.8	0.120	35	3.9	4.5	
101491	10000	14.1	6.8	0.120	35	3.9	4.4	
101491	20000	14.1	6.8	0.120	34	3.8	4.3	
101491	30000	14.0	6.8	0.121	33	3.7	4.2	
101491	40000	14.0	6.8	0.121	33	3.6	4.2	
101491	50000	13.9	6.8	0.121	32	3.5	4.1	
101491	60000	13.9	6.8	0.121	32	3.5	4.1	
101491	70000	13.9	6.8	0.121	31	3.5	4.0	
101491	80000	13.8	6.8	0.121	30	3.3	3.9	
101491	90000	13.8	6.8	0.121	30	3.3	3.8	
101491	100000	13.8	6.8	0.121	30	3.3	3.8	
101491	110000	13.9	6.8	0.121	30	3.3	3.9	
101491	120000	13.9	6.8	0.121	30	3.4	3.9	
101491	130000	13.9	6.8	0.121	31	3.4	3.9	
101491	132500					[3.4]		3.7
101491	140000	13.9	6.8	0.121	31	3.5	4.0	
101491	150000	14.1	6.8	0.120	32	3.5	4.1	4.1

Appendix E
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DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch5792
Setup Date (MMDDYY) : 050792
Setup Time (HHMMSS) : 093849
Starting Date (MMDDYY) : 050792
Starting Time (HHMMSS) : 100000
Stopping Date (MMDDYY) : 050892
Stopping Time (HHMMSS) : 190000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 36
Stn ID: Below Overhanging Tree
RM: Chehalis River 69.6

Temp (F,mx/av/mn): 75/56/44
Precip (in): 0
Wind (mph,avg): 10
Clouds(0-10): 5-10
Description: Sunny, warm - rainy,cloudy,cool

Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND mmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
50792	125000					[9.0]		8.9
50792	130000	17.7	7.1	0.067	95	9.0	8.9	
50792	140000	17.8	7.0	0.067	95	9.0	8.9	
50792	150000	17.9	7.0	0.067	95	9.0	8.9	
50792	160000	18.0	7.0	0.067	95	9.0	8.9	
50792	170000	17.9	7.0	0.067	95	8.9	8.8	
50792	180000	17.9	7.0	0.067	95	8.9	8.8	
50792	190000	17.8	7.0	0.067	94	8.9	8.8	
50792	200000	17.7	7.0	0.067	94	8.9	8.8	
50792	210000	17.6	7.0	0.067	94	8.9	8.8	
50792	220000	17.5	7.0	0.068	93	8.9	8.7	
50792	230000	17.4	7.0	0.068	93	8.8	8.7	
50892	0	17.3	7.0	0.068	92	8.8	8.7	
50892	10000	17.2	7.0	0.068	92	8.8	8.7	
50892	20000	17.1	7.0	0.068	92	8.8	8.7	
50892	30000	17.1	7.0	0.068	92	8.8	8.7	
50892	40000	17.0	7.0	0.068	92	8.8	8.7	
50892	50000	17.0	7.0	0.068	92	8.9	8.8	
50892	60000	17.0	7.0	0.068	92	8.9	8.8	
50892	70000	17.0	7.0	0.068	93	8.9	8.8	
50892	80000	16.9	7.0	0.069	93	8.9	8.8	
50892	90000	16.9	7.0	0.069	93	8.9	8.8	
50892	100000	16.9	7.0	0.069	93	8.9	8.8	
50892	110000	16.9	7.0	0.069	93	8.9	8.8	
50892	111800					[8.9]		8.9

Appendix E
Table E.2, page 19

DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch528
Setup Date (MMDDYY) : 052792
Setup Time (HHMMSS) : 153241
Starting Date (MMDDYY) : 052892
Starting Time (HHMMSS) : 090000
Stopping Date (MMDDYY) : 052992
Stopping Time (HHMMSS) : 120000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit#: 34
Stn ID: Below Overhanging Tree
RM: Chehalis River 69.6

Temp (F,mx/av/mn): 67/59/50
Precip (in): 0.01
Wind (mph,avg): 5.3
Clouds(0-10): 9-1-8
Description: Overcast, mild

pH Reference Electrode Cap was not removed

Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND µmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
52892	100000	18.4		88	89	8.4	8.1	
52892	110000	18.4		88	88	8.3	8.1	
52892	120000	18.4		88	89	8.4	8.1	
52892	122500					[8.4]		8.1
52892	130000	18.3		89	88	8.4	8.1	
52892	140000	18.3		89	88	8.4	8.1	
52892	150000	18.3		89	89	8.4	8.1	
52892	160000	18.3		90	88	8.4	8.1	
52892	170000	18.2		90	88	8.4	8.1	
52892	180000	18.2		90	88	8.4	8.1	
52892	190000	18.2		90	88	8.4	8.1	
52892	200000	18.1		90	88	8.4	8.1	
52892	210000	18.1		90	88	8.4	8.1	
52892	220000	18.1		90	88	8.4	8.2	
52892	230000	18.0		90	88	8.4	8.2	
52992	0	18.0		90	88	8.4	8.2	
52992	10000	18.0		90	88	8.4	8.2	
52992	20000	17.9		90	88	8.4	8.2	
52992	30000	17.8		90	88	8.4	8.1	
52992	40000	17.8		89	88	8.4	8.2	
52992	50000	17.7		89	88	8.4	8.2	
52992	60000	17.7		89	88	8.4	8.2	
52992	70000	17.6		89	88	8.4	8.2	
52992	80000	17.6		89	88	8.4	8.2	
52992	90000	17.6		88	88	8.5	8.2	
52992	100000	17.6		88	88	8.5	8.2	
52992	102500					[8.4]		8.3

Appendix E
Table E.2, page 20

DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch616
Setup Date (MMDDYY) : 061692
Setup Time (HHMMSS) : 083216
Starting Date (MMDDYY) : 061692
Starting Time (HHMMSS) : 110000
Stopping Date (MMDDYY) : 061792
Stopping Time (HHMMSS) : 180000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 35
Stn ID: Below Overhanging Tree
RM: Chehalis River 69.6

Temp (F,mx/av/mn): 72/58/45
Precip (in): 0
Wind (mph,avg): 5.7
Clouds(0-10): 10-7
Description: Cloudy w/ drizzle - partly cloudy,warm

Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND µmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
61692	130000	17.3	7.1	97	95	9.1	8.9	
61692	140000	17.3	7.1	97	95	9.1	8.9	
61692	150000	17.4	7.1	96	95	9.1	8.9	8.7
61692	160000	17.4	7.1	96	95	9.1	8.9	
61692	170000	17.4	7.1	96	95	9.1	8.9	
61692	180000	17.4	7.1	96	95	9.1	8.9	
61692	190000	17.4	7.1	96	95	9.1	8.9	
61692	200000	17.4	7.1	96	95	9.1	8.9	
61692	210000	17.3	7.1	96	95	9.1	8.9	
61692	220000	17.3	7.1	96	94	9.1	8.9	
61692	230000	17.2	7.1	96	94	9.1	8.9	
61792	0	17.2	7.1	96	94	9.1	8.9	
61792	10000	17.2	7.1	96	94	9.1	8.9	
61792	20000	17.1	7.1	96	94	9.0	8.8	
61792	30000	17.1	7.1	96	94	9.1	8.9	
61792	40000	17.0	7.1	96	94	9.0	8.8	
61792	50000	17.0	7.1	97	94	9.0	8.8	
61792	60000	17.0	7.1	97	94	9.0	8.8	
61792	70000	17.0	7.1	97	94	9.0	8.8	
61792	80000	17.0	7.1	97	94	9.0	8.8	
61792	90000	17.1	7.0	98	94	9.0	8.8	
61792	100000	17.2	7.0	98	94	9.0	8.8	
61792	110000	17.2	7.0	98	94	9.0	8.8	
61792	120000	17.4	7.1	99	94	9.0	8.8	
61792	130000	17.6	7.1	99	94	9.0	8.8	
61792	140000	17.4	7.1	99	93	8.9	8.7	
61792	150000	17.6	7.1	99	94	8.9	8.7	
61792	153000					[8.9]		9.1
61792	160000	17.7	7.1	99	94	8.9	8.7	

Appendix E
Table E.2, page 21

DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch706
Setup Date (MMDDYY) : 070692
Setup Time (HHMMSS) : 082737
Starting Date (MMDDYY) : 070692
Starting Time (HHMMSS) : 140000
Stopping Date (MMDDYY) : 070792
Stopping Time (HHMMSS) : 180000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 34
Stn ID: Below Overhanging Tree
RM: Chehalis River 69.6

Temp (F,mx/av/mn): 73/61/48
Precip (in): 0
Wind (mph,avg): 7
Clouds(0-10): 9
Description: Overcast, warm - cloudy,cool

Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND µmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
70692	160500					[6.5]		6.4
70692	170000	20.8	7.0	111	71	6.4	6.3	
70692	180000	20.6	6.9	111	69	6.2	6.1	
70692	190000	20.7	6.9	111	70	6.3	6.2	
70692	200000	20.6	6.9	111	69	6.2	6.1	
70692	210000	20.5	6.9	111	68	6.2	6.1	
70692	220000	20.4	6.9	111	68	6.2	6.1	
70692	230000	20.3	6.9	111	69	6.2	6.1	
70792	0	20.2	6.9	111	69	6.2	6.1	
70792	10000	20.1	6.9	110	69	6.3	6.2	
70792	20000	20.0	6.9	109	69	6.3	6.2	
70792	30000	19.9	6.9	108	70	6.3	6.2	
70792	40000	19.9	6.9	108	70	6.4	6.3	
70792	50000	19.8	6.9	107	70	6.4	6.3	
70792	60000	19.7	6.9	107	70	6.4	6.3	
70792	70000	19.7	6.9	106	71	6.5	6.4	
70792	80000	19.7	6.9	105	72	6.6	6.5	
70792	90000	19.6	6.9	104	72	6.6	6.5	
70792	100000	19.6	6.9	104	73	6.7	6.6	
70792	110000	19.6	6.9	103	74	6.7	6.6	
70792	114700					[6.8]		6.7
70792	120000	19.7	6.9	103	74	6.8	6.7	
70792	130000	19.7	6.9	102	75	6.9	6.8	
70792	140000	19.7	6.9	102	75	6.9	6.8	

Appendix E
Table E.2, page 22

DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch722
Setup Date (MMDDYY) : 072092
Setup Time (HHMMSS) : 084254
Starting Date (MMDDYY) : 072292
Starting Time (HHMMSS) : 080000
Stopping Date (MMDDYY) : 072392
Stopping Time (HHMMSS) : 180000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 35
Stn ID: Below Overhanging Tree
RM: Chehalis River 69.6

Temp (F,mx/av/mn): 72/65/56
Precip (in): 0.01
Wind (mph,avg): 6.4
Clouds(0-10): 10
Description: cloudy, warm

Date MMDDYY	Time HHMMSS	TEMP ˚C	PH s.u.	COND µmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
72292	110000	22.2	6.9	120	65	5.7	5.6	
72292	120000	22.2	6.8	121	65	5.6	5.6	
72292	130000	22.2	6.8	122	65	5.6	5.6	
72292	140000	22.2	6.8	123	64	5.6	5.5	
72292	150000	22.2	6.8	123	63	5.5	5.5	
72292	150500					[5.5]		5.5
72292	160000	22.2	6.8	123	64	5.6	5.5	
72292	170000	22.1	6.8	124	64	5.5	5.5	
72292	180000	22.1	6.9	125	64	5.6	5.5	
72292	190000	22.1	6.8	124	63	5.5	5.5	
72292	200000	22.0	6.8	125	63	5.5	5.4	
72292	210000	22.0	6.8	126	62	5.4	5.4	
72292	220000	21.9	6.8	127	62	5.4	5.4	
72292	230000	21.9	6.8	128	62	5.4	5.3	
72392	0	21.8	6.9	128	61	5.4	5.3	
72392	10000	21.8	6.8	128	61	5.3	5.3	
72392	20000	21.7	6.8	128	61	5.3	5.3	
72392	30000	21.7	6.8	128	61	5.3	5.3	
72392	40000	21.6	6.9	129	60	5.3	5.3	
72392	50000	21.6	6.8	129	60	5.3	5.2	
72392	60000	21.5	6.8	129	60	5.3	5.2	
72392	70000	21.5	6.8	129	60	5.3	5.2	
72392	80000	21.4	6.8	129	59	5.2	5.2	
72392	90000	21.4	6.8	129	59	5.3	5.2	
72392	100000	21.4	6.8	130	59	5.2	5.2	
72392	110000	21.4	6.8	130	60	5.3	5.2	
72392	120000	21.3	6.8	130	59	5.3	5.2	
72392	130000	21.3	6.8	130	59	5.2	5.2	
72392	133000					[5.3]		5.2
72392	140000	21.3	6.8	131	60	5.3	5.2	

Appendix E
Table E.2, page 23

DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch803
Setup Date (MMDDYY) : 080392
Setup Time (HHMMSS) : 080228
Starting Date (MMDDYY) : 080392
Starting Time (HHMMSS) : 110000
Stopping Date (MMDDYY) : 080492
Stopping Time (HHMMSS) : 190000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 35
Stn ID: Below Overhanging Tree
RM: Chehalis River 69.6

Temp (F,mx/av/mn): 84/63/51
Precip (in): 0
Wind (mph,avg): 6.5
Clouds(0-10): 0-10
Description: warm, clear - cool, cloudy

Date MMDDYY	Time HHMMSS	TEMP ˚C	PH s.u.	COND µmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
80392	130000	23.2	7.0	123	100	8.5	8.5	
80392	133800					[8.7]		8.7
80392	140000	23.3	7.1	122	103	8.8	8.8	
80392	150000	23.4	7.1	122	106	9.0	9.0	
80392	160000	23.4	7.1	122	101	8.6	8.6	
80392	170000	23.5	7.1	123	109	9.3	9.2	
80392	180000	23.4	7.1	122	109	9.3	9.3	
80392	190000	23.4	7.1	122	107	9.1	9.1	
80392	200000	23.5	7.1	122	104	8.8	8.8	
80392	210000	23.7	7.1	122	102	8.7	8.6	
80392	220000	23.6	7.1	122	102	8.6	8.6	
80392	230000	23.5	7.1	122	101	8.5	8.5	
80492	0	23.6	7.1	122	103	8.8	8.7	
80492	10000	23.7	7.1	122	104	8.8	8.8	
80492	20000	23.8	7.1	122	101	8.6	8.5	
80492	30000	23.7	7.1	122	100	8.5	8.4	
80492	40000	23.6	7.1	122	99	8.4	8.4	
80492	50000	23.5	7.1	122	99	8.4	8.4	
80492	60000	23.5	7.0	122	99	8.4	8.3	
80492	70000	23.5	7.0	123	98	8.3	8.3	
80492	80000	23.4	7.0	123	97	8.3	8.2	
80492	90000	23.4	7.1	123	97	8.3	8.3	
80492	100000	23.4	7.0	123	98	8.3	8.3	
80492	110000	23.3	7.1	123	98	8.3	8.3	
80492	120000	23.3	7.0	123	97	8.3	8.3	8.3
80492	130000	23.3	7.0	123	98	8.4	8.4	
80492	140000	23.3	7.0	123	101	8.6	8.6	
80492	150000	23.3	7.0	123	101	8.6	8.6	

Appendix E
Table E.2, page 24

DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch0820
Setup Date (MMDDYY) : 081792
Setup Time (HHMMSS) : 084401
Starting Date (MMDDYY) : 082092
Starting Time (HHMMSS) : 080000
Stopping Date (MMDDYY) : 082192
Stopping Time (HHMMSS) : 120000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 36
Stn ID: Below Overhanging Tree
RM: Chehalis River 69.6

Temp (F,mx/av/mn): 79/61/44
Precip (in): 0
Wind (mph,avg): 6.9
Clouds(0-10): 1-8
Description: warm, clear - mild, cloudy

Date MMDDYY	Time HHMMSS	TEMP ˚C	PH s.u.	COND µmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
82092	130000	23.3	7.0	131	90	7.6	8.2	
82092	140000	23.4	7.0	131	92	7.9	8.4	
82092	143000					[7.9]		8.6
82092	150000	23.5	7.0	131	92	7.9	8.4	
82092	160000	23.5	7.0	131	95	8.1	8.6	
82092	170000	23.5	7.1	131	97	8.3	8.8	
82092	180000	23.6	7.1	131	100	8.5	9.0	
82092	190000	23.6	7.1	131	96	8.2	8.7	
82092	200000	23.5	7.0	131	94	8.0	8.5	
82092	210000	23.5	7.2	131	96	8.2	8.7	
82092	220000	23.3	7.2	131	100	8.5	9.1	
82092	230000	23.1	7.0	131	90	7.7	8.2	
82192	0	23.1	7.0	131	87	7.5	8.0	
82192	10000	23.0	7.0	131	85	7.3	7.8	
82192	20000	23.0	6.9	131	83	7.1	7.6	
82192	30000	22.9	6.9	131	82	7.0	7.5	
82192	40000	22.9	6.9	131	80	6.9	7.4	
82192	50000	22.8	6.9	131	79	6.8	7.3	
82192	60000	22.8	6.9	130	78	6.7	7.2	
82192	70000	22.7	6.9	130	77	6.6	7.2	
82192	80000	22.7	6.9	130	77	6.7	7.2	
82192	90000	22.6	6.9	130	78	6.7	7.2	
82192	100000	22.7	6.9	130	78	6.7	7.3	
82192	110000	22.7	6.9	130	79	6.8	7.3	
82192	113100					[6.8]		7.2
82192	120000	22.7	6.9	130	80	6.9	7.4	

Appendix E
Table E.2, page 25

DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch0908
Setup Date (MMDDYY) : 090892
Setup Time (HHMMSS) : 105431
Starting Date (MMDDYY) : 090892
Starting Time (HHMMSS) : 110000
Stopping Date (MMDDYY) : 090992
Stopping Time (HHMMSS) : 160000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 34
Stn ID: Below Overhanging Tree
RM: Chehalis River 69.6

Temp (F,mx/av/mn): 76/58/38
Precip (in): 0
Wind (mph,avg): 7
Clouds(0-10): 1-4-1
Description: Rain prev nt - Ptly cloudy, mild - foggy, cool - sunny after 915

Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND µmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
90892	230000	18.3	6.7	149	68	6.4	6.2	
90992	0	18.2	6.7	149	67	6.3	6.1	
90992	10000	18.2	6.7	149	67	6.3	6.1	
90992	20000	18.1	6.7	149	66	6.2	6.0	
90992	30000	18.1	6.7	149	65	6.2	5.9	
90992	40000	18.1	6.7	149	65	6.1	5.9	
90992	50000	18.0	6.7	149	65	6.1	5.9	
90992	60000	18.0	6.7	149	65	6.2	5.9	
90992	70000	18.0	6.7	149	64	6.1	5.8	
90992	80000	17.9	6.7	149	65	6.1	5.9	
90992	90000	17.9	6.7	149	65	6.2	5.9	
90992	100000	17.9	6.7	150	66	6.2	6.0	
90992	110000	17.9	6.7	150	66	6.3	6.0	
90992	120000	18.0	6.7	152	66	6.3	6.1	
90992	130000	17.9	6.7	153	67	6.3	6.1	
90992	140000	18.0	6.7	153	67	6.3	6.1	
90992	141200					[6.3]		6.1
90992	150000	18.2	6.7	154	68	6.4	6.2	
90992	160000	18.0	6.7	154	68	6.5	6.2	

Appendix E
Table E.2, page 26

DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch686
Setup Date (MMDDYY) : 081991
Setup Time (HHMMSS) : 085935
Starting Date (MMDDYY) : 081991
Starting Time (HHMMSS) : 100000
Stopping Date (MMDDYY) : 082491
Stopping Time (HHMMSS) : 140000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: DS 35
Stn ID: Above Midway Meats
RM: Chehalis River 68.6

Temp (F,mx/av/mn): 88/65/47
Precip (in): 0
Wind (mph,avg): 6.9
Clouds(0-10): 1-3-9
Description: Sunny, warm, clear

Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND mmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
82191	140000	23.6	7.2	0.137	109	9.3	9.2	
82191	150000	23.7	7.4	0.137	116	9.9	9.8	
82191	150700					[10.0]		
82191	160000	23.8	7.6	0.136	125	10.7	10.6	
82191	170000	23.9	7.5	0.137	118	10.0	9.9	
82191	180000	23.8	7.6	0.136	120	10.3	10.2	
82191	190000	23.9	7.4	0.138	119	10.2	10.1	
82191	200000	23.9	7.3	0.138	115	9.8	9.7	
82191	210000	24.7	7.5	0.137	124	10.4	10.3	
82191	220000	24.7	7.6	0.137	123	10.4	10.3	
82191	230000	24.5	7.4	0.137	119	10.1	10.0	
82291	0	24.3	7.3	0.136	111	9.4	9.3	
82291	10000	24.3	7.4	0.136	112	9.5	9.4	
82291	20000	24.1	7.3	0.137	108	9.2	9.1	
82291	30000	23.9	7.2	0.137	104	8.9	8.8	
82291	40000	23.8	7.3	0.136	109	9.3	9.2	
82291	50000	23.6	7.3	0.136	109	9.3	9.2	
82291	60000	23.5	7.3	0.136	105	9.1	9.0	
82291	70000	23.3	7.2	0.137	101	8.7	8.6	
82291	80000	23.2	7.1	0.137	97	8.4	8.3	
82291	90000	23.2	7.1	0.137	94	8.2	8.1	
82291	100000	23.2	7.0	0.138	92	8.0	7.9	
82291	110000	23.3	7.0	0.137	94	8.1	8.0	
82291	120000	23.4	7.0	0.138	97	8.3	8.2	
82291	130000	23.5	7.2	0.137	107	9.2	9.1	
82291	140000	23.6	7.4	0.137	118	10.2	10.1	
82291	150000	23.7	7.4	0.138	116	10.0	9.9	
82291	160000	23.9	7.6	0.137	124	10.6	10.5	
82291	170000	23.8	7.4	0.137	128	11.0	10.9	
82291	180000	24.0	7.5	0.138	124	10.6	10.5	
82291	190000	24.4	7.4	0.138	124	10.5	10.4	
82291	200000	24.3	7.5	0.137	122	10.4	10.3	
82291	210000	24.5	7.6	0.137	123	10.4	10.3	
82291	220000	24.1	7.5	0.138	121	10.3	10.2	
82291	230000	24.0	7.5	0.138	118	10.1	10.0	
82391	0	24.0	7.4	0.138	116	9.9	9.8	
82391	10000	23.9	7.5	0.138	122	10.4	10.3	
82391	20000	23.7	7.4	0.139	116	10.0	9.9	
82391	30000	23.5	7.4	0.139	108	9.3	9.2	
82391	40000	23.3	7.3	0.139	109	9.4	9.3	
82391	50000	23.2	7.2	0.140	102	8.9	8.8	
82391	60000	23.0	7.1	0.140	99	8.6	8.5	
82391	70000	22.9	7.1	0.142	93	8.1	8.0	
82391	80000	22.8	7.0	0.143	91	7.9	7.8	
82391	90000	22.7	7.0	0.145	88	7.6	7.5	
82391	100000	22.6	7.0	0.145	87	7.6	7.5	
82391	100500					[7.6]		7.5

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DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch35
Setup Date (MMDDYY) : 100991
Setup Time (HHMMSS) : 150937
Starting Date (MMDDYY) : 101091
Starting Time (HHMMSS) : 080000
Stopping Date (MMDDYY) : 101491
Stopping Time (HHMMSS) : 170000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 35
Stn ID: Above Midway Meats
RM: Chehalis River 68.6

Temp (F,mx/av/mn): 86/57/35
Precip (in): 0
Wind (mph,avg): 3.9
Clouds(0-10): 0-2-1-7-4-2-0
Description: n/a

Date MMDDYY	Time HHMMSS	TEMP ˚C	PH s.u.	COND mmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
101091	135500							3.5
101091	150000	15.1	6.9	0.121	30	3.3	3.4	
101091	160000	15.0	6.9	0.121	30	3.3	3.4	
101091	170000	15.0	6.9	0.121	32	3.4	3.6	
101091	180000	15.0	6.9	0.121	30	3.3	3.4	
101091	190000	15.1	6.9	0.119	26	2.9	3.0	
101091	200000	15.2	6.9	0.120	25	2.7	2.9	
101091	210000	15.0	6.9	0.121	25	2.7	2.9	
101091	220000	15.1	6.9	0.120	27	2.9	3.1	
101091	230000	15.0	6.8	0.119	19	2.1	2.2	
101191	0	15.1	6.9	0.120	29	3.1	3.3	
101191	10000	14.8	6.9	0.120	22	2.4	2.6	
101191	20000	14.7	6.9	0.120	22	2.4	2.5	
101191	30000	14.6	6.9	0.119	23	2.5	2.6	
101191	40000	14.5	6.9	0.121	24	2.6	2.8	
101191	50000	14.4	6.8	0.121	22	2.5	2.6	
101191	60000	14.2	6.8	0.120	19	2.1	2.3	
101191	70000	14.1	6.8	0.120	17	1.9	2.1	
101191	80000	14.1	6.8	0.120	13	1.5	1.6	
101191	90000	14.1	6.8	0.120	13	1.5	1.6	
101191	100000	14.1	6.8	0.120	13	1.5	1.6	
101191	110000	14.2	6.8	0.120	14	1.5	1.6	
101191	120000	14.2	6.8	0.120	14	1.6	1.8	
101191	130000	14.3	6.8	0.120	16	1.8	1.9	
101191	140000	14.3	6.8	0.120	17	1.9	2.1	
101191	150000	14.4	6.8	0.120	19	2.1	2.3	
101191	160000	14.4	6.8	0.120	22	2.5	2.6	
101191	170000	14.6	6.8	0.120	22	2.4	2.6	
101191	180000	14.8	6.8	0.119	22	2.4	2.6	
101191	190000	14.5	6.8	0.119	21	2.3	2.5	
101191	200000	14.4	6.8	0.119	22	2.4	2.6	

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(continued from page 27)

Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND mmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
101191	210000	14.5	6.8	0.119	23	2.5	2.7	
101191	220000	14.6	6.8	0.119	22	2.5	2.6	
101191	230000	14.5	6.8	0.119	21	2.3	2.4	
101291	0	14.8	6.8	0.119	27	2.9	3.1	
101291	10000	14.4	6.8	0.121	19	2.1	2.2	
101291	20000	14.5	6.8	0.120	21	2.3	2.5	
101291	30000	14.6	6.8	0.119	27	2.9	3.1	
101291	40000	14.5	6.8	0.119	26	2.9	3.1	
101291	50000	14.4	6.8	0.119	25	2.8	2.9	
101291	60000	14.3	6.8	0.119	23	2.6	2.7	
101291	70000	14.3	6.8	0.120	23	2.6	2.7	
101291	80000	14.2	6.8	0.119	23	2.5	2.7	
101291	90000	14.2	6.8	0.119	23	2.6	2.7	
101291	100000	14.2	6.8	0.119	23	2.6	2.7	
101291	110000	14.3	6.8	0.119	24	2.7	2.9	
101291	120000	14.4	6.8	0.120	26	2.8	3.0	
101291	130000	14.5	6.8	0.120	28	3.1	3.3	
101291	140000	14.6	6.8	0.120	30	3.3	3.4	
101291	150000	14.7	6.8	0.120	32	3.5	3.6	
101291	160000	14.8	6.9	0.119	34	3.8	3.9	
101291	170000	14.8	6.9	0.120	33	3.7	3.8	
101291	180000	14.6	6.8	0.120	32	3.5	3.7	
101291	190000	14.6	6.9	0.119	33	3.6	3.8	
101291	200000	14.6	6.9	0.119	33	3.6	3.7	
101291	210000	14.7	6.9	0.119	32	3.5	3.6	
101291	220000	14.6	6.8	0.120	31	3.4	3.6	
101291	230000	14.9	6.9	0.120	34	3.7	3.8	
101391	0	14.7	6.9	0.120	31	3.4	3.6	
101391	10000	14.6	6.9	0.119	32	3.5	3.7	
101391	20000	14.3	6.8	0.120	28	3.1	3.2	
101391	30000	14.4	6.8	0.120	29	3.2	3.4	
101391	40000	14.3	6.9	0.120	34	3.8	4.0	
101391	50000	14.2	6.9	0.120	33	3.7	3.8	
101391	60000	14.2	6.8	0.120	31	3.5	3.6	
101391	70000	14.1	6.8	0.121	29	3.3	3.4	
101391	80000	14.0	6.8	0.121	28	3.1	3.3	
101391	90000	14.0	6.8	0.120	30	3.4	3.5	
101391	100000	14.0	6.8	0.121	28	3.2	3.3	
101391	110000	14.0	6.8	0.121	30	3.4	3.5	
101391	120000	14.2	6.8	0.121	30	3.3	3.4	
101391	130000	14.3	6.8	0.121	33	3.6	3.8	
101391	140000	14.5	6.8	0.121	34	3.8	3.9	

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Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND mmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
101391	150000	14.6	6.8	0.121	36	3.9	4.1	
101391	160000	14.7	6.8	0.121	38	4.1	4.3	
101391	170000	14.7	6.8	0.121	38	4.2	4.4	
101391	180000	14.6	6.8	0.121	39	4.2	4.4	
101391	190000	14.5	6.9	0.121	38	4.2	4.3	
101391	200000	14.4	6.9	0.121	38	4.2	4.3	
101391	210000	14.4	6.9	0.122	38	4.2	4.3	
101391	220000	14.4	6.9	0.122	36	4.0	4.2	
101391	230000	14.4	6.9	0.121	36	4.0	4.2	
101491	0	14.3	6.9	0.121	35	3.9	4.0	
101491	10000	14.2	6.8	0.122	35	3.9	4.1	
101491	20000	14.2	6.8	0.122	35	3.8	4.0	
101491	30000	14.1	6.8	0.122	34	3.8	4.0	
101491	40000	14.0	6.8	0.122	33	3.7	3.8	
101491	50000	14.0	6.8	0.122	32	3.6	3.8	
101491	60000	13.9	6.8	0.122	31	3.5	3.7	
101491	70000	13.9	6.8	0.123	30	3.4	3.5	
101491	80000	13.8	6.8	0.123	29	3.2	3.4	
101491	90000	13.8	6.8	0.123	29	3.2	3.4	
101491	100000	13.9	6.8	0.124	30	3.3	3.4	
101491	110000	14.0	6.8	0.123	31	3.5	3.6	
101491	120000	14.1	6.8	0.123	33	3.7	3.8	
101491	130000	14.2	6.8	0.124	34	3.7	3.9	
101491	131500					[3.8]		4.0
101491	140000	14.7	6.8	0.124	36	4.0	4.2	
101491	150000	14.7	6.8	0.124	38	4.2	4.3	
101491	152000					[4.2]		4.3

Appendix E
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DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch5792
Setup Date (MMDDYY) : 050792
Setup Time (HHMMSS) : 091716
Starting Date (MMDDYY) : 050792
Starting Time (HHMMSS) : 100000
Stopping Date (MMDDYY) : 050892
Stopping Time (HHMMSS) : 190000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 35
Stn ID: Above Midway Meats
RM: Chehalis River 68.6

Temp (F,mx/av/mn): 75/56/44
Precip (in): 0
Wind (mph,avg): 10
Clouds(0-10): 5-10
Description: Sunny, warm - rainy,cloudy,cool

Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND µmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
50792	130000	17.3	7.0	69	95	9.1	8.9	
50792	133000					[9.1]		8.9
50792	140000	17.5	7.0	69	95	9.1	8.9	
50792	150000	17.7	6.9	68	96	9.1	8.8	
50792	160000	17.8	6.9	69	96	9.0	8.8	
50792	170000	17.9	6.9	68	96	9.0	8.8	
50792	180000	17.9	6.9	68	95	9.0	8.8	
50792	190000	17.9	6.9	69	95	9.0	8.7	
50792	200000	17.9	6.9	69	95	9.0	8.7	
50792	210000	17.8	6.9	69	95	9.0	8.7	
50792	220000	17.7	6.9	69	94	8.9	8.7	
50792	230000	17.6	6.9	69	94	8.9	8.7	
50892	0	17.5	6.9	69	94	8.9	8.7	
50892	10000	17.3	6.9	69	93	8.9	8.7	
50892	20000	17.2	6.9	69	93	8.9	8.7	
50892	30000	17.1	6.9	69	93	8.9	8.7	
50892	40000	17.0	6.9	70	92	8.9	8.7	
50892	50000	16.9	6.9	70	92	8.9	8.7	
50892	60000	16.8	6.9	70	92	8.9	8.7	
50892	70000	16.8	6.9	70	92	8.9	8.7	
50892	80000	16.8	6.9	70	92	8.9	8.7	
50892	90000	16.7	6.9	70	92	8.9	8.7	
50892	100000	16.7	6.9	70	93	9.0	8.7	
50892	110000	16.7	6.9	70	93	9.0	8.8	8.8

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DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch528
Setup Date (MMDDYY) : 052792
Setup Time (HHMMSS) : 155042
Starting Date (MMDDYY) : 052892
Starting Time (HHMMSS) : 090000
Stopping Date (MMDDYY) : 052992
Stopping Time (HHMMSS) : 120000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 36
Station: Above Midway Meats
RM: Chehalis River 68.6

Temp (F,mx/av/mn): 67/59/50
Precip (in): 0.01
Wind (mph,avg): 5.3
Clouds(0-10): 9-1-8
Description: Overcast, mild

Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND µmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
52892	100000	18.8	7.2	83	90	8.4	8.0	
52892	110000	18.8	7.1	83	90	8.4	8.0	
52892	120000	18.8	7.1	83	89	8.3	8.0	
52892	130000	18.8	7.0	83	89	8.3	7.9	8.0
52892	140000	18.8	7.0	83	88	8.3	7.9	
52892	150000	18.9	7.0	83	89	8.3	7.9	
52892	160000	18.9	7.0	82	89	8.3	7.9	
52892	170000	18.9	7.0	82	89	8.3	7.9	
52892	180000	18.8	7.0	82	89	8.3	8.0	
52892	190000	18.7	7.0	82	89	8.4	8.0	
52892	200000	18.6	7.0	82	89	8.4	8.0	
52892	210000	18.6	7.1	82	89	8.3	7.9	
52892	220000	18.5	7.0	82	88	8.3	7.9	
52892	230000	18.4	7.0	82	88	8.3	7.9	
52992	0	18.3	7.0	83	88	8.3	7.9	
52992	10000	18.2	7.0	83	88	8.3	7.9	
52992	20000	18.2	7.0	83	88	8.3	7.9	
52992	30000	18.1	7.0	84	88	8.3	7.9	
52992	40000	18.1	7.0	84	88	8.3	7.9	
52992	50000	18.1	7.0	84	87	8.3	7.9	
52992	60000	18.0	7.0	84	87	8.3	7.9	
52992	70000	18.0	7.0	84	88	8.3	7.9	
52992	80000	18.0	7.0	83	87	8.3	7.9	
52992	90000	18.0	7.0	83	88	8.3	7.9	
52992	100000	18.0	7.0	83	88	8.4	8.0	
52992	100700					[8.3]		7.9

Appendix E
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DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch616
Setup Date (MMDDYY) : 061692
Setup Time (HHMMSS) : 083936
Starting Date (MMDDYY) : 061692
Starting Time (HHMMSS) : 110000
Stopping Date (MMDDYY) : 061792
Stopping Time (HHMMSS) : 180000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 34
Stn ID: Above Midway Meats
RM: Chehalis River 68.6

Temp (F,mx/av/mn): 72/58/45
Precip (in): 0
Wind (mph,avg): 5.7
Clouds(0-10): 10-7
Description: Cloudy w/ drizzle - partly cloudy,warm

Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND µmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
61692	130000	17.3	7.1	95	90	8.6	8.9	
61692	140000	17.3	7.0	95	90	8.6	8.9	
61692	150000	17.4	7.0	95	90	8.6	8.9	
61692	153500					[8.6]		8.8
61692	160000	17.4	7.0	95	90	8.6	8.9	
61692	170000	17.4	7.0	95	90	8.6	8.9	
61692	180000	17.4	7.0	95	90	8.6	8.9	
61692	190000	17.4	7.0	95	89	8.5	8.8	
61692	200000	17.5	7.0	95	89	8.5	8.8	
61692	210000	17.4	7.0	95	89	8.5	8.8	
61692	220000	17.4	7.0	95	88	8.5	8.7	
61692	230000	17.4	7.0	95	88	8.4	8.7	
61792	0	17.4	7.0	95	87	8.4	8.7	
61792	10000	17.3	7.0	95	87	8.4	8.7	
61792	20000	17.3	7.0	95	87	8.3	8.6	
61792	30000	17.3	7.0	96	86	8.3	8.6	
61792	40000	17.2	7.0	96	86	8.3	8.6	
61792	50000	17.2	7.0	96	86	8.3	8.5	
61792	60000	17.1	7.0	96	85	8.2	8.5	
61792	70000	17.1	7.0	96	85	8.2	8.5	
61792	80000	17.1	7.0	96	85	8.2	8.5	
61792	90000	17.1	7.0	96	85	8.2	8.5	
61792	100000	17.2	7.0	96	85	8.2	8.5	
61792	110000	17.1	7.0	95	85	8.2	8.5	
61792	120000	17.2	7.0	95	85	8.2	8.5	
61792	130000	17.3	7.0	94	86	8.2	8.5	
61792	140000	17.4	7.0	94	86	8.2	8.5	
61792	150000	17.9	7.0	94	88	8.3	8.6	
61792	152500					[8.3]		8.7
61792	160000	18.4	7.0	94	89	8.4	8.7	

Appendix E
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DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch706
Setup Date (MMDDYY) : 070692
Setup Time (HHMMSS) : 083119
Starting Date (MMDDYY) : 070692
Starting Time (HHMMSS) : 140000
Stopping Date (MMDDYY) : 070792
Stopping Time (HHMMSS) : 180000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 35
Stn ID: Above Midway Meats
RM: Chehalis River 68.6

Temp (F,mx/av/mn): 73/61/48
Precip (in): 0
Wind (mph,avg): 7
Clouds(0-10): 9
Description: Overcast, warm - cloudy,cool

Date MMDDYY	Time HHMMSS	TEMP ˚C	PH s.u.	COND µmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
70692	160000	20.8	7.2	116	80	7.1	6.9	
70692	170000	21.0	7.0	115	81	7.3	7.0	
70692	170900					[7.2]		7.1
70692	180000	21.0	7.0	116	80	7.2	6.9	
70692	190000	20.9	6.9	117	79	7.1	6.8	
70692	200000	20.8	6.9	118	78	6.9	6.7	
70692	210000	20.8	7.0	117	79	7.0	6.8	
70692	220000	20.8	7.0	117	77	6.9	6.7	
70692	230000	20.6	7.0	119	76	6.8	6.6	
70792	0	20.6	7.0	120	74	6.7	6.4	
70792	10000	20.5	6.9	119	73	6.6	6.4	
70792	20000	20.5	6.9	120	72	6.5	6.3	
70792	30000	20.4	6.9	121	72	6.5	6.2	
70792	40000	20.3	6.9	121	71	6.4	6.2	
70792	50000	20.3	6.9	121	70	6.4	6.1	
70792	60000	20.2	6.9	121	70	6.3	6.1	
70792	70000	20.2	6.9	122	69	6.3	6.0	
70792	80000	20.1	6.9	122	69	6.2	6.0	
70792	90000	20.1	6.9	122	69	6.2	6.0	
70792	100000	20.0	6.9	121	69	6.2	6.0	
70792	110000	20.0	6.9	121	69	6.2	6.0	
70792	111200					[6.2]		5.9
70792	120000	20.0	6.9	121	69	6.3	6.0	
70792	130000	20.0	6.9	120	70	6.3	6.1	
70792	140000	20.0	6.9	119	71	6.4	6.2	

Appendix E
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DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch722
Setup Date (MMDDYY) : 072092
Setup Time (HHMMSS) : 083855
Starting Date (MMDDYY) : 072292
Starting Time (HHMMSS) : 080000
Stopping Date (MMDDYY) : 072392
Stopping Time (HHMMSS) : 180000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 36
Stn ID: Above Midway Meats
RM: Chehalis River 68.6

Temp (F,mx/av/mn): 72/65/56
Precip (in): 0.01
Wind (mph,avg): 6.4
Clouds(0-10): 10
Description: cloudy, warm

Date MMDDYY	Time HHMMSS	TEMP ˚C	PH s.u.	COND µmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
72292	110000	22.1	7.0	123	68	5.9	5.9	
72292	120000	22.1	7.0	124	68	5.9	5.9	
72292	130000	22.2	6.9	124	68	5.9	5.9	
72292	140000	22.2	7.0	124	68	5.9	5.9	
72292	150000	22.2	7.0	124	68	5.9	5.9	
72292	160000	22.2	7.0	124	68	5.9	5.9	
72292	165700					[5.7]		5.7
72292	170000	22.2	6.9	124	66	5.7	5.7	
72292	180000	22.2	7.0	123	68	5.9	5.9	
72292	190000	22.2	7.0	123	67	5.8	5.8	
72292	200000	22.2	6.9	123	66	5.8	5.7	
72292	210000	22.1	7.0	123	66	5.8	5.8	
72292	220000	22.1	6.9	123	65	5.6	5.6	
72292	230000	22.1	6.9	123	65	5.7	5.6	
72392	0	22.1	6.9	123	64	5.6	5.6	
72392	10000	22.0	6.9	123	64	5.6	5.5	
72392	20000	22.0	6.9	124	63	5.5	5.5	
72392	30000	21.9	6.9	124	62	5.4	5.4	
72392	40000	21.9	6.9	124	62	5.4	5.4	
72392	50000	21.9	6.9	125	61	5.3	5.3	
72392	60000	21.8	6.9	125	60	5.3	5.3	
72392	70000	21.7	6.9	127	59	5.2	5.2	
72392	80000	21.7	6.9	127	59	5.2	5.2	
72392	90000	21.7	6.9	128	59	5.2	5.1	
72392	100000	21.7	6.9	129	60	5.2	5.2	
72392	110000	21.7	6.9	129	60	5.3	5.2	
72392	120000	21.6	6.9	130	60	5.2	5.2	
72392	130000	21.7	6.9	131	59	5.2	5.2	
72392	131700					[5.2]		5.2
72392	140000	21.7	6.9	131	59	5.2	5.2	

Appendix E
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DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch803
Setup Date (MMDDYY) : 080392
Setup Time (HHMMSS) : 075737
Starting Date (MMDDYY) : 080392
Starting Time (HHMMSS) : 110000
Stopping Date (MMDDYY) : 080492
Stopping Time (HHMMSS) : 190000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 34
Stn ID: Above Midway Meats
RM: Chehalis River 68.6
Temp (F,mx/av/mn): 84/63/51
Precip (in): 0
Wind (mph,avg): 6.5
Clouds(0-10): 0-10
Description: warm, clear - cool, cloudy

Date MMDDYY	Time HHMMSS	TEMP ˚C	PH s.u.	COND µmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
80392	120000	22.9	7.4	122	96	8.3	8.2	
80392	130000	23.1	7.1	122	98	8.4	8.3	
80392	134700					[8.4]		8.5
80392	140000	23.2	7.1	122	99	8.5	8.5	
80392	150000	23.5	7.1	121	101	8.6	8.6	
80392	160000	23.7	7.1	124	102	8.7	8.6	
80392	170000	23.8	7.1	123	102	8.6	8.6	
80392	180000	23.6	7.1	123	101	8.6	8.5	
80392	190000	24.2	7.1	122	103	8.7	8.6	
80392	200000	24.5	7.1	122	105	8.8	8.8	
80392	210000	24.2	7.1	122	102	8.6	8.5	
80392	220000	24.2	7.1	122	104	8.7	8.7	
80392	230000	24.2	7.1	122	101	8.5	8.4	
80492	0	24.1	7.2	122	103	8.6	8.6	
80492	10000	23.9	7.2	122	103	8.7	8.7	
80492	20000	23.6	7.1	122	101	8.6	8.5	
80492	30000	23.4	7.1	122	99	8.4	8.4	
80492	40000	23.3	7.0	122	99	8.4	8.4	
80492	50000	23.2	7.0	122	99	8.4	8.4	
80492	60000	23.2	7.0	122	98	8.4	8.3	
80492	70000	23.1	7.0	122	98	8.4	8.3	
80492	80000	23.1	7.0	122	97	8.3	8.3	
80492	90000	23.0	7.0	122	97	8.3	8.3	
80492	100000	23.0	7.0	123	97	8.3	8.2	
80492	103800					[8.3]		8.2
80492	110000	22.9	7.0	123	97	8.3	8.3	8.2
80492	120000	22.9	7.0	124	96	8.3	8.2	
80492	130000	22.9	7.0	124	96	8.3	8.2	
80492	140000	22.9	7.0	124	97	8.3	8.3	
80492	150000	22.9	7.0	124	97	8.3	8.3	
80492	160000	23.0	7.0	124	97	8.4	8.3	

Appendix E
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DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch0820
Setup Date (MMDDYY) : 081792
Setup Time (HHMMSS) : 083336
Starting Date (MMDDYY) : 082092
Starting Time (HHMMSS) : 080000
Stopping Date (MMDDYY) : 082192
Stopping Time (HHMMSS) : 120000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 34
Stn ID: Above Midway Meats
RM: Chehalis River 68.6

Temp (F,mx/av/mn): 79/61/44
Precip (in): 0
Wind (mph,avg): 6.9
Clouds(0-10): 1-8
Description: warm, clear - mild, cloudy

Date MMDDYY	Time HHMMSS	TEMP ˚C	PH s.u.	COND µmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
82092	120000	22.9	7.3	132	90	7.7	7.9	
82092	130000	23.1	7.0	131	94	8.1	8.2	
82092	140000	23.3	7.0	132	100	8.6	8.7	
82092	150000	23.4	7.0	131	101	8.6	8.7	
82092	152200					[8.8]		10.0
82092	160000	23.5	7.1	132	108	9.2	9.3	
82092	170000	23.9	7.2	132	114	9.6	9.7	
82092	180000	24.3	7.3	133	119	9.9	10.1	
82092	190000	24.1	7.2	132	109	9.2	9.3	
82092	200000	24.2	7.2	133	111	9.3	9.4	
82092	210000	24.1	7.2	133	109	9.2	9.3	
82092	220000	23.8	7.3	132	113	9.5	9.6	
82092	230000	23.6	7.3	132	110	9.3	9.4	
82192	0	23.4	7.2	132	104	8.9	9.0	
82192	10000	23.2	7.1	132	101	8.6	8.7	
82192	20000	23.1	7.1	132	97	8.3	8.5	
82192	30000	22.9	7.0	133	94	8.0	8.2	
82192	40000	22.8	7.0	133	92	7.9	8.0	
82192	50000	22.7	7.0	133	91	7.8	8.0	
82192	60000	22.7	7.0	133	90	7.8	7.9	
82192	70000	22.6	7.0	133	90	7.8	7.9	
82192	80000	22.5	7.0	133	90	7.8	7.9	
82192	90000	22.5	7.0	133	90	7.8	7.9	
82192	100000	22.5	7.0	133	91	7.9	8.0	
82192	110000	22.6	7.0	133	91	7.9	8.0	
82192	112200					[7.9]		8.0
82192	120000	22.6	7.0	133	93	8.1	8.2	

Appendix E
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DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch0908
Setup Date (MMDDYY) : 090892
Setup Time (HHMMSS) : 101122
Starting Date (MMDDYY) : 090892
Starting Time (HHMMSS) : 110000
Stopping Date (MMDDYY) : 090992
Stopping Time (HHMMSS) : 160000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 36
Stn ID: Above Midway Meats
RM: Chehalis River 68.6

Temp (F,mx/av/mn): 76/58/38
Precip (in): 0
Wind (mph,avg): 7
Clouds(0-10): 1-4-1
Description: Rain prev nt - Ptly cloudy, mild - foggy, cool - sunny after 915

Date MMDDYY	Time HHMMSS	TEMP ˚C	PH s.u.	COND μmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
90892	130400					[6.0]		6.4
90892	140000	18.7	7.0	143	66	6.2	6.7	
90892	150000	19.0	7.0	143	69	6.4	6.9	
90892	160000	19.0	7.0	143	70	6.5	7.1	
90892	170000	19.1	7.0	143	71	6.6	7.2	
90892	180000	19.0	7.0	143	71	6.6	7.1	
90892	190000	19.2	7.0	143	70	6.5	7.1	
90892	200000	19.3	7.0	143	75	7.0	7.5	
90892	210000	19.2	7.1	143	77	7.1	7.6	
90892	220000	19.0	7.0	143	75	7.0	7.5	
90892	230000	18.8	7.0	143	72	6.7	7.2	
90992	0	18.7	7.0	143	70	6.5	7.1	
90992	10000	18.5	7.0	143	68	6.4	6.9	
90992	20000	18.4	7.0	144	67	6.3	6.9	
90992	30000	18.3	6.9	144	63	5.9	6.5	
90992	40000	18.3	6.9	145	61	5.8	6.3	
90992	50000	18.3	6.9	145	61	5.8	6.3	
90992	60000	18.2	6.9	146	62	5.8	6.4	
90992	70000	18.2	6.9	146	61	5.8	6.3	
90992	80000	18.1	6.9	147	61	5.7	6.3	
90992	90000	18.1	6.9	148	60	5.7	6.2	
90992	100000	18.0	6.9	148	60	5.7	6.2	
90992	110000	18.0	6.9	148	60	5.7	6.3	
90992	120000	18.4	6.9	147	64	6.0	6.5	
90992	130000	18.6	6.9	148	66	6.2	6.7	
90992	134700					[5.4]		6.2
90992	140000	18.8	6.9	148	56	5.2	5.8	
90992	150000	19.0	6.9	148	57	5.3	5.8	
90992	160000	19.1	6.9	147	49	4.5	5.1	

Appendix E Table E.2, page 38	DO/corr = Corrected DO Measurement DO/mtr = DO measurement by DS3 meter DO/Wink = DO measurement by Winkler method

Log File Name : ch685
Setup Date (MMDDYY) : 081991
Setup Time (HHMMSS) : 090318
Starting Date (MMDDYY) : 081991
Starting Time (HHMMSS) : 100000
Stopping Date (MMDDYY) : 082491
Stopping Time (HHMMSS) : 140000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: DS 36
Stn ID: Near Midway Meats
RM: Chehalis River 68.5

Temp (F,mx/av/mn): 88/66/47
Precip (in): 0
Wind (mph,avg): 6.9
Clouds(0-10): 2-0-1-3-9
Description: Sunny, warm, clear

Date MMDDYY	Time HHMMSS	TEMP ˚C	PH s.u.	COND mmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
82091	140000	23.4	7.2	0.135	104	8.9	9.0	
82091	150000	23.5	7.3	0.135	110	9.5	9.5	
82091	155000					[9.3]		9.4
82091	160000	23.8	7.2	0.135	109	9.3	9.4	
82091	170000	23.7	7.5	0.135	117	10.0	10.1	
82091	180000	23.5	7.3	0.135	115	9.9	10.0	
82091	190000	23.6	7.3	0.135	111	9.5	9.6	
82091	200000	23.8	7.2	0.135	106	9.1	9.2	
82091	210000	24.3	7.2	0.135	102	8.7	8.7	
82091	220000	23.8	7.1	0.137	103	8.8	8.9	
82091	230000	23.8	7.1	0.135	102	8.7	8.8	
82191	0	23.9	7.1	0.136	100	8.6	8.6	
82191	10000	23.6	7.1	0.135	98	8.4	8.5	
82191	20000	23.8	7.1	0.136	98	8.4	8.5	
82191	30000	23.7	7.1	0.136	97	8.3	8.4	
82191	40000	23.7	7.1	0.136	95	8.1	8.2	
82191	50000	23.6	7.1	0.136	99	8.5	8.6	
82191	60000	23.4	7.1	0.136	98	8.4	8.5	
82191	70000	23.3	7.1	0.136	95	8.2	8.3	
82191	80000	23.2	7.1	0.136	92	8.0	8.0	
82191	90000	23.2	7.0	0.136	91	7.9	7.9	
82191	95500					[7.9]		8.0
82191	100000	23.2	7.1	0.135	91	7.9	8.0	
82191	110000	23.2	7.0	0.136	89	7.7	7.7	
82191	120000	23.3	7.0	0.135	92	7.9	8.0	
82191	130000	23.5	7.1	0.135	101	8.7	8.8	
82191	140000	23.7	7.2	0.134	110	9.4	9.5	
82191	150000	23.8	7.3	0.133	113	9.7	9.8	
82191	160000	24.1	7.2	0.134	104	8.8	8.9	
82191	170000	24.0	7.6	0.132	124	10.5	10.6	
82191	180000	24.0	7.4	0.132	117	10.0	10.0	

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(continued from page 38)

Date MMDDYY	Time HHMMSS	TEMP ˚C	PH s.u.	COND mmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
82191	190000	24.2	7.4	0.134	123	10.5	10.5	
82191	200000	24.4	7.4	0.133	119	10.1	10.2	
82191	210000	24.3	7.3	0.132	115	9.7	9.8	
82191	220000	24.4	7.3	0.133	109	9.2	9.3	
82191	230000	24.3	7.2	0.133	108	9.2	9.2	
82291	0	24.3	7.3	0.132	107	9.1	9.1	
82291	10000	24.2	7.2	0.132	104	8.8	8.9	
82291	20000	24.0	7.1	0.133	103	8.8	8.8	
82291	30000	24.0	7.1	0.133	103	8.8	8.8	
82291	40000	23.9	7.2	0.133	108	9.2	9.3	
82291	50000	23.7	7.2	0.133	106	9.0	9.1	
82291	60000	23.6	7.2	0.133	103	8.9	8.9	
82291	70000	23.4	7.1	0.133	100	8.6	8.7	
82291	80000	23.3	7.1	0.133	96	8.3	8.4	
82291	90000	23.3	7.1	0.133	94	8.2	8.2	
82291	100000	23.4	7.1	0.133	94	8.1	8.2	
82291	110000	23.3	7.1	0.133	94	8.1	8.2	
82291	120000	23.6	7.1	0.133	97	8.3	8.4	
82291	130000	23.8	7.1	0.134	103	8.8	8.9	
82291	140000	23.8	7.2	0.133	107	9.2	9.3	
82291	150000	24.1	7.4	0.133	118	10.1	10.1	
82291	160000	24.3	7.4	0.133	116	9.8	9.9	
82291	170000	24.1	7.4	0.133	127	10.8	10.9	
82291	180000	24.2	7.4	0.133	129	10.9	11.0	
82291	190000	24.4	7.4	0.134	117	9.9	10.0	
82291	200000	24.3	7.3	0.134	112	9.5	9.6	
82291	210000	24.3	7.3	0.134	114	9.7	9.7	
82291	220000	24.4	7.5	0.134	118	10.0	10.0	
82291	230000	24.1	7.4	0.134	116	9.8	9.9	
82391	0	23.9	7.3	0.134	113	9.7	9.8	
82391	10000	23.8	7.2	0.135	106	9.1	9.1	
82391	20000	23.7	7.2	0.135	107	9.2	9.3	
82391	30000	23.6	7.2	0.135	111	9.6	9.6	
82391	40000	23.4	7.2	0.135	107	9.3	9.3	
82391	50000	23.3	7.2	0.136	103	8.9	9.0	
82391	60000	23.2	7.1	0.137	97	8.4	8.5	
82391	70000	23.1	7.1	0.138	94	8.1	8.2	
82391	80000	23.0	7.0	0.138	92	8.0	8.0	
82391	90000	22.9	7.0	0.140	89	7.7	7.8	
82391	100000	22.8	7.0	0.140	87	7.6	7.6	
82391	102000					[7.5]		7.6

Appendix E
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DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch34
Setup Date (MMDDYY) : 100991
Setup Time (HHMMSS) : 145543
Starting Date (MMDDYY) : 101091
Starting Time (HHMMSS) : 080000
Stopping Date (MMDDYY) : 101491
Stopping Time (HHMMSS) : 170000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 34
Stn ID: Above Mellen St Bridge
RM: Chehalis River 67.6
Temp (F,mx/av/mn): 86/57/35
Precip (in): 0
Wind (mph,avg): 3.9
Clouds(0-10): 0-2-1-7-4-2-0
Description: n/a

Date MMDDYY	Time HHMMSS	TEMP ˚C	PH s.u.	COND mmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
101091	142500					[6.1]		6.1
101091	150000	15.3	7.2	0.130	58	6.3	6.4	
101091	160000	15.4	7.0	0.129	60	6.5	6.7	
101091	170000	15.5	7.0	0.129	63	6.9	7.0	
101091	180000	15.5	7.0	0.129	63	6.8	7.0	
101091	190000	15.2	7.0	0.128	58	6.3	6.5	
101091	200000	15.2	7.0	0.129	57	6.2	6.4	
101091	210000	15.5	7.0	0.129	58	6.3	6.4	
101091	220000	15.3	6.9	0.128	50	5.4	5.5	
101091	230000	15.4	6.9	0.129	54	5.8	5.9	
101191	0	15.0	6.9	0.129	43	4.7	4.8	
101191	10000	15.3	7.0	0.129	58	6.3	6.5	
101191	20000	15.1	6.9	0.128	55	6.0	6.2	
101191	30000	14.9	6.9	0.128	52	5.7	5.9	
101191	40000	14.8	6.9	0.128	50	5.5	5.6	
101191	50000	14.7	6.9	0.128	45	5.0	5.1	
101191	60000	14.6	6.8	0.128	43	4.7	4.8	
101191	70000	14.5	6.8	0.129	39	4.3	4.5	
101191	80000	14.4	6.8	0.129	38	4.2	4.4	
101191	90000	14.4	6.8	0.129	36	4.0	4.1	
101191	100000	14.4	6.8	0.129	35	3.8	4.0	
101191	110000	14.5	6.8	0.129	35	3.8	4.0	
101191	120000	14.8	6.8	0.129	37	4.1	4.3	
101191	130000	14.7	6.8	0.129	38	4.1	4.3	
101191	140000	14.9	6.8	0.128	36	3.9	4.1	
101191	150000	14.8	6.8	0.129	42	4.6	4.8	
101191	160000	14.9	6.8	0.128	39	4.3	4.5	
101191	170000	15.1	6.8	0.128	42	4.6	4.8	
101191	180000	14.9	6.9	0.127	41	4.5	4.7	
101191	190000	14.8	6.8	0.127	38	4.1	4.3	
101191	200000	14.9	6.8	0.126	37	4.1	4.2	

Appendix E
Table E.2, page 41
(continued from page 40)

Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND mmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
101191	210000	14.7	6.8	0.127	33	3.6	3.7	
101191	220000	14.7	6.8	0.126	31	3.4	3.5	
101191	230000	15.2	6.8	0.127	39	4.2	4.3	
101291	0	14.7	6.8	0.126	27	3.0	3.1	
101291	10000	14.9	6.8	0.126	37	4.1	4.2	
101291	20000	14.9	6.8	0.126	35	3.8	3.9	
101291	30000	14.9	6.8	0.126	32	3.5	3.7	
101291	40000	14.8	6.8	0.127	31	3.4	3.5	
101291	50000	14.8	6.8	0.126	30	3.3	3.4	
101291	60000	14.8	6.8	0.126	30	3.3	3.5	
101291	70000	14.7	6.8	0.126	29	3.1	3.3	
101291	80000	14.6	6.8	0.126	27	3.0	3.2	
101291	90000	14.5	6.8	0.126	26	2.8	3.0	
101291	100000	14.5	6.8	0.127	25	2.7	2.9	
101291	110000	14.6	6.8	0.126	26	2.9	3.0	
101291	120000	14.6	6.8	0.127	26	2.9	3.0	
101291	130000	14.7	6.8	0.126	29	3.2	3.3	
101291	140000	14.9	6.8	0.126	31	3.4	3.6	
101291	150000	14.9	6.8	0.126	38	4.1	4.3	
101291	160000	15.1	6.8	0.126	37	4.0	4.1	
101291	170000	15.1	6.9	0.126	41	4.5	4.6	
101291	180000	15.1	6.8	0.126	39	4.3	4.4	
101291	190000	15.0	6.9	0.126	42	4.6	4.8	
101291	200000	15.0	6.8	0.126	38	4.1	4.3	
101291	210000	15.0	6.8	0.126	34	3.7	3.9	
101291	220000	14.8	6.8	0.126	28	3.1	3.2	
101291	230000	15.2	6.8	0.126	37	4.0	4.2	
101391	0	14.8	6.8	0.127	28	3.0	3.2	
101391	10000	14.9	6.9	0.126	39	4.3	4.5	
101391	20000	14.8	6.8	0.126	38	4.2	4.4	
101391	30000	14.7	6.8	0.126	35	3.8	4.0	
101391	40000	14.6	6.8	0.127	34	3.7	3.9	
101391	50000	14.5	6.8	0.126	33	3.7	3.8	
101391	60000	14.4	6.8	0.127	30	3.3	3.4	
101391	70000	14.3	6.8	0.127	28	3.1	3.2	
101391	80000	14.3	6.8	0.127	23	2.5	2.7	
101391	90000	14.2	6.7	0.127	24	2.7	2.8	
101391	100000	14.2	6.7	0.127	22	2.5	2.6	
101391	110000	14.3	6.7	0.127	24	2.6	2.8	
101391	120000	14.5	6.7	0.128	25	2.8	2.9	
101391	130000	14.7	6.7	0.128	26	2.9	3.1	
101391	140000	15.0	6.8	0.127	31	3.4	3.6	

Appendix E
Table E.2, page 42
(continued from page 41)

Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND mmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
101391	150000	15.0	6.8	0.127	32	3.5	3.7	
101391	160000	15.0	6.8	0.128	33	3.6	3.7	
101391	170000	15.1	6.8	0.129	36	3.9	4.0	
101391	180000	15.1	6.8	0.128	38	4.2	4.3	
101391	190000	15.0	6.8	0.128	35	3.9	4.0	
101391	200000	15.0	6.8	0.128	36	3.9	4.1	
101391	210000	14.9	6.8	0.128	35	3.8	4.0	
101391	220000	14.8	6.8	0.128	34	3.7	3.9	
101391	230000	14.6	6.8	0.128	32	3.6	3.7	
101491	0	14.5	6.8	0.128	31	3.4	3.6	
101491	10000	14.4	6.8	0.128	30	3.3	3.5	
101491	20000	14.3	6.8	0.128	30	3.3	3.4	
101491	30000	14.3	6.7	0.128	29	3.2	3.4	
101491	40000	14.2	6.7	0.128	27	3.0	3.2	
101491	50000	14.2	6.7	0.128	27	3.0	3.1	
101491	60000	14.2	6.7	0.128	26	2.9	3.1	
101491	70000	14.1	6.7	0.128	26	2.9	3.0	
101491	80000	14.1	6.7	0.129	25	2.8	3.0	
101491	90000	14.0	6.7	0.129	26	2.9	3.1	
101491	100000	14.1	6.7	0.129	28	3.1	3.2	
101491	110000	14.2	6.7	0.129	30	3.3	3.5	
101491	120000	14.4	6.8	0.129	31	3.5	3.6	
101491	130000	14.6	6.8	0.129	32	3.6	3.7	
101491	130500					[3.6]		3.9
101491	140000	14.7	6.8	0.129	34	3.8	3.9	
101491	150000	14.9	6.8	0.129	36	3.9	4.1	
101491	154000					[4.0]		4.4

Appendix E
Table E.2, page 43

DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch67
Setup Date (MMDDYY) : 081991
Setup Time (HHMMSS) : 085340
Starting Date (MMDDYY) : 081991
Starting Time (HHMMSS) : 100000
Stopping Date (MMDDYY) : 082491
Stopping Time (HHMMSS) : 140000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 34
Stn ID: Above Skookumchuck River
RM: Chehalis River 67.0

Temp (F,mx/av/mn): 88/65/47
Precip (in): 0
Wind (mph,avg): 6.9
Clouds(0-10): 1-3-9
Description: Sunny, warm, clear

Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND mmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
82191	140000	23.4	7.1	0.126	95	8.2	8.4	8.6
82191	150000	23.5	7.0	0.127	96	8.3	8.4	
82191	160000	23.5	7.0	0.129	94	8.1	8.2	
82191	170000	23.6	7.1	0.128	97	8.3	8.4	
82191	180000	23.7	7.1	0.126	101	8.6	8.8	
82191	190000	23.5	7.1	0.128	96	8.3	8.4	
82191	200000	23.5	7.1	0.126	97	8.4	8.5	
82191	210000	23.6	7.1	0.126	98	8.4	8.6	
82191	220000	23.5	7.1	0.126	94	8.1	8.3	
82191	230000	23.6	7.0	0.127	93	8.0	8.1	
82291	0	23.5	7.0	0.128	91	7.8	8.0	
82291	10000	23.4	7.0	0.130	90	7.7	7.9	
82291	20000	23.3	7.0	0.130	87	7.6	7.7	
82291	30000	23.3	7.0	0.129	88	7.6	7.7	
82291	40000	23.2	7.0	0.127	87	7.6	7.7	
82291	50000	23.1	7.0	0.126	88	7.7	7.8	
82291	60000	23.0	7.0	0.127	85	7.4	7.5	
82291	70000	22.8	7.0	0.128	83	7.2	7.3	
82291	80000	22.8	7.0	0.129	81	7.0	7.2	
82291	90000	22.8	7.0	0.129	81	7.0	7.2	
82291	91500					[7.1]		7.2
82291	100000	22.8	7.0	0.129	82	7.1	7.3	
82291	110000	22.9	7.0	0.129	84	7.3	7.4	
82291	120000	23.1	7.0	0.129	87	7.5	7.7	
82291	130000	23.3	7.0	0.129	90	7.8	7.9	
82291	140000	23.4	7.0	0.127	94	8.1	8.2	
82291	150000	23.4	7.0	0.130	93	8.0	8.2	
82291	160000	23.5	7.0	0.130	93	8.0	8.2	
82291	170000	23.5	7.1	0.130	95	8.2	8.3	
82291	180000	23.5	7.1	0.128	96	8.3	8.4	
82291	190000	23.3	7.1	0.130	94	8.1	8.2	
82291	200000	23.3	7.1	0.129	93	8.0	8.2	
82291	210000	23.2	7.0	0.130	89	7.7	7.9	
82291	220000	23.2	7.0	0.131	88	7.6	7.7	
82291	230000	23.3	7.0	0.130	90	7.8	7.9	
82391	0	23.2	7.1	0.129	90	7.8	8.0	
82391	10000	23.2	7.1	0.129	91	7.9	8.0	
82391	20000	23.0	7.1	0.127	90	7.8	7.9	
82391	30000	22.9	7.0	0.128	86	7.5	7.6	
82391	40000	22.8	7.0	0.129	83	7.2	7.3	
82391	50000	22.7	7.0	0.130	81	7.1	7.2	
82391	60000	22.6	7.0	0.131	80	7.0	7.1	
82391	70000	22.5	7.0	0.132	78	6.8	7.0	
82391	80000	22.4	6.9	0.134	76	6.7	6.9	
82391	90000	22.3	7.0	0.134	77	6.8	6.9	
82391	100000	22.3	7.0	0.134	79	6.9	7.1	
82391	105000					[7.2]		7.2
82391	110000	22.3	7.0	0.134	80	7.0	7.2	

Appendix E
Table E.2, page 44

DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch5792
Setup Date (MMDDYY) : 050792
Setup Time (HHMMSS) : 091918
Starting Date (MMDDYY) : 050792
Starting Time (HHMMSS) : 100000
Stopping Date (MMDDYY) : 050892
Stopping Time (HHMMSS) : 190000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 34
Station: Below Centralia Boat Launch
RM: Chehalis River 66.5

Temp (F,mx/av/mn): 75/56/44
Precip (in): 0
Wind (mph,avg): 10
Clouds(0-10): 5-10
Description: Sunny, warm - rainy,cloudy,cool

Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND mmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
50792	120000	17.1	7.1	0.078	92	8.9	9.3	
50792	130000	17.2	7.0	0.078	93	8.9	9.3	
50792	140000	17.4	7.0	0.078	94	8.9	9.3	
50792	141500					[8.9]		9.4
50792	150000	17.6	7.0	0.078	94	8.9	9.3	
50792	160000	17.7	7.0	0.078	94	9.0	9.3	
50792	170000	17.8	7.0	0.078	94	8.9	9.3	
50792	180000	17.7	7.0	0.079	93	8.9	9.2	
50792	190000	17.7	7.0	0.078	92	8.7	9.1	
50792	200000	17.6	7.0	0.078	90	8.6	9.0	
50792	210000	17.6	7.0	0.079	89	8.5	8.9	
50792	220000	17.6	7.0	0.078	88	8.4	8.8	
50792	230000	17.5	7.0	0.078	88	8.4	8.8	
50892	0	17.5	7.0	0.078	87	8.4	8.7	
50892	10000	17.4	7.0	0.078	87	8.3	8.7	
50892	20000	17.3	7.0	0.078	87	8.3	8.7	
50892	30000	17.2	7.0	0.078	86	8.3	8.6	
50892	40000	17.1	7.0	0.078	86	8.3	8.6	
50892	50000	17.0	7.0	0.078	86	8.3	8.6	
50892	60000	16.9	7.0	0.078	86	8.3	8.6	
50892	70000	16.8	7.0	0.078	85	8.3	8.6	
50892	80000	16.7	7.0	0.078	86	8.4	8.7	
50892	90000	16.7	7.0	0.078	86	8.4	8.8	
50892	100000	16.6	7.0	0.078	86	8.4	8.8	
50892	104200					[8.4]		8.7

Appendix E
Table E.2, page 45

DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch528
Setup Date (MMDDYY) : 052792
Setup Time (HHMMSS) : 154204
Starting Date (MMDDYY) : 052892
Starting Time (HHMMSS) : 090000
Stopping Date (MMDDYY) : 052992
Stopping Time (HHMMSS) : 120000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 35
Station: Blw Centralia Boat Launch
RM: Chehalis River 66.5

Temp (F,mx/av/mn): 67/59/50
Precip (in): 0.01
Wind (mph,avg): 5.3
Clouds(0-10): 9-1-8
Description: Overcast, mild

Unit was heavily fouled with weeds

Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND µmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
52892	110000	17.8	7.1	82	92	8.8	9.0	
52892	120000	17.8	7.1	82	92	8.8	9.0	
52892	130000	17.9	7.1	82	94	8.9	9.1	
52892	135000					[8.9]		8.9
52892	140000	17.9	7.1	82	94	8.9	9.1	
52892	150000	17.9	7.1	83	94	8.9	9.1	
52892	160000	17.9	7.1	83	92	8.8	9.0	
52892	170000	18.0	7.2	83	96	9.1	9.3	
52892	180000	18.0	7.2	83	94	8.9	9.1	
52892	190000	18.0	7.1	83	94	8.9	9.1	
52892	200000	17.9	7.1	83	90	8.6	8.7	
52892	210000	17.8	7.1	83	87	8.3	8.4	
52892	220000	17.8	7.0	83	85	8.1	8.3	
52892	230000	17.8	7.0	83	83	7.9	8.1	
52992	0	17.7	7.0	84	81	7.8	7.9	
52992	10000	17.7	7.0	84	82	7.9	8.0	
52992	20000	17.7	7.0	84	80	7.7	7.9	
52992	30000	17.7	7.0	84	79	7.6	7.8	
52992	40000	17.6	7.0	83	78	7.5	7.7	
52992	50000	17.6	7.0	83	79	7.5	7.7	
52992	60000	17.6	7.0	83	77	7.4	7.5	
52992	70000	17.5	7.0	82	78	7.5	7.6	
52992	80000	17.5	7.0	82	78	7.5	7.7	
52992	90000	17.5	7.0	82	82	7.9	8.1	
52992	93200					[8.1]		8.5

Appendix E Table E.2, page 46	DO/corr = Corrected DO Measurement DO/mtr = DO measurement by DS3 meter DO/Wink = DO measurement by Winkler method

Log File Name : ch53
Setup Date (MMDDYY) : 091091
Setup Time (HHMMSS) : 092203
Starting Date (MMDDYY) : 091091
Starting Time (HHMMSS) : 100000
Stopping Date (MMDDYY) : 091391
Stopping Time (HHMMSS) : 140000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 36
Stn ID: Below Independence Bridge
RM: Chehalis River 53

Temp (F,mx/av/mn): 70/59/48
Precip (in): 0
Wind (mph,avg): 5.1
Clouds(0-10): 1-8-1
Description: Partly sunny - Sunny, warm

Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND mmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
91191	140000	17.2	7.4	0.086	107	10.5	10.4	
91191	150000	17.6	7.5	0.087	111	10.8	10.7	
91191	160000	17.8	7.5	0.087	112	10.9	10.8	
91191	170000	18.0	7.6	0.087	113	10.9	10.8	
91191	180000	17.9	7.5	0.087	111	10.8	10.7	
91191	190000	17.8	7.5	0.087	108	10.6	10.5	
91191	200000	17.5	7.4	0.087	103	10.1	10.0	
91191	210000	17.3	7.3	0.088	99	9.8	9.7	
91191	220000	17.2	7.3	0.087	98	9.6	9.5	
91191	230000	17.1	7.2	0.087	96	9.5	9.4	
91291	0	17.0	7.2	0.087	96	9.5	9.4	
91291	10000	17.0	7.2	0.087	96	9.5	9.4	
91291	20000	17.0	7.2	0.087	95	9.4	9.3	
91291	30000	17.0	7.2	0.087	95	9.4	9.3	
91291	40000	17.0	7.2	0.088	93	9.2	9.1	
91291	50000	17.0	7.2	0.088	91	9.0	8.9	
91291	60000	16.9	7.1	0.088	89	8.8	8.7	
91291	70000	16.8	7.1	0.088	87	8.6	8.5	
91291	80000	16.8	7.1	0.088	85	8.5	8.4	
91291	90000	16.7	7.1	0.088	86	8.5	8.4	
91291	100000	16.7	7.1	0.088	89	8.8	8.7	
91291	110000	16.7	7.2	0.088	92	9.2	9.1	
91291	120000	16.8	7.2	0.088	95	9.4	9.3	
91291	130000	16.9	7.3	0.088	100	9.9	9.8	
91291	140000	17.2	7.4	0.088	106	10.4	10.3	
91291	150000	17.6	7.5	0.088	109	10.7	10.6	
91291	150500					[10.7]		10.6

Appendix E
Table E.2, page 47

DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch42
Setup Date (MMDDYY) : 091091
Setup Time (HHMMSS) : 091951
Starting Date (MMDDYY) : 091091
Starting Time (HHMMSS) : 100000
Stopping Date (MMDDYY) : 091391
Stopping Time (HHMMSS) : 140000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 35
Stn ID: Below Oakville Boat Launch
RM: Chehalis River 42.2

Temp (F,mx/av/mn): 70/59/48
Precip (in): 0
Wind (mph,avg): 5.1
Clouds(0-10): 1-8-1
Description: Partly sunny - Sunny, warm

Date MMDDYY	Time HHMMSS	TEMP °C	PH s.u.	COND mmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
91191	120000	17.1	7.3	0.093	97	9.6	9.5	
91191	123500					[9.8]		9.7
91191	130000	17.2	7.4	0.093	101	10.0	9.9	
91191	140000	17.5	7.5	0.093	105	10.3	10.2	
91191	150000	17.8	7.6	0.093	109	10.6	10.6	
91191	160000	18.1	7.7	0.093	112	10.9	10.8	
91191	170000	18.2	7.8	0.093	114	11.0	11.0	
91191	180000	18.1	7.9	0.093	115	11.1	11.0	
91191	190000	18.0	7.9	0.093	113	10.9	10.9	
91191	200000	17.9	7.8	0.093	111	10.7	10.7	
91191	210000	17.7	7.7	0.094	108	10.5	10.5	
91191	220000	17.7	7.6	0.094	106	10.3	10.3	
91191	230000	17.7	7.6	0.094	105	10.2	10.2	
91291	0	17.7	7.5	0.094	104	10.1	10.1	
91291	10000	17.6	7.5	0.094	102	10.0	9.9	
91291	20000	17.6	7.4	0.094	101	9.9	9.8	
91291	30000	17.5	7.4	0.094	99	9.7	9.6	
91291	40000	17.4	7.4	0.094	97	9.5	9.4	
91291	50000	17.2	7.3	0.094	95	9.3	9.2	
91291	60000	17.1	7.3	0.094	93	9.1	9.1	
91291	70000	17.0	7.2	0.094	91	9.0	8.9	
91291	80000	17.0	7.2	0.093	90	8.9	8.9	
91291	90000	16.9	7.2	0.093	91	9.0	9.0	
91291	100000	16.9	7.2	0.093	93	9.2	9.1	
91291	110000	16.9	7.3	0.093	96	9.5	9.5	
91291	120000	17.0	7.3	0.093	100	9.9	9.8	
91291	123500					[10.1]		10.0

Appendix E
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DO/corr = Corrected DO Measurement
DO/mtr = DO measurement by DS3 meter
DO/Wink = DO measurement by Winkler method

Log File Name : ch33
Setup Date (MMDDYY) : 091091
Setup Time (HHMMSS) : 091443
Starting Date (MMDDYY) : 091091
Starting Time (HHMMSS) : 100000
Stopping Date (MMDDYY) : 091391
Stopping Time (HHMMSS) : 140000
Interval (HHMMSS) : 010000
Warmup : Enable

Unit #: 34
Stn ID: Porter Rd Bridge
RM: Chehalis River 33

Temp (F,mx/av/mn): 70/59/48
Precip (in): 0
Wind (mph,avg): 5.1
Clouds(0-10): 1-8-1
Description: Partly sunny - Sunny, warm

Date MMDDYY	Time HHMMSS	TEMP ˚C	PH s.u.	COND mmho/cm	DO %Sat	DO/mtr mg/l	DO/corr mg/l	DO/Wink mg/l
91191	122500					[9.3]		9.6
91191	130000	17.4	7.5	0.093	96	9.5	9.7	
91191	140000	17.5	7.5	0.093	99	9.7	9.9	
91191	150000	17.7	7.6	0.093	103	10.0	10.2	
91191	155000					[10.3]		10.6
91191	160000	17.9	7.7	0.093	107	10.4	10.6	
91191	170000	18.1	7.8	0.093	109	10.5	10.8	
91191	180000	18.2	7.9	0.093	110	10.6	10.8	
91191	190000	18.1	8.0	0.093	110	10.6	10.8	
91191	200000	18.0	7.9	0.093	109	10.5	10.7	
91191	210000	17.9	7.8	0.094	105	10.2	10.4	
91191	220000	17.9	7.7	0.094	103	10.0	10.2	
91191	230000	17.8	7.6	0.094	100	9.8	10.0	
91291	0	17.7	7.5	0.094	97	9.5	9.7	
91291	10000	17.7	7.5	0.094	96	9.3	9.5	
91291	20000	17.6	7.4	0.094	94	9.2	9.4	
91291	30000	17.5	7.4	0.094	93	9.1	9.3	
91291	40000	17.5	7.4	0.094	92	9.1	9.3	
91291	50000	17.4	7.4	0.094	92	9.0	9.2	
91291	60000	17.3	7.4	0.094	91	8.9	9.1	
91291	70000	17.3	7.3	0.094	90	8.9	9.1	
91291	80000	17.2	7.3	0.094	90	8.8	9.0	
91291	90000	17.2	7.3	0.094	89	8.8	9.0	9.0
91291	100000	17.2	7.3	0.094	90	8.8	9.1	
91291	110000	17.2	7.3	0.094	91	9.0	9.2	
91291	120000	17.2	7.4	0.094	94	9.2	9.4	
91291	130000	17.3	7.5	0.094	97	9.5	9.7	
91291	140000	17.5	7.5	0.094	101	9.9	10.1	
91291	140500					[9.9]		10.0

Appendix F. Tributary Survey Results

Flow measurements for the tributaries are presented in Appendix Table C.1. Field water quality measurement data are listed in Appendix Table F.1, and laboratory results for tributary sampling are presented in Appendix Tables F.2 through F.5.

F.1 Elk Creek

Elk Creek enters the Chehalis River at RM 100.2, and during the low flow period of this study it contributed about one-half the flow in the river below the confluence. Temperature, pH, and DO all indicated good water quality and were within water quality criteria.

Laboratory parameters mostly indicated good water quality, with the notable exception of fecal coliform bacteria. FC at the stream sampling station near Doty (RM Code 100.2005) exceeded the 100 #/100 mL criterion in 5 out of 6 samples and exceeded 200 #/100mL in 2 out of 6 samples. The high FC value of 2,000 #/100 mL from the August 27, 1991 sample was associated with elevated BOD, TOC, TP, and chloride. Samples taken farther upstream in 1992 (below Seven Creek, RM Code 100.2028) showed lower levels of fecal coliform and chloride than samples taken downstream. This suggests that the source or sources lie between the two stations, which lie about 2.3 miles apart.

The USFWS habitat degradation survey (Wampler *et al.*, 1993) found pollution inputs and livestock access in the area of Murnen on Elk Creek and on Nine Creek just upstream of Elk Creek. Murnen is also a residential area where inadequate on-site wastewater systems may exist. Efforts to correct the FC problem should begin by examining these potential sources.

F.2 South Fork Chehalis River

Flow in the South Fork Chehalis River ranged from 9 to 15 cfs under low flow conditions on sampling survey dates, which represents 20 to 25% of the flow in the Chehalis River below the confluence. At the sampling site above the mouth (RM Code 88.0007), temperature exceeded 18°C on several sampling dates and DO was below 8.0 mg/L on one occasion. Compared to an upstream sampling station at Boistfort (RM Code 88.0059), temperature was similar and DO slightly higher downstream. The USFWS survey documented loss of riparian canopy over about one-third of the stream/river miles in the basin. Protection and replanting of canopy would increase shading, which would be expected to reduce temperatures in the South Fork.

Laboratory data indicated good water quality, with the exception of fecal coliform bacteria, which exceeded the water quality criteria. Examination of the data for upstream and downstream sites indicates that conductivity and nitrate/nitrite were elevated at the Boistfort sampling site, while chloride was higher downstream. Other parameters showed results that were similar at both stations. No definite conclusions about potential sources of pollution can be drawn from these data.

However, the USFWS survey identified widespread water quality impacts. Pollutant inputs were identified in over 15 separate locations, and cattle access was identified on over 21% of stream/river miles in the South Fork basin. Areas that showed particularly concentrated impacts were Lake Creek downstream of Barney Creek, Lost Creek, and a number of locations on the South Fork itself upstream of Boistfort. Numerous dairies have been identified in the South Fork basin, including one at the mouth of Lake Creek near Curtis, and ten farms in the Boistfort Prairie area.

Efforts to correct FC problems in the South Fork Chehalis River should focus on a survey of livestock operations in areas with impacts identified by USFWS. The survey would determine where farm management practices are most likely contributing to water quality problems, which would direct those facilities that have the greatest potential for improvement into the development of farm plans. Additional sampling to better define the extent and source of pollution problems may also be desirable.

F.3 Bunker and Stearns Creek

Bunker Creek flows were 1.3 cfs in 1991 and less than 0.5 cfs in 1992, or less than about 2% of the flow in the Chehalis River below the confluence. Temperature and pH did not show unusual levels, but DO was consistently depressed below the water quality criterion. Turbidity, TSS, TDS, BOD, TOC, and chloride were fairly high compared to other tributaries. Fecal coliform were above 100 #/100 mL on both bacteria sampling dates, with a high value of 840 #/100 mL. The USFWS identified livestock access and pollutant inputs both on Deep Creek and on Bunker Creek upstream and downstream of Shaw Creek.

Stearns Creek flows were in the range of 2 to 4 cfs, or roughly 5% of the flow in the Chehalis River below the confluence. Temperatures were measured above 18 °C on two occasions, and the DO was consistently depressed below 8.0 mg/L. Turbidity and TSS were the highest found in any tributary in this study. TDS, TOC, NH3N, and TP were slightly elevated compared to other tributaries. Two fecal coliform samples showed results of 540 and 80 #/100 mL. The USFWS survey estimated that 26% of the stream miles of this creek were degraded by livestock impacts. The survey also identified two points of pollutant inputs. Most of the documented impacts were on tributaries of Stearns Creek from the West Fork upstream.

Bunker and Stearns Creeks both showed DO and fecal coliform levels that did not meet water quality standards. The most likely source of impairment is the impact of agricultural practices, many of which have been documented by USFWS. Efforts to correct these problems should be best focused on farm practice improvements at locations where the possibility of water quality impacts are highest.

F.4 Newaukum River

Flow in the Newaukum River ranged from 27 to 72 cfs during the intensive surveys, and made up about one-half of the flow below the confluence, essentially doubling the flow in the Chehalis River. DO and pH mostly met the water quality standards, with one DO measurement just below 8.0 mg/L in an early morning sample. Temperatures exceeded 18°C on three of the six dates measurements were taken. Temperatures on the North and South Forks of the Newaukum River were also above 18°C, but the water temperature increased by about 2°C before reaching the mouth. Extensive stretches of reduced stream canopy were observed by the USFWS degradation survey between the confluence of the North and South Forks and the mouth of the Newaukum River.

As measured by laboratory parameters, water quality in the Newaukum River was quite good during the dry season study period. No parameter showed levels that exceeded water quality criteria or that were noteworthy as being unusually high, with a few minor exceptions - chloride was slightly elevated as compared to other tributaries, and turbidity was much higher in the North Fork than in the South Fork. In the absence of any other elevated parameters, the chloride values are not of particular concern. The high turbidity in the North Fork may be have been related to a major landslide that was an on-going problem in the basin during the study period.

F.5 Dillenbaugh Creek

Flow in Dillenbaugh Creek ranged from 0.3 to 1.4 cfs during the study period, contributing about 1% of the flow to the Chehalis River below the confluence. Berwick Creek and Dillenbaugh Creek above Berwick Creek both contribute flow, while very little flow was observed in the small tributary near the Chehalis Industrial Park (RM Code 74.5023004).

Temperature and pH met water quality standards, except for one temperature measurement. The pH near the mouth of Dillenbaugh Creek was above 8.0 on two dates, which was one of the highest pH measurements observed in any tributary. The high pH was not associated with high DO, but may have been related to the rainfall occurring during the sampling. High pH discharges have been documented in the past from a concrete batch plant in the Chehalis Industrial Park (Crawford, 1987a); this site should be revisited. DO in Dillenbaugh Creek and Berwick Creek was consistently below 8.0 mg/L. DO in Dillenbaugh Creek above Berwick Creek (LaBree Rd, RM Code 74.5034) was above 9 mg/L. Lower Dillenbaugh Creek flows through wetland areas which was likely contributing to low DO levels; this observation is consistent with the results of Joy (1988).

Compared to other tributaries, Dillenbaugh Creek had relatively high turbidity and TSS. The BOD_5 of 5.8 mg/L and TOC of 13.4 mg/L detected in August 1991 were the second highest found in any natural tributary, and the ammonia of 0.568 mg/L was the highest found in any natural tributary. TN, TP and chloride were also relatively high compared to other tributaries. Fecal coliform bacteria exceeded 100 cfu/100 mL in only one of four samples at the mouth of Dillenbaugh Creek, also in August 1991. Urban stormwater discharges to Dillenbaugh Creek have been identified, and these may contribute to the high pollutant levels observed in August 1991.

Compared to the creek near the mouth, Dillenbaugh Creek above Berwick Creek had relatively good water quality, but Berwick Creek and the Industrial Park tributary were relatively poor. One exception to this pattern was fecal coliform bacteria, which were detected at levels well above 100 #/100 mL in all three tributaries of Dillenbaugh Creek, but appeared to be reduced at the mouth, possibly due to natural die-off or the effect of wetlands.

A third possibility exists that may contribute to the reduction in fecal coliform near the mouth of Dillenbaugh Creek. The American Crossarm and Conduit (ACC) Superfund toxic cleanup site is located along a portion of Dillenbaugh Creek (EPA, 1993). ACC was formerly a wood-treating facility that is now heavily contaminated with pentachlorophenol (PCP). The Remedial Investigation (RI) for the site (Weston, 1992) found PCP levels in Dillenbaugh Creek as high as 19 μg/L during the spring of 1991. Water quality criteria for PCP are dependent on pH, with toxicity increasing with lower pH. For conditions observed in Dillenbaugh Creek, the criteria were as low as 2.8 μg/L for chronic effects, and 4.5 μg/L for acute effects. EPA (1986) indicates that PCP at the levels found in Dillenbaugh Creek is toxic to larval common carp, cladocerans (zooplankton), and algae. Joy (1988) evaluated benthic macroinvertebrates, and could not draw any conclusion except that acute toxicity did not appear to be present. Thus, it cannot be ruled out that toxic levels of PCP from the ACC site were "disinfecting" Dillenbaugh Creek.

Although this may seem a benefit when viewed superficially, it raises concerns about impacts to the aquatic ecology of Dillenbaugh Creek caused by toxicity to microorganisms that make up the bottom of the food chain. EPA (1986) notes that PCP is particularly toxic when DO is low, and when PCP is of industrial grade - conditions which both hold true for this area. Also taking into consideration that PCP may bioaccumulate as much as 1000 times in fish, and that PCP as low as 1.74 μg/L reduces the growth of yearling sockeye salmon (EPA, 1986), the contamination from ACC may be causing serious impacts on the fishery that historically been supported by Dillenbaugh Creek. Additional site improvements at ACC were made as part of the emergency remediation since the sampling in 1991, so hopefully PCP levels have dropped in Dillenbaugh Creek, and no toxicity is present. Additional monitoring would be desirable to characterize conditions subsequent to the emergency remediation which has been completed.

The high fecal coliform levels in Berwick and upper Dillenbaugh Creeks were probably mostly due to livestock impacts, although failing or inadequate septic systems may have also contributed to the problem. The USFWS survey found several sites with "pollutant inputs" and livestock access on both creeks. The pattern of pollutants in the two creeks also are similar to those found by Crawford (1987a). Crawford identified a number of livestock waste inputs, but also suspected other sources, like failing septic systems, as being responsible for high FC in the Industrial Park tributary. High pH and temperature found by Crawford and attributed to Industrial Park activities were not apparent in the measurements made in this survey. Due to the lack of flow, the Industrial Park tributary probably had very little impact on Dillenbaugh Creek.

Several areas in particular are key to the protection and restoration of Dillenbaugh Creek water quality:

- Dillenbaugh Creek is currently the object of a model watershed project where extensive nonpoint source controls are being implemented. The Dillenbaugh Creek project should be completed, with improved controls on livestock waste management and correction of failing or inadequate on-site sewage systems.

- Protection of the existing wetlands in the lower Dillenbaugh Creek basin is needed to maintain the capability of the system to filter and remove pollutants, especially BOD, nutrients, and bacteria.

- Stormwater BMPs are recommended for urban discharges to Dillenbaugh Creek. Combination of planned stormwater improvements on Interstate 5 with urban stormwater BMPs in Chehalis is an opportunity that could reduce costs, and should be seriously considered.

- The American Crossarm & Conduit cleanup action, which is currently on hold due to lack of funding, should be completed. At a minimum, additional monitoring should determine current PCP levels in Dillenbaugh Creek. A continuing discharge of toxic materials may severely limit the success of other projects to restore Dillenbaugh Creek and its fishery.

F.6 Salzer Creek

Flow in Salzer Creek was between 2 and 4 cfs in 1991 and 0.5 cfs or less in 1992, which constituted less than about 2% of the flow in the Chehalis River. Salzer Creek was easily the tributary with the worst water quality problems found in this study. Dissolved oxygen at Airport Road (RM Code 69.2002) was well below the Class A criterion of 8.0 mg/L during the study, and in late August 1991 the creek was virtually anoxic. Temperatures exceeded 18°C on several occasions, and conductivities were extremely high, with one value exceeding 1,000 μmho/cm.

Salzer Creek at Airport Road also had some of the highest values for almost every laboratory parameter in any tributary in the study. Alkalinity and TDS were well above any other tributary, and chlorides were 200 mg/L or greater on several different dates. BOD_5 concentrations were as high as 9.5 mg/L, and TOC reached 20 mg/L. Fecal coliform bacteria exceeded 1,000 #/100 mL on three different dates, with a high value of 8,400 #/100 mL. Nutrient levels were among the highest of any tributaries, with TP in particular found in levels higher than any other natural tributary.

Three "mini-surveys" were conducted on Salzer Creek in 1992 to evaluate the possible sources of high pollutant levels found at Airport Road. A number of possible sources were identified for consideration.

Between Airport Road and the BN/UP trestle (RM Codes 69.2002 and 69.2006) two candidates exist - the Centralia Landfill (CLF) north of the creek, and a National Frozen Foods (NFF) wastewater application field ("Field 1"), which straddles the creek to the south. CLF is a Superfund cleanup site that is under remediation; ground water and surface water, including Salzer Creek, are sampled regularly. NFF generates wastewater from corn, pea, and carrot processing, and uses Field 1 as one of its five land application fields.

Immediately upstream of the BN/UP trestle is a sump that pumps into Salzer Creek (RM Code 69.2006002). The sump is located on the Southwest Washington (SWW) Fairgrounds property, and removes water from a drainage ditch that originates as stormwater from the fairgrounds and from the surrounding city.

Coal Creek flows into Salzer Creek 0.2 mile upstream of the BN/UP trestle. Salzer and Coal Creeks were sampled at bridges where the creeks pass from agricultural to urban areas - at Fair Street (RM Code 69.2017) and National Avenue (RM Code 69.2008009) respectively. Water quality in Salzer Creek at Fair Street was poor. DO was below 2 mg/L and fecal coliform bacteria above 200 #/100 mL on all three dates. BOD_5, TOC, and chloride were slightly elevated. A failing on-site sewage system at a trailer park upstream of this site was a major source of pollutants identified by both Crawford (1987b) and a Centralia College environmental studies class in 1992 (Martin, 1992). The trailer park was connected to the city sewer in August 1992. The USFWS survey also identified extensive livestock access in the basin above Fair Street. Flow at this site was extremely low, which most likely limited its impact on the creek downstream.

Coal Creek had relatively good water quality, although problems were still found. Two out of three DO measurements were below 8.0 mg/L; however, all were above 6 mg/L, which made this site the highest DO levels found in the Salzer Creek basin. Turbidity was elevated, and fecal coliform bacteria were over 100 #/100 mL in one sample and over 200 #/100 mL in another. Other parameters were not particularly high. Livestock access and a "pollutant input" were identified by USFWS along Coal Creek, which may have been the causes of the high FC and low DO. Most of the flow in Salzer Creek appeared to originate in Coal Creek.

From Coal Creek at National Avenue to Salzer Creek at the BN/UP trestle, most parameters changed only slightly, except for DO which was 3 to 5 mg/L lower at the downstream location. The lower DO at the BN/UP trestle is not easily explained. The fairgrounds sump only discharges intermittently and is only a few feet from the sampling site, so it probably had little direct effect on the results at the trestle. The BOD observed at the upstream station was not high enough to explain the oxygen deficit at the trestle. An unknown source may exist that was discharging BOD into Salzer Creek or Coal Creek between the upstream study sampling stations. The USFWS identified a pollutant source in this stretch, and this should be further investigated. SOD may have also contributed to the low oxygen at the BN/UP trestle. Again, to have produced a significant effect, a source or sources of settleable materials.

From the BN/UP trestle to Airport Road the quality of Salzer Creek was significantly different. Conductivity and chloride increased substantially. DO increased somewhat and BOD dropped. Nutrients increased slightly, particularly in June and July. Fecal coliform bacteria increased downstream in the July sampling, but decreased in September.

Data are available from each of the three sources (CLF, NFF Field 1, and the fairgrounds sump) that may have contributed to these water quality changes in Salzer Creek. Samples taken from the fairgrounds sump showed extremely high BOD, nutrients, and fecal coliform. In September 1992, piles of manure were observed in the ditch. While 1992 was a fairly dry summer, sampling in 1991 was conducted in a period of fairly heavy rain (discussed earlier), and one week after the SWW Fair. However, according to fairgrounds staff, even in a dry summer the sump discharges intermittently due to ground water inflows. Therefore, the fairgrounds sump must be strongly suspected as a contributing source of the high nutrients, fecal coliform, and low DO observed in Salzer Creek at Airport Road. The specific source may be the fairgrounds itself, an auction yard that is under investigation (Harvester, 1994), or other unknown sources, including urban runoff. The quality of the water in the ditch discharged by the sump must be improved in order to reduce the impacts on Salzer Creek water quality.

The very high chlorides detected in Salzer Creek at Airport Road also point to a specific source of pollutants other than the fairgrounds sump. Chloride in NFF effluent sampled by Carey (1992) was 66.8 mg/L, but chloride reported by NFF (Brown and Caldwell, 1993) in lysimeters in Field 1 ranged as high as 730 mg/L. Specific conductance observed by Carey in October 1991 was 1,225 μmho/cm in the effluent. Effluent conductance reported by NFF was around 1,000 μmho/cm in October 1992, but was as high as 5,360 μmho/cm in August 1992. The seasonal variability in effluent salts is dependant on the product being processed, which varies over the course of the year.

Centralia Landfill leachate has been extensively characterized. Chloride in the leachate was reported as ranging from 37 to 77 mg/L (CH2M Hill, 1993). Quarterly reports indicate maximum chloride levels in the ground water averaging 53 mg/L. Since this is well below levels observed in Salzer Creek, CLF is not likely contributing pollutants to Salzer Creek during the dry season. This conclusion is also supported by the observation that surface drainages from the CLF were dry during the study. In addition, iron levels, which are over 6 mg/L in the ground water and even higher in the leachate, did not increase in Salzer Creek from the BN\UP trestle to Airport Road and remained below 2 mg/L.

The available evidence suggests that NFF wastewater has been reaching Salzer Creek. The chloride levels and conductivity observed in the creek can only be attributed to the wastewater applied at NFF Field 1. Also, the pattern of conductivity, nutrients and chlorides matches the application schedule at Field 1, where application began in June, was heaviest in July, and ended by the end of August. Whether the wastewater reached the creek by ground water or surface runoff cannot be determined. However, saturated conditions and indications of runoff have been observed (Harvester, 1994). Also, the relative contribution of the fairgrounds sump and NFF wastewater cannot be determined, since both sources were characterized by high BOD, nutrients, and fecal coliform.

In summary, Salzer Creek suffers from severe water quality degradation, and several sources need to be investigated and corrected if improvement is to occur:

- Sources of bacteria, BOD, and oxygen-demanding solids in the Salzer and Coal Creek Valleys should be identified and BMPs implemented to reduce loading of pollutants. Possible sources were identified in Crawford (1987b) and in the USFWS degradation survey.

- The possibility of an unidentified source upstream of the BN/UP trestle should be investigated. Urban sources were observed by Crawford (1987b), and a pollutant source near National Avenue was identified in the USFWS survey.

- The drainage ditch and sump at the SWW fairgrounds has been an intermittent source of pollutant loading. Sources tributary to this sump should be investigated and corrected. In particular, problems at an auction yard that have been identified should be corrected, and technical assistance should be provided to the SWW Fair to provide BMPs during the fair and any other livestock events. BMPs for urban runoff are strongly recommended for this discharge location. The potential combination of stormwater improvements to Interstate 5 with urban stormwater BMPs in Centralia/Chehalis is an opportunity that could reduce costs, and should be seriously considered.

- Land application of wastewater at NFF Field 1 should be maintained strictly at agronomic rates, so that ground water quality is not degraded and surface runoff does not occur. Monitoring wells should be installed upgradient and downgradient of this location to ensure that degraded ground water is not reaching Salzer Creek either directly or through adjacent drainage ditches.

- The cleanup action at CLF should continue to ensure that leachate, degraded ground water, and contaminated stormwater do not reach Salzer Creek. In addition, discharge of treated leachate or stormwater to Salzer Creek should not be allowed during the dry season.

F.7 Centralia Reach Miscellaneous Sources

Several minor sources along the Centralia reach of the Chehalis River were observed and monitored during the study. These are the golf course discharge pipe (RM Code 72.0001), Scheuber Drainage Ditch (RM Code 71.6001), the storm drain at the Centralia WTP (RM Code 67.4002), China Creek (RM Code 67.3001), and the storm drain below the Skookumchuck River (RM Code 66.8001).

The golf course discharge pipe was discovered high on the east bank at RM 72.0. It is a large diameter steel pipe with a flap gate. The pipe has been observed to discharge only intermittently, which is why it wasn't discovered until late in the study. Its purpose has not been investigated, but it likely drains ponds on the golf course. The volume of flow in the dry season is not known. Quality of the discharge was reasonably good, except for fecal coliforms which were 300 #/100 mL. BOD was low, but above the detection level. This is a minor discharge that probably does not have a serious impact on the river, yet with only one sample available, and considering the problems in the river in this stretch, the discharge must still be viewed with concern. The source should be investigated, and the golf course encouraged to improve the discharge to reduce bacteria levels, possible with a wetlands water storage area.

The Scheuber Drainage Ditch drains an agricultural area on the west bank and enters the Chehalis River at RM 71.6. Flow in the ditch was very low - 0.03 to 0.24 cfs. DO was between 6 and 8 mg/L, but other parameters were not remarkably high. This discharge does not appear to be of concern during the dry season.

During the August 1991 sampling survey, discharge was observed from the 60-inch storm drain located just below the Mellen Street bridge at the Centralia WTP. Flow was not measured, but was low with a depth of about 1 inch. The quality of samples taken from this discharge was mixed. Conductivity was low and chloride below the detection level of 1.0 mg/L. However, ammonia nitrogen, total nitrogen, phosphorus, and turbidity were relatively high. This combination was curious, since the low chloride values suggest roof drainage, but the high nutrients and turbidity are more typical of urban runoff.

China Creek discharges to the Chehalis River at RM 67.3, just downstream of the Centralia WTP. Flow was 2.3 cfs on August 28, 1991 during the rainy period, but was very low or nonexistent at other times, suggesting that the creek is primarily a conduit of urban stormwater during the dry season. DO was high and pH very high (8.8) when monitored in August 1991. Nitrogen, phosphorus, and turbidity were also high.

Discharge was observed from a storm drain on the north bank of the Chehalis River just downstream of the Skookumchuck River during light rain on July 22, 1992. The pipe is 12 inches diameter or less, and the discharge flow was substantial. Samples were taken, and the quality of the samples were extremely poor. BOD_5 was greater than 47 mg/L and TOC over 100 mg/L. Fecal coliforms were detected at 28,000 #/100 mL. Turbidity was 20 NTU, and nutrients were relatively high. The source of the flow is unknown, but it is likely urban runoff from the area north of the Chehalis and Skookumchuck Rivers.

It is important to note that stormwater discharges were discovered from urban runoff even during the critical low flow season. The poor quality of stormwater discharges and their effect on the river raises concerns. In light of the low DO and high FC found in the Chehalis River in this reach, urban stormwater must be considered a significant potential source of degradation. BMPs for urban runoff are strongly recommended for the Centralia/Chehalis urban area. As mentioned earlier, combination of stormwater improvements to Interstate 5 with urban stormwater BMPs in Centralia/Chehalis is an opportunity that could reduce costs, and should be seriously considered.

F.8 Skookumchuck River

The Skookumchuck River enters the Chehalis River at RM 66.9. Flows measured during this study in the Skookumchuck River at its mouth (RM Code 66.9001) ranged from 60 to 150 cfs; its contribution to the Chehalis River below the confluence ranged from 30 to 60% of combined flow. The Skookumchuck River is the only tributary in the study area for which flows are largely regulated by reservoir releases. Hanaford Creek is a major tributary of the Skookumchuck River, and its basin is the site of a major open-pit coal mine and power plant.

The Skookumchuck River was characterized by temperatures that were above 18°C on several occasions. During the August 1991 survey, pH values of 8.8 were detected, but pH fell into a more normal range during the rest of the study. DO was always well above the criterion of 8.0 mg/L. Hanaford Creek (RM Code 66.903801) temperatures were above 18°C on one of three sampling dates, and DO fell below the Special Conditions criterion of 6.5 mg/L on one of three sampling dates. Conductivity in Hanaford Creek was slightly higher than in other tributaries (except Salzer Creek). The Skookumchuck River above Hanaford Creek (RM Code 66.9045) resembled the river at the mouth, with temperature elevated on one of three dates and DO consistently high. In late August 1991, the pH in the Skookumchuck River was much higher at the mouth than above Hanaford Creek, suggesting a source in this stretch of the river.

Laboratory samples in the Skookumchuck indicated water quality that was generally quite good. Turbidity, BOD, TOC, FC, nutrients and chloride were all detected at relatively low levels. In the upper basin, Hanaford Creek had slightly higher levels than the Skookumchuck above Hanaford Creek for all parameters except NO23N.

F.9 Lincoln and Scammon Creek

Lincoln Creek enters the Chehalis River on the southwest bank at RM 61.8. Flow in Lincoln Creek ranged from 0.6 to 3.1 cfs and made up less than 1% of the flow in the Chehalis River below the confluence. Lincoln Creek (RM Code 68.1011) consistently had DO below 6.0 mg/L during the study. Temperature was above 18.0 °C on one of five sampling dates. Turbidity and TOC were relatively high, and the two fecal coliform analyses were both well above water quality criteria. The USFWS degradation survey identified livestock access, livestock waste inputs, and other pollutant sources at numerous locations.

Scammon Creek enters the Chehalis River on the south bank at RM 65.8. Its flow in the dry season is very low. One measurement taken in August 1991 (RM Code 65.8006) showed DO below the 8.0 mg/L criterion.

F.10 Scatter Creek

Scatter Creek enters the Chehalis on the north bank at RM 55.2. Flow in Scatter Creek ranged from 0.6 to 4.5 cfs during the study, which represents a contribution of less than 2% of Chehalis River flow. Temperatures in Scatter Creek (RM Code 55.2007) were 19 °C and higher on the July and August sampling dates. DO was consistently above 10.0 mg/L, and pH consistently exceeded 8.0, with levels above the pH 8.5 criterion on two sampling dates. This pattern suggests that Scatter Creek has extremely high primary productivity.

The two samples from Scatter Creek for fecal coliform bacteria both had levels well above the water quality criteria. Total nitrogen in Scatter Creek was the highest found in any tributary. The high nutrient levels can be attributed, at least in part, to discharges from two permitted aquaculture facilities on the creek - Global Aqua (RM 55.2060001) and Seafarm Washington (RM Code 55.2080001). The sampling of these two discharges is discussed in detail in Das (1993). The flow in Scatter Creek during the dry season was made up almost entirely of effluent from the two facilities. In addition, livestock access has been identified by USFWS along several stretches of the creek.

Scatter Creek is unique in both its high nutrient levels and in its high level of productivity, which is producing pH levels that exceed water quality standards. DO may also be dropping to low levels in the morning hours, but this was not documented. Since the stream is dominated by effluent, reducing nutrient levels in the effluent would probably have a beneficial effect on the water quality of the creek. This should be done in combination with controls on livestock access and other waste inputs.

Further study would be needed to quantify the nutrient reduction that would reduce productivity and improved water quality. Therefore, a study is recommended that would investigate the causes of high pH levels, determine whether morning DO levels are dropping below the water quality standards, determine the cause of productivity and what controls on pollutant loading would be necessary to allow Scatter Creek to meet water quality standards. This study could contribute to establishing a TMDL for eutrophication in Scatter Creek, and could possibly be done in conjunction with a nutrient and macrophyte/periphyton productivity study in the mainstem Chehalis River.

F.11 Independence and Garrard Creeks

Independence Creek flows into the Chehalis River from the south bank at RM 51.5. Flow was measured at 0.5 cfs during the study, which made a very small contribution of flow to the Chehalis River. DO was between 4 and 5 mg/L in the creek (RM

51.5003), and turbidity was elevated compared to other tributaries. The USFWS identified a number of locations of livestock access, livestock waste input, and other pollutant inputs.

Garrard Creek flows into the Chehalis River from the south bank at RM 44.9. Flow ranged from 1.8 to 3.9 cfs, and contributed about 1% of the flow in the Chehalis River. DO was below 8.0 mg/L on three of five sampling dates, and temperature exceeded 18 °C on one occasion. Otherwise, the water quality in Garrard Creek was reasonably good. Several areas of livestock access, livestock waste input, and other pollutant input were observed by the USFWS in the Garrard Creek basin.

F.12 Black River

The Black River enters the Chehalis River at RM 47.0. Flows measured during the study ranged from 45 to 75 cfs, contributing between 15 and 23% of the flow to the Chehalis River below the confluence. The Black River was studied extensively as a part of the overall Chehalis TMDL project, and the results are reported in Pickett (1994). A brief comparison will be made here to the other tributaries of the Chehalis River in the study area.

Temperatures in the Black River at Howanut Road (RM Code 47.0012) were among the highest of all tributaries in the basin, exceeding 20°C on several sampling dates. The highest observed DO and pH levels in the Black River occurred on the same dates, and again were among the highest of any tributary in the basin. This pattern indicates that the Black River is a highly productive system, more so than most of the other tributaries, except perhaps Scatter Creek. DO was frequently below the criterion of 8.0 mg/L in the morning hours. Most laboratory parameters at the mouth of the Black River were not at levels that were remarkable. The only exception was TN, which was found at some of the highest levels of any natural tributary.

F.13 Rock, Cedar, and Porter Creeks

Rock Creek enters the Chehalis River from the south bank at RM 39.4, and Cedar Creek enters from the north bank at RM 38.8. Porter Creek enters just upstream of the Porter bridge at RM 33.9. Since Porter Creek is so close to the bridge, the assumption made for this study is that Porter Creek contributes to the flow but does not contribute to the physical or chemical parameters measured from the bridge.

Rock Creek flows measured in the study were 2 to 3 cfs, and contributed less than 1% to flow in the Chehalis River. Cedar Creek flows were 11 to 14 cfs, which made up 3 to 5% of the flow in the Chehalis River at Porter. Porter Creek flows ranged from 8.7 to 13.2 cfs, which contributed 3 to 3.5% of the flow in the river at Porter.

Temperatures in the three creeks were consistently below 18°C, and DO concentrations were always above 8.0 mg/L. Fecal coliform bacteria levels were slightly above 100 #/100 mL for one sample each in Rock Creek and Cedar Creek; the one FC sample in Porter Creek was 580 #/100 mL. Otherwise the water quality in Rock and Cedar Creeks was quite good, with some of the lowest levels of almost every parameter found in any tributary of the Chehalis River. In the USFWS habitat degradation survey, the subbasin that includes Cedar Creek had one of the lowest percentages of streambank with livestock access impacts.

F.14 Permitted Discharges

Results of sampling from the four permitted WTPs that discharge directly to the mainstem Chehalis River (Pe Ell, Darigold, Chehalis, and Centralia) are discussed in detail in Das (1993). These discharges will also be discussed later in Section 4.

Flow from the four plants was about 0.2 cfs from Pe Ell, 0.6 cfs from Darigold, 1.8 cfs from Chehalis, and 2.3 cfs from Centralia. The percentage contributions of Chehalis River flow from these plants were less than 1% for Pe Ell and Darigold, about 2.5% for Chehalis, and about 3% for Centralia.

Concentrations of almost all parameters were higher in the WTP effluents than in natural tributaries. Most significant were BOD, FC and nutrients. Maximum BOD_5 at the plants was 11 mg/L at Pe Ell, over 20 mg/L at Chehalis WTP, over 30 mg/L at Centralia, and over 40 mg/L at Darigold. Fecal coliform bacteria at all plants were quite low, except for Darigold where levels as high as 2,200 #/100 mL were detected. Nitrogen from Pe Ell was about 12.8 mg/L, mostly as NO23N, and phosphorus was about 2 mg/L. At Darigold, nitrogen ranged from 2.7 to 6.5 mg/L, mostly in the organic form, and phosphorus ranged from 21.5 to 44.3 mg/L. Chehalis WTP nitrogen levels were between 23.8 and 33.8 mg/L, mostly in the form of ammonia, while phosphate ranged from 3.5 to 9.3 mg/L. Centralia nitrogen levels ranged from 20.0 to 25.6 mg/L, mostly as ammonia, while phosphorus fell between 3.7 and 6.3 mg/L. Phosphorus at all the WTPs was mostly in the form of SRP.

Appendix F

Table F.1 Tributary Field Measurement Data

RM Code	Site Description	Date	Time	Depth	TEMP meter	TEMP Hg	pH	COND	DO meter	DO Winkler
				(m)	(°C)	(°C)	(s.u.)	(µho/cm)	(mg/L)	(mg/L)
100.2028	Elk Ck blw Seven Creek	07/22/92	1155	0.0		16.7	7.7			9.7
		08/04/92	1101	0.0	17.2	16.0	7.6			9.1
100.2005	Elk Ck @ Elk Ck Rd Br	07/25/91	1230	0.5	16.3		6.9	68	9.8	
		08/27/91	901	0.0	14.7		7.7			9.2
		08/28/91	842	0.0	14.4		7.5			10.0
		07/22/92	1110	0.0		17.0	7.8			9.5
		07/22/92	1110	0.0		17.0	7.8			10.7
		08/04/92	1000	0.0	17.2		7.8			9.0
		08/04/92	1000	0.0	17.2		7.8			9.1
88.0059	SF Chehalis R @ Boistfort Br	07/25/91	1130	0.2	19.4		6.6	106	7.9	
		08/27/91	1330	0.0	17.1		6.8			8.3
		08/28/91	1145	0.0	16.0		7.2			8.1
88.0007	SF Chehalis R @ Tanker Intake	07/25/91	1330	0.5	19.6		6.6	98	8.4	
		08/27/91	1205	0.0	17.1		7.8			8.4
		08/28/91	1121	0.0	16.2		7.5			8.5
		07/22/92	935	0.0		18.2	7.5			8.5
		08/04/92	850	0.0	19.5	20.0	7.4			6.8
84.4006	Bunker Ck @ Br abv mouth	07/25/91	1400	0.0	17.4		6.2	106	5.4	
		08/27/91	1115	0.0	15.2		6.3			5.5
		08/28/91	1000	0.0	14.9		6.8			4.3
		07/22/92	1130	0.0		17.4	6.7			3.3
		08/04/92	1000	0.0		17.5	7.6	118		5.2
78.0004	Stearns Ck @ Twin Oaks Rd	07/25/91	1500	0.5	18.8		6.4	95	6.5	
		08/27/91	1215	0.0	15.2		7.2			6.7
		08/28/91	1100	0.0	14.8		7.0			6.8
		07/22/92	1215	0.0		17.5	7.4			7.4
		08/04/92	1050	0.0		18.0	7.5	91		7.1
75.2111	SF Newaukum R @ Forest	08/01/91	1100	0.5	19.1		7.3	86	9.5	
		08/27/91	915	0.0	16.4		7.7			8.8
		08/28/91	850	0.0	15.8		7.4			9.1
75.2109003	NF Newaukum R @ Forest	08/01/91	1115	0.5	19.2		7.2	89	9.2	
		08/27/91	931	0.0	15.9		7.6			8.5
		08/28/91	910	0.0	15.5		7.4			8.8
75.20015	Newaukum R @ mouth	08/01/91	1205	0.3	21.2		7.1	89	8.8	
		08/27/91	1523	0.0	17.7		7.5			9.2
		08/28/91	1359	0.0	16.6		7.6			9.1
		10/10/91	1829	0.0	14.2		7.0	97	10.3	
		07/22/92	840	0.0		18.8	7.1			8.3
		07/22/92	1345	0.0		19.7	7.6			9.2
		08/04/92	756	0.0		20.4	7.3	100		7.9
		08/04/92	1315	0.0		20.5	7.7	74		8.7
74.5034	Dillenbaugh Creek @ LaBree Rd	07/07/92	842	0.0	14.9		7.3	79	9.3	9.4
		08/05/92	1015	0.0	16.0	15.0	7.0			9.3
74.5032005	Berwick Ck @ Hamilton Rd	07/07/92	915	0.0	15.1		7.0	100	7.9	
		08/05/92	1040	0.0	16.6	15.0	7.0			6.3
74.5023004	Industrial Pk Trib @ Bishop Rd	07/07/92	940	0.0	14.4		7.1	152	7.4	
		08/05/92	942	0.0	15.3	14.5	7.1			6.8
74.5001	Dillenbaugh Ck nr mouth	08/02/91	1205	0.0	18.8		6.3	119	4.7	
		08/27/91	1130	0.0	16.2		8.1	144	6.4	
		08/28/91	1225	0.0	16.2		8.1	132	5.9	
		10/10/91	1129	0.0	11.3		6.4	109	7.6	7.0
		07/07/92	1340	0.0	17.7		6.6	113	6.1	
74.5002	Dillenbaugh Creek abv mouth	07/22/92	1045	0.0		18.6	6.7			2.1
74.5003	Dillenbaugh Creek nr I-5	08/05/92	846	0.0	17.7	17.0	6.9			3.1
74.3001	Chehalis WTP (outfall)	10/10/91	1150	0.0	13.8		6.6	245	6.3	
		10/10/91	1150	0.0	13.9		6.7	234	6.3	
71.6001	Scheuber Drainage Ditch	08/02/91	1310	0.0	19.0		6.5	118	6.1	
		08/27/91	1415	0.0	14.8		8.3	183	6.8	
		08/28/91	1411	0.0	15.0		8.3	146	7.3	

RM Code	Site Description	Date	Time	Depth (m)	TEMP meter (˚C)	TEMP Hg (˚C)	pH (s.u.)	COND (µho/cm)	DO meter (mg/L)	DO Winkler (mg/L)
71.2001	Seeps blw Scheuber Ditch	08/02/91	1330	0.0	12.6		6.1	259	9.5	
69.2017	Salzer Ck @ Fair St	06/16/92	1805	0.0	15.6		6.7	171	1.6	
		07/21/92	940	0.0		17.5	6.8			0.6
		07/21/92	940	0.0		17.5	6.8			1.1
69.2008009	Coal Ck @ National Ave	06/16/92	1750	0.0	14.0		7.1	118	8.3	
		07/21/92	1105	0.0		16.3	7.1			6.7
		09/09/92	915	0.0	11.0		7.0	116	7.5	
		09/09/92	918	0.0						7.5
69.2006	Salzer Ck @ BN/UP Trestle	06/16/92	1715	0.0	15.7		6.9	146	5.7	
		07/21/92	1030	0.0		18.2	6.9			2.3
		09/09/92	1010	0.0	13.5		7.0	168	2.5	
69.2002	Salzer Ck @ Airport Rd	08/02/91	1700	0.2	19.2		6.5	341	4.2	
		08/27/91	1230	0.2	15.1	15.4	6.9			0.5
		08/28/91	1135	0.2	14.9	15.2	6.8			0.4
		06/16/92	1835	0.0	16.2		7.0	376	6.4	
		07/21/92	1140	0.0		18.0	6.9			3.2
		08/04/92	1430	0.0		18.2	7.3	1000		1.6
		09/09/92	1125	0.0	13.1		6.9	191	3.9	
		09/09/92	1135	0.0						4.0
		09/09/92	1135	0.0						4.0
67.3001	China Ck nr mouth	08/28/91	1710	0.0	16.1		8.8	143	10.3	
66.9045	Skookumchuck R abv Hanaford	08/01/91	1240	0.5	18.6		6.8	60	9.0	
		08/01/91	1240	2.0	18.6		6.8	60	9.0	
		08/27/91	1400	0.5	14.9	15.2	7.3			9.5
		08/28/91	1255	0.5	14.4	14.7	7.4			9.7
66.903801	Hanaford Ck abv Skook R	08/01/91	1255	0.5	19.4		6.5	131	6.0	
		08/01/91	1255	1.5	19.2		6.5	132	5.9	
		08/27/91	1430	0.2	16.4	16.7	7.0			7.3
		08/28/91	1325	0.2	15.5	15.8	7.0			7.2
66.9001	Skookumchuck R nr mouth	08/01/91	1315	0.5	19.7		7.2	67	9.8	
		08/01/91	1315	1.5	19.7		7.2	68	9.7	
		08/02/91	1541	0.0	20.4		7.4	63	9.8	
		08/27/91	1828	0.0	15.3		8.8	65	10.8	
		08/28/91	1743	0.0	15.0		8.8	65	11.0	
		10/14/91	1250	0.0	12.7		6.7	63	10.7	
		07/22/92	1805	0.0	17.3		7.2	71	9.7	
		08/04/92	920	0.0	18.5		7.1	86	8.9	
		08/04/92	1650	0.0	18.7		7.6	83	9.9	
65.8006	Scammon Ck @ County Rd	08/01/91	1350	0.3	17.4		6.5	123	5.6	
61.8011	Lincoln Ck @ Lincoln Ck Rd	08/01/91	1410	0.3	19.0		6.5	100	5.6	
		08/27/91	1045	0.2	15.0	15.3	6.9			
		08/28/91	955	0.2	14.7	15.0	6.8			4.2
		07/21/92	1325	0.0		17.9	7.1			4.1
		08/05/92	1143	0.0	16.2	15.0	6.9			3.9
58.2001	Blanksma Dairy Pump Springs	08/12/91	1615	0.0	11.5		6.6	125	8.6	
		09/10/91	1145	0.0	11.6		6.8			10.5
		09/11/91	1230	0.0	11.4		6.7			9.5
55.2007	Scatter Ck @ Br abv mouth	08/01/91	1530	0.2	20.9		8.0	119	10.0	
		09/10/91	1050	0.0	15.7		8.3			12.8
		09/11/91	1140	0.0	15.7		8.2			12.1
		07/21/92	1530	0.0		20.2	9.0			14.0
		08/05/92	1402	0.0	21.1	19.0	8.6			11.9
51.5003	Independence Ck @ 201st St	08/01/91	1610	0.2	17.4		6.4	112	5.6	
		09/10/91	931	0.0	13.6		6.8			4.9
		09/11/91	825	0.0	13.9		6.8			4.1

RM Code	Site Description	Date	Time	Depth (m)	TEMP meter (˚C)	TEMP Hg (˚C)	pH (s.u.)	COND (μho/cm)	DO meter (mg/L)	DO Winkler (mg/L)
47.0012	Black R @ Howanut Rd Br	08/01/91	1725	0.2	20.8		7.9	101	12.7	
		08/01/91	1725	1.0	20.7		7.8	102	12.6	
		08/21/91	720	0.0	18.7		6.9	109	7.3	
		08/21/91	720	0.9	18.7		6.9	111	7.3	
		08/22/91	1711	0.0	21.0		7.1	106	11.5	
		08/22/91	1711	0.8	20.9		7.1	108	11.4	
		09/03/91	1310	0.0	17.4		7.1	107	9.4	
		09/03/91	1310	1.0	17.1		7.1	108	9.4	
		09/06/91	755	0.0	16.7		6.8	108	7.5	
		09/06/91	755	0.8	16.8		6.8	109	7.5	
		09/10/91	825	0.0						8.3
		09/10/91	825	0.0	14.4		7.3			8.1
		09/10/91	1330	0.0	16.5		7.3			9.7
		09/11/91	755	0.0						7.9
		09/11/91	755	0.0	15.1		7.2			7.9
		09/11/91	1350	0.0	16.5		7.4			9.2
		09/12/91	805	0.0						7.9
		09/12/91	805	0.0	15.2		7.3			7.9
		09/12/91	1325	0.0	16.0		7.4			9.1
		09/12/91	1530	0.0						10.0
		09/12/91	1530	0.0						10.1
		09/13/91	1145	0.0						8.6
		09/13/91	1145	0.0						8.7
		07/21/92	820	0.0		17.5	7.0			7.2
		07/21/92	1445	0.0	18.2	17.8	7.0			7.8
		08/05/92	815	0.0		17.5	7.0	103		7.5
		08/05/92	1710	0.0		18.7	7.3	107		10.5
		08/24/92	1900	0.5						12.4
		08/25/92	748	0.5						8.0
44.9009	Garrard Ck @ Mattson Rd	08/01/91	1750	0.3	18.3		6.6	82	7.3	
		09/10/91	1600	0.0	15.7	16.0	7.1	100		8.0
		09/11/91	1100	0.0	14.5	14.7	6.6	95		8.3
		07/21/92	1030	0.0		17.1	7.0			7.0
		08/05/92	1045	0.0		15.9	6.9	100		6.4
39.4006	Rock Ck @ South Bank Rd	09/10/91	1055	0.0	14.5	14.7	7.0	76		8.4
		09/11/91	1000	0.0	14.4	14.7	6.6	70		8.2
38.8008	Cedar Ck @ Elma-Gate Rd	09/10/91	1435	0.0	14.9	15.1	7.5	88		10.4
		09/11/91	1355	0.0	15.0	15.0	7.6	86		10.3
		09/12/91	1100	0.0	14.4	14.4	6.8	70		10.0
		07/21/92	1000	0.0		15.6	6.6			9.2
		08/05/92	1000	0.0		15.0	7.7	74		9.6
33.9002	Porter Ck @ RR Trestle	09/10/91	1000	0.0	13.3	13.5	7.3	71		9.6
		09/11/91	905	0.0	14.1	14.3	6.7	70		9.6
		09/12/91	1015	0.0	14.5	14.4	6.6	68		9.7

Appendix F

Table F.2 Tributary Laboratory Results: Conventional Parameters and Metals

RM Code	Site Description	Lab #	Date	Time	Depth	COND (µmho/cm)	ALK (mg/L)	TURB (NTU)	TSS (mg/L)	TDS (mg/L)	FE (µg/L)	SI (µg/L)
105.5001	Pe Ell WTP (Composite)	358372	08/27/91		0.0	243		25.0	5			
	(Grab)	358373	08/27/91		0.0	239		2.2	5			
	(Grab)	358374	08/27/91		0.0							
	(Composite)	358472	08/28/91		0.0	235		2.6	2			
	(Composite)	358473	08/28/91		0.0	238		2.3	1			
	(Grab)	358474	08/28/91		0.0							
	(Grab)	358475	08/28/91		0.0							
100.2028	Elk Ck abv Seven Ck	308560	07/22/92	1155	0.0	77		2.5	5			
		328545	08/04/92	1101	0.0	79		2.5	1 B			
100.2005	Elk Ck @ Elk Ck Rd Br	358342	08/27/91	901	0.0	76		3.2	6	73		
		358442	08/28/91	840	0.0							
		358442	08/28/91	840	0.0	74		4.3	4	57		
		308558	07/22/92	1110	0.0							
		308558	07/22/92	1110	0.0	78	27.1	2.0	4	62		
		308559	07/22/92	1115	0.0	77	26.8	2.0	2			
		328543	08/04/92	1000	0.0	78	27.4	2.8	1 B	208		
		328544	08/04/92	1000	0.0	77	27.3	2.0	1 UB	96		
88.0059	SF Chehalis R @ Boistfort Br	358323	08/27/91	1330	0.0	132		1.5				
		358423	08/28/91	1145	0.0	131		1.6				
88.0007	SF Chehalis R @ Tanker Intake	358343	08/27/91	1205	0.0	118		1.5	2	79		
		358443	08/28/91	1120	0.0	118		1.5	1	62		
		308556	07/22/92	935	0.0							
		328541	08/04/92	850	0.0							
84.4006	Bunker Ck @ Br abv mouth	358324	08/27/91	1115	0.0	131		10.0	8	132		
		358424	08/28/91	1000	0.0	129		8.3	5	77		
		308588	07/22/92	1130	0.0							
		328572	08/04/92	1000	0.0							
78.0004	Stearns Ck @ Twin Oaks Rd	358325	08/27/91	1215	0.0	106		21.0	13	149		
		358425	08/28/91	1100	0.0	107		12.0	16	76		
		308589	07/22/92	1215	0.0							
		328573	08/04/92	1050	0.0							
75.2111	SF Newaukum R @ Forest	358327	08/27/91	915	0.0	96		1.3				
		358427	08/28/91	850	0.0	92		1.4				
75.2109003	NF Newaukum R @ Forest	358326	08/27/91	930	0.0	97		6.6				
		358426	08/28/91	910	0.0	97		9.3				
75.20015	Newaukum River @ mouth	358344	08/27/91	1523	0.0	97		1.9	1	70		
		358444	08/28/91	1355	0.0	97		2.2	4	63		
		418031	10/10/91	1829	0.0	108		2.0	2			
		308585	07/22/92	840	0.0	103	36.0	1.6	4	68		
		308591	07/22/92	1345	0.0	102	35.4	1.6	4	73		
		328570	08/04/92	756	0.0	107	36.4	1.1	4 B	116		
		328575	08/04/92	1315	0.0	105	35.9	1.1	2 B	89		

Table F.2, page 2

RM Code	Site Description	Lab #	Date	Time	Depth	COND (µmho/cm)	ALK (mg/L)	TURB (NTU)	TSS (mg/L)	TDS (mg/L)	FE (µg/L)	SI (µg/L)
74.5034	Dillenbaugh Ck @ LaBree Rd	288031	07/07/92	845	0.0	87		3.4	2			
		288034	07/07/92	845	0.0	86		3.3	2			
		328558	08/05/92	1015	0.0	93		2.1	1			
74.5032005	Berwick Ck @ Hamilton Rd	288032	07/07/92	915	0.0	108		7.5	4			
		328559	08/05/92	1000	0.0	143		8.1	6			
74.5023004	Indust Pk Trib @ Bishop Rd	288033	07/07/92	940	0.0	167		6.0	3			
		328560	08/05/92	942	0.0	147		7.8	2			
74.5003	Dillenbaugh Creek nr I-5	308587	07/22/92	1045	0.0	122	48.1	4.7	4	93		
74.5002	Dillenbaugh Ck abv mouth	328557	08/05/92	846	0.0	121		4.7	1	101		
74.5001	Dillenbaugh Ck nr mouth	358300	08/27/91	1130	0.0	156		9.0	20	163		
		358400	08/28/91	1225	0.0	142		6.5	12	101		
		418021	10/10/91	1129	0.0	120		4.5	5			
		288030	07/07/92	1340	0.0	120		5.0	7			
74.4001	Darigold WTP (Grab)	498023	12/03/91		0.0							
	(Composite)	498024	12/04/91		0.0	3210	649.0	10.0	34			
	(Composite)	498025	12/04/91		0.0	3060	658.0	11.0	36			
	(Composite)	498026	12/04/91		0.0							
	(Grab)	308313	07/20/92						25			
	(Grab)	308314	07/20/92			3660	834.0	5.5	20	2170		
	(Composite)	308315	07/21/92			2950	693.0	4.0	12	1710		
	(Composite)	308316	07/21/92			3110	713.0	5.2	13	1840		
	(Grab)	308317	07/21/92						12			
	(Grab)	328250	08/04/92									
	(Grab)	328250	08/04/92						5			
	(Grab)	328251	08/04/92									
	(Grab)	328251	08/04/92			3660	751.0	4.8	13	2120		
	(Composite)	328252	08/05/92			3410	790.0	3.8	9	1960		
	(Composite)	328253	08/05/92									
	(Composite)	328253	08/05/92			3460	807.0	5.3	8	2000		
	(Grab)	328254	08/05/92									
	(Grab)	328254	08/05/92						8			
74.3001	Chehalis WTP (Composite)	358379	08/27/91									
	(Composite)	358379	08/27/91			623		12.0	9			
	(Composite)	358380	08/27/91			629		10.0	9			
	(Grab)	358381	08/27/91									
	(Composite)	358479	08/28/91			496		11.0	5			
	(Composite)	358480	08/28/91			494		12.0	18			
	(Grab)	358481	08/28/91									
	(Grab)	358482	08/28/91									
	(Outfall)	418022	10/10/91	1150	0.0	608		8.0	9			
	(Grab)	308293	07/20/92						20			
	(Grab)	308294	07/20/92									
	(Grab)	308294	07/20/92			584	168.0	18.0	18	333		
	(Composite)	308295	07/21/92			587	159.0	22.0	26	313		
	(Composite)	308296	07/21/92			609	155.0	20.0	25	335		
	(Grab)	308297	07/21/92									

Table F.2, page 3

RM Code	Site Description	Lab #	Date	Time	Depth	COND (µmho/cm)	ALK (mg/L)	TURB (NTU)	TSS (mg/L)	TDS (mg/L)	FE (µg/L)	SI (µg/L)
74.3001	Chehalis WTP (Grab)	328240	08/04/92						21			
	(Grab)	328241	08/04/92			645	120.0	17.0	17	353		
	(Composite)	328242	08/05/92			656	119.0	17.0	19	334		
	(Composite)	328243	08/05/92									
	(Composite)	328243	08/05/92			646	116.0	22.0	20	343		
	(Grab)	328244	08/05/92						13			
72.0001	Golf Course Discharge Pipe	328517	08/04/92	1345	0.0							
71.6001	Scheuber Drainage Ditch	358306	08/27/91	1415	0.0	200		12.0				
		358406	08/28/91	1411	0.0	175		12.0				
69.2017	Salzer Ck @ Fair St	258109	06/16/92	1805	0.0	180		4.9	11			
		308542	07/21/92	940	0.0							
		308542	07/21/92	940	0.0	202	83.5	17.0	18		4340	
		308543	07/21/92	940	0.0						5310	
69.2008009	Coal Ck @ National Ave	258110	06/16/92	1750	0.0	128		12.0	5			
		308547	07/21/92	1105	0.0	149		9.1	9			
		378032	09/09/92	915	0.0	144		18.0	8	123		
69.2006002	Stormwater Ditch nr Fairgnds	258108	06/17/92	1430	0.0	297		6.7	23			
		308545	07/21/92	1015	0.0	201		26.0	23			
		378034	09/09/92	1035	0.0	299		4.0	119	207		
69.2006	Salzer Ck @ BN/UP Trestle	258106	06/16/92	1715	0.0	157		6.0	4		1640	
		258107	06/16/92	1715	0.0	157		6.1	4		1800	
		308544	07/21/92	1105	0.0	196		6.5	4		1620	
		378033	09/09/92	1010	0.0	186		7.0	3	215	1680	
69.2002	Salzer Ck @ Airport Rd	358354	08/27/91	1230	0.2	772		11.0	6	426		
		358454	08/28/91	1135	0.0	268	62.8	11.0	14	180		
		258105	06/16/92	1835	0.0	405		4.9	3		1430	
		308546	07/21/92	1140	0.0	858	92.2	5.7	4		1650	
		328578	08/04/92	1430	0.0	1210	91.8	3.0	6 B			
		378030	09/09/92	1125	0.0	212		4.4	1	159	1130	
		378031	09/09/92	1125	0.0	207		4.5	1	301	1140	
67.4002	Storm Drain @ Centralia WTP	358366	08/27/91	1750	0.0	87		25.0				
		358466	08/28/91	1654	0.0	33		21.0				
67.4001	Centralia WTP (Grab)	358388	08/27/91		0.0							
	(Grab)	358389	08/27/91		0.0							
	(Composite)	358386	08/27/91		0.0	527		20.0	26			
	(Composite)	358387	08/27/91		0.0	527		20.0	37			
	(Composite)	358486	08/28/91		0.0	515		21.0	28			
	(Composite)	358487	08/28/91		0.0	489		17.0	16			
	(Grab)	358488	08/28/91		0.0							
	(Grab)	358489	08/28/91		0.0							
	(Grab)	308283	07/20/92						28			
	(Grab)	308284	07/20/92			600	168.0	21.0	21	364		
	(Composite)	308285	07/21/92			598	159.0	23.0	29	344		
	(Composite)	308286	07/21/92			598	161.0	23.0	25	342		
	(Grab)	308287	07/21/92						21			

Table F.2, page 4

RM Code	Site Description	Lab #	Date	Time	Depth	COND (µmho/cm)	ALK (mg/L)	TURB (NTU)	TSS (mg/L)	TDS (mg/L)	FE (µg/L)	SI (µg/L)
67.4001	Centralia WTP (Grab)	328230	08/04/92						33			
	(Grab)	328231	08/04/92			559	140.0	22.0	28	297		
	(Composite)	328232	08/05/92			624	157.0	22.0	30	328		
	(Composite)	328233	08/05/92									
	(Composite)	328233	08/05/92			588	155.0	22.0	27	310		
	(Grab)	328234	08/05/92						31			
67.3001	China Ck nr mouth	358367	08/27/91	1912	0.0	119		7.7				
		358467	08/28/91	1710	0.0	159		13.0				
66.9045	Skookumchuck R abv Hanaford	358356	08/27/91	1400	0.5	59		4.9				
		358456	08/28/91	1255	0.0	57	22.9	5.3				
66.903801	Hanaford Ck abv Skook R	358355	08/27/91	1430	0.2	160		8.0				
		358455	08/28/91	1325	0.0	164	33.6	9.0				
66.9001	Skookumchuck River nr mouth	358317	08/27/91	1828	0.0	69		3.9	3	77		
		358417	08/28/91	1743	0.0	70		4.0	1	33		
		308520	07/22/92	1145	0.0	75	26.1	1.7	5	91		
		308535	07/22/92	1810	0.0	75	25.8	1.6	7	47		
		328515	08/04/92	930	0.0	89	28.2	1.6	3 B	117		
		328500	08/04/92	1650	0.0	95	27.7	1.5	1 UB	111		
66.8001	Storm Drain below Skook R	308538	07/22/92	1822	0.0	179		20.0				
61.8011	Lincoln Ck @ Lincoln Ck Rd	358357	08/27/91	1045	0.2	126		10.0	4	79		
		358457	08/28/91	955	0.0	124	53.3	11.0	12	78		
		308548	07/21/92	1325	0.0							
		328561	08/05/92	1143	0.0							
58.2001	Blanksma Dairy Pump Springs	378344	09/10/91	1145	0.0	129		1.2				
		378444	09/11/91	1230	0.0	128		1.5				
55.208	Seafarm WA/Scatter Ck	378373	09/09/91		0.0	153		0.4	1	102		
		378473	09/10/91		0.0	152		0.5	1	135		
55.206	Global Aqua/Scatter Ck	378378	09/09/91		0.0	133		1.3	1	94		
		378478	09/10/91		0.0	133		1.0	1	119		
55.2007	Scatter Ck @ Br abv mouth	378345	09/10/91	1050	0.0	130		1.7	1	91		
		378445	09/11/91	1140	0.0	132		1.6	3	126		
		308549	07/21/92	1530	0.0							
		328562	08/05/92	1402	0.0							
51.5003	Independence Ck @ 201st St	378346	09/10/91	930	0.0	134		7.5				
		378446	09/11/91	825	0.0	135		8.8				
47.0012	Black R @ Howanut Rd Br	378326	09/10/91	825	0.0	118		1.0				
		378327	09/10/91	825	0.0	118		1.2				
		378334	09/10/91	1330	0.0	117		1.0	2	79		
		378426	09/11/91	755	0.0	117		1.1				
		378427	09/11/91	755	0.0	117		1.3				
		378434	09/11/91	1350	0.0	116		1.0	2	138		
		378526	09/12/91	805	0.0	117		1.3				
		378527	09/12/91	805	0.0	117		1.2				
		378534	09/12/91	1325	0.0	116		1.0				

Table F.2, page 5

RM Code	Site Description	Lab #	Date	Time	Depth	COND (µmho/cm)	ALK (mg/L)	TURB (NTU)	TSS (mg/L)	TDS (mg/L)	FE (µg/L)	SI (µg/L)
47.0012	Black R @ Howanut Rd Br	308570	07/21/92	820	0.0	117	45.4	1.7	4	86		
		308581	07/21/92	1445	0.0	116	44.2	1.2	3	94		
		328585	08/05/92	815	0.0	116	45.4	1.2	2	97		
		328596	08/05/92	1710	0.0							
		328596	08/05/92	1710	0.0	116	45.6	1.5	2	92		
44.9009	Garrard Ck @ Mattson Rd	378358	09/10/91	1600	0.0	92	36.0	2.2				
		378458	09/11/91	1100	0.0	92	35.6	2.3				
		308573	07/21/92	1030	0.0							
		328588	08/05/92	1045	0.0							
39.4006	Rock Ck @ South Bank Rd	378357	09/10/91	1055	0.0	70	25.2	1.7				
		378457	09/11/91	1000	0.0	70	25.2	1.6				
38.8008	Cedar Ck @ Elma-Gate Rd	378360	09/10/91	1435	0.0	81	35.4	1.1	1	68		
		378460	09/11/91	1355	0.0	81	35.7	1.2		96		
		378560	09/12/91	1100	0.0	81	35.5	1.5				
		308572	07/21/92	1000	0.0							
		328587	08/05/92	1000	0.0							
33.9002	Porter Ck @ RR Trestle	378461	09/11/91	905	0.0							

Appendix F

Table F.3 Tributary Laboratory Results: Biological Parameters

RM Code	Site Description	Lab #	Date	Time	Depth (m)	BOD5 (mg/L)	BOD5 (mg/L)	TOC (mg/L)	CHLA (µg/L)	FC (#/100mL)	KES (%)	FS (#/100mL)
105.5001	Pe Ell WTP (Composite)	358372	08/27/91		0.0	11.0		5.5	1.5			
105.5001	Pe Ell WTP (Grab)	358373	08/27/91		0.0			6.6	1.5			
105.5001	Pe Ell WTP (Grab)	358374	08/27/91		0.0					9		
105.5001	Pe Ell WTP (Composite)	358472	08/28/91		0.0	11.0		6.3	1.0 U			
105.5001	Pe Ell WTP (Composite)	358473	08/28/91		0.0			6.7	1.4			
105.5001	Pe Ell WTP (Grab)	358474	08/28/91		0.0					3		
105.5001	Pe Ell WTP (Grab)	358475	08/28/91		0.0					10		
100.2028	Elk Creek above Seven Creek	308560	07/22/92	1155	0.0	2.0 U	2.0 U	6.2		56		
100.2028	Elk Creek above Seven Creek	328545	08/04/92	1101	0.0	2.0 U	2.0 U	5.2		80		
100.2005	Elk Ck near Doty	358342	08/27/91	901	0.0			7.9		2000 J		
100.2005	Elk Ck near Doty	358442	08/28/91	840	0.0				1.0 U			
100.2005	Elk Ck near Doty	358442	08/28/91	840	0.0			6.3	1.5	310		
100.2005	Elk Ck near Doty	308558	07/22/92	1110	0.0				0.0			
100.2005	Elk Ck near Doty	308558	07/22/92	1110	0.0	2.0 U	2.0 U	5.6	0.0	130		
100.2005	Elk Ck near Doty	308559	07/22/92	1115	0.0	2.0 U	2.0 U	5.5		88		
100.2005	Elk Ck near Doty	328543	08/04/92	1000	0.0	2.0 U	2.0 U	4.7	0.0	120		
100.2005	Elk Ck near Doty	328544	08/04/92	1000	0.0	2.0 U	2.0 U	4.7	1.0	100		
88.0059	SF Chehalis nr Boistfort	358323	08/27/91	1330	0.0							
88.0059	SF Chehalis nr Boistfort	358423	08/28/91	1145	0.0							
88.0007	SF Chehalis nr Weyco Pump	358343	08/27/91	1205	0.0			2.6	1.0 U	160		
88.0007	SF Chehalis nr Weyco Pump	358443	08/28/91	1120	0.0			2.6	1.4	230 B		
88.0007	SF Chehalis nr Weyco Pump	308556	07/22/92	935	0.0			2.1				
88.0007	SF Chehalis nr Weyco Pump	328541	08/04/92	850	0.0			2.0				
84.4006	Bunker Ck @ Bridge blw Deep Ck	358324	08/27/91	1115	0.0			7.5	8.1	840		
84.4006	Bunker Ck @ Bridge blw Deep Ck	358424	08/28/91	1000	0.0			6.7	1.5	180		
84.4006	Bunker Ck @ Bridge blw Deep Ck	308588	07/22/92	1130	0.0			6.4				
84.4006	Bunker Ck @ Bridge blw Deep Ck	328572	08/04/92	1000	0.0			6.1				
78.0004	Stearns Ck @ Twin Oaks Rd	358325	08/27/91	1215	0.0			7.1	1.0 U	570		
78.0004	Stearns Ck @ Twin Oaks Rd	358425	08/28/91	1100	0.0			6.6	1.5	80		
78.0004	Stearns Ck @ Twin Oaks Rd	308589	07/22/92	1215	0.0			4.6				
78.0004	Stearns Ck @ Twin Oaks Rd	328573	08/04/92	1050	0.0			4.2				
75.2111	SF Newaukum R @ Forest	358327	08/27/91	915	0.0							
75.2111	SF Newaukum R @ Forest	358427	08/28/91	850	0.0							
75.2109003	NF Newaukum R @ Forest	358326	08/27/91	930	0.0							
75.2109003	NF Newaukum R @ Forest	358426	08/28/91	910	0.0							
75.20015	Newaukum River near mouth	358344	08/27/91	1523	0.0			6.2	1.0 U	68		
75.20015	Newaukum River near mouth	358444	08/28/91	1355	0.0			2.6	1.0 U	55 B		
75.20015	Newaukum River near mouth	418031	10/10/91	1829	0.0	2.0 U		1.6		11	27	55
75.20015	Newaukum River near mouth	308585	07/22/92	840	0.0	2.0 U	2.0 U	2.1	0.0			
75.20015	Newaukum River near mouth	308591	07/22/92	1345	0.0			3.1	0.0	45		
75.20015	Newaukum River near mouth	328570	08/04/92	756	0.0	2.0 U	2.0 U	2.1	0.0			
75.20015	Newaukum River near mouth	328575	08/04/92	1315	0.0			2.1	0.7	33		

Table F.3, page 2

RM Code	Site Description	Lab #	Date	Time	Depth (m)	BOD5 (mg/L)	BOD5 (mg/L)	TOC (mg/L)	CHLA (µg/L)	FC (#/100mL)	KES (%)	FS (#/100mL)
74.5034	Dillenbaugh Creek at LaBree Rd	288031	07/07/92	845	0.0	2.0 U		4.8		220		
74.5034	Dillenbaugh Creek at LaBree Rd	288034	07/07/92	845	0.0	2.0 U		4.9		250		
74.5034	Dillenbaugh Creek at LaBree Rd	328558	08/05/92	1015	0.0	2.0 U	2.0 U	3.7		410		
74.5032005	Berwick Creek	288032	07/07/92	915	0.0	2.0 U		7.0		700		
74.5032005	Berwick Creek	328559	08/05/92	1000	0.0	3.4	3.2	7.8		3100 J		
74.5023004	Indust Pk Trib @ Bishop Rd	288033	07/07/92	940	0.0	2.0 U		9.0		800		
74.5023004	Indust Pk Trib @ Bishop Rd	328560	08/05/92	942	0.0	2.4	2.2	7.5		3300 J		
74.5003	Dillenbaugh Creek near I-5	308587	07/22/92	1045	0.0			5.5	0.0	41		
74.5002	Dillenbaugh Ck above mouth	328557	08/05/92	846	0.0	2.0 U	2.0 U	4.9		51		
74.5001	Dillenbaugh Ck near mouth	358300	08/27/91	1130	0.0			13.4	3.2	540 B		
74.5001	Dillenbaugh Ck near mouth	358400	08/28/91	1225	0.0			11.4	1.0 U			
74.5001	Dillenbaugh Ck near mouth	418021	10/10/91	1129	0.0	2.0		3.7				
74.5001	Dillenbaugh Ck near mouth	288030	07/07/92	1340	0.0	2.0 U		5.8		37		
74.4001	Darigold WTP (Grab)	498023	12/03/91		0.0					35	67	
74.4001	Darigold WTP (Composite)	498024	12/04/91		0.0	47.8		30.1 J				
74.4001	Darigold WTP (Composite)	498025	12/04/91		0.0	26.7		33.6 J				
74.4001	Darigold WTP (Grab)	498026	12/04/91		0.0					150	58	
74.4001	Darigold WTP (Grab)	308313	07/20/92			17.8				2200		
74.4001	Darigold WTP (Grab)	308314	07/20/92			16.6		32.1	0.0			
74.4001	Darigold WTP (Composite)	308315	07/21/92					OH	1.9			U
74.4001	Darigold WTP (Composite)	308316	07/21/92			2.0 U	2.0 U		0.0			
74.4001	Darigold WTP (Grab)	308317	07/21/92			8.1	8.1			220		
74.4001	Darigold WTP (Grab)	328250	08/04/92			4.2	5.4					
74.4001	Darigold WTP (Grab)	328250	08/04/92			4.6				51 X		
74.4001	Darigold WTP (Grab)	328251	08/04/92			3.9	3.3		2.2			
74.4001	Darigold WTP (Grab)	328251	08/04/92					15.2				
74.4001	Darigold WTP (Composite)	328252	08/05/92					17.4	0.0			
74.4001	Darigold WTP (Composite)	328253	08/05/92			7.8	8.1		1.4			
74.4001	Darigold WTP (Composite)	328253	08/05/92					16.5				
74.4001	Darigold WTP (Grab)	328254	08/05/92			6.9	6.6					
74.4001	Darigold WTP (Grab)	328254	08/05/92			6.8				48		
74.3001	Chehalis WTP (Composite)	358379	08/27/91			21.4						
74.3001	Chehalis WTP (Composite)	358379	08/27/91					34.9	4.4			
74.3001	Chehalis WTP (Composite)	358380	08/27/91					32.9	1.0 U			
74.3001	Chehalis WTP (Grab)	358381	08/27/91							1 U		
74.3001	Chehalis WTP (Composite)	358479	08/28/91			21.0		29.9	2.8			
74.3001	Chehalis WTP (Composite)	358480	08/28/91					35.0	4.6			
74.3001	Chehalis WTP (Grab)	358481	08/28/91							3		
74.3001	Chehalis WTP (Grab)	358482	08/28/91							2		
74.3001	Chehalis WTP outfall	418022	10/10/91	1150	0.0	9.0		24.5				
74.3001	Chehalis WTP (Grab)	308293	07/20/92			14.7				7 U		
74.3001	Chehalis WTP (Grab)	308294	07/20/92						9.4			
74.3001	Chehalis WTP (Grab)	308294	07/20/92			11.2		40.9	8.3			
74.3001	Chehalis WTP (Composite)	308295	07/21/92					OH	7.1			
74.3001	Chehalis WTP (Composite)	308296	07/21/92			19.0	19.2	OH	6.5			
74.3001	Chehalis WTP (Grab)	308297	07/21/92			17.4	18.0			3 B		

Table F.3, page 3

RM Code	Site Description	Lab #	Date	Time	Depth (m)	BOD5 (mg/L)	BOD5 (mg/L)	TOC (mg/L)	CHLA (µg/L)	FC (#/100mL)	KES (%)	FS (#/100mL)
74.3001	Chehalis WTP (Grab)	328240	08/04/92			16.0	16.0					270
74.3001	Chehalis WTP (Grab)	328241	08/04/92			17.0	17.0	34.8	10.3			
74.3001	Chehalis WTP (Composite)	328242	08/05/92					35.3	19.5			
74.3001	Chehalis WTP (Composite)	328243	08/05/92						10.8			
74.3001	Chehalis WTP (Composite)	328243	08/05/92			19.0	21.0	35.5				
74.3001	Chehalis WTP (Grab)	328244	08/05/92			20.0	19.0					69
72.0001	Golf Course Discharge Pipe	328517	08/04/92	1345	0.0	2.4	2.2	3.5		300		
71.6001	Scheuber Drainage Ditch	358306	08/27/91	1415	0.0							
71.6001	Scheuber Drainage Ditch	358406	08/28/91	1411	0.0							
69.2017	Salzer Creek at Fair St	258109	06/16/92	1805	0.0	4.0 U		7.4		250		
69.2017	Salzer Creek at Fair St	308542	07/21/92	940	0.0				0.0			
69.2017	Salzer Creek at Fair St	308542	07/21/92	940	0.0	3.2	3.2	9.6	2.1	210		
69.2017	Salzer Creek at Fair St	308543	07/21/92	940	0.0			9.4	3.5	250		
69.2008009	Coal Creek at National Ave	258110	06/16/92	1750	0.0	4.0 U		6.2		45		
69.2008009	Coal Creek at National Ave	308547	07/21/92	1105	0.0	2.0 U	2.0 U	8.0		180		
69.2008009	Coal Creek at National Ave	378032	09/09/92	915	0.0	3.0 U	3.0 U	6.5		220		
69.2006002	Fairgrounds Drain	258108	06/17/92	1430	0.0	9.0		10.5		2400		
69.2006002	Fairgrounds Drain	308545	07/21/92	1015	0.0	8.4	8.4	13.9		830		
69.2006002	Fairgrounds Drain	378034	09/09/92	1035	0.0	49.5	46.5	14.2		14000		
69.2006	Salzer Creek at BN/UPRR	258106	06/16/92	1715	0.0	4.0 U		6.9		23		
69.2006	Salzer Creek at BN/UPRR	258107	06/16/92	1715	0.0	4.0 U		6.8		19		
69.2006	Salzer Creek at BN/UPRR	308544	07/21/92	1105	0.0	2.6	2.4	8.1		32		
69.2006	Salzer Creek at BN/UPRR	378033	09/09/92	1010	0.0	4.5	4.2	10.7		270		
69.2002	Salzer Ck @ Airport Rd	358354	08/27/91	1230	0.2			17.6	1.0 U	1600		
69.2002	Salzer Ck @ Airport Rd	358454	08/28/91	1135	0.0			20.6	1.0 U	8400		
69.2002	Salzer Ck @ Airport Rd	258105	06/16/92	1835	0.0	4.0 U		7.7		33		
69.2002	Salzer Ck @ Airport Rd	308546	07/21/92	1140	0.0	2.2	2.2	8.7	1.2	250		
69.2002	Salzer Ck @ Airport Rd	328578	08/04/92	1430	0.0			7.7	0.0	1800		
69.2002	Salzer Ck @ Airport Rd	378030	09/09/92	1125	0.0	3.0 U	3.0 U	9.9		130		
69.2002	Salzer Ck @ Airport Rd	378031	09/09/92	1125	0.0	3.0 U	3.0 U	8.5		84		
67.4002	Storm Drain @ Centralia WTP	358366	08/27/91	1750	0.0							
67.4002	Storm Drain @ Centralia WTP	358466	08/28/91	1654	0.0							
67.4001	Centralia WTP (Grab)	358388	08/27/91		0.0					34		
67.4001	Centralia WTP (Grab)	358389	08/27/91		0.0					56		
67.4001	Centralia WTP (Composite)	358386	08/27/93		0.0	31.6		33.3	1.0 U			
67.4001	Centralia WTP (Composite)	358387	08/27/93		0.0	35.0		34.9	4.8			
67.4001	Centralia WTP (Composite)	358486	08/28/91		0.0	39.0		36.4	4.7			
67.4001	Centralia WTP (Composite)	358487	08/28/91		0.0	31.0		34.3	4.6			
67.4001	Centralia WTP (Grab)	358488	08/28/91		0.0					13		
67.4001	Centralia WTP (Grab)	358489	08/28/91		0.0					19		
67.4001	Centralia WTP (Grab)	308283	07/20/92			22.0				14 U		
67.4001	Centralia WTP (Grab)	308284	07/20/92			22.0		42.8	6.3			
67.4001	Centralia WTP (Composite)	308285	07/21/92					OH	13.2			
67.4001	Centralia WTP (Composite)	308286	07/21/92			31.0	30.0	OH	10.1			
67.4001	Centralia WTP (Grab)	308287	07/21/92			31.0	30.0			32		

Table F.3, page 4

RM Code	Site Description	Lab #	Date	Time	Depth (m)	BOD5 (mg/L)	BOD5 (mg/L)	TOC (mg/L)	CHLA (µg/L)	FC (#/100mL)	KES (%)	FS (#/100mL)
67.4001	Centralia WTP (Grab)	328230	08/04/92			20.0	21.0			13		
67.4001	Centralia WTP (Grab)	328231	08/04/92			22.0	22.0	35.6	9.4			
67.4001	Centralia WTP (Composite)	328232	08/05/92					37.9	4.5			
67.4001	Centralia WTP (Composite)	328233	08/05/92						8.0			
67.4001	Centralia WTP (Composite)	328233	08/05/92			26.0	26.0	38.6				
67.4001	Centralia WTP (Grab)	328234	08/05/92			28.0	27.0			41		
67.3001	China Ck near mouth	358367	08/27/91	1912	0.0							
67.3001	China Ck near mouth	358467	08/28/91	1710	0.0							
66.9045	Skookumchuck R above Hanaford (	358356	08/27/91	1400	0.5							
66.9045	Skookumchuck R above Hanaford (	358456	08/28/91	1255	0.0							
66.903801	Hanaford Ck abv Skook R	358355	08/27/91	1430	0.2							
66.903801	Hanaford Ck abv Skook R	358455	08/28/91	1325	0.0							
66.9001	Skookumchuck River above Mouth	358317	08/27/91	1828	0.0			2.5	8.1	110 B		
66.9001	Skookumchuck River above Mouth	358417	08/28/91	1743	0.0			2.8	1.0 U	96 B		
66.9001	Skookumchuck River above Mouth	308520	07/22/92	1145	0.0	3.6	3.0	2.3	1.7			
66.9001	Skookumchuck River above Mouth	308535	07/22/92	1810	0.0			2.2	0.0	49		
66.9001	Skookumchuck River above Mouth	328515	08/04/92	930	0.0			1.9	0.0	27		
66.9001	Skookumchuck River above Mouth	328500	08/04/92	1650	0.0	2.0 U	2.0 U	2.0	1.1			
66.8001	Storm Drain below Skook R	308538	07/22/92	1822	0.0	47.0 L	47.0 L	118.0	0.0	28000 J		
61.8011	Lincoln Ck nr Galvin	358357	08/27/91	1045	0.2			6.3	1.4	2600 J		
61.8011	Lincoln Ck nr Galvin	358457	08/28/91	955	0.0			4.9	1.5	830		
61.8011	Lincoln Ck nr Galvin	308548	07/21/92	1325	0.0			4.3				
61.8011	Lincoln Ck nr Galvin	328561	08/05/92	1143	0.0			6.0				
58.2001	Blanksma Dairy Pump Springs	378344	09/10/91	1145	0.0							
58.2001	Blanksma Dairy Pump Springs	378444	09/11/91	1230	0.0							
55.208	Seafarm Washington	378373	09/09/91		0.0			3.0	0.0	1 U		
55.208	Seafarm Washington	378473	09/10/91		0.0			1.0 U	0.2	20		
55.206	Global Aqua/SC	378378	09/09/91		0.0			4.1	3.8	3		
55.206	Global Aqua/SC	378478	09/10/91		0.0			3.9	4.4	1		
55.2007	Scatter Creek @ Bridge above mou	378345	09/10/91	1050	0.0			3.3	1.9	740		
55.2007	Scatter Creek @ Bridge above mou	378445	09/11/91	1140	0.0			3.1	5.8	1500		
55.2007	Scatter Creek @ Bridge above mou	308549	07/21/92	1530	0.0			4.0				
55.2007	Scatter Creek @ Bridge above mou	328562	08/05/92	1402	0.0			5.7				
51.5003	Independence Ck @ 201st St	378346	09/10/91	930	0.0							
51.5003	Independence Ck @ 201st St	378446	09/11/91	825	0.0					20		
47.0012	Black R @ Howanut Rd Br	378326	09/10/91	825	0.0							
47.0012	Black R @ Howanut Rd Br	378327	09/10/91	825	0.0							
47.0012	Black R @ Howanut Rd Br	378334	09/10/91	1330	0.0			3.5	0.9	27		
47.0012	Black R @ Howanut Rd Br	378426	09/11/91	755	0.0							
47.0012	Black R @ Howanut Rd Br	378427	09/11/91	755	0.0							
47.0012	Black R @ Howanut Rd Br	378434	09/11/91	1350	0.0			3.1	1.0	35		
47.0012	Black R @ Howanut Rd Br	378526	09/12/91	805	0.0							
47.0012	Black R @ Howanut Rd Br	378527	09/12/91	805	0.0							
47.0012	Black R @ Howanut Rd Br	378534	09/12/91	1325	0.0			3.3	0.7	32		

Table F.3, page 5

RM Code	Site Description	Lab #	Date	Time	Depth (m)	BOD5 (mg/L)	BOD5 (mg/L)	TOC (mg/L)	CHLA (µg/L)	FC (#/100mL)	KES (%)	FS (#/100mL)
47.0012	Black R @ Howanut Rd Br	308570	07/21/92	820	0.0	2.0 U	2.0 U	3.3	0.0			
47.0012	Black R @ Howanut Rd Br	308581	07/21/92	1445	0.0			2.0	0.9	43		
47.0012	Black R @ Howanut Rd Br	328585	08/05/92	815	0.0	2.0 U	2.0 U	1.9	2.2			
47.0012	Black R @ Howanut Rd Br	328596	08/05/92	1710	0.0				1.3			
47.0012	Black R @ Howanut Rd Br	328596	08/05/92	1710	0.0			1.8	2.5	28		
44.9009	Garrard Ck @ Mattson Rd	378358	09/10/91	1600	0.0							
44.9009	Garrard Ck @ Mattson Rd	378458	09/11/91	1100	0.0					33		
44.9009	Garrard Ck @ Mattson Rd	308573	07/21/92	1030	0.0			3.4				
44.9009	Garrard Ck @ Mattson Rd	328588	08/05/92	1045	0.0			3.2				
39.4006	Rock Ck @ South Bank Rd	378357	09/10/91	1055	0.0							
39.4006	Rock Ck @ South Bank Rd	378457	09/11/91	1000	0.0					130 S		
38.8008	Cedar Ck @ Elma-Gate Rd	378360	09/10/91	1435	0.0			2.7	0.2	49		
38.8008	Cedar Ck @ Elma-Gate Rd	378460	09/11/91	1355	0.0			2.7	0.2	29		
38.8008	Cedar Ck @ Elma-Gate Rd	378560	09/12/91	1100	0.0			2.5	11.2	110		
38.8008	Cedar Ck @ Elma-Gate Rd	308572	07/21/92	1000	0.0			1.8				
38.8008	Cedar Ck @ Elma-Gate Rd	328587	08/05/92	1000	0.0			1.6				
33.9002	Porter Ck @ RR Trestle	378461	09/11/91	905	0.0					580		

Appendix F

Table F.4 Tributary Laboratory Results: Nutrients and Chloride

RM Code	Site Description	Lab #	Date	Time	Depth (m)	NH3N (mg/L)	NO23N (mg/L)	TN (mg/L)	SRP (mg/L)	TP (mg/L)	CL (mg/L)
105.5001	Pe Ell WTP (Composite)	358372	08/27/91		0.0	0.034	11.600	12.700	1.940	2.000	20.5
105.5001	Pe Ell WTP (Grab)	358373	08/27/91		0.0	0.029	12.400	12.800		2.040	18.3
105.5001	Pe Ell WTP (Grab)	358374	08/27/91		0.0						
105.5001	Pe Ell WTP (Composite)	358472	08/28/91		0.0	0.023	11.600	12.800	1.730	2.100	18.9
105.5001	Pe Ell WTP (Composite)	358473	08/28/91		0.0	0.031	11.800	12.900		2.340	19.0
105.5001	Pe Ell WTP (Grab)	358474	08/28/91		0.0						
105.5001	Pe Ell WTP (Grab)	358475	08/28/91		0.0						
100.2028	Elk Creek above Seven Creek	308560	07/22/92	1155	0.0	0.014	0.069	0.244		0.021	5.1
100.2028	Elk Creek above Seven Creek	328545	08/04/92	1101	0.0	0.011	0.057	0.276		0.019	5.2
100.2005	Elk Ck near Doty	358342	08/27/91	901	0.0	0.018	0.077	0.258	0.005	0.120	6.5
100.2005	Elk Ck near Doty	358442	08/28/91	840	0.0						
100.2005	Elk Ck near Doty	358442	08/28/91	840	0.0	0.010 U	0.089	0.321	0.006	0.025 L	5.4
100.2005	Elk Ck near Doty	308558	07/22/92	1110	0.0						
100.2005	Elk Ck near Doty	308558	07/22/92	1110	0.0	0.014	0.070	0.222	0.011	0.021	5.8
100.2005	Elk Ck near Doty	308559	07/22/92	1115	0.0	0.013	0.070	0.238	0.010 U	0.019	5.6
100.2005	Elk Ck near Doty	328543	08/04/92	1000	0.0	0.015	0.052	0.303	0.010 U	0.018	5.6
100.2005	Elk Ck near Doty	328544	08/04/92	1000	0.0	0.014	0.050	0.307	0.015	0.015	5.6
88.0059	SF Chehalis nr Boistfort	358323	08/27/91	1330	0.0	0.018	0.833	1.010	0.003	0.010 U	9.9
88.0059	SF Chehalis nr Boistfort	358423	08/28/91	1145	0.0	0.016	0.916	1.120	0.007	0.016 L	9.9
88.0007	SF Chehalis nr Weyco Pump	358343	08/27/91	1205	0.0	0.010 U	0.115	0.230	0.003 U	0.010 L	11.6
88.0007	SF Chehalis nr Weyco Pump	358443	08/28/91	1120	0.0	0.011	0.169	0.316	0.003	0.016 L	11.3
88.0007	SF Chehalis nr Weyco Pump	308556	07/22/92	935	0.0	0.031	0.175	0.278	0.010 U	0.013	11.4
88.0007	SF Chehalis nr Weyco Pump	328541	08/04/92	850	0.0	0.033	0.095	0.313	0.010 U	0.013	13.0
84.4006	Bunker Ck @ Bridge blw Deep Ck	358324	08/27/91	1115	0.0	0.041	0.099	0.457	0.062	0.055 L	10.1
84.4006	Bunker Ck @ Bridge blw Deep Ck	358424	08/28/91	1000	0.0	0.024	0.078	0.453	0.041	0.082 L	10.0
84.4006	Bunker Ck @ Bridge blw Deep Ck	308588	07/22/92	1130	0.0	0.055	0.062	0.401	0.046	0.073	10.4
84.4006	Bunker Ck @ Bridge blw Deep Ck	328572	08/04/92	1000	0.0	0.035	0.023	0.526	0.039	0.083	9.8
78.0004	Stearns Ck @ Twin Oaks Rd	358325	08/27/91	1215	0.0	0.034	0.272	0.677	0.056	0.065 L	4.1
78.0004	Stearns Ck @ Twin Oaks Rd	358425	08/28/91	1100	0.0	0.093	0.443	0.871	0.056	0.095 L	4.4
78.0004	Stearns Ck @ Twin Oaks Rd	308589	07/22/92	1215	0.0	0.069	0.163	0.516	0.064	0.104	3.6
78.0004	Stearns Ck @ Twin Oaks Rd	328573	08/04/92	1050	0.0	0.053	0.130	0.569	0.043	0.106	3.6
75.2111	SF Newaukum R @ Forest	358327	08/27/91	915	0.0	0.010 U	0.105	0.170	0.009	0.020 L	8.7
75.2111	SF Newaukum R @ Forest	358427	08/28/91	850	0.0	0.022	0.120	0.250	0.014	0.023 L	8.0
75.2109003	NF Newaukum R @ Forest	358326	08/27/91	930	0.0	0.010 U	0.051	0.117	0.003	0.013 L	7.7
75.2109003	NF Newaukum R @ Forest	358426	08/28/91	910	0.0	0.010 U	0.112	0.222	0.004	0.020 L	7.8
75.20015	Newaukum River near mouth	358344	08/27/91	1523	0.0	0.011	0.010 U	0.132	0.005	0.022 L	8.7
75.20015	Newaukum River near mouth	358444	08/28/91	1355	0.0	0.010 U	0.010 U	0.134	0.004	0.015 L	8.5
75.20015	Newaukum River near mouth	418031	10/10/91	1829	0.0	0.039	0.013	0.138	0.012	0.018 L	11.5
75.20015	Newaukum River near mouth	308585	07/22/92	840	0.0	0.018	0.012	0.171	0.010	0.018	9.4
75.20015	Newaukum River near mouth	308591	07/22/92	1345	0.0	0.018	0.010 U	0.171	0.011	0.019	9.5
75.20015	Newaukum River near mouth	328570	08/04/92	756	0.0	0.015	0.026	0.242	0.016	0.012	10.1
75.20015	Newaukum River near mouth	328575	08/04/92	1315	0.0	0.016	0.017	0.199	0.015	0.014	10.4

Table F.4, page 2

RM Code	Site Description	Lab #	Date	Time	Depth (m)	NH3N (mg/L)	NO23N (mg/L)	TN (mg/L)	SRP (mg/L)	TP (mg/L)	CL (mg/L)
74.5034	Dillenbaugh Creek at LaBree Rd	288031	07/07/92	845	0.0	0.013	0.065	0.301		0.078	2.8
74.5034	Dillenbaugh Creek at LaBree Rd	288034	07/07/92	845	0.0	0.015	0.064	0.303		0.076	2.8
74.5034	Dillenbaugh Creek at LaBree Rd	328558	08/05/92	1015	0.0	0.014	0.086	0.305		0.077	2.6
74.5032005	Berwick Creek	288032	07/07/92	915	0.0	0.052	0.331	0.785		0.123	7.5
74.5032005	Berwick Creek	328559	08/05/92	1000	0.0	0.244	1.010	2.260		0.197	10.7
74.5023004	Indust Pk Trib @ Bishop Rd	288033	07/07/92	940	0.0	0.033	0.304	0.652		0.106	19.7
74.5023004	Indust Pk Trib @ Bishop Rd	328560	08/05/92	942	0.0	0.037	0.298	0.742		0.149	6.8
74.5003	Dillenbaugh Creek near I-5	308587	07/22/92	1045	0.0	0.154	0.026	0.485	0.029	0.106	7.0
74.5002	Dillenbaugh Ck above mouth	328557	08/05/92	846	0.0	0.032	0.033	0.406	0.032	0.129	8.1
74.5001	Dillenbaugh Ck near mouth	358300	08/27/91	1130	0.0	0.568	0.217	0.930	0.045	0.097 L	10.2
74.5001	Dillenbaugh Ck near mouth	358400	08/28/91	1225	0.0	0.070	0.031	0.588	0.033	0.118	12.6
74.5001	Dillenbaugh Ck near mouth	418021	10/10/91	1129	0.0	0.025	0.049	0.358	0.052	0.066 L	6.0
74.5001	Dillenbaugh Ck near mouth	288030	07/07/92	1340	0.0	0.059	0.103	0.517		0.152	8.2
74.4001	Darigold WTP (Grab)	498023	12/03/91		0.0						
74.4001	Darigold WTP (Composite)	498024	12/04/91		0.0	0.135	0.328	4.870	47.600	43.400	657.0
74.4001	Darigold WTP (Composite)	498025	12/04/91		0.0	0.127	0.423	5.770 J	32.900	44.300	598.0
74.4001	Darigold WTP (Grab)	498026	12/04/91		0.0						
74.4001	Darigold WTP (Grab)	308313	07/20/92								
74.4001	Darigold WTP (Grab)	308314	07/20/92			0.240 B	0.041	2.670	27.000	32.700	751.0
74.4001	Darigold WTP (Composite)	308315	07/21/92			1.180	0.302	3.070	9.440	21.500	588.0
74.4001	Darigold WTP (Composite)	308316	07/21/92			0.293	0.628	3.110	9.390	21.700	623.0
74.4001	Darigold WTP (Grab)	308317	07/21/92								
74.4001	Darigold WTP (Grab)	328250	08/04/92								
74.4001	Darigold WTP (Grab)	328250	08/04/92								
74.4001	Darigold WTP (Grab)	328251	08/04/92								
74.4001	Darigold WTP (Grab)	328251	08/04/92			0.045	3.990	6.600	32.300	34.200	748.0
74.4001	Darigold WTP (Composite)	328252	08/05/92			0.512	3.790	6.320	32.200	31.000	650.0
74.4001	Darigold WTP (Composite)	328253	08/05/92								
74.4001	Darigold WTP (Composite)	328253	08/05/92			0.323	3.880	6.460	32.800	35.600	661.0
74.4001	Darigold WTP (Grab)	328254	08/05/92								
74.4001	Darigold WTP (Grab)	328254	08/05/92								
74.3001	Chehalis WTP (Composite)	358379	08/27/91								
74.3001	Chehalis WTP (Composite)	358379	08/27/91			19.000	6.400	28.800	4.950	9.280	42.1
74.3001	Chehalis WTP (Composite)	358380	08/27/91			18.500	8.120	31.600		7.410	42.3
74.3001	Chehalis WTP (Grab)	358381	08/27/91								
74.3001	Chehalis WTP (Composite)	358479	08/28/91			15.200	5.230	23.800	3.120	5.780	34.8
74.3001	Chehalis WTP (Composite)	358480	08/28/91			15.100	5.100	24.200		6.940	32.9
74.3001	Chehalis WTP (Grab)	358481	08/28/91								
74.3001	Chehalis WTP (Grab)	358482	08/28/91								
74.3001	Chehalis WTP outfall	418022	10/10/91	1150	0.0	16.200	9.390	30.600	5.060	5.650	44.7
74.3001	Chehalis WTP (Grab)	308293	07/20/92								
74.3001	Chehalis WTP (Grab)	308294	07/20/92								
74.3001	Chehalis WTP (Grab)	308294	07/20/92			23.800	2.300	29.100	3.920	5.790	39.6
74.3001	Chehalis WTP (Composite)	308295	07/21/92			27.300	2.300	30.300	5.530	5.080	41.2
74.3001	Chehalis WTP (Composite)	308296	07/21/92			29.100	2.180	29.300	4.350	5.040	42.9
74.3001	Chehalis WTP (Grab)	308297	07/21/92								

Table F.4, page 3

RM Code	Site Description	Lab #	Date	Time	Depth (m)	NH3N (mg/L)	NO23N (mg/L)	TN (mg/L)	SRP (mg/L)	TP (mg/L)	CL (mg/L)
74.3001	Chehalis WTP (Grab)	328240	08/04/92								
74.3001	Chehalis WTP (Grab)	328241	08/04/92			25.400	1.760	31.300	3.220	4.260	53.7
74.3001	Chehalis WTP (Composite)	328242	08/05/92			25.800	1.770	33.800	2.900	3.510	43.8
74.3001	Chehalis WTP (Composite)	328243	08/05/92								
74.3001	Chehalis WTP (Composite)	328243	08/05/92			24.600	2.000		2.910	3.920	45.1
74.3001	Chehalis WTP (Grab)	328244	08/05/92								
72.0001	Golf Course Discharge Pipe	328517	08/04/92	1345	0.0	0.013	0.067	0.621	0.113	0.175	10.7
71.6001	Scheuber Drainage Ditch	358306	08/27/91	1415	0.0	0.066	0.049	0.508	0.019	0.027 L	15.5
71.6001	Scheuber Drainage Ditch	358406	08/28/91	1411	0.0	0.062	0.047	0.522	0.011	0.040 L	14.5
69.2017	Salzer Creek at Fair St	258109	06/16/92	1805	0.0	0.028	0.017	0.558		0.085	12.2
69.2017	Salzer Creek at Fair St	308542	07/21/92	940	0.0						
69.2017	Salzer Creek at Fair St	308542	07/21/92	940	0.0	0.014	0.010 U	0.771	0.010 U	0.116	14.4
69.2017	Salzer Creek at Fair St	308543	07/21/92	940	0.0	0.017	0.010 U	0.769	0.010 U	0.129	14.5
69.2008009	Coal Creek at National Ave	258110	06/16/92	1750	0.0	0.070	0.128	0.541		0.047	7.0
69.2008009	Coal Creek at National Ave	308547	07/21/92	1105	0.0	0.053	0.132	0.524		0.058	7.6
69.2008009	Coal Creek at National Ave	378032	09/09/92	915	0.0	0.047	0.067	0.501		0.033	6.8
69.2006002	Fairgrounds Drain	258108	06/17/92	1430	0.0	1.640	2.940	5.990		0.385	31.0
69.2006002	Fairgrounds Drain	308545	07/21/92	1015	0.0	0.842	1.360	3.980		0.289	16.4
69.2006002	Fairgrounds Drain	378034	09/09/92	1035	0.0	1.170	1.100	12.200		0.636	27.1
69.2006	Salzer Creek at BN/UPRR	258106	06/16/92	1715	0.0	0.033	0.056	0.431		0.055	7.2
69.2006	Salzer Creek at BN/UPRR	258107	06/16/92	1715	0.0	0.041	0.064	0.414		0.057	7.3
69.2006	Salzer Creek at BN/UPRR	308544	07/21/92	1105	0.0	0.040	0.012	0.416		0.063	8.9
69.2006	Salzer Creek at BN/UPRR	378033	09/09/92	1010	0.0	0.016	0.010 U	0.475		0.058	
69.2002	Salzer Ck @ Airport Rd	358354	08/27/91	1230	0.2	0.310	0.142	1.140	0.044	0.169	195.0
69.2002	Salzer Ck @ Airport Rd	358454	08/28/91	1135	0.0	0.015	0.010 U	1.050	0.097	0.230	39.9
69.2002	Salzer Ck @ Airport Rd	258105	06/16/92	1835	0.0	0.048	0.056	0.469		0.050	80.6
69.2002	Salzer Ck @ Airport Rd	308546	07/21/92	1140	0.0	0.103	0.095	0.640	0.053	0.101	207.0
69.2002	Salzer Ck @ Airport Rd	328578	08/04/92	1430	0.0	0.035	0.010 U	0.536	0.025	0.069	334.0
69.2002	Salzer Ck @ Airport Rd	378030	09/09/92	1125	0.0	0.014	0.010 U	0.422		0.077	23.0
69.2002	Salzer Ck @ Airport Rd	378031	09/09/92	1125	0.0	0.015	0.010 U	0.486		0.062	22.4
67.4002	Storm Drain @ Centralia WTP	358366	08/27/91	1750	0.0	1.330	0.434		0.167	0.364	1.0 U
67.4002	Storm Drain @ Centralia WTP	358466	08/28/91	1654	0.0	0.651	0.187	1.880		0.316	1.0 U
67.4001	Centralia WTP (Grab)	358388	08/27/91		0.0						
67.4001	Centralia WTP (Grab)	358389	08/27/91		0.0						
67.4001	Centralia WTP (Composite)	358386	08/27/93		0.0	12.900	3.350	20.000	3.790	5.180	48.0
67.4001	Centralia WTP (Composite)	358387	08/27/93		0.0	12.800	3.570	20.100		5.220	46.7
67.4001	Centralia WTP (Composite)	358486	08/28/91		0.0	14.900	3.110	23.100	4.460	5.300	41.0
67.4001	Centralia WTP (Composite)	358487	08/28/91		0.0	12.000	4.340	20.600	3.940	5.010	41.4
67.4001	Centralia WTP (Grab)	358488	08/28/91		0.0						
67.4001	Centralia WTP (Grab)	358489	08/28/91		0.0						
67.4001	Centralia WTP (Grab)	308283	07/20/92								
67.4001	Centralia WTP (Grab)	308284	07/20/92			17.000	3.870	24.900	5.560	6.250	54.1
67.4001	Centralia WTP (Composite)	308285	07/21/92			18.200	3.640	22.200	7.900	6.020	53.5
67.4001	Centralia WTP (Composite)	308286	07/21/92			17.900	3.750	22.600	8.800	5.820	53.0
67.4001	Centralia WTP (Grab)	308287	07/21/92								

Table F.4, page 4

RM Code	Site Description	Lab #	Date	Time	Depth (m)	NH3N (mg/L)	NO23N (mg/L)	TN (mg/L)	SRP (mg/L)	TP (mg/L)	CL (mg/L)
67.4001	Centralia WTP (Grab)	328230	08/04/92								
67.4001	Centralia WTP (Grab)	328231	08/04/92			11.800	3.820	21.300	4.210	6.290	55.7
67.4001	Centralia WTP (Composite)	328232	08/05/92			16.200	3.740	25.100	4.130	3.660	55.3
67.4001	Centralia WTP (Composite)	328233	08/05/92								
67.4001	Centralia WTP (Composite)	328233	08/05/92			16.400	3.710	25.600	3.680	3.880	53.8
67.4001	Centralia WTP (Grab)	328234	08/05/92								
67.3001	China Ck near mouth	358367	08/27/91	1912	0.0	0.019	0.914		0.054	0.089 L	7.3
67.3001	China Ck near mouth	358467	08/28/91	1710	0.0	0.060	1.120	1.800		0.361	10.3
66.9045	Skookumchuck R above Hanaford (	358356	08/27/91	1400	0.5	0.010 U	0.335	0.432	0.008	0.024 L	2.7
66.9045	Skookumchuck R above Hanaford (	358456	08/28/91	1255	0.0	0.011	0.370	0.466	0.009	0.022 L	3.6
66.903801	Hanaford Ck abv Skook R	358355	08/27/91	1430	0.2	0.010 U	0.293	0.535	0.020	0.055 L	9.5
66.903801	Hanaford Ck abv Skook R	358455	08/28/91	1325	0.0	0.030	0.334	0.554	0.021	0.051 L	9.3
66.9001	Skookumchuck River above Mouth	358317	08/27/91	1828	0.0	0.010 U	0.298	0.383	0.009	0.015 L	3.0
66.9001	Skookumchuck River above Mouth	358417	08/28/91	1743	0.0	0.010 U	0.310	0.444	0.013	0.024 L	3.3
66.9001	Skookumchuck River above Mouth	308520	07/22/92	1145	0.0	0.020	0.357	0.468	0.013	0.021	3.6
66.9001	Skookumchuck River above Mouth	308535	07/22/92	1810	0.0	0.025	0.359	0.455	0.018	0.024	3.6
66.9001	Skookumchuck River above Mouth	328515	08/04/92	930	0.0	0.012	0.319	0.466	0.019	0.021	4.4
66.9001	Skookumchuck River above Mouth	328500	08/04/92	1650	0.0	0.013	0.290	0.460	0.018	0.017	4.3
66.8001	Storm Drain below Skook R	308538	07/22/92	1822	0.0	1.230	1.200	5.610	0.131	0.417	10.8
61.8011	Lincoln Ck nr Galvin	358357	08/27/91	1045	0.2	0.048	0.116	0.476	0.048	0.105	6.6
61.8011	Lincoln Ck nr Galvin	358457	08/28/91	955	0.0	0.053	0.118	0.484	0.044	0.111	6.3
61.8011	Lincoln Ck nr Galvin	308548	07/21/92	1325	0.0	0.062	0.085	0.442	0.048	0.087	6.6
61.8011	Lincoln Ck nr Galvin	328561	08/05/92	1143	0.0	0.068	0.069	0.466	0.050	0.102	9.4
58.2001	Blanksma Dairy Pump Springs	378344	09/10/91	1145	0.0	0.010 U	3.290	3.450	0.018	0.033 L	4.9
58.2001	Blanksma Dairy Pump Springs	378444	09/11/91	1230	0.0	0.010 U	3.350	3.370	0.019	0.046 L	4.7
55.208	Seafarm Washington	378373	09/09/91		0.0	0.124	3.760	4.120	0.066	0.076 L	5.5
55.208	Seafarm Washington	378473	09/10/91		0.0	0.121	3.870	4.010	0.058	0.119	5.5
55.206	Global Aqua/SC	378378	09/09/91		0.0	0.107	3.000	3.490	0.037	0.059 L	5.2
55.206	Global Aqua/SC	378478	09/10/91		0.0	0.105	3.250	3.540	0.031	0.067 L	5.0
55.2007	Scatter Creek @ Bridge above mou	378345	09/10/91	1050	0.0	0.010 U	1.820	1.960	0.035	0.056 L	5.4
55.2007	Scatter Creek @ Bridge above mou	378445	09/11/91	1140	0.0	0.010 U	1.900	2.150	0.035	0.061 L	5.4
55.2007	Scatter Creek @ Bridge above mou	308549	07/21/92	1530	0.0	0.011	1.650	1.910	0.010 U	0.022	7.9
55.2007	Scatter Creek @ Bridge above mou	328562	08/05/92	1402	0.0	0.039	0.063	0.670	0.055	0.086	8.3
51.5003	Independence Ck @ 201st St	378346	09/10/91	930	0.0	0.088	0.079	0.428	0.056	0.091 L	9.3
51.5003	Independence Ck @ 201st St	378446	09/11/91	825	0.0	0.092	0.077	0.420	0.056	0.058 L	9.0
47.0012	Black R @ Howanut Rd Br	378326	09/10/91	825	0.0	0.010 U	0.943	1.120		0.041 L	5.8
47.0012	Black R @ Howanut Rd Br	378327	09/10/91	825	0.0	0.010 U	0.945	1.170		0.042 L	5.7
47.0012	Black R @ Howanut Rd Br	378334	09/10/91	1330	0.0	0.010 U	0.921	1.100	0.026	0.040 L	5.7
47.0012	Black R @ Howanut Rd Br	378426	09/11/91	755	0.0	0.015	0.909	1.120		0.041 L	5.6
47.0012	Black R @ Howanut Rd Br	378427	09/11/91	755	0.0	0.010 U	0.911	1.120		0.040 L	5.6
47.0012	Black R @ Howanut Rd Br	378434	09/11/91	1350	0.0	0.010 U	0.917	1.100	0.027	0.040 L	5.6
47.0012	Black R @ Howanut Rd Br	378526	09/12/91	805	0.0	0.034	0.912	1.110		0.036 L	5.4
47.0012	Black R @ Howanut Rd Br	378527	09/12/91	805	0.0	0.010 U	0.916	1.100		0.035 L	5.4
47.0012	Black R @ Howanut Rd Br	378534	09/12/91	1325	0.0	0.010 U	0.920	1.080	0.027	0.037 L	5.7

Table F.4, page 5

RM Code	Site Description	Lab #	Date	Time	Depth (m)	NH3N (mg/L)	NO23N (mg/L)	TN (mg/L)	SRP (mg/L)	TP (mg/L)	CL (mg/L)
47.0012	Black R @ Howanut Rd Br	308570	07/21/92	820	0.0	0.047	0.905	1.050	0.024	0.024	5.3
47.0012	Black R @ Howanut Rd Br	308581	07/21/92	1445	0.0	0.030	0.930	1.060	0.017	0.022	5.4
47.0012	Black R @ Howanut Rd Br	328585	08/05/92	815	0.0	0.027	0.807	0.970	0.021	0.028	5.4
47.0012	Black R @ Howanut Rd Br	328596	08/05/92	1710	0.0						
47.0012	Black R @ Howanut Rd Br	328596	08/05/92	1710	0.0	0.010		0.962	0.019	0.010	5.4
44.9009	Garrard Ck @ Mattson Rd	378358	09/10/91	1600	0.0	0.010 U	0.135	0.290	0.036	0.054 L	5.4
44.9009	Garrard Ck @ Mattson Rd	378458	09/11/91	1100	0.0	0.010 U	0.130	0.284	0.038	0.041 L	5.3
44.9009	Garrard Ck @ Mattson Rd	308573	07/21/92	1030	0.0	0.018	0.169	0.312	0.048	0.049	5.7
44.9009	Garrard Ck @ Mattson Rd	328588	08/05/92	1045	0.0	0.028	0.150	0.345	0.062	0.086	6.2
39.4006	Rock Ck @ South Bank Rd	378357	09/10/91	1055	0.0	0.010 U	0.082	0.256	0.015	0.035 L	5.2
39.4006	Rock Ck @ South Bank Rd	378457	09/11/91	1000	0.0	0.010 U	0.078	0.252	0.004	0.026 L	5.0
38.8008	Cedar Ck @ Elma-Gate Rd	378360	09/10/91	1435	0.0	0.010 U	0.193	0.262	0.004	0.010 U	4.0
38.8008	Cedar Ck @ Elma-Gate Rd	378460	09/11/91	1355	0.0	0.010 U	0.198	0.271	0.016	0.010 U	3.9
38.8008	Cedar Ck @ Elma-Gate Rd	378560	09/12/91	1100	0.0	0.010 U	0.196	0.266	0.043	0.010 U	3.9
38.8008	Cedar Ck @ Elma-Gate Rd	308572	07/21/92	1000	0.0	0.010 U	0.225	0.275	0.010 U	0.010 U	3.8
38.8008	Cedar Ck @ Elma-Gate Rd	328587	08/05/92	1000	0.0	0.010 U	0.248	0.296	0.010 U	0.010 U	4.3
33.9002	Porter Ck @ RR Trestle	378461	09/11/91	905	0.0						

Appendix F

Table F.5 Ultimate CBOD Analysis Summary - Tributary

RM Code	Site Description	Lab #	Date	Time	Depth (m)	BOD5 (mg/L)	UBOD (mg/L)	u/5 (n.d.)	k (1/day)	SS	Dltn (n.d.)	Days
100.2005	Elk Ck @ Elk Ck Rd Br	358342	8/27/91	901	0.0	3.5	6.9	1.96	0.1539	1.2E-01	1	29
		328543	8/4/92	1000	0.0	0.7	2.2	3.07	0.0734	6.4E-02	1	34
		328544	8/4/92	1000	0.0	0.5	2.1	3.91	0.0661	4.4E-02	1	34
88.0007	SF Chehalis R @ Tanker Int	358343	8/27/91	1205	0.0	1.1	2.3	1.99	0.1895	1.4E-01	1	29
84.4006	Bunker Ck @ BR abv mouth	358324	8/27/91	1115	0.0	2.6	5.5	2.09	0.1262	7.4E-01	1	29
		358324R	8/27/91	1115	0.0	2.2	5.3	2.43	0.1238	6.0E-01	1	29
78.0004	Stearns Dk @ Twin Oaks Rd	358325	8/27/91	1215	0.0	1.3	3.3	2.51	0.1034	1.1E-01	1	29
75.20015	Newaukum R @ mouth	358344	8/27/91	1523	0.0	0.6	1.9	3.23	0.1222	2.2E-01	1	29
		308591	7/22/92	1345	0.0	0.8	1.8	2.12	0.0954	3.8E-01	1	34
		328575	8/4/92	1315	0.0	0.6	1.7	2.97	0.1121	9.2E-02	1	34
74.5003	Dillenbaugh Ck nr I-5	308587	7/22/92	1045	0.0	1.0	2.9	2.87	0.0631	5.2E-01	1	34
74.5001	Dillenbaugh Ck abv mouth	358300	8/27/91	1130	0.0	5.8	13.3	2.28	0.1162	2.1E+00	1	29
74.4001	Darigold WTP	498024	12/3/91		0.0	17.8	66.8	3.74	0.0671	1.5E+01	2	32
		498024	12/3/91		0.0	28.1	56.3	2.00	0.1790	8.9E+01	4	32
		308315	7/21/92			14.1	26.1	1.86	0.1319	1.6E+01	1	34
		308315	7/21/92			13.0	24.4	1.88	0.1336	1.6E+01	2	34
		308315R	7/21/92			12.8	25.4	1.99	0.1169	1.7E+01	2	34
		328252	8/5/92			5.1	18.6	3.69	0.0450	6.6E+00	2	34
		328252	8/5/92			6.5	31.7	4.88	0.0160	5.3E+01	4	34
		328252	8/5/92			7.8	18.1	2.32	0.0500	4.3E+01	4	34
74.3001	Chehalis WTP	358379	8/27/91			19.1	30.8	1.61	0.2005	4.5E-01	2	12
		358379R	8/27/91			21.7	30.4	1.40	0.2488	6.5E-03	2	12
		358379	8/27/91			18.7	22.9	1.22	0.2898	2.9E+00	4	12
		358379R	8/27/91			18.0	27.0	1.50	0.1865	6.6E+00	4	12
		308295	7/21/92			22.9	52.5	2.29	0.1258	8.1E+00	2	12
		328242	8/5/92			17.3	52.5	3.03	0.0850	3.8E+00	2	12
		328242	8/5/92			19.1	92.7	4.86	0.0440	1.2E+00	4	12
69.2002	Salzer Ck @ Airport Rd	358354	8/27/91	1230	0.2	9.5	17.2	1.81	0.1605	3.7E+00	1	29
		328578	8/4/92	1430	0.0	1.3	5.4	4.12	0.0573	6.6E-02	1	34
67.4001	Centralia WTP	358386	8/27/91		0.0	29.2	42.2	1.44	0.2337	1.4E+02	2	60
		358386	8/27/91		0.0	29.8	47.6	1.60	0.1682	1.2E+02	4	60
		308285	7/21/92			26.7	57.0	2.14	0.1367	5.6E+00	2	12
		328232	8/5/92			28.0	70.7	2.52	0.1067	4.9E+00	2	12
		328232	8/5/92			28.6	61.2	2.14	0.1410	1.4E+01	4	12
66.9001	Skookumchuck R nr mouth	358317	8/27/91	1828	0.0	0.6	1.9	3.07	0.0965	5.9E-02	1	29
		308535	7/22/92	1810	0.0	0.7	2.1	3.09	0.0581	1.3E-01	1	34
		328515	8/4/92	930	0.0	0.8	1.6	2.07	0.1331	4.9E-02	1	34
61.8011	Lincoln Ck @ Lincoln Ck Rd	358357	8/27/91	1045	0.2	0.8	3.7	4.84	0.0724	4.2E-01	1	29
55.208	Seafarm WA/Scatter Ck	378373R	9/10/91		0.0	0.8	1.8	2.30	0.1478	4.3E-01	2	29
		378373	9/10/91		0.0	1.0	3.1	3.22	0.0714	1.2E+00	2	29
		378373	9/10/91		0.0	1.7	2.0	1.15	0.4259	7.3E-01	1	29
55.206	Global Aqua/Scatter Ck	378378	9/10/91		0.0	2.1	3.0	1.48	0.3218	1.3E+00	2	29
		378378	9/10/91		0.0	2.9	2.9	1.00	0.5655	4.6E-02	4	12
55.2007	Scatter Ck @ BR abv mouth	378345	9/10/91	1050	0.0	0.7	3.1	4.66	0.0483	4.5E-02	1	29
47.0012	Black R @ Howanut Rd Br	378334	9/10/91	1330	0.0	1.0	2.2	2.14	0.139	1.5E-01	1	29
		308581	7/21/92	1445	0.0	1.4	1.9	1.40	0.209	1.7E-01	1	34
		328596	8/5/92	1710	0.0	0.6	2.0	3.16	0.103	1.3E-01	1	34
38.8008	Cedar Ck @ Elma-Gate Rd	378360	9/10/91	1435	0.0	0.3	2.0	6.45	0.0412	1.7E-01	1	60

u/5 = UBOD/CBOD5; k = bottle deoxygenation rate; SS = Residual sum of squares for 1st-order fit; Dltn = dilution used; Days = # of days used in 1st-order fit.

Appendix G. Model Calibration

G.1 Segment Dimensions and Dispersion Coefficients

To develop model segmentation, the WASP5 user's manual (Ambrose *et al*, 1993) and another support document (NCASI, 1991) suggest that attention should be paid to the relative size of segments and the residence time or travel time for each segment. Therefore, the initial estimates of travel time discussed above helped define model segmentation. Maximum segment size was established in swifter stretches of the river based on the distance between sampling locations, and then smaller segments with similar travel times were defined in the slower Centralia reach.

Cross-sectional areas that were measured as part of flow determinations were used to develop channel geometry. After segment volumes were established, average segment depth, width, length, and inter-segment surface areas were defined consistent with field data.

Dispersion coefficients for the model were developed vertically and longitudinally between neighboring water column segments. Dispersion coefficients were applied globally to sections of the river with similar characteristics - one horizontal coefficient each for the lower and upper river, and a horizontal and vertical coefficient for the Centralia reach. Horizontal coefficients are velocity-based using the method in Liu (1977) cited in EPA (1985). Vertical dispersion coefficients were developed from temperature profile data using the method presented in Thomann and Mueller (1987).

To test the appropriateness of the estimated dispersion coefficients, the model was run with several different coefficients. The model was insensitive to the dispersion coefficients, *i.e.*, variation of the dispersion coefficients produced very little change in the model results.

G.2 Flow, Velocity, and Depth

For the WASP5 model of the Chehalis River, flows were specified in the input file. A flow mass balance was developed with a spreadsheet, so that changes in flows could be balanced and then entered in the input file. A copy of the spreadsheets for July and August 1992 conditions are presented in Appendix Tables G.1 and G.2, respectively. Flows in the input file are organized into instream horizontal flows, tributary/point source flows, consumptive use withdrawals, vertical flows, and ground water flows.

Tributary stream flows were measured during the surveys, as were river flows at selected locations. Ground water inflows were estimated by mass balance, with consideration given to the regional ground water flow patterns described in Sinclair and Herschey (1992) and Erickson (1993), as well as local topography and geology. Measured effluent flows from permitted discharges reported in Das (1993) and in DMRs were used in the model.

Consumptive use withdrawals were estimated by reviewing all water rights on the Chehalis River, and totaling these by segment. A percentage of the total permitted withdrawals was applied to each segment based on how many pumps had been observed in the area compared to the number of water rights. As with ground water flows, this initial rough estimate was refined using the flow and chloride mass balance.

WASP5 requires hydraulic coefficients and exponents that specify velocity and depth as a function of flow. The format of these equations is $v = a * Q^b$ and $h = c * Q^d$, where v = velocity, Q = flow, h = depth, and a, b, c, and d are the hydraulic coefficients and exponents. Using the method recommended in the WASP5 documentation (Ambrose *et al.*, 1993), exponents were selected that are typical of temperate rivers with cohesive soils. Coefficients for each segment were then derived from the selected exponents and from the flow, velocity, and depth measurements of the river.

G.3 Loading Sources and Boundary Concentrations

For chloride tracer modeling in the Chehalis River, ground water chloride sources were input as boundary concentrations. Boundary concentrations for ground water were set to levels that appeared to be typical for the region. Regional ground water quality data were found in Pearson and Higgins (1977), Carey (1992), Sinclair and Herschey (1992), Erickson (1993), National Frozen Foods annual reports (Hunter, 1991; Wilson, 1992; Brown and Caldwell, 1993), and Centralia Landfill quarterly reports (First, 1991a; First, 1991b).

Tributary, point source, and headwater chloride sources were input as waste loads. Loading was calculated from measured or estimated flows and chloride concentrations measured during the surveys. Where necessary to meet the chloride mass balance, additional loading was input as a waste load to benthic segments, under the assumption that unknown sources were reaching the river through ground water.

For full eutrophication modeling, boundary conditions and waste loads must be specified for the state variables of eight systems. The method to set the inputs for the eight parameters was similar to the way chloride inputs were set. Boundary conditions were set to background levels for regional ground water quality. Tributaries and point sources were given loadings for the eight systems calculated from measured flows and concentrations. The loading sources identified by the chloride mass balance were determined using several different approaches (explained below), depending on the probable source and pathway to the river.

Appendix Tables G.4 and G.5 show the waste loads and boundary conditions for July and August 1992 conditions, respectively. Point source loads for the upstream boundary on the mainstem, the permitted NPDES dischargers, and major natural tributaries were measured directly by intensive survey sampling.

To estimate the loading from livestock, ground water quality data were used from an assessment of a dairy lagoon near the Chehalis River in Adna (Erickson, 1992). The ratio between each eutrophication parameter and chloride in the ground water near the dairy waste lagoon was evaluated. To estimate the loading of the eight parameters to the Chehalis River where dairies were the suspect sources, this ratio was applied to the chloride calibration input loadings . Similarly, loading from National Frozen Food wastewater application was estimated with the ratio of each parameter to chloride. The ratios were developed from monitoring well and lysimeter data from the NFF fields. Use of the chloride ratios assumes that the behavior of the constituents in the ground water where the data was collected will be similar in the areas where the ratio is applied. This assumption cannot be tested, but it allows a rough estimate of loading that cannot otherwise be measured.

Regional ground water data for nutrients were used to develop boundary conditions for ground water inputs. Chlorophyll *a* and organic nutrients were assumed to be absent in ground water. Ultimate BOD was set to 0.5 mg/L and DO to 2 mg/L based on available data.

G.4 Parameters, Constants, and Miscellaneous Time Functions

WASP5 requires a number of parameters, constants, and time functions for eutrophication modeling. Parameters were entered that varied for different segments. Constants and time functions were applied as a single value for all segments and times. In addition, solids settling was included to remove phytoplankton from the water column. Settling velocities varied by segment, but were held constant over time.

Three parameters were developed for the Chehalis River model - temperature, light extinction coefficient, and sediment oxygen demand (SOD). Temperature input values were developed from field measurements during the intensive surveys. Temperatures for segments at sampling locations were applied to neighboring unsampled segments based on similarities in channel and flow characteristics.

Light extinction coefficients were measured directly at four sites on the Chehalis and Chehalis Rivers. Linear regression was used to relate Secchi disk depths to light extinction. A reasonably good relationship was found ($r^2=0.85$, $p<0.05$). Extinction coefficients were then estimated for all the Secchi readings, and coefficients were selected that were typical of the river location and season. Five extinction coefficients were applied to different reaches of the river, ranging from 0.75 at the upstream end of the model, to 1.5 at the lower end of the two-layer reach.

SOD values were developed by using an initial input value of 2.0 g/m^2-day, and then calibrating values to observed oxygen levels. The resulting SOD values used were 0.5 g/m^2-day in segments 32 through 37; 1.0 g/m^2-day in segments 1 through 9, 23 through 31, and 38; and 2.0 g/m^2-day in segments 17 through 22 and 39 through 45.

With a few exceptions, constants were taken from Ambrose *et al* (1993), or from the literature data for diatom-dominated waters in EPA (1985). To improve model results during calibration, constants in some cases were adjusted within the reported range to achieve best fit.

The nitrification rate was estimated from observed data by applying linear regression to the log of the net change in ammonia with river mile. The deoxygenation rate was also estimated from observed data, by applying linear regression to the log of the net change in UBOD with river mile. With both the nitrification rate and the deoxygenation rate, values developed from field data were compared to literature values to ensure that they were reasonable.

Incident light energy and air temperature were entered as time functions. Incident light energy was based on field measurements, and adjusted to account for the season and to fit the algorithm used by the model, which is based on the average light during the photoperiod and the length of the photoperiod as a percentage of the day. Air temperature was obtained from National Weather Service data for the Olympia Airport weather station.

Initial calibration runs of the Chehalis River model indicated that increased phytoplankton settling was necessary to reduce the biomass in the water column. Settling of phytoplankton solids was included in the model, and the rates calibrated to observed chlorophyll *a* data. Settling for the middle reach of the river was set at the upper end of the range of literature values, since a relative high value seemed reasonable for diatoms.

Appendix G

Table G.1 Chehalis River Segment Flow and Chloride Balance - July 1992

Surface Flow Segments — All flows in cfs, concentrations in mg/L, loads in lb/day

RM	Seg	Horizontal	Vertical	Horizontal	Pumping	Ground Water		Tributary #1		Tributary #2		Tributary #3	
Code	No	Inflow	Inflow	Outflow	Withdrawal	Flow	Conc	Flow	Load	Flow	Load	Flow	Load
33.8	1	293.6	12.7	312.8	-7.8			11.4	233.7	2.9	59.4	0.0	100.0
39.5	2	286.4	12.7	293.6	-5.5								
44.0	3	216.3	12.0	286.4	-1.1			3.2	99.4	5.0	80.7	51.0	1469.5
48.6	4	203.9	11.7	216.3	-1.4			2.1	65.3				
54.2	5	190.8	13.4	203.9	-0.9			0.6	27.2				
59.9	6	187.1	4.8	190.8	-1.6			0.5	21.0				
62.0	7	178.7	10.1	187.1	-1.7								
64.2	8	176.7	3.4	178.7	-1.4								
66.5	9	113.7	1.5	176.7	-0.6			60.3	1169.3	1.8	540.8		
67.5	10	113.1	1.2	113.7	-0.6								
68.1	11	112.6	1.0	113.1	-0.5								
68.6	12	111.0	2.5	112.6	-0.9								
69.1	13	108.0	3.0	111.0									
69.6	14	108.5	0.2	108.0	-0.7								
70.1	15	109.0	0.3	108.5	-0.8								
70.7	16	110.3	0.2	109.0	-1.5								
71.2	17	111.6	0.2	110.3	-1.5								
71.7	18	112.6	1.1	111.6	-2.1								
72.4	19	112.0	1.2	112.6	-0.6								
73.0	20	111.2	1.2	112.0	-0.4								
73.6	21	110.0	1.3	111.2	-0.1								
74.1	22	106.2	1.3	110.0	-0.1			1.3	296.7	0.6	1819.3	0.7	28.3
74.6	23	59.7	5.8	106.2	-5.8			46.5	2368.2				
76.0	24	59.7	6.7	59.7	-6.7								
77.6	25	60.5	2.7	59.7	-7.1			3.6	71.1				
79.3	26	64.4	2.6	60.5	-6.5								
81.0	27	65.0	1.8	64.4	-2.4								
82.7	28	65.4	1.9	65.0	-2.6			0.3	17.9				
84.5	29	66.1	2.2	65.4	-2.9								
86.5	30	51.9	1.7	66.1	-2.3			14.8	910.3				
88.1	31	52.6	2.0	51.9	-2.7								
90.0	32	53.5	0.2	52.6	-1.1								
92.1	33	54.5		53.5	-1.0								
94.4	34	49.2	6.2	54.5	-0.9								
97.1	35	33.3	8.5	49.2	-1.2			8.6	264.3				
100.5	36	31.0	3.0	33.3	-0.7								
103.0	37	0.0	2.3	31.0	-1.3			0.1	21.1	29.9	579.8		
106.4													

Table G.1, page 2

Subsurface Segments								All flows in cfs, concentrations in mg/L, loads in lb/day					
RM Code	Seg No	Horizontal Inflow	Vertical Inflow	Horizontal Outflow	Pumping Withdrawal	Ground Water Flow	Ground Water Conc	Tributary #1 Flow	Tributary #1 Load	Tributary #2 Flow	Tributary #2 Load	Tributary #3 Flow	Tributary #3 Load
66.5	38		1.5	1.5									
67.5	39		1.2	1.2									
68.1	40		1.0	1.0				0.0	0.0				
68.6	41		2.5	2.5				0.0	50.0				
69.1	42		2.5	3.0				0.5	24.2	0.0	0.0		
69.6	43		0.2	0.2									
70.1	44		0.3	0.3									
70.7	45		0.2	0.2				0.0	50.0				
71.2													
Benthic Segments													
33.8	46			25.4		25.4	7.0						
44.0	47			23.7		23.7	4.5						
54.2	48			13.4		13.4	5.7						
59.9	49			14.9		14.9	7.2						
64.2	50			4.9		4.9	4.6						
67.5	51			2.2		2.2	3.5						
68.6	52			5.0		5	2.5						
69.6	53			0.7		0.7	2.5						
71.2	54			1.3		1.3	2.5						
72.4	55			5.0		5.0	3.7						
74.6	56			12.5		12.5	8.0						
77.6	57			5.3		5.3	4.5						
81.0	58			9.6		9.6	9.0						
90.0	59			14.9		14.9	5.5						
100.5	60			5.3		5.3	8.0						
106.4													

Appendix G

Table G.2 Chehalis River Segment Flow and Chloride Balance - August 1992

Surface Flow Segments — All flows in cfs, concentrations in mg/L, loads in lb/day

RM Code	Seg No	Horizontal Inflow	Vertical Inflow	Horizontal Outflow	Pumping Withdrawal	Ground Water Flow	Ground Water Conc	Tributary #1 Flow	Tributary #1 Load	Tributary #2 Flow	Tributary #2 Load	Tributary #3 Flow	Tributary #3 Load
33.8	1	228.8	10.8	245.3	-7.8			11.9	277.4	1.6	55.0	0.0	100.0
39.5	2	223.5	10.8	228.8	-5.5								
44.0	3	163.3	10.2	223.5	-1.1			1.8	61.4	5.0	80.7	44.3	1290.4
48.6	4	153.6	9.9	163.3	-1.4			1.2	40.4				
54.2	5	144.3	9.5	153.6	-0.9			0.7	33.5				
59.9	6	144.0	1.4	144.3	-1.6			0.5	29.9				
62.0	7	142.7	3.0	144.0	-1.7								
64.2	8	143.1	1.0	142.7	-1.4								
66.5	9	73.7	1.0	143.1	-0.6			67.2	1575.0	1.8	554.8		
67.5	10	73.1	1.2	73.7	-0.6								
68.1	11	72.6	1.0	73.1	-0.5								
68.6	12	71.0	2.5	72.6	-0.9								
69.1	13	68.4	2.6	71.0									
69.6	14	68.9	0.2	68.4	-0.7								
70.1	15	69.4	0.3	68.9	-0.8								
70.7	16	70.7	0.2	69.4	-1.5								
71.2	17	72.0	0.2	70.7	-1.5								
71.7	18	73.0	1.1	72.0	-2.1								
72.4	19	72.4	1.2	73.0	-0.6								
73.0	20	71.6	1.2	72.4	-0.4								
73.6	21	70.4	1.3	71.6	-0.1								
74.1	22	67.1	1.3	70.4	-0.1			1.3	349.1	0.5	722.2	0.3	14.4
74.6	23	40.5	5.8	67.1	-5.8			26.6	1469.8				
76.0	24	40.5	6.7	40.5	-6.7								
77.6	25	43.0	2.7	40.5	-7.1			1.9	37.6				
79.3	26	46.9	2.6	43.0	-6.5								
81.0	27	47.5	1.8	46.9	-2.4								
82.7	28	48.2	1.9	47.5	-2.6			0.0	4.7				
84.5	29	48.9	2.2	48.2	-2.9								
86.5	30	40.2	1.7	48.9	-2.3			9.3	653.8				
88.1	31	40.9	2.0	40.2	-2.7								
90.0	32	41.8	0.2	40.9	-1.1								
92.1	33	42.8		41.8	-1.0								
94.4	34	37.5	6.2	42.8	-0.9								
97.1	35	20.8	8.5	37.5	-1.2			9.4	283.8				
100.5	36	18.5	3.0	20.8	-0.7								
103.0	37	0.0	2.3	18.5	-1.3			0.1	21.1	17.4	356.2		
106.4													

Table G.2, page 2

Subsurface Segments — All flows in cfs, concentrations in mg/L, loads in lb/day

RM Code	Seg No	Horizontal Inflow	Vertical Inflow	Horizontal Outflow	Pumping Withdrawal	Ground Water Flow	Ground Water Conc	Tributary #1 Flow	Tributary #1 Load	Tributary #2 Flow	Tributary #2 Load	Tributary #3 Flow	Tributary #3 Load
66.5	38		1.0	1.0									
67.5	39		1.2	1.2									
68.1	40		1.0	1.0				0.0	0.0				
68.6	41		2.5	2.5				0.0	150.0				
69.1	42		2.5	2.6				0.1	4.8	0.0	150.0		
69.6	43		0.2	0.2									
70.1	44		0.3	0.3									
70.7	45		0.2	0.2				0.0	350.0				
71.2													
Benthic Segments													
33.8	46			21.6		21.6	7.0						
44.0	47			20.1		20.1	4.5						
54.2	48			9.5		9.5	5.7						
59.9	49			4.4		4.4	7.2						
64.2	50			2.0		2.0	4.6						
67.5	51			2.2		2.2	3.5						
68.6	52			5.0		5	2.5						
69.6	53			0.7		0.7	2.5						
71.2	54			1.3		1.3	2.5						
72.4	55			5.0		5.0	3.7						
74.6	56			12.5		12.5	8.0						
77.6	57			5.3		5.3	4.5						
81.0	58			9.6		9.6	9.0						
90.0	59			14.9		14.9	5.5						
100.5	60			5.3		5.3	8.0						

Appendix G

Table G.3 Chloride Modeling Results - July and August 1992

Root Mean Square Error (RMSE) Summary

	Flow	<--- Chloride ----------->					Flow	<--- Chloride ----------->			
	All (cfs)	Lower (mg/L)	Middle (mg/L)	Upper (mg/L)	Deep (mg/L)		(cfs)	Lower (mg/L)	Middle (mg/L)	Upper (mg/L)	Deep (mg/L)
July	3.9	0.29	0.67	0.13	1.41	August	4.3	0.29	0.82	0.27	0.53

JULY 1992

RM Code	Seg No	<-------- Chloride ---> Model (mg/l)	Obsrv (mg/l)	(Error)2	<-------- Flow ---> Model (cfs)	Obsrv (cfs)	(Error)2
33.8	1	7.1	7.0	0.0169	313	311	2.15
39.5	2	7.2			294		
44.0	3	7.3	7.0	0.0625	286		
48.6	4	8.0	7.9	0.0036	216		
54.2	5	8.2			204	213	75.86
59.9	6	8.4	8.0	0.1296	191	191	0.04
62.0	7	8.4			187		
64.2	8	8.5	8.0	0.2116	179		
RMSE				0.29			
66.5	9	8.5	8.5	0.0009	177	173	13.03
67.5	10	10.5	10.7	0.0400	114		
68.1	11	10.5			113		
68.6	12	10.6	10.9	0.0900	113		
69.1	13	10.7	9.9	0.6400	111		
69.6	14	10.9	10.5	0.2025	108		
70.1	15	10.9			109		
70.7	16	10.9	11.3	0.1600	109		
71.2	17	10.9			110		
71.7	18	10.9			112		
72.4	19	11.0	12.0	1.0000	113		
73.0	20	11.0			112		
73.6	21	11.1	12.3	1.4400	111		
74.1	22	11.2			110		
RMSE				0.67			
74.6	23	7.8	7.7	0.0169	106	105	0.86
76.0	24	6.6			60		
77.6	25	6.4	6.6	0.0441	60		
79.3	26	6.6			60		
81.0	27	6.7			64		
82.7	28	6.7			65		
84.5	29	6.6			65		
86.5	30	6.5			66		
88.1	31	5.0			52		
90.0	32	4.9	4.9	0.0016	53	54	3.35
92.1	33	4.9			53		
94.4	34	4.9			54		
97.1	35	4.8			49		
100.5	36	4.4	4.4	0.0025	33	30	8.80
103.0	37	4.0			31		
RMSE				0.13			3.86
66.5	38	8.0					
67.5	39	8.3					
68.1	40	8.2					
68.6	41	8.3					
69.1	42	6.6	7.8	1.5129			
69.6	43	10.3	10.1	0.0400			
70.1	44	10.2					
70.7	45	14.2	16.3	4.4100			
RMSE				1.41			

AUGUST 1992

RM Code	Seg No	<-------- Chloride ---> Model (mg/l)	Obsrv (mg/l)	(Error)2	<-------- Flow ---> Model (cfs)	Obsrv (cfs)	(Error)2
33.8	1	7.1	7.5	0.1156	245	246	0.13
39.5	2	7.2			229		
44.0	3	7.2	7.4	0.0441	223		
48.6	4	8.0	7.9	0.0049	163		
54.2	5	8.2	7.8	0.1764	154	143	108.78
59.9	6	8.4	8.2	0.0215	144	144	0.00
62.0	7	8.4			144		
64.2	8	8.4	8.8	0.1521	143		
RMSE				0.29			
66.5	9	8.4	8.4	0.0016	143	144	0.96
67.5	10	11.0	11.2	0.0225	74		
68.1	11	11.2			73		
68.6	12	11.3	10.3	1.0000	73		
69.1	13	11.2	9.9	1.6900	71		
69.6	14	11.1	9.7	1.9600	68		
70.1	15	11.1			69		
70.7	16	11.2	10.8	0.1600	69		
71.2	17	10.3			71		
71.7	18	10.3			72		
72.4	19	10.4	11.1	0.4900	73		
73.0	20	10.5			72		
73.6	21	10.6	10.7	0.0100	72		
74.1	22	10.8			70		
RMSE				0.82			
74.6	23	8.2	8.1	0.0169	67	68	0.55
76.0	24	7.0			40		
77.6	25	6.8	6.4	0.1369	40		
79.3	26	7.1			43		
81.0	27	7.2			47		
82.7	28	7.1			47		
84.5	29	7.0			48		
86.5	30	6.9			49		
88.1	31	5.5			40		
90.0	32	5.3	5.2	0.0144	41	38	9.06
92.1	33	5.3			42		
94.4	34	5.3			43		
97.1	35	5.2			38		
100.5	36	5.0	4.6	0.1296	21	24	8.22
103.0	37	4.5			19		
RMSE				0.27			4.27
66.5	38	8.1					
67.5	39	8.7					
68.1	40	8.7					
68.6	41	12.5	11.9	0.3600			
69.1	42	12.4	13.0	0.3600			
69.6	43	10.4	10.7	0.0625			
70.1	44	10.4					
70.7	45	37.8	37.2	0.3600			
RMSE				0.53			

Appendix G

Table G.4 EUTRO5 Calibration Loading and Boundary Conditions - July 1992

Point Source Loads — Flow in cfs, Loads in lb/day

RM	SgNo	Flow	NH3N	NO23N	SRP	Phyt-C	UBOD	DO	Org-N	Org-P
33.8	1	11.4	0.31	13.81	0.31	0.25	122.8	562.9	2.76	0.00
33.8	1	0.0	1.49	0.00	0.44	0.00	8.9	0.0	1.78	0.00
33.8	1	2.9	0.08	1.25	0.15	0.06	31.2	124.9	2.64	0.33
44.0	3	3.2	0.31	2.91	0.83	0.07	34.5	119.8	2.15	0.02
44.0	3	5.0	3.28	102.58	1.67	0.06	51.2	188.5	3.43	0.96
44.0	3	51.0	10.57	251.96	5.63	2.36	530.0	2066.5	27.19	0.69
48.6	4	2.1	0.20	1.91	0.54	0.05	22.6	78.6	1.41	0.01
54.2	5	0.6	0.04	5.33	0.02	0.25	10.0	45.2	0.80	0.05
59.9	6	0.5	0.17	0.23	0.13	0.08	10.0	11.0	0.79	0.11
66.5	9	60.3	7.31	116.24	5.03	5.39	694.9	3139.8	26.30	2.27
66.5	9	1.8	174.95	35.81	80.93	2.26	552.5	77.5	6.35	0.00
74.1	22	1.3	197.40	15.68	34.58	0.95	367.5	49.0	0.00	0.84
74.1	22	0.6	2.38	1.50	30.42	0.06	81.7	22.6	6.10	39.37
74.1	22	0.7	0.58	0.10	0.11	0.00	11.0	7.8	1.15	0.29
74.6	23	46.5	4.51	2.13	2.63	0.00	448.2	2192.2	36.18	2.00
77.6	25	3.6	1.34	3.16	1.24	0.39	64.0	143.8	5.51	0.78
82.7	28	0.3	0.09	0.10	0.07	0.03	8.7	5.3	0.46	0.04
86.5	30	14.8	2.47	13.95	0.40	1.59	183.3	675.8	5.74	0.64
97.1	35	8.6	0.63	3.24	0.37	0.00	92.6	467.7	6.78	0.56
103.0	37	0.1	0.01	6.28	0.97	0.01	8.9	3.0	0.56	0.18
103.0	37	29.9	2.09	14.49	0.81	2.77	322.0	1732.4	7.73	0.00
68.5	41	0	0.30	0.00	0.01	0.00	6.75	0.00	0.03	0.00
69.1	42	0.5	0.28	0.26	0.14	0.06	26.9	8.6	1.19	0.13
70.7	45	0	0.74	0.00	0.22	0.00	4.44	0.00	0.89	0.00

Boundary Conditions — CHLA in µg/L, all others in mg/L

RM	SgNo		NH3N	NO23N	SRP	CHLA	UBOD	DO	Org-N	Org-P
33.8	46		0.005	5.000	0.020	0.0	0.5	2.0	0.000	0.000
44.0	47		0.005	1.600	0.020	0.0	0.5	2.0	0.000	0.000
54.2	48		0.005	2.800	0.020	0.0	0.5	2.0	0.000	0.000
59.9	49		0.005	2.900	0.025	0.0	0.5	2.0	0.000	0.000
64.2	50		0.005	1.500	0.044	0.0	0.5	2.0	0.000	0.000
67.5	51		0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
69.1	52		0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
70.1	53		0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
71.2	54		0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
72.4	55		0.050	0.005	0.080	0.0	0.5	2.0	0.000	0.000
74.6	56		0.050	0.005	0.080	0.0	0.5	2.0	0.000	0.000
77.6	57		0.005	0.840	0.016	0.0	0.5	2.0	0.000	0.000
81.0	58		0.080	0.010	0.030	0.0	0.5	2.0	0.000	0.000
90.0	59		0.080	0.010	0.030	0.0	0.5	2.0	0.000	0.000
100.5	60		0.080	0.010	0.030	0.0	0.5	2.0	0.000	0.000

Org-N = Organic Nitrogen

Org-P = Organic Phosphorus

Phyt-C = Phytoplankton Carbon

Appendix G

Table G.5 EUTRO5 Calibration Loading and Boundary Conditions - Aug 1992

Point Source Loads — Flow in cfs, Loads in lb/day

RM	SgNo	Flow	NH3N	NO23N	SRP	Phyt-C	UBOD	DO	Org-N	Org-P
33.8	1	11.9	0.32	15.89	0.32	0.26	128.2	613.9	2.76	0.00
33.8	1	0.0	1.49	0.00	0.44	0.00	8.9	0.0	1.78	0.00
33.8	1	1.6	0.04	0.69	0.08	0.03	17.2	68.9	1.46	0.18
44.0	3	1.8	0.27	1.45	0.60	0.04	19.4	61.9	1.62	0.23
44.0	3	5.0	3.28	102.58	1.67	0.06	51.2	188.5	3.43	0.96
44.0	3	44.3	4.41	192.50	4.77	9.48	474.7	2137.3	33.52	0.00
48.6	4	1.2	0.18	0.96	0.40	0.03	12.8	41.3	1.07	0.15
54.2	5	0.7	0.15	0.24	0.21	0.29	11.7	44.7	2.14	0.12
59.9	6	0.5	0.18	0.19	0.13	0.08	10.0	10.4	0.89	0.14
66.5	9	67.2	4.52	110.18	6.69	3.84	560.9	3401.4	52.83	0.18
66.5	9	1.8	157.99	36.10	37.85	1.21	639.2	77.5	51.61	0.00
74.1	22	1.3	176.40	13.20	20.34	2.12	508.2	49.0	47.01	5.67
74.1	22	0.5	1.12	10.33	87.50	0.04	61.4	18.8	5.75	2.15
74.1	22	0.3	0.05	0.05	0.05	0.00	4.7	5.0	0.55	0.16
74.6	23	26.6	2.22	3.08	2.22	1.03	246.4	1187.4	26.28	0.00
77.6	25	1.9	0.54	1.33	0.44	0.20	33.8	72.7	3.95	0.64
82.7	28	0.0	0.00	0.00	0.00	0.00	0.0	0.0	0.00	0.00
86.5	30	9.3	1.65	4.76	0.25	1.00	115.2	339.0	9.26	0.40
97.1	35	9.4	0.73	2.58	0.51	0.51	106.8	459.6	12.12	0.33
103.0	37	0.1	0.01	6.28	0.97	0.01	8.9	3.0	0.56	0.18
103.0	37	17.4	0.94	6.93	0.47	3.02	173.3	917.3	12.55	0.00
68.5	41	0	0.30	0.00	0.01	0.00	6.75	0.00	0.03	0.00
69.1	42	0.5	0.09	0.01	0.07	0.00	14.4	4.2	1.34	0.12
70.7	45	0	0.74	0.00	0.22	0.00	4.44	0.00	0.89	0.00

Boundary Conditions — CHLA in µg/L, all others in mg/L

RM	SgNo	NH3N	NO23N	SRP	CHLA	UBOD	DO	Org-N	Org-P
33.8	46	0.005	5.000	0.020	0.0	0.5	2.0	0.000	0.000
44.0	47	0.005	1.600	0.020	0.0	0.5	2.0	0.000	0.000
54.2	48	0.005	2.800	0.020	0.0	0.5	2.0	0.000	0.000
59.9	49	0.005	2.900	0.025	0.0	0.5	2.0	0.000	0.000
64.2	50	0.005	1.500	0.044	0.0	0.5	2.0	0.000	0.000
67.5	51	0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
69.1	52	0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
70.1	53	0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
71.2	54	0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
72.4	55	0.050	0.005	0.080	0.0	0.5	2.0	0.000	0.000
74.6	56	0.050	0.005	0.080	0.0	0.5	2.0	0.000	0.000
77.6	57	0.005	0.840	0.016	0.0	0.5	2.0	0.000	0.000
81.0	58	0.080	0.010	0.030	0.0	0.5	2.0	0.000	0.000
90.0	59	0.080	0.010	0.030	0.0	0.5	2.0	0.000	0.000
100.5	60	0.080	0.010	0.030	0.0	0.5	2.0	0.000	0.000

Org-N = Organic Nitrogen
Org-P = Organic Phosphorus
Phyt-C = Phytoplankton Carbon

Appendix G

Table G.6 Calibration Modeled and Observed Results - Chehalis River, July 1992

Surface Segments

All units in mg/L, except CHLA in µg/L

RM	Seg	NH3N		NO23N		SRP		CHLA		UBOD		DO		Org-N		Org-P	
Code	No	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs
33.8	1	0.083	0.025	1.290	0.406	0.108	0.021	0.4	0.7	2.0	2.1	8.7	8.8	0.062	0.210	0.012	0.002
39.5	2	0.095		1.180		0.116		0.5		2.2		8.8		0.065		0.014	
44.0	3	0.105	0.026	1.010	0.521	0.120	0.027	0.5	0.0	2.3	2.0	8.7	8.1	0.069	0.117	0.015	0.006
48.6	4	0.134	0.005	0.936	0.541	0.151	0.041	0.7	2.6	2.5	2.0	8.8	8.3	0.066	0.111	0.019	0.002
54.2	5	0.155		0.895		0.160		0.8		2.7		8.6	8.6	0.071		0.021	
59.9	6	0.182	0.025	0.749	0.306	0.169	0.069	0.9	2.3	3.0	2.1	8.1	7.7	0.077	0.165	0.023	0.000
62.0	7	0.200		0.684		0.173		0.9		3.2		8.0		0.079		0.025	
64.2	8	0.229	0.091	0.547	0.262	0.181	0.105	0.9		3.5		8.2	7.3	0.083	0.158	0.027	0.004
66.5	9	0.253	0.240	0.507	0.302	0.183	0.159	0.9		3.7		7.7	7.3	0.085	0.164	0.028	0.015
67.5	10	0.125	0.283	0.496	0.223	0.144	0.204	1.2	0.0	2.4	1.6	6.5	6.1	0.079	0.178	0.041	0.015
68.1	11	0.142		0.468		0.144		1.0		2.5		6.5		0.078		0.043	
68.6	12	0.155	0.152	0.439	0.182	0.144	0.212	0.9		2.5		6.5	5.6	0.078	0.188	0.044	0.020
69.1	13	0.171	0.179	0.365	0.189	0.146	0.198	0.8	0.7	2.6		6.5	6.2	0.079	0.152	0.047	0.017
69.6	14	0.189	0.169	0.306	0.188	0.148	0.229	0.7	2.1	2.7	5.4	6.5	5.4	0.079	0.153	0.049	0.015
70.1	15	0.204		0.289		0.147		0.6		2.8		6.5		0.080		0.051	
70.7	16	0.222	0.183	0.266	0.173	0.145	0.268	0.5		3.0	4.3	6.5	5.7	0.080	0.193	0.054	0.010
71.2	17	0.237		0.250		0.143		0.5		3.1		6.5		0.081		0.056	
71.7	18	0.255		0.228		0.141		0.4		3.2		6.6		0.082		0.058	
72.4	19	0.276	0.234	0.187	0.145	0.140	0.204	0.4	0.9	3.4	4.3	6.8	7.4	0.084	0.187	0.061	0.017
73.0	20	0.297		0.169		0.138		0.4		3.6		7.0		0.087		0.064	
73.6	21	0.321	0.253	0.149	0.124	0.136	0.238	0.3		3.8		7.2	6.8	0.090	0.221	0.068	0.018
74.1	22	0.342		0.133		0.135		0.3		3.9		7.5		0.092		0.071	
74.6	23	0.026	0.036	0.084	0.086	0.022	0.013	0.3	0.9	1.8	1.6	7.8	7.9	0.085	0.321	0.006	0.011
76.0	24	0.030		0.148		0.025		0.5		1.4		7.6		0.049		0.005	
77.6	25	0.029	0.033	0.163	0.178	0.019	0.015	0.4		1.5		7.8	7.7	0.054	0.138	0.005	0.009
79.3	26	0.029		0.132		0.017		0.4		1.4		8.0		0.043		0.003	
81.0	27	0.031		0.102		0.017		0.4		1.5		8.1		0.044		0.003	
82.7	28	0.032		0.103		0.016		0.3		1.6		8.2		0.046		0.004	
84.5	29	0.032		0.104		0.016		0.3		1.6		8.3		0.046		0.004	
86.5	30	0.031		0.105		0.015		0.3		1.7		8.4		0.048		0.004	
88.1	31	0.031		0.087		0.018		0.2		1.5		8.7		0.042		0.002	
90.0	32	0.031	0.019	0.088	0.029	0.017	0.005	0.2	0.0	1.5	1.1	9.0	8.6	0.045	0.122	0.002	0.009
92.1	33	0.032		0.086		0.017		0.2		1.6		9.0		0.045		0.003	
94.4	34	0.033		0.085		0.017		0.2		1.6		8.8		0.046		0.003	
97.1	35	0.029		0.091		0.016		0.2		1.8		9.1		0.053		0.003	
100.5	36	0.022	0.021	0.113	0.053	0.014	0.005	0.2		2.0		9.3	9.7	0.044	0.083	0.001	0.007
103.0	37	0.017		0.121		0.012		0.2		2.2		9.6		0.050		0.001	
106.4																	

Table G.6, page 2

Subsurface Segments																	
RM	Seg	NH3N		NO23N		SRP		CHLA		UBOD		DO		Org-N		Org-P	
Code	No	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs
66.5	38	0.212		0.641		0.165		0.9		3.2		5.7		0.076		0.024	
67.5	39	0.000		1.080		0.110		1.3		1.1		0.0	0.9	0.063		0.023	
68.1	40	0.083		1.210		0.110		1.1		2.0		0.2		0.059		0.022	
68.6	41	0.069	0.163	1.930	0.183	0.083	0.205	0.9		2.6		1.8	5.4	0.046	0.163	0.020	0.015
69.1	42	0.071	1.070	1.360	0.005	0.080	0.585	0.8	0.9	2.2		1.8	1.8	0.078	0.165	0.021	0.945
69.6	43	0.124	0.215	0.511	0.172	0.147	0.080	0.9	0.0	2.1	1.7	1.7	2.7	0.069	0.125	0.035	0.030
70.1	44	0.167		0.487		0.141		0.7		2.4		1.0		0.071		0.041	
70.7	45	0.226	0.394	0.348	0.005	0.166	0.034	0.6		3.0		0.0	1.3	0.118	0.192	0.034	0.125
71.2																	

Root Mean Square Error (RMSE) Summary		July 1992 Data					
	NH3N	NO23N	SRP	CHLA	UBOD	DO	Org-N	Org-P
Seg 1-9	0.108	0.500	0.086	1.2	0.6	0.5	0.087	0.017
Seg 10-22	0.069	0.168	0.082	0.9	1.8	0.7	0.102	0.037
Seg 23-37	0.008	0.043	0.009	0.5	0.3	0.3	0.133	0.005
Seg 38-45	0.511	1.131	0.270	0.6	0.4	1.8	0.086	0.464

Org-N = Organic Nitrogen; Org-P = Organic Phosphorus

Appendix G
Table G.7 Calibration Modeled and Observed Results - Chehalis River, Aug 1992

Surface Segments — All units in mg/L, except CHLA in µg/L

RM	Seg	NH3N		NO23N		SRP		CHLA		UBOD		DO		Org-N		Org-P	
Code	No	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs
33.8	1	0.053	0.015	1.240	0.278	0.097	0.023	1.3	0.0	2.6	2.2	8.7	9.9	0.152	0.235	0.010	0.000
39.5	2	0.060		1.130		0.106		1.6		2.8		8.8		0.168		0.011	
44.0	3	0.066	0.025	0.938	0.434	0.111	0.028	1.8	0.0	3.0	2.0	8.8	8.8	0.182	0.216	0.012	0.017
48.6	4	0.087	0.013	0.849	0.485	0.144	0.041	2.6	3.5	3.4	2.0	8.8	10.3	0.211	0.151	0.015	0.007
54.2	5	0.105	0.018	0.799	0.621	0.154	0.048	3.2		3.8		8.7	9.2	0.234	0.166	0.017	0.009
59.9	6	0.130	0.023	0.666	0.339	0.165	0.068	3.8	0.6	4.3	2.5	8.5	8.7	0.257	0.172	0.018	0.000
62.0	7	0.150		0.637		0.169		3.9		4.5		8.6		0.262		0.018	
64.2	8	0.174	0.068	0.581	0.273	0.174	0.092	3.9		4.7		9.0	7.6	0.268	0.196	0.018	0.026
66.5	9	0.197	0.076	0.561	0.248	0.177	0.087	4.0		4.9		8.8	7.9	0.272	0.281	0.018	0.028
67.5	10	0.026	0.114	0.678	0.180	0.238	0.134	7.6	7.2	4.0	2.1	8.4	7.9	0.270	0.305	0.033	0.037
68.1	11	0.051		0.672		0.250		6.1		3.8		7.8		0.242		0.029	
68.6	12	0.079	0.061	0.651	0.179	0.259	0.139	5.0		3.6		7.4	8.5	0.222	0.259	0.026	0.036
69.1	13	0.113	0.080	0.561	0.196	0.272	0.142	4.0	4.7	3.6		7.1	8.1	0.210	0.303	0.024	0.032
69.6	14	0.148	0.084	0.488	0.207	0.286	0.148	3.3	5.5	3.6	2.2	6.9	8.6	0.201	0.273	0.022	0.042
70.1	15	0.182		0.469		0.290		2.6		3.7		6.5		0.194		0.021	
70.7	16	0.220	0.147	0.438	0.222	0.293	0.198	2.0		3.8		6.2	7.1	0.190	0.293	0.020	0.066
71.2	17	0.247		0.414		0.295		1.6		4.0		6.0		0.189		0.020	
71.7	18	0.281		0.378		0.296		1.3		4.2		6.1		0.192		0.020	
72.4	19	0.321	0.168	0.310	0.198	0.301	0.206	1.1	2.2	4.5	2.2	6.2	7.4	0.200	0.282	0.020	0.039
73.0	20	0.363		0.276		0.304		0.9		4.8		6.4		0.210		0.021	
73.6	21	0.410	0.405	0.234	0.157	0.308	0.145	0.8		5.2		6.6	6.3	0.222	0.407	0.022	0.025
74.1	22	0.450		0.199		0.312		0.7		5.5		7.0		0.233		0.023	
74.6	23	0.028	0.017	0.091	0.084	0.027	0.016	0.6	1.8	1.7	2.0	7.5	7.9	0.106	0.207	0.003	0.000
76.0	24	0.033		0.146		0.028		0.8		1.4		7.4		0.073		0.005	
77.6	25	0.032	0.032	0.167	0.179	0.019	0.018	0.8		1.5		7.7	7.3	0.084	0.263	0.006	0.003
79.3	26	0.035		0.126		0.019		0.7		1.4		7.8		0.076		0.004	
81.0	27	0.039		0.084		0.019		0.6		1.5		7.9		0.080		0.004	
82.7	28	0.040		0.084		0.019		0.5		1.6		7.9		0.084		0.004	
84.5	29	0.040		0.084		0.019		0.5		1.7		8.0		0.088		0.004	
86.5	30	0.040		0.084		0.018		0.4		1.7		8.0		0.094		0.004	
88.1	31	0.040		0.081		0.021		0.4		1.5		8.4		0.079		0.003	
90.0	32	0.040	0.018	0.081	0.025	0.021	0.011	0.3	0.0	1.6	2.0	8.8	7.9	0.085	0.178	0.003	0.000
92.1	33	0.041		0.078		0.021		0.3		1.6		8.8		0.088		0.002	
94.4	34	0.042		0.075		0.021		0.3		1.7		8.6		0.090		0.002	
97.1	35	0.037		0.081		0.019		0.3		1.9		8.9		0.109		0.003	
100.5	36	0.029	0.017	0.115	0.035	0.019	0.010	0.4		2.0		9.1	8.6	0.102	0.132	0.002	0.000
103.0	37	0.021		0.127		0.017		0.4		2.3		9.4		0.123		0.002	
106.4																	

Table G.7, page 2

Subsurface Segments																	
RM	Seg	NH3N		NO23N		SRP		CHLA		UBOD		DO		Org-N		Org-P	
Code	No	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs
66.5	38	0.171		0.646		0.165		4.0		4.6		7.0		0.253		0.017	
67.5	39	0.012		1.370		0.154		8.0		4.4		1.9	0.2	0.277		0.035	
68.1	40	0.017		1.400		0.159		6.7		4.0		2.4		0.246		0.031	
68.6	41	0.023	0.068	2.000	0.180	0.127	0.130	5.1		3.8		3.0	5.5	0.166	0.297	0.021	0.035
69.1	42	0.027	0.482	1.520	0.005	0.127	0.176	4.4	4.5	2.9		2.4	1.9	0.198	0.339	0.022	0.193
69.6	43	0.060	0.218	0.630	0.186	0.252	0.089	4.1	3.4	3.2	0.9	3.4	3.4	0.207	0.198	0.024	0.034
70.1	44	0.128		0.645		0.262		2.9		3.2		1.5		0.183		0.020	
70.7	45	0.240	0.675	0.508	0.005	0.283	0.042	2.4		4.2		0.1	0.7	0.227	0.380	0.018	0.402
71.2																	

Root Mean Square Error (RMSE) Summary			July 1992 Data					
	NH3N	NO23N	SRP	CHLA	UBOD	DO	Org-N	Org-P
Seg 1-9	0.087	0.518	0.089	2.0	1.3	1.0	0.063	0.011
Seg 10-22	0.078	0.327	0.123	1.3	2.8	1.1	0.099	0.021
Seg 23-37	0.014	0.049	0.008	0.9	0.3	0.6	0.114	0.003
Seg 38-45	0.325	1.231	0.148	0.5	2.3	1.4	0.123	0.211

Org-N = Organic Nitrogen; Org-P = Organic Phosphorus

Appendix H. Model Verification

Appendix H

Table H.1 Chehalis River Segment Flow and Chloride Balance - August 1991

Surface Flow Segments — All flows in cfs, concentrations in mg/L, loads in lb/day

RM Code	Seg No	Horizontal Inflow	Vertical Inflow	Horizontal Outflow	Pumping Withdrawal	Ground Water Flow	Ground Water Conc	Tributary #1 Flow	Tributary #1 Load	Tributary #2 Flow	Tributary #2 Load	Tributary #3 Flow	Tributary #3 Load
59.9	6	215.9	5.7	221.1	-1.6			1.1	40.9				
62.0	7	205.5	12.1	215.9	-1.7								
64.2	8	202.8	4.1	205.5	-1.4								
66.5	9	125.4	1.8	202.8	-0.6			74.0	1196.9	2.2	581.3		
67.5	10	124.6	1.4	125.4	-0.6								
68.1	11	123.9	1.2	124.6	-0.5								
68.6	12	121.8	3.0	123.9	-0.9								
69.1	13	115.3	6.5	121.8									
69.6	14	115.7	0.3	115.3	-0.7								
70.1	15	116.2	0.3	115.7	-0.8								
70.7	16	117.4	0.3	116.2	-1.5								
71.2	17	118.6	0.3	117.4	-1.5								
71.7	18	119.3	1.4	118.6	-2.1								
72.4	19	118.5	1.4	119.3	-0.6								
73.0	20	117.5	1.4	118.5	-0.4								
73.6	21	116.1	1.5	117.5	-0.1								
74.1	22	110.9	1.5	116.1	-0.1			1.9	431.7	0.5	1777.0	1.4	77.4
74.6	23	63.7	4.7	110.9	-5.8			48.3	2265.5				
76.0	24	65.1	5.3	63.7	-6.7								
77.6	25	67.0	2.1	65.1	-7.1			3.1	69.1				
79.3	26	71.5	2.0	67.0	-6.5								
81.0	27	72.5	1.4	71.5	-2.4								
82.7	28	72.3	1.5	72.5	-2.6			1.3	71.2				
84.5	29	73.5	1.7	72.3	-2.9								
86.5	30	63.4	1.4	73.5	-2.3			11.0	692.1				
88.1	31	64.5	1.6	63.4	-2.7								
90.0	32	65.5	0.1	64.5	-1.1								
92.1	33	66.5		65.5	-1.0								
94.4	34	62.4	5.0	66.5	-0.9								
97.1	35	39.4	6.8	62.4	-1.2			17.4	612.0				
100.5	36	37.7	2.4	39.4	-0.7								
103.0	37	0.0	1.8	37.7	-1.3			0.1	20.5	37.1	766.8		
106.4													

Subsurface Segments — All flows in cfs, concentrations in mg/L, loads in lb/day

RM Code	Seg No	Horizontal Inflow	Vertical Inflow	Horizontal Outflow	Pumping Withdrawal	Ground Water Flow	Ground Water Conc	Tributary #1 Flow	Tributary #1 Load	Tributary #2 Flow	Tributary #2 Load	Tributary #3 Flow	Tributary #3 Load
66.5	38		1.8	1.8									
67.5	39		1.4	1.4									
68.1	40		1.2	1.2				0.0	100.0				
68.6	41		3.0	3.0				0.0	150.0				
69.1	42		3.0	6.5				3.5	169.6	0.0	600.0		
69.6	43		0.3	0.3									
70.1	44		0.3	0.3									
70.7	45		0.3	0.3				0.0	100.0				
71.2													

Benthic Segments

RM Code	Seg No	Horizontal Inflow	Vertical Inflow	Horizontal Outflow	Pumping Withdrawal	Ground Water Flow	Ground Water Conc	Tributary #1 Flow	Tributary #1 Load	Tributary #2 Flow	Tributary #2 Load	Tributary #3 Flow	Tributary #3 Load
59.9	49			17.8		17.8	7.2						
64.2	50			5.9		5.9	4.6						
67.5	51			2.6		2.6	3.5						
68.6	52			6.0		6	2.5						
69.6	53			0.9		0.9	2.5						
71.2	54			1.7		1.7	2.5						
72.4	55			5.8		5.8	3.7						
74.6	56			10.0		10.0	8.0						
77.6	57			4.1		4.1	4.5						
81.0	58			7.6		7.6	9.0						
90.0	59			11.9		11.9	5.5						
100.5	60			4.2		4.2	8.0						

Appendix H

Table H.2 Chehalis River Segment Flow and Chloride Balance - September 1991

All flows in cfs, concentrations in mg/L, loads in lb/day

RM Code	Seg No	Horizontal Inflow	Vertical Inflow	Horizontal Outflow	Pumping Withdrawal	Ground Water Flow	Ground Water Conc.	Tributary #1 Flow	Tributary #1 Load	Tributary #2 Flow	Tributary #2 Load	Tributary #3 Flow	Tributary #3 Load
Surface Flow Segments													
33.8	1	394.3	8.9	411.9	-7.8			13.9	294.5	0.0	500.0	2.6	71.5
39.5	2	390.9	8.9	394.3	-5.5								
44.0	3	308.4	8.4	390.9	-1.1			3.9	113.4	5.0	80.7	66.3	2006.1
48.6	4	301.1	8.2	308.4	-1.4			0.5	27.6				
54.2	5	0.0	9.3	301.1	-0.9			4.0	117.2	288.7	10028.6		
59.9													
Benthic Segments													
33.8	6			17.8		17.8	7.0						
44.0	7			16.6		16.6	3.0						
54.2	8			9.3		9.3	5.7						

Appendix H

Table H.3 Chloride Modeling Results - August and September 1991

Root Mean Square Error (RMSE) Summary

	Flow	<--- Chloride ----------->					Flow	<--- Chloride ----------->
	All	Lower	Middle	Upper	Deep			Lower
	(cfs)	(mg/L)	(mg/L)	(mg/L)	(mg/L)		(cfs)	(mg/L)
August	3.4	0.33	0.88	0.22	1.47	September	0.3	0.02

AUGUST 1991

RM Code	Seg No	<-------- Chloride ---> Model (mg/l)	Obsrv (mg/l)	(Error)2	<-------- Flow ---> Model (cfs)	Obsrv (cfs)	(Error)2
33.8	1						
38.9	2						
44.0	3						
48.6	4						
54.2	5						
59.9	6	8.4	8.3	0.0036	221	224	8.41
62.0	7	8.4			216		
64.2	8	8.5	8.0	0.2116	205		
RMSE				0.33			
66.5	9	8.5	7.6	0.8836	203		
67.5	10	11.2	12.3	1.2100	125		
68.1	11	11.2			125		
68.6	12	11.2	12.5	1.6900	124		
69.1	13	11.2	11.8	0.3600	122		
69.6	14	10.5	11.7	1.4400	115		
70.1	15	10.5			116		
70.7	16	10.5	10.2	0.0900	116		
71.2	17	10.4			117		
71.7	18	10.4			119		
72.4	19	10.5	10.0	0.2500	119		
73.0	20	10.6			119		
73.6	21	10.7	10.2	0.2500	118		
74.1	22	10.8			116		
RMSE				0.88			
74.6	23	7.4	7.433	0.0019	111	109	3.61
76.0	24	6.4			64		
77.6	25	6.2			65		
79.3	26	6.4			67		
81.0	27	6.4	6.8	0.1369	72		
82.7	28	6.4			73		
84.5	29	6.3			72		
86.5	30	6.2			74		
88.1	31	5.2			63		
90.0	32	5.1	5.0	0.0100	65	58	44.22
92.1	33	5.1			66		
94.4	34	5.1			67	66	0.02
97.1	35	5.1			62		
100.5	36	4.3	4.6	0.0441	39	38	1.96
103.0	37	4.1			38		
RMSE				0.22			3.41
66.5	38	7.9					
67.5	39	8.5	6.1				
68.1	40	14.1					
68.6	41	11.5	11.4	0.0100			
69.1	42	20.1	20.1	0.0000			
69.6	43	9.6	12.5	8.5264			
70.1	44	9.8					
70.7	45	17.1	17.4	0.090			
RMSE				1.47			

SEPTEMBER 1991

RM Code	Seg No	<-------- Chloride ---> Model (mg/l)	Obsrv (mg/l)	(Error)2	<-------- Flow ---> Model (cfs)	Obsrv (cfs)	(Error)2
33.8	1	6.3	6.3	0.0003	412	412	0.01
39.5	2	6.1	6.1	0.0000	394		
44.0	3	6.1	6.1	0.0013	391		
48.6	4	6.3			308		
54.2	5	6.4	6.4	0.0003	301	302	0.23
59.9	6						
62.0	7						
64.2	8						
RMSE				0.02			0.3
66.5	9						
67.5	10						
68.1	11						
68.6	12						
69.1	13						
69.6	14						
70.1	15						
70.7	16						
71.2	17						
71.7	18						
72.4	19						
73.0	20						
73.6	21						
74.1	22						
RMSE							
74.6	23						
76.0	24						
77.6	25						
79.3	26						
81.0	27						
82.7	28						
84.5	29						
86.5	30						
88.1	31						
90.0	32						
92.1	33						
94.4	34						
97.1	35						
100.5	36						
103.0	37						
RMSE							
66.5	38						
67.5	39						
68.1	40						
68.6	41						
69.1	42						
69.6	43						
70.1	44						
70.7	45						
RMSE							

Appendix H

Table H.4 EUTRO5 Verification Loading and Boundary Conditions - Aug/Sept 1991

Point Source Loads — Flow in cfs, Loads in lb/day

RM	SgNo	Flow	NH3N	NO23N	SRP	Phyt-C	UBOD	DO	Org-N	Org-P
33.8	1	13.9	0.37	14.65	1.56	5.83	152.7	766.9	4.91	0.00
33.8	1	0.0	7.44	0.00	2.22	0.00	44.4	0.0	8.89	0.00
33.8	1	2.6	0.07	1.12	0.13	1.09	28.6	115.6	2.37	0.30
44.0	3	3.9	0.11	2.78	0.78	1.63	42.8	170.8	3.14	0.21
44.0	3	5.0	3.28	102.58	1.67	0.06	51.2	188.5	3.43	0.96
44.0	3	66.3	3.33	329.00	9.46	6.07	792.6	2981.4	65.13	4.50
48.6	4	0.5	0.24	0.21	0.15	0.21	5.5	12.1	0.69	0.05
54.2	5	4.0	0.11	40.06	0.75	1.65	66.6	268.6	4.09	0.51
54.2	5	288.	60.89	686.86	105.04	30.40	2580.6	13156.8	231.37	32.80
59.9	6	1.1	0.28	0.69	0.28	0.17	22.2	43.8	1.85	0.34
66.5	9	74.0	1.99	118.74	3.59	64.55	753.1	4311.4	31.88	2.39
66.5	9	2.2	152.23	40.99	44.90	0.63	531.9	88.8	44.31	16.70
74.1	22	1.9	191.83	74.28	50.64	0.55	284.2	81.8	42.87	34.73
74.1	22	0.5	1.76	1.01	108.37	0.05	82.9	18.8	11.55	9.69
74.1	22	1.4	4.28	1.64	0.34	0.48	100.2	48.2	1.09	0.39
74.6	23	48.3	2.86	1.30	1.30	5.20	491.6	2379.7	30.17	4.42
77.6	25	3.1	0.57	4.54	0.93	0.33	55.3	111.8	6.19	0.15
82.7	28	1.3	0.29	0.69	0.43	1.13	37.3	38.5	2.22	0.00
86.5	30	11.0	0.59	6.81	0.18	1.18	135.0	495.2	6.22	0.41
97.1	35	17.4	1.69	7.21	0.47	2.81	650.2	862.0	15.27	10.77
103.0	37	0.1	0.02	6.25	1.04	0.02	8.9	2.9	0.57	0.03
103.0	37	37.1	1.00	13.12	0.30	4.99	2016.7	1957.8	11.32	0.70
68.1	40	0	0.60	0.00	0.02	0.00	13.5	0.0	0.07	0.00
68.6	41	0	0.90	0.00	0.04	0.00	20.3	0.0	0.10	0.00
69.1	42	0.5	0.83	0.38	0.12	0.03	46.4	1.3	1.85	0.34
69.1	42	0	3.60	0.02	0.14	0.00	81.0	0.0	0.39	0.00
70.7	45	0	1.49	0.00	0.44	0.00	8.9	0.0	1.78	0.00

Boundary Conditions — CHLA in μg/L, all others in mg/L

RM	SgNo	NH3N	NO23N	SRP	CHLA	UBOD	DO	Org-N	Org-P
33.8	46	0.005	5.000	0.020	0.0	0.5	2.0	0.000	0.000
44.0	47	0.005	1.600	0.020	0.0	0.5	2.0	0.000	0.000
54.2	48	0.005	2.800	0.020	0.0	0.5	2.0	0.000	0.000
59.9	49	0.005	2.900	0.025	0.0	0.5	2.0	0.000	0.000
64.2	50	0.005	1.500	0.044	0.0	0.5	2.0	0.000	0.000
67.5	51	0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
69.1	52	0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
70.1	53	0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
71.2	54	0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
72.4	55	0.050	0.005	0.080	0.0	0.5	2.0	0.000	0.000
74.6	56	0.050	0.005	0.080	0.0	0.5	2.0	0.000	0.000
77.6	57	0.005	0.840	0.016	0.0	0.5	2.0	0.000	0.000
81.0	58	0.080	0.010	0.030	0.0	0.5	2.0	0.000	0.000
90.0	59	0.080	0.010	0.030	0.0	0.5	2.0	0.000	0.000
100.5	60	0.080	0.010	0.030	0.0	0.5	2.0	0.000	0.000

Org-N = Organic Nitrogen
Org-P = Organic Phosphorus
Phyt-C = Phytoplankton Carbon

Appendix H
Table H.5 Verification Modeled and Observed Results - Aug/Sept 1991

Surface Segments — All units in mg/L, except CHLA in μg/L

RM	Seg	NH3N		NO23N		SRP		CHLA		UBOD		DO		Org-N		Org-P	
Code	No	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs
33.8	1	0.037	0.006	0.847	0.501	0.057	0.038	0.2	1.6	2.2	2.6	9.1	9.8	0.131	0.161	0.015	0.015
39.5	2	0.035	0.008	0.781	0.571	0.058	0.029	0.2	0.5	2.3	2.4	9.1	9.9	0.135	0.138	0.016	0.030
44.0	3	0.035	0.005	0.684	0.600	0.058	0.047	0.2	1.7	2.3		9.0	9.6	0.140	0.144	0.017	0.015
48.6	4	0.039		0.564		0.066		0.2		2.3		9.1	9.9	0.138		0.019	
54.2	5	0.039	0.014	0.534	0.650	0.066	0.060	0.2	1.2	2.4	1.7	9.0	9.0	0.145	0.138	0.020	0.020
59.9	6	0.185	0.035	0.745	0.426	0.195	0.117	0.7	0.5	3.5	1.9	8.4	8.0	0.127	0.160	0.037	0.026
62.0	7	0.198		0.686		0.199		0.8		3.7		8.4		0.132		0.039	
64.2	8	0.219	0.095	0.548	0.308	0.208	0.116	0.9	0.5	4.0		8.5	7.5	0.142	0.177	0.043	0.041
66.5	9	0.234	0.163	0.514	0.324	0.210	0.108	0.9	2.5	4.2		8.0	8.0	0.148	0.173	0.045	0.061
67.5	10	0.169	0.399	0.557	0.285	0.268	0.322	0.4	1.4	3.3	3.6	6.2	5.9	0.115	0.290	0.045	0.021
68.1	11	0.182		0.525		0.268		0.4		3.5		6.2		0.119		0.047	
68.6	12	0.190	0.055	0.498	0.208	0.269	0.171	0.4	3.2	3.6		6.2	6.6	0.122	0.180	0.049	0.137
69.1	13	0.202	0.043	0.414	0.218	0.274		0.4		3.7		6.3	7.5	0.128	0.190	0.052	
69.6	14	0.216	0.059	0.361	0.214	0.286		0.4		3.8		6.6	7.8	0.134	0.187	0.057	
70.1	15	0.227		0.343		0.285		0.4		4.0		6.6		0.138		0.059	
70.7	16	0.239	0.080	0.323	0.214	0.283	0.142	0.3	4.8	4.1	2.0	6.6	8.4	0.142	0.169	0.062	0.071
71.2	17	0.248		0.308		0.280		0.3		4.2		6.7		0.144		0.065	
71.7	18	0.260		0.288		0.278		0.3		4.4		6.9		0.148		0.067	
72.4	19	0.275	0.142	0.246	0.242	0.279	0.247	0.3	1.6	4.6		7.0	8.8	0.153	0.181	0.071	0.001
73.0	20	0.291		0.234		0.278		0.3		4.8		7.2		0.159		0.075	
73.6	21	0.308	0.293	0.219	0.224	0.278	0.254	0.3		5.1		7.5	8.5	0.165	0.218	0.079	0.073
74.1	22	0.323		0.207		0.278		0.3		5.3		7.8		0.170		0.082	
74.6	23	0.022	0.005	0.070	0.080	0.020	0.009	0.3	0.5	3.0	2.7	8.1	8.5	0.087	0.110	0.015	0.004
76.0	24	0.028		0.123		0.027		0.4		3.7		7.8		0.070		0.014	
77.6	25	0.027		0.132		0.022		0.4		4.1		8.0		0.077		0.016	
79.3	26	0.027		0.103		0.020		0.4		4.3		8.1		0.066		0.017	
81.0	27	0.028	0.005	0.081	0.1465	0.020	0.004	0.4	1.6	4.5		8.2	8.4	0.069	0.116	0.018	0.006
82.7	28	0.027		0.081		0.019		0.4		4.7		8.2		0.071		0.019	
84.5	29	0.026		0.081		0.017		0.3		4.9		8.4		0.068		0.020	
86.5	30	0.025		0.082		0.016		0.3		5.2		8.5		0.071		0.022	
88.1	31	0.027		0.077		0.018		0.3		5.9		8.8		0.067		0.025	
90.0	32	0.026	0.005	0.077	0.013	0.016	0.002	0.3	0.5	6.2	11.7	9.1	8.5	0.070	0.114	0.027	0.012
92.1	33	0.026		0.076		0.015		0.3		6.4		9.1		0.071		0.028	
94.4	34	0.026		0.075		0.014		0.3		6.6		9.0		0.072		0.029	
97.1	35	0.022		0.079		0.012		0.3		7.3		9.3		0.079		0.032	
100.5	36	0.013	0.005	0.090	0.014	0.009	0.002	0.3	1.0	8.7	3.05	9.5	9.3	0.055	0.093	0.004	0.011
103.0	37	0.009		0.094		0.008		0.3		9.6		9.8		0.060		0.004	
106.4																	

Table H.5, page 2

Subsurface Segments																	
RM	Seg	NH3N		NO23N		SRP		CHLA		UBOD		DO		Org-N		Org-P	
Code	No	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs	Mod	Obs
66.5	38	0.193		0.668		0.186		0.9		3.6		5.8		0.126		0.038	
67.5	39	0.028	0.576	1.260	0.332	0.189	0.323	0.4	1.5	1.7		0.0	5.7	0.065	0.302	0.022	0.082
68.1	40	0.162		1.210		0.187		0.4		3.2		0.0		0.066		0.021	
68.6	41	0.104	0.055	2.200	0.212	0.134		0.4		3.8		1.5	4.1	0.055	0.170	0.019	
69.1	42	0.140	0.627	0.969	0.005	0.084		0.3		4.1		0.9	1.2	0.077	0.358	0.018	
69.6	43	0.158	0.066	0.641	0.220	0.268		0.4		2.8		1.5	6.5	0.100	0.156	0.037	
70.1	44	0.196		0.540		0.269		0.4		3.4		1.0		0.116		0.046	
70.7	45	0.317	0.339	0.452	0.014	0.301	0.026	0.4	4.8	4.6	2.28	0.0	2.9	0.203	0.163	0.037	0.064
71.2																	

Root Mean Square Error (RMSE) Summary		July 1992 Data					
	NH3N	NO23N	SRP	CHLA	UBOD	DO	Org-N	Org-P
Seg 1-9	0.081	0.233	0.061	1.1	0.8	0.6	0.023	0.009
Seg 10-22	0.153	0.181	0.082	2.8	1.5	1.2	0.080	0.051
Seg 23-37	0.018	0.059	0.013	0.7	4.6	0.4	0.039	0.011
Seg 38-45	0.331	1.106	0.216	3.2	2.3	3.8	0.175	0.047

Org-N = Organic Nitrogen; Org-P = Organic Phosphorus

Appendix I. TMDL Analyses

Appendix I

Table I.1 Chehalis River Segment Flow Balance - Existing Critical Conditions

Surface Flow Segments										All flows in cfs
RM Code	Seg No	Horizontal Inflow	Vertical Inflow	Horizontal Outflow	Pumping Withdrawal	Ground Water Flow	Tributary #1 Flow	Tributary #2 Flow	Tributary #3 Flow	
33.8	1	184.8	9.8	200.3	-7.8		11.9	1.6	0.0	
39.5	2	180.5	9.8	184.8	-5.5					
44.0	3	135.6	9.2	180.5	-1.1		1.8	5.0	30.0	
48.6	4	127.8	9.0	135.6	-1.4		0.2			
54.2	5	119.3	8.7	127.8	-0.9		0.7			
59.9	6	119.0	1.4	119.3	-1.6		0.5			
62.0	7	117.7	3.0	119.0	-1.7					
64.2	8	118.1	1.0	117.7	-1.4					
66.5	9	65.6	0.9	118.1	-0.6		45.6	6.6		
67.5	10	65.2	1.0	65.6	-0.6					
68.1	11	64.9	0.8	65.2	-0.5					
68.6	12	63.7	2.1	64.9	-0.9					
69.1	13	61.5	2.2	63.7						
69.6	14	62.0	0.2	61.5	-0.7					
70.1	15	62.6	0.2	62.0	-0.8					
70.7	16	63.9	0.2	62.6	-1.5					
71.2	17	65.2	0.2	63.9	-1.5					
71.7	18	66.3	1.0	65.2	-2.1					
72.4	19	65.9	1.0	66.3	-0.6					
73.0	20	65.3	1.0	65.9	-0.4					
73.6	21	64.3	1.1	65.3	-0.1					
74.1	22	58.9	1.1	64.3	-0.1		3.4	0.7	0.3	
74.6	23	37.4	5.8	58.9	-5.8		21.5			
76.0	24	37.4	6.7	37.4	-6.7					
77.6	25	40.8	2.7	37.4	-7.1		1.0			
79.3	26	44.7	2.6	40.8	-6.5					
81.0	27	45.3	1.8	44.7	-2.4					
82.7	28	45.9	1.9	45.3	-2.6		0.1			
84.5	29	46.6	2.2	45.9	-2.9					
86.5	30	40.5	1.7	46.6	-2.3		6.7			
88.1	31	41.2	2.0	40.5	-2.7					
90.0	32	42.1	0.2	41.2	-1.1					
92.1	33	43.1		42.1	-1.0					
94.4	34	37.8	6.2	43.1	-0.9					
97.1	35	23.5	8.5	37.8	-1.2		7.0			
100.5	36	21.2	3.0	23.5	-0.7					
103.0	37	0.0	2.3	21.2	-1.3		0.2	20.0		
106.4										

Table I.1, page 2

RM Code	Seg No	Horizontal Inflow	Vertical Inflow	Horizontal Outflow	Pumping Withdrawal	Ground Water Flow	Tributary #1 Flow	Tributary #2 Flow	Tributary #3 Flow
Subsurface Segments									All flows in cfs
66.5	38		0.9	0.9					
67.5	39		1.0	1.0					
68.1	40		0.8	0.8			0.0		
68.6	41		2.1	2.1			0.0		
69.1	42		2.1	2.2			0.1	0.0	
69.6	43		0.2	0.2					
70.1	44		0.2	0.2					
70.7	45		0.2	0.2			0.0		
71.2									
Benthic Segments									
33.8	46			19.6		19.6			
44.0	47			18.2		18.2			
54.2	48			8.7		8.7			
59.9	49			4.4		4.4			
64.2	50			1.9		1.9			
67.5	51			1.8		1.8			
68.6	52			4.2		4.2			
69.6	53			0.6		0.6			
71.2	54			1.2		1.2			
72.4	55			4.2		4.2			
74.6	56			12.5		12.5			
77.6	57			5.3		5.3			
81.0	58			9.6		9.6			
90.0	59			14.9		14.9			
100.5	60			5.3		5.3			

Appendix I

Table I.2 EUTRO5 Loading and Boundary Conditions - Existing Critical

Point Source Loads — Flow in cfs, Loads in lb/day

RM	SgNo	Flow	NH3N	NO23N	SRP	Phyt-C	UBOD	DO	Org-N	Org-P
33.8	1	11.9	0.32	15.89	2.76	14.35	128.2	589.5	2.76	0.00
33.8	1	0.0	7.44	0.00	2.22	0.00	44.4	0.0	8.89	0.00
33.8	1	1.6	0.04	0.71	0.13	0.26	31.9	70.6	1.46	0.17
44.0	3	1.8	0.27	1.64	0.60	0.29	35.9	62.0	1.43	0.23
44.0	3	5	3.28	102.58	1.67	0.06	242.3	188.5	3.43	7.78
44.0	3	30	7.59	152.66	4.36	8.08	355.4	1179.2	28.75	2.42
48.6	4	0.2	0.10	0.09	0.06	0.03	4.0	4.4	0.28	0.04
54.2	5	0.7	0.15	7.16	0.21	0.44	11.7	37.7	0.80	0.12
59.9	6	0.5	0.18	0.32	0.13	0.08	10.0	10.5	0.80	0.16
66.5	9	45.6	6.14	88.15	4.67	39.78	515.6	2185.3	20.63	1.23
66.5	9	6.6	646.81	154.24	312.74	9.38	3228.0	284.3	108.75	0.00
74.1	22	3.4	532.76	148.66	101.24	7.14	1666.0	117.2	0.00	68.65
74.1	22	0.7	22.62	14.62	179.42	0.14	190.0	26.4	0.00	0.00
74.1	22	0.3	0.92	0.35	0.08	0.10	21.5	7.6	0.23	0.16
74.6	23	21.5	4.52	3.01	1.85	1.62	220.0	914.6	20.49	0.69
77.6	25	1	0.50	2.39	0.34	0.16	17.8	35.0	1.80	0.23
82.7	28	0.1	0.03	0.05	0.03	0.09	3.0	1.8	0.20	0.01
86.5	30	6.7	1.19	6.31	0.18	1.01	83.0	245.3	3.90	0.40
97.1	35	7	0.68	3.35	0.57	1.50	260.1	339.2	8.07	3.96
103.0	37	0.2	9.69	13.35	2.09	0.03	96.9	5.8	0.50	0.43
103.0	37	20	1.40	9.69	0.54	3.45	1109.2	990.8	12.38	0.00
68.1	40	0	0.60	0.00	0.02	0.00	13.5	0.0	0.07	0.00
68.6	41	0	0.90	0.00	0.04	0.00	20.3	0.0	0.10	0.00
69.1	42	0.1	0.02	0.03	0.01	0.01	4.8	0.2	0.20	0.03
69.1	42	0	3.60	0.02	0.14	0.00	81.0	0.0	0.39	0.00
70.7	45	0	5.21	0.00	1.56	0.00	31.1	0.0	6.22	0.00

Boundary Conditions — CHLA in µg/L, all others in mg/L

RM	SgNo	NH3N	NO23N	SRP	CHLA	UBOD	DO	Org-N	Org-P
33.8	46	0.005	5.000	0.020	0.0	0.5	2.0	0.000	0.000
44.0	47	0.005	1.600	0.020	0.0	0.5	2.0	0.000	0.000
54.2	48	0.005	2.800	0.020	0.0	0.5	2.0	0.000	0.000
59.9	49	0.005	2.900	0.025	0.0	0.5	2.0	0.000	0.000
64.2	50	0.005	1.500	0.044	0.0	0.5	2.0	0.000	0.000
67.5	51	0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
69.1	52	0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
70.1	53	0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
71.2	54	0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
72.4	55	0.050	0.005	0.080	0.0	0.5	2.0	0.000	0.000
74.6	56	0.050	0.005	0.080	0.0	0.5	2.0	0.000	0.000
77.6	57	0.005	0.840	0.016	0.0	0.5	2.0	0.000	0.000
81.0	58	0.080	0.010	0.030	0.0	0.5	2.0	0.000	0.000
90.0	59	0.080	0.010	0.030	0.0	0.5	2.0	0.000	0.000
100.5	60	0.080	0.010	0.030	0.0	0.5	2.0	0.000	0.000

Org-N = Organic Nitrogen
Org-P = Organic Phosphorus
Phyt-C = Phytoplankton Carbon

Appendix I

Table I.3 Existing Critical Conditions Modeled Results - Summer

Surface Segments

RM Code	Seg No	Flow (cfs)	NH3N (mg/L)	NH3N (lb/day)	NO23N (mg/L)	SRP (mg/L)	CHLA (ug/L)	UBOD (mg/L)	UBOD (lb/day)	DO(Max) (mg/L)	DO(Avg) (mg/L)	DO(Min) (mg/L)	Org-N (mg/L)	Org-P (mg/L)
33.8	1	200.3	0.011	11.5	0.995	0.326	14.6	10.1	10893.4	10.56	8.86	7.16	0.662	0.091
39.5	2	184.8	0.009	9.3	0.916	0.371	16.2	11.1	11045.5	10.65	8.95	7.25	0.718	0.101
44.0	3	180.5	0.011	10.4	0.758	0.398	18.7	12.1	11760.5	10.70	9.00	7.30	0.772	0.110
48.6	4	135.6	0.010	7.4	0.650	0.533	26.0	15.3	11171.5	10.87	9.17	7.47	0.982	0.134
54.2	5	127.8	0.030	20.9	0.729	0.593	30.5	17.0	11698.8	10.81	9.11	7.41	1.060	0.146
59.9	6	119.3	0.140	89.9	0.703	0.668	34.7	19.0	12205.5	11.42	9.72	8.02	1.120	0.156
62.0	7	119.0	0.318	203.8	0.705	0.706	32.9	19.4	12431.1	11.80	10.10	8.40	1.060	0.150
64.2	8	117.7	0.553	350.5	0.640	0.752	30.2	20.1	12739.0	12.90	11.20	9.50	0.997	0.142
66.5	9	118.1	0.775	492.8	0.585	0.781	28.6	20.8	13227.4	15.40	13.70	12.00	0.944	0.136
67.5	10	65.6	0.003	1.1	0.225	0.558	48.3	18.5	6534.9	21.10	19.40	17.70	1.240	0.231
68.1	11	65.2	0.003	0.9	0.552	0.608	43.3	16.6	5828.0	19.30	17.60	15.90	1.070	0.215
68.6	12	64.9	0.003	1.0	0.836	0.651	37.2	14.7	5137.2	17.20	15.50	13.80	0.899	0.198
69.1	13	63.7	0.009	3.0	1.100	0.706	30.5	12.9	4424.8	14.90	13.20	11.50	0.741	0.184
69.6	14	61.5	0.054	17.7	1.250	0.759	24.6	11.4	3775.2	12.90	11.20	9.50	0.600	0.174
70.1	15	62.0	0.198	66.1	1.330	0.784	18.4	10.5	3505.4	10.84	9.14	7.44	0.464	0.163
70.7	16	62.6	0.399	134.5	1.320	0.805	13.0	10.2	3438.2	9.09	7.39	5.69	0.346	0.156
71.2	17	63.9	0.541	186.1	1.270	0.809	10.0	10.1	3475.2	8.12	6.42	4.72	0.265	0.155
71.7	18	65.2	0.709	248.9	1.200	0.816	7.2	10.4	3651.3	7.61	5.91	4.21	0.207	0.157
72.4	19	66.3	0.883	315.2	1.080	0.827	5.6	11.1	3962.8	7.28	5.58	3.88	0.175	0.164
73.0	20	65.9	1.060	376.1	0.978	0.835	4.3	11.9	4222.7	7.28	5.58	3.88	0.150	0.173
73.6	21	65.3	1.260	443.0	0.847	0.839	3.3	13.0	4571.1	7.60	5.90	4.20	0.132	0.185
74.1	22	64.3	1.430	495.1	0.735	0.845	2.8	14.1	4881.9	8.09	6.39	4.69	0.125	0.197
74.6	23	58.9	0.026	8.3	0.099	0.028	2.1	2.6	831.0	9.16	7.46	5.76	0.121	0.011
76.0	24	37.4	0.021	4.2	0.159	0.028	2.8	2.8	555.8	8.26	7.46	7.46	0.095	0.014
77.6	25	37.4	0.022	4.4	0.194	0.020	2.6	3.1	616.2	8.47	7.67	7.67	0.099	0.015
79.3	26	40.8	0.028	6.0	0.153	0.021	2.1	3.1	687.6	8.54	7.74	7.74	0.086	0.013
81.0	27	44.7	0.034	8.3	0.117	0.023	1.7	3.3	794.3	8.66	7.86	7.86	0.083	0.013
82.7	28	45.3	0.038	9.2	0.121	0.023	1.4	3.5	844.0	8.67	7.87	7.87	0.081	0.013
84.5	29	45.9	0.041	10.2	0.125	0.023	1.2	3.7	902.1	8.75	7.95	7.95	0.079	0.013
86.5	30	46.6	0.044	11.1	0.129	0.023	1.0	3.9	981.1	8.77	7.97	7.97	0.080	0.013
88.1	31	40.5	0.052	11.3	0.122	0.025	0.8	4.5	970.5	9.14	8.34	8.34	0.074	0.014
90.0	32	41.2	0.055	12.2	0.123	0.025	0.7	4.8	1067.1	9.52	8.72	8.72	0.077	0.015
92.1	33	42.1	0.059	13.3	0.120	0.024	0.5	5.0	1142.5	9.56	8.76	8.76	0.078	0.016
94.4	34	43.1	0.063	14.5	0.116	0.024	0.5	5.3	1220.7	9.34	8.54	8.54	0.078	0.016
97.1	35	37.8	0.066	13.4	0.125	0.022	0.4	6.3	1290.5	9.66	8.86	8.86	0.093	0.020
100.5	36	23.5	0.083	10.5	0.166	0.019	0.4	8.5	1076.9	9.89	9.09	9.09	0.092	0.004
103.0	37	21.2	0.092	10.5	0.177	0.018	0.4	10.2	1164.4	10.11	9.31	9.31	0.108	0.004
106.4														

Subsurface Segments

RM Code	Seg No	Flow (cfs)	NH3N (mg/L)	NH3N (lb/day)	NO23N (mg/L)	SRP (mg/L)	CHLA (ug/L)	UBOD (mg/L)	UBOD (lb/day)	DO(Max) (mg/L)	DO(Avg) (mg/L)	DO(Min) (mg/L)	Org-N (mg/L)	Org-P (mg/L)
66.5	38		0.657		0.676	0.717	28.4	19.4		13.30	11.60	9.90	0.913	0.131
67.5	39		0.046		0.484	0.424	42.2	18.1		7.28	5.58	3.88	1.330	0.209
68.1	40		0.065		0.757	0.465	37.3	17.4		6.18	4.48	2.78	1.220	0.194
68.6	41		0.017		0.955	0.340	32.5	12.8		9.01	7.31	5.61	0.831	0.145
69.1	42		0.054		1.680	0.359	26.6	13.7		6.93	5.23	3.53	0.728	0.127
69.6	43		0.013		1.060	0.682	25.7	12.2		11.27	9.57	7.87	0.788	0.166
70.1	44		0.058		1.340	0.730	19.5	10.1		6.98	5.28	3.58	0.542	0.152
70.7	45		0.514		1.500	0.867	13.9	14.5		2.80	1.10	0.00	0.842	0.125
71.2														

Shaded areas are below the water quality criterion

Appendix I
Table I.4 Existing Critical Conditions Modeled Results - Fall

Surface Segments

RM Code	Seg No	Flow (cfs)	NH3N (mg/L)	NH3N (lb/day)	NO23N (mg/L)	SRP (mg/L)	CHLA (ug/L)	UBOD (mg/L)	UBOD (lb/day)	DO(Max) (mg/L)	DO(Avg) (mg/L)	DO(Min) (mg/L)	Org-N (mg/L)	Org-P (mg/L)
33.8	1	200.3	0.403	434.7	1.970	0.518	0.2	5.4	5845.8	11.19	9.79	8.39	0.136	0.020
39.5	2	184.8	0.474	471.7	1.910	0.575	0.1	6.1	6090.0	11.39	9.99	8.59	0.142	0.023
44.0	3	180.5	0.526	511.2	1.710	0.604	0.2	6.8	6570.3	11.19	9.79	8.39	0.154	0.026
48.6	4	135.6	0.725	529.4	1.780	0.793	0.2	8.3	6089.6	11.37	9.97	8.57	0.165	0.022
54.2	5	127.8	0.837	576.0	1.740	0.850	0.3	9.6	6578.9	11.15	9.75	8.35	0.184	0.026
59.9	6	119.3	0.976	627.0	1.580	0.912	0.4	11.1	7130.6	10.52	9.12	7.72	0.206	0.030
62.0	7	119.0	1.050	672.8	1.510	0.925	0.6	11.9	7625.3	10.41	9.01	7.61	0.215	0.032
64.2	8	117.7	1.150	728.8	1.400	0.945	0.7	12.9	8175.8	10.38	8.98	7.58	0.228	0.036
66.5	9	118.1	1.230	782.2	1.320	0.952	0.8	13.7	8712.3	7.85	7.45	7.05	0.237	0.038
67.5	10	65.6	0.514	181.6	1.540	0.823	0.1	5.4	1911.0	6.17	5.77	5.37	0.054	0.067
68.1	11	65.2	0.585	205.4	1.510	0.830	0.1	6.1	2127.6	5.98	5.58	5.18	0.057	0.074
68.6	12	64.9	0.652	227.9	1.470	0.834	0.1	6.6	2317.0	5.82	5.42	5.02	0.060	0.080
69.1	13	63.7	0.722	247.6	1.420	0.855	0.1	7.2	2479.9	5.74	5.34	4.94	0.064	0.089
69.6	14	61.5	0.792	262.3	1.340	0.877	0.2	7.7	2549.9	5.68	5.28	4.88	0.067	0.098
70.1	15	62.0	0.857	286.1	1.270	0.872	0.2	8.3	2757.6	5.53	5.13	4.73	0.070	0.107
70.7	16	62.6	0.935	315.2	1.200	0.866	0.2	9.0	3016.9	5.39	4.99	4.59	0.073	0.116
71.2	17	63.9	0.986	339.3	1.140	0.855	0.2	9.3	3213.7	5.27	4.87	4.47	0.062	0.126
71.7	18	65.2	1.070	375.7	1.060	0.848	0.2	10.0	3510.8	5.62	5.22	4.82	0.064	0.136
72.4	19	66.3	1.170	417.7	0.951	0.850	0.3	10.9	3891.4	5.75	5.35	4.95	0.068	0.148
73.0	20	65.9	1.280	454.2	0.871	0.851	0.3	11.8	4187.3	6.13	5.73	5.33	0.072	0.161
73.6	21	65.3	1.410	495.8	0.775	0.850	0.3	12.9	4535.9	6.70	6.30	5.90	0.076	0.176
74.1	22	64.3	1.520	526.3	0.698	0.853	0.4	13.8	4778.1	7.27	6.87	6.47	0.079	0.190
74.6	23	58.9	0.042	13.4	0.119	0.033	0.2	2.2	681.9	8.40	8.00	7.60	0.084	0.005
76.0	24	37.4	0.044	8.8	0.185	0.036	0.2	2.1	431.0	8.85	8.15	7.45	0.047	0.006
77.6	25	37.4	0.045	9.1	0.214	0.027	0.2	2.5	503.5	9.12	8.42	7.72	0.056	0.008
79.3	26	40.8	0.048	10.6	0.165	0.027	0.2	2.7	595.4	9.26	8.56	7.86	0.054	0.008
81.0	27	44.7	0.053	12.7	0.122	0.027	0.2	3.0	717.3	9.43	8.73	8.03	0.059	0.009
82.7	28	45.3	0.054	13.1	0.123	0.026	0.2	3.2	783.0	9.45	8.75	8.05	0.063	0.009
84.5	29	45.9	0.055	13.6	0.124	0.026	0.2	3.5	855.2	9.54	8.84	8.14	0.066	0.010
86.5	30	46.6	0.056	14.1	0.126	0.025	0.2	3.8	946.0	9.56	8.86	8.16	0.071	0.011
88.1	31	40.5	0.063	13.7	0.116	0.027	0.2	4.4	948.6	10.07	9.37	8.67	0.069	0.013
90.0	32	41.2	0.064	14.2	0.117	0.026	0.2	4.7	1051.6	10.49	9.79	9.09	0.074	0.014
92.1	33	42.1	0.066	15.0	0.114	0.025	0.2	5.0	1131.2	10.51	9.81	9.11	0.076	0.015
94.4	34	43.1	0.069	15.9	0.111	0.025	0.2	5.2	1213.8	10.21	9.51	8.81	0.078	0.016
97.1	35	37.8	0.070	14.3	0.121	0.022	0.3	6.3	1284.3	10.56	9.86	9.16	0.093	0.020
100.5	36	23.5	0.088	11.1	0.161	0.020	0.3	8.5	1074.3	10.90	10.20	9.50	0.092	0.003
103.0	37	21.2	0.095	10.8	0.174	0.018	0.3	10.2	1164.4	11.00	10.30	9.60	0.108	0.004
106.4														

Subsurface Segments

RM Code	Seg No	Flow (cfs)	NH3N (mg/L)	NH3N (lb/day)	NO23N (mg/L)	SRP (mg/L)	CHLA (ug/L)	UBOD (mg/L)	UBOD (lb/day)	DO(Max) (mg/L)	DO(Avg) (mg/L)	DO(Min) (mg/L)	Org-N (mg/L)	Org-P (mg/L)
66.5	38		1.100		1.360	0.878	0.8	12.4		7.37	5.47	3.57	0.217	0.034
67.5	39		0.000		1.440	0.615	0.1	0.9		1.90	0.00	0.00	0.034	0.034
68.1	40		0.000		1.400	0.623	0.1	1.6		1.90	0.00	0.00	0.038	0.034
68.6	41		0.345		1.430	0.455	0.1	4.1		2.83	0.93	0.00	0.033	0.035
69.1	42		0.477		1.880	0.452	0.2	7.3		2.48	0.58	0.00	0.052	0.035
69.6	43		0.683		1.380	0.834	0.2	6.3		2.21	0.31	0.00	0.053	0.066
70.1	44		0.784		1.210	0.836	0.2	7.2		1.90	0.00	0.00	0.061	0.085
70.7	45		1.300		0.999	0.953	0.2	13.1		1.90	0.00	0.00	0.442	0.070
71.2														

Shaded areas are below the water quality criterion

Appendix I

Table I.5 EUTRO5 Loading and Boundary Conditions - Critical w/ Reductions

Point Source Loads — Flow in cfs, Loads in lb/day

RM	SgNo	Flow	NH3N	NO23N	SRP	Phyt-C	UBOD	DO	Org-N	Org-P
33.8	1	11.9	0.32	15.89	2.76	14.35	96.1	589.5	2.76	0.00
33.8	1	0	0.00	0.00	2.22	0.00	0.0	0.0	8.89	0.00
33.8	1	1.6	0.04	0.71	0.13	0.26	12.9	70.6	1.46	0.17
44.0	3	1.8	0.05	1.64	0.60	0.29	14.5	77.5	1.43	0.23
44.0	3	5	3.28	102.58	1.67	0.06	242.3	188.5	3.43	7.78
44.0	3	30	0.81	152.66	4.36	8.08	242.3	1292.3	28.75	2.42
48.6	4	0.2	0.01	0.09	0.06	0.03	1.6	8.6	0.28	0.04
54.2	5	0.7	0.02	7.16	0.21	0.44	5.7	37.7	0.80	0.12
59.9	6	0.5	0.01	0.32	0.13	0.08	4.0	21.5	0.80	0.16
66.5	9	45.6	1.23	88.15	4.67	39.78	368.3	2185.3	20.63	1.23
66.5	9	6.6	106.62	154.24	312.74	9.38	3228.0	284.3	108.75	0.00
74.1	22	3.4	91.54	148.66	101.24	7.14	1666.0	117.2	0.00	68.65
74.1	22	0.7	20.73	14.62	179.42	0.14	190.0	26.4	0.00	0.00
74.1	22	0.3	0.01	0.35	0.08	0.10	2.4	12.9	0.23	0.16
74.6	23	21.5	0.58	3.01	1.85	1.62	173.7	926.2	20.49	0.69
77.6	25	1	0.03	2.39	0.34	0.16	8.1	43.1	1.80	0.23
82.7	28	0.1	0.00	0.05	0.03	0.09	0.8	4.3	0.20	0.01
86.5	30	6.7	0.18	6.31	0.18	1.01	54.1	288.6	3.90	0.40
97.1	35	7	0.19	3.35	0.57	1.50	56.5	339.2	8.07	3.96
103.0	37	0.2	9.69	13.35	2.09	0.03	96.9	5.8	0.50	0.43
103.0	37	20	0.54	9.69	0.54	3.45	161.5	990.8	12.38	0.00
68.1	40	0	0.00	0.00	0.00	0.00	0.0	0.0	0.00	0.00
68.6	41	0	0.00	0.00	0.00	0.00	0.0	0.0	0.00	0.00
69.1	42	0.1	0.00	0.03	0.01	0.01	3.6	4.3	0.20	0.03
69.1	42	0	0.00	0.00	0.00	0.00	0.0	0.0	0.00	0.00
70.7	45	0	0.00	0.00	0.00	0.00	0.0	0.0	0.00	0.00

Boundary Conditions — CHLA in µg/L, all others in mg/L

RM	SgNo	NH3N	NO23N	SRP	CHLA	UBOD	DO	Org-N	Org-P
33.8	46	0.005	5.000	0.020	0.0	0.5	2.0	0.000	0.000
44.0	47	0.005	1.600	0.020	0.0	0.5	2.0	0.000	0.000
54.2	48	0.005	2.800	0.020	0.0	0.5	2.0	0.000	0.000
59.9	49	0.005	2.900	0.025	0.0	0.5	2.0	0.000	0.000
64.2	50	0.005	1.500	0.044	0.0	0.5	2.0	0.000	0.000
67.5	51	0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
69.1	52	0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
70.1	53	0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
71.2	54	0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
72.4	55	0.050	0.005	0.080	0.0	0.5	2.0	0.000	0.000
74.6	56	0.050	0.005	0.080	0.0	0.5	2.0	0.000	0.000
77.6	57	0.005	0.840	0.016	0.0	0.5	2.0	0.000	0.000
81.0	58	0.080	0.010	0.030	0.0	0.5	2.0	0.000	0.000
90.0	59	0.080	0.010	0.030	0.0	0.5	2.0	0.000	0.000
100.5	60	0.080	0.010	0.030	0.0	0.5	2.0	0.000	0.000

Org-N = Organic Nitrogen

Org-P = Organic Phosphorus

Phyt-C = Phytoplankton Carbon

Appendix I

Table I.6 Modeled Results: Critical Conditions with Reductions - Summer

Surface Segments

RM Code	Seg No	Flow (cfs)	NH3N (mg/L)	NH3N (lb/day)	NO23N (mg/L)	SRP (mg/L)	CHLA (ug/L)	UBOD (mg/L)	UBOD (lb/day)	DO(Max) (mg/L)	DO(Avg) (mg/L)	DO(Min) (mg/L)	Org-N (mg/L)	Org-P (mg/L)
33.8	1	200.3	0.017	17.9	1.100	0.443	4.2	5.4	5802.6	10.55	8.85	7.15	0.296	0.044
39.5	2	184.8	0.017	17.2	0.975	0.496	4.6	6.1	6030.3	10.66	8.96	7.26	0.330	0.050
44.0	3	180.5	0.017	16.3	0.772	0.523	5.4	6.6	6453.7	10.66	8.96	7.26	0.359	0.055
48.6	4	135.6	0.016	12.0	0.596	0.689	7.6	8.3	6023.9	10.76	9.06	7.36	0.442	0.062
54.2	5	127.8	0.020	13.8	0.558	0.744	9.2	9.3	6413.7	10.61	8.91	7.21	0.488	0.069
59.9	6	119.3	0.032	20.4	0.435	0.806	10.9	10.5	6745.1	10.67	8.97	7.27	0.537	0.078
62.0	7	119.0	0.053	33.6	0.434	0.825	10.7	10.9	6984.5	10.77	9.07	7.37	0.536	0.078
64.2	8	117.7	0.087	54.8	0.395	0.851	10.3	11.5	7288.5	11.04	9.34	7.64	0.536	0.080
66.5	9	118.1	0.123	78.2	0.391	0.863	10.1	11.9	7567.6	11.70	10.00	8.30	0.534	0.081
67.5	10	65.6	0.005	1.8	0.004	0.677	16.2	9.0	3179.1	13.70	12.00	10.30	0.568	0.140
68.1	11	65.2	0.005	1.7	0.009	0.685	20.4	9.9	3468.7	14.70	13.00	11.30	0.608	0.152
68.6	12	64.9	0.004	1.4	0.044	0.695	23.5	10.4	3634.5	15.40	13.70	12.00	0.622	0.161
69.1	13	63.7	0.003	1.0	0.134	0.730	22.9	10.2	3498.7	15.20	13.50	11.80	0.580	0.163
69.6	14	61.5	0.003	0.9	0.225	0.773	19.9	9.4	3112.9	14.20	12.50	10.80	0.497	0.161
70.1	15	62.0	0.004	1.2	0.384	0.791	15.8	8.4	2791.0	12.80	11.10	9.40	0.400	0.155
70.7	16	62.6	0.010	3.4	0.531	0.806	11.6	7.4	2497.8	11.27	9.57	7.87	0.305	0.152
71.2	17	63.9	0.030	10.3	0.603	0.813	9.1	7.0	2412.0	10.32	8.62	6.92	0.248	0.153
71.7	18	65.2	0.073	25.7	0.636	0.818	6.7	6.8	2383.8	9.64	7.94	6.24	0.198	0.156
72.4	19	66.3	0.127	45.3	0.615	0.828	5.3	7.0	2495.5	9.29	7.59	5.89	0.170	0.164
73.0	20	65.9	0.182	64.6	0.616	0.835	4.1	7.3	2579.8	9.11	7.41	5.71	0.148	0.173
73.6	21	65.3	0.240	84.4	0.605	0.840	3.2	7.7	2704.0	9.09	7.39	5.69	0.131	0.185
74.1	22	64.3	0.285	98.7	0.593	0.845	2.8	8.1	2818.4	9.20	7.50	5.80	0.125	0.197
74.6	23	58.9	0.016	5.0	0.097	0.028	2.1	1.9	586.7	9.60	7.90	6.20	0.121	0.011
76.0	24	37.4	0.018	3.7	0.160	0.029	2.8	1.7	334.3	8.76	7.96	7.16	0.096	0.014
77.6	25	37.4	0.018	3.7	0.196	0.021	2.6	1.7	340.3	9.03	8.23	7.43	0.100	0.015
79.3	26	40.8	0.025	5.4	0.156	0.022	2.1	1.6	351.5	9.08	8.28	7.48	0.087	0.013
81.0	27	44.7	0.031	7.5	0.120	0.023	1.7	1.6	382.7	9.18	8.38	7.58	0.083	0.013
82.7	28	45.3	0.034	8.2	0.125	0.024	1.4	1.6	385.4	9.21	8.41	7.61	0.081	0.013
84.5	29	45.9	0.037	9.0	0.130	0.024	1.2	1.6	393.0	9.26	8.46	7.66	0.079	0.013
86.5	30	46.6	0.039	9.7	0.135	0.024	1.0	1.6	411.5	9.30	8.50	7.70	0.080	0.014
88.1	31	40.5	0.049	10.7	0.130	0.027	0.8	1.6	355.5	9.46	8.66	7.86	0.075	0.014
90.0	32	41.2	0.052	11.5	0.132	0.026	0.7	1.7	379.4	9.62	8.82	8.02	0.078	0.015
92.1	33	42.1	0.055	12.6	0.129	0.026	0.6	1.8	399.0	9.68	8.88	8.08	0.078	0.016
94.4	34	43.1	0.059	13.6	0.125	0.025	0.5	1.8	420.1	9.56	8.76	7.96	0.078	0.016
97.1	35	37.8	0.061	12.4	0.137	0.023	0.4	2.1	419.3	9.80	9.00	8.20	0.093	0.020
100.5	36	23.5	0.078	9.9	0.186	0.021	0.4	2.5	320.1	10.03	9.23	8.43	0.092	0.004
103.0	37	21.2	0.086	9.8	0.201	0.020	0.4	2.9	334.5	10.20	9.40	8.60	0.108	0.004
106.4														

Subsurface Segments

RM Code	Seg No	Flow (cfs)	NH3N (mg/L)	NH3N (lb/day)	NO23N (mg/L)	SRP (mg/L)	CHLA (ug/L)	UBOD (mg/L)	UBOD (lb/day)	DO(Max) (mg/L)	DO(Avg) (mg/L)	DO(Min) (mg/L)	Org-N (mg/L)	Org-P (mg/L)
66.5	38		0.100		0.477	0.795	10.2	11.0		10.51	8.81	7.11	0.506	0.075
67.5	39		0.016		0.227	0.490	16.1	8.2		9.26	7.56	5.86	0.579	0.108
68.1	40		0.022		0.234	0.497	19.4	9.5		9.96	8.26	6.56	0.677	0.122
68.6	41		0.007		0.499	0.360	21.7	8.4		10.37	8.67	6.97	0.571	0.110
69.1	42		0.007		1.090	0.363	20.7	8.4		9.98	8.28	6.58	0.565	0.107
69.6	43		0.010		0.134	0.703	20.8	10.1		14.10	12.40	10.70	0.647	0.148
70.1	44		0.004		0.347	0.739	16.7	8.5		11.57	9.87	8.17	0.468	0.143
70.7	45		0.009		0.473	0.750	12.5	7.3		9.27	7.57	5.87	0.424	0.119
71.2														

Shaded areas are below the water quality criteria

Appendix I
Table I.7 Modeled Results: Critical Conditions with Reductions - Fall

Surface Segments

RM Code	Seg No	Flow (cfs)	NH3N (mg/L)	NH3N (lb/day)	NO23N (mg/L)	SRP (mg/L)	CHLA (ug/L)	UBOD (mg/L)	UBOD (lb/day)	DO(Max) (mg/L)	DO(Avg) (mg/L)	DO(Min) (mg/L)	Org-N (mg/L)	Org-P (mg/L)
33.8	1	200.3	0.089	95.7	1.540	0.515	0.2	3.6	3872.0	11.50	10.10	8.70	0.126	0.020
39.5	2	184.8	0.102	101.5	1.440	0.573	0.1	4.1	4060.0	11.70	10.30	8.90	0.140	0.023
44.0	3	180.5	0.110	106.9	1.250	0.602	0.2	4.5	4354.3	11.60	10.20	8.80	0.151	0.026
48.6	4	135.6	0.145	105.9	1.200	0.791	0.2	5.3	3899.1	11.70	10.30	8.90	0.161	0.022
54.2	5	127.8	0.163	112.2	1.160	0.848	0.3	6.1	4190.9	11.50	10.10	8.70	0.179	0.026
59.9	6	119.3	0.184	118.2	1.020	0.909	0.4	7.0	4490.3	11.29	9.89	8.49	0.201	0.030
62.0	7	119.0	0.194	124.3	0.990	0.923	0.6	7.5	4786.6	11.14	9.74	8.34	0.210	0.032
64.2	8	117.7	0.208	131.8	0.930	0.943	0.7	8.1	5120.9	10.88	9.48	8.08	0.222	0.036
66.5	9	118.1	0.218	138.6	0.909	0.949	0.8	8.6	5462.7	8.89	8.49	8.09	0.231	0.038
67.5	10	65.6	0.109	38.5	0.912	0.819	0.1	3.0	1042.0	8.14	7.74	7.34	0.043	0.067
68.1	11	65.2	0.120	42.1	0.892	0.825	0.1	3.2	1134.0	8.03	7.63	7.23	0.046	0.074
68.6	12	64.9	0.131	45.8	0.875	0.830	0.1	3.5	1219.6	7.96	7.56	7.16	0.048	0.080
69.1	13	63.7	0.146	50.1	0.848	0.850	0.1	3.8	1313.7	8.00	7.60	7.20	0.051	0.089
69.6	14	61.5	0.162	53.6	0.781	0.873	0.2	4.2	1394.2	8.06	7.66	7.26	0.054	0.098
70.1	15	62.0	0.177	59.1	0.761	0.868	0.2	4.5	1512.3	8.01	7.61	7.21	0.057	0.106
70.7	16	62.6	0.194	65.4	0.738	0.862	0.2	4.9	1651.7	7.95	7.55	7.15	0.059	0.116
71.2	17	63.9	0.211	72.6	0.716	0.855	0.2	5.3	1809.9	7.93	7.53	7.13	0.062	0.126
71.7	18	65.2	0.229	80.4	0.692	0.848	0.2	5.6	1980.1	8.04	7.64	7.24	0.064	0.136
72.4	19	66.3	0.251	89.6	0.644	0.850	0.2	6.1	2181.3	8.06	7.66	7.26	0.068	0.148
73.0	20	65.9	0.275	97.6	0.632	0.851	0.3	6.6	2342.0	8.20	7.80	7.40	0.072	0.161
73.6	21	65.3	0.302	106.2	0.616	0.851	0.3	7.2	2514.1	8.41	8.01	7.61	0.076	0.176
74.1	22	64.3	0.326	112.9	0.607	0.854	0.4	7.7	2648.7	8.63	8.23	7.83	0.079	0.190
74.6	23	58.9	0.029	9.2	0.120	0.034	0.2	1.4	431.3	9.19	8.79	8.39	0.084	0.005
76.0	24	37.4	0.039	7.9	0.188	0.036	0.2	1.0	205.4	9.78	9.08	8.38	0.047	0.006
77.6	25	37.4	0.039	7.9	0.218	0.028	0.2	1.1	225.6	10.15	9.45	8.75	0.056	0.008
79.3	26	40.8	0.044	9.7	0.169	0.028	0.2	1.2	257.0	10.27	9.57	8.87	0.055	0.008
81.0	27	44.7	0.048	11.6	0.128	0.028	0.2	1.3	305.7	10.39	9.69	8.99	0.059	0.009
82.7	28	45.3	0.049	11.9	0.129	0.027	0.2	1.3	324.4	10.42	9.72	9.02	0.063	0.009
84.5	29	45.9	0.049	12.2	0.131	0.027	0.2	1.4	348.5	10.46	9.76	9.06	0.066	0.010
86.5	30	46.6	0.050	12.5	0.133	0.026	0.2	1.5	376.4	10.48	9.78	9.08	0.071	0.011
88.1	31	40.5	0.059	12.9	0.125	0.028	0.2	1.5	335.8	10.70	10.00	9.30	0.069	0.013
90.0	32	41.2	0.061	13.4	0.127	0.027	0.2	1.6	363.8	10.90	10.20	9.50	0.074	0.014
92.1	33	42.1	0.062	14.1	0.124	0.027	0.2	1.7	387.6	10.80	10.10	9.40	0.076	0.015
94.4	34	43.1	0.064	14.9	0.121	0.026	0.2	1.8	413.1	10.54	9.84	9.14	0.078	0.016
97.1	35	37.8	0.065	13.3	0.133	0.024	0.3	2.0	415.2	10.80	10.10	9.40	0.093	0.020
100.5	36	23.5	0.082	10.4	0.182	0.022	0.3	2.5	318.9	11.10	10.40	9.70	0.092	0.003
103.0	37	21.2	0.088	10.0	0.198	0.021	0.3	2.9	334.5	11.20	10.50	9.80	0.108	0.004
106.4														

Subsurface Segments

RM Code	Seg No	Flow (cfs)	NH3N (mg/L)	NH3N (lb/day)	NO23N (mg/L)	SRP (mg/L)	CHLA (ug/L)	UBOD (mg/L)	UBOD (lb/day)	DO(Max) (mg/L)	DO(Avg) (mg/L)	DO(Min) (mg/L)	Org-N (mg/L)	Org-P (mg/L)
66.5	38		0.197		0.960	0.876	0.8	7.8		8.00	7.60	7.20	0.212	0.034
67.5	39		0.058		1.070	0.612	0.1	1.6		5.23	4.83	4.43	0.027	0.034
68.1	40		0.059		1.070	0.618	0.1	1.6		4.88	4.48	4.08	0.028	0.034
68.6	41		0.057		1.110	0.452	0.1	1.6		4.41	4.01	3.61	0.024	0.035
69.1	42		0.061		1.620	0.444	0.1	1.8		4.36	3.96	3.56	0.033	0.035
69.6	43		0.110		0.956	0.830	0.2	3.0		5.66	5.26	4.86	0.044	0.065
70.1	44		0.142		0.885	0.833	0.2	3.7		6.28	5.88	5.48	0.050	0.085
70.7	45		0.124		0.933	0.827	0.2	3.2		5.13	4.73	4.33	0.047	0.070
71.2														

Shaded areas are below the water quality criterion

Appendix I
Table I.8 Modeled Results: Background Conditions - Summer

Surface Segments

RM Code	Seg No	Flow (cfs)	NH3N (mg/L)	NH3N (lb/day)	NO23N (mg/L)	SRP (mg/L)	CHLA (ug/L)	UBOD (mg/L)	UBOD (lb/day)	DO(Max) (mg/L)	DO(Avg) (mg/L)	DO(Min) (mg/L)	Org-N (mg/L)	Org-P (mg/L)
33.8	1	184.7	0.013	13.1	1.090	0.015	0.7	1.3	1312.8	10.52	8.82	7.12	0.084	0.008
39.5	2	169.2	0.013	11.8	0.935	0.012	0.7	1.4	1239.1	10.65	8.95	7.25	0.092	0.009
44.0	3	164.9	0.012	10.6	0.696	0.012	0.9	1.5	1314.1	10.64	8.94	7.24	0.102	0.010
48.6	4	125.0	0.012	7.9	0.577	0.007	1.2	1.4	955.8	10.73	9.03	7.33	0.095	0.010
54.2	5	117.2	0.011	6.9	0.502	0.006	1.6	1.6	1016.0	10.54	8.84	7.14	0.108	0.012
59.9	6	108.7	0.010	5.8	0.321	0.006	2.2	1.8	1071.1	10.43	8.73	7.03	0.124	0.013
62.0	7	108.4	0.009	5.3	0.291	0.006	2.4	1.9	1114.9	10.45	8.75	7.05	0.128	0.014
64.2	8	107.1	0.008	4.8	0.230	0.007	2.7	2.0	1159.2	10.53	8.83	7.13	0.133	0.014
66.5	9	107.5	0.007	4.3	0.223	0.007	2.9	2.1	1209.8	10.42	8.72	7.02	0.137	0.015
67.5	10	61.6	0.008	2.8	0.122	0.002	4.0	2.0	676.7	10.49	8.79	7.09	0.154	0.019
68.1	11	61.2	0.007	2.2	0.116	0.003	4.6	2.1	698.6	10.61	8.91	7.21	0.158	0.020
68.6	12	60.9	0.006	2.0	0.122	0.006	4.5	2.1	675.5	10.54	8.84	7.14	0.152	0.019
69.1	13	59.7	0.007	2.2	0.110	0.010	3.9	1.9	617.2	10.42	8.72	7.02	0.140	0.017
69.6	14	57.5	0.008	2.6	0.054	0.014	3.3	1.8	548.0	10.28	8.58	6.88	0.128	0.015
70.1	15	58.0	0.009	2.8	0.067	0.018	3.0	1.7	524.7	10.06	8.36	6.66	0.119	0.014
70.7	16	58.6	0.010	3.3	0.080	0.021	2.5	1.6	501.7	9.79	8.09	6.39	0.111	0.012
71.2	17	59.9	0.012	3.8	0.088	0.023	2.2	1.5	490.3	9.54	7.84	6.14	0.104	0.011
71.7	18	61.2	0.014	4.5	0.092	0.026	1.8	1.5	481.1	9.45	7.75	6.05	0.099	0.010
72.4	19	62.3	0.015	5.2	0.063	0.027	1.7	1.5	493.1	9.41	7.71	6.01	0.098	0.010
73.0	20	61.9	0.016	5.5	0.070	0.028	1.6	1.5	493.3	9.43	7.73	6.03	0.098	0.009
73.6	21	61.3	0.017	5.7	0.077	0.028	1.4	1.5	498.4	9.45	7.75	6.05	0.099	0.009
74.1	22	60.3	0.018	5.7	0.082	0.028	1.4	1.5	500.0	9.48	7.78	6.08	0.101	0.009
74.6	23	59.0	0.018	5.8	0.087	0.028	1.3	1.6	498.8	9.55	7.85	6.15	0.102	0.009
76.0	24	37.5	0.021	4.3	0.138	0.028	1.6	1.3	254.4	8.69	7.89	7.09	0.071	0.011
77.6	25	37.5	0.020	4.1	0.165	0.020	1.5	1.3	262.5	8.97	8.17	7.37	0.077	0.012
79.3	26	40.9	0.025	5.5	0.117	0.019	1.2	1.3	275.3	9.04	8.24	7.44	0.069	0.011
81.0	27	44.8	0.029	7.0	0.077	0.020	1.0	1.3	306.4	9.15	8.35	7.55	0.069	0.011
82.7	28	45.4	0.030	7.3	0.079	0.020	0.9	1.3	315.4	9.18	8.38	7.58	0.070	0.012
84.5	29	46.0	0.030	7.5	0.080	0.019	0.7	1.3	324.5	9.24	8.44	7.64	0.070	0.012
86.5	30	46.7	0.030	7.6	0.082	0.018	0.6	1.4	339.5	9.27	8.47	7.67	0.073	0.013
88.1	31	40.3	0.034	7.5	0.067	0.020	0.6	1.3	277.8	9.47	8.67	7.87	0.069	0.014
90.0	32	41.0	0.034	7.6	0.067	0.019	0.5	1.3	293.6	9.63	8.83	8.03	0.073	0.015
92.1	33	41.9	0.036	8.0	0.066	0.018	0.4	1.4	309.1	9.69	8.89	8.09	0.074	0.016
94.4	34	42.9	0.037	8.5	0.063	0.018	0.4	1.4	325.7	9.57	8.77	7.97	0.075	0.016
97.1	35	37.6	0.032	6.4	0.068	0.015	0.4	1.6	315.8	9.81	9.01	8.21	0.090	0.020
100.5	36	23.3	0.023	2.9	0.077	0.007	0.4	1.7	207.0	10.03	9.23	8.43	0.088	0.004
103.0	37	21.0	0.015	1.7	0.083	0.003	0.4	1.9	209.2	10.21	9.41	8.61	0.104	0.004
106.4														

Subsurface Segments

RM Code	Seg No	Flow (cfs)	NH3N (mg/L)	NH3N (lb/day)	NO23N (mg/L)	SRP (mg/L)	CHLA (ug/L)	UBOD (mg/L)	UBOD (lb/day)	DO(Max) (mg/L)	DO(Avg) (mg/L)	DO(Min) (mg/L)	Org-N (mg/L)	Org-P (mg/L)
66.5	38		0.007		0.321	0.010	2.9	2.0		9.28	7.58	5.88	0.130	0.014
67.5	39		0.011		0.438	0.003	4.0	1.9		5.85	4.15	2.45	0.150	0.019
68.1	40		0.012		0.435	0.003	4.5	2.1		6.50	4.80	3.10	0.165	0.021
68.6	41		0.005		0.647	0.006	4.6	1.8		6.82	5.12	3.42	0.132	0.017
69.1	42		0.005		1.190	0.009	4.0	1.8		6.76	5.06	3.36	0.130	0.016
69.6	43		0.008		0.174	0.005	3.8	2.0		8.72	7.02	5.32	0.148	0.018
70.1	44		0.007		0.170	0.012	3.3	1.7		7.71	6.01	4.31	0.128	0.015
70.7	45		0.009		0.210	0.012	3.0	1.7		6.97	5.27	3.57	0.130	0.015
71.2														

Shaded areas are below the water quality criteria

Appendix I

Table I.9 Modeled Results: Background Conditions - Fall

Surface Segments

RM Code	Seg No	Flow (cfs)	NH3N (mg/L)	NH3N (lb/day)	NO23N (mg/L)	SRP (mg/L)	CHLA (ug/L)	UBOD (mg/L)	UBOD (lb/day)	DO(Max) (mg/L)	DO(Avg) (mg/L)	DO(Min) (mg/L)	Org-N (mg/L)	Org-P (mg/L)
33.8	1	184.7	0.014	13.4	1.180	0.029	0.2	1.0	973.7	11.50	10.10	8.70	0.059	0.004
39.5	2	169.2	0.014	12.6	1.040	0.028	0.1	1.0	884.7	11.60	10.20	8.80	0.063	0.004
44.0	3	164.9	0.014	12.0	0.807	0.028	0.2	1.1	932.3	11.50	10.10	8.70	0.069	0.005
48.6	4	125.0	0.015	10.0	0.722	0.028	0.1	0.8	559.3	11.60	10.20	8.80	0.048	0.003
54.2	5	117.2	0.015	9.7	0.653	0.029	0.2	0.9	575.6	11.50	10.10	8.70	0.054	0.003
59.9	6	108.7	0.016	9.1	0.478	0.029	0.3	1.0	597.0	11.24	9.84	8.44	0.060	0.004
62.0	7	108.4	0.015	9.0	0.444	0.029	0.4	1.1	624.6	11.14	9.74	8.34	0.062	0.004
64.2	8	107.1	0.015	8.8	0.377	0.029	0.6	1.2	669.0	10.93	9.53	8.13	0.067	0.004
66.5	9	107.5	0.015	8.7	0.362	0.029	0.7	1.2	712.0	9.21	8.81	8.41	0.070	0.005
67.5	10	61.6	0.022	7.4	0.344	0.036	0.0	0.6	188.7	8.81	8.41	8.01	0.040	0.002
68.1	11	61.2	0.023	7.7	0.323	0.036	0.0	0.6	203.0	8.78	8.38	7.98	0.042	0.002
68.6	12	60.9	0.024	7.9	0.305	0.036	0.0	0.7	216.1	8.74	8.34	7.94	0.045	0.002
69.1	13	59.7	0.025	8.1	0.266	0.036	0.0	0.7	230.8	8.80	8.40	8.00	0.048	0.003
69.6	14	57.5	0.026	8.2	0.184	0.037	0.0	0.8	238.1	8.86	8.46	8.06	0.052	0.003
70.1	15	58.0	0.027	8.4	0.173	0.037	0.0	0.8	254.8	8.75	8.35	7.95	0.054	0.003
70.7	16	58.6	0.027	8.6	0.162	0.036	0.0	0.9	275.5	8.63	8.23	7.83	0.058	0.003
71.2	17	59.9	0.028	8.9	0.152	0.036	0.1	0.9	298.4	8.51	8.11	7.71	0.060	0.004
71.7	18	61.2	0.028	9.1	0.142	0.036	0.1	1.0	322.3	8.55	8.15	7.75	0.063	0.004
72.4	19	62.3	0.028	9.4	0.102	0.036	0.1	1.0	348.9	8.54	8.14	7.74	0.067	0.004
73.0	20	61.9	0.028	9.2	0.101	0.035	0.1	1.1	370.0	8.61	8.21	7.81	0.071	0.005
73.6	21	61.3	0.027	8.9	0.100	0.034	0.1	1.2	389.5	8.68	8.28	7.88	0.076	0.005
74.1	22	60.3	0.026	8.6	0.100	0.033	0.1	1.2	402.6	8.75	8.35	7.95	0.080	0.005
74.6	23	59.0	0.026	8.1	0.099	0.031	0.1	1.3	416.2	8.90	8.50	8.10	0.084	0.005
76.0	24	37.5	0.033	6.6	0.152	0.032	0.1	0.9	185.4	9.43	8.73	8.03	0.046	0.006
77.6	25	37.5	0.031	6.3	0.175	0.023	0.2	1.0	200.1	9.78	9.08	8.38	0.056	0.008
79.3	26	40.9	0.034	7.5	0.123	0.022	0.2	1.0	224.6	9.90	9.20	8.50	0.054	0.008
81.0	27	44.8	0.037	8.9	0.080	0.022	0.2	1.1	262.9	10.04	9.34	8.64	0.058	0.009
82.7	28	45.4	0.036	8.8	0.080	0.022	0.2	1.2	281.1	10.07	9.37	8.67	0.062	0.010
84.5	29	46.0	0.035	8.8	0.081	0.021	0.2	1.2	297.2	10.12	9.42	8.72	0.065	0.011
86.5	30	46.7	0.034	8.6	0.081	0.020	0.2	1.3	319.4	10.13	9.43	8.73	0.070	0.012
88.1	31	40.3	0.038	8.2	0.066	0.021	0.2	1.2	262.6	10.45	9.75	9.05	0.067	0.013
90.0	32	41.0	0.037	8.1	0.066	0.020	0.2	1.3	282.6	10.62	9.92	9.22	0.072	0.014
92.1	33	41.9	0.037	8.4	0.064	0.019	0.2	1.3	300.1	10.67	9.97	9.27	0.074	0.015
94.4	34	42.9	0.038	8.7	0.062	0.018	0.2	1.4	318.8	10.48	9.78	9.08	0.076	0.016
97.1	35	37.6	0.032	6.4	0.067	0.015	0.2	1.5	311.8	10.70	10.00	9.30	0.091	0.020
100.5	36	23.3	0.023	2.8	0.077	0.007	0.3	1.6	205.8	11.00	10.30	9.60	0.089	0.003
103.0	37	21.0	0.014	1.6	0.083	0.003	0.3	1.9	209.2	11.20	10.50	9.80	0.105	0.004
106.4														

Subsurface Segments

RM Code	Seg No	Flow (cfs)	NH3N (mg/L)	NH3N (lb/day)	NO23N (mg/L)	SRP (mg/L)	CHLA (ug/L)	UBOD (mg/L)	UBOD (lb/day)	DO(Max) (mg/L)	DO(Avg) (mg/L)	DO(Min) (mg/L)	Org-N (mg/L)	Org-P (mg/L)
66.5	38		0.014		0.453	0.030	0.7	1.2		8.00	7.60	7.20	0.065	0.004
67.5	39		0.015		0.644	0.032	0.0	0.3		3.75	3.35	2.95	0.024	0.001
68.1	40		0.015		0.644	0.033	0.0	0.3		4.20	3.80	3.40	0.024	0.001
68.6	41		0.012		0.803	0.029	0.0	0.3		4.42	4.02	3.62	0.021	0.001
69.1	42		0.014		1.320	0.030	0.0	0.5		4.44	4.04	3.64	0.030	0.002
69.6	43		0.023		0.374	0.036	0.0	0.6		6.09	5.69	5.29	0.040	0.002
70.1	44		0.025		0.312	0.036	0.0	0.7		5.72	5.32	4.92	0.047	0.002
70.7	45		0.024		0.362	0.036	0.1	0.6		4.65	4.25	3.85	0.043	0.002
71.2														

Shaded areas are below the water quality criterion

Appendix I

Table I.10 EUTRO5 Loading and Boundary Conditions - TMDL Alternative #1

Point Source Loads — Flow in cfs, Loads in lb/day

RM	SgNo	Flow	NH3N	NO23N	SRP	Phyt-C	UBOD	DO	Org-N	Org-P
33.8	1	11.9	0.32	15.89	2.76	14.35	128.2	589.5	2.76	0.00
33.8	1	0.0	7.44	0.00	2.22	0.00	44.4	0.0	8.89	0.00
33.8	1	1.6	0.04	0.71	0.13	0.26	31.9	70.6	1.46	0.17
44.0	3	1.8	0.27	1.64	0.60	0.29	35.9	77.5	1.43	0.23
44.0	3	5.0	3.28	102.58	1.67	0.06	242.3	0.0	3.43	7.78
44.0	3	30.0	7.59	152.66	4.36	8.08	355.4	1292.3	28.75	2.42
48.6	4	0.2	0.10	0.09	0.06	0.03	4.0	8.6	0.28	0.04
54.2	5	0.7	0.15	7.16	0.21	0.44	11.7	37.7	0.80	0.12
54.2	5	1.2	161.54	36.35	49.68	1.98	581.5	48.2	8.83	8.24
59.9	6	0.5	0.18	0.32	0.13	0.08	10.0	21.5	0.80	0.16
66.5	9	45.6	1.23	88.15	4.67	39.78	368.3	2185.3	20.63	1.23
66.5	9	6.6	54.34	154.24	312.74	9.38	1066.2	284.3	73.57	0.00
74.1	22	0.0	0.00	0.00	0.00	0.00	0.0	0.0	0.00	0.00
74.1	22	0.0	0.00	0.00	0.00	0.00	0.0	0.0	0.00	0.00
74.1	22	0.3	0.01	0.35	0.08	0.10	2.4	12.9	0.23	0.16
74.6	23	21.5	0.58	3.01	1.85	1.62	173.7	926.2	20.49	0.69
77.6	25	1.0	0.03	2.39	0.34	0.16	8.1	43.1	1.80	0.23
82.7	28	0.1	0.00	0.05	0.03	0.09	0.8	4.3	0.20	0.01
86.5	30	7.0	0.18	6.31	0.18	1.01	54.1	288.6	3.90	0.40
97.1	35	7.0	0.19	3.35	0.57	1.50	56.5	339.2	8.07	3.96
103.0	37	0.2	9.69	13.35	2.09	0.03	96.9	5.8	0.50	0.43
103.0	37	20.0	0.54	9.69	0.54	3.45	161.5	990.8	12.38	0.00
68.1	40	0.0	0.00	0.00	0.00	0.00	0.0	0.0	0.00	0.00
68.6	41	0.0	0.00	0.00	0.00	0.00	0.0	0.0	0.00	0.00
69.1	42	0.1	0.00	0.03	0.01	0.01	3.6	4.3	0.20	0.03
69.1	42	0.0	0.00	0.00	0.00	0.00	0.0	0.0	0.00	0.00
70.7	45	0.0	0.00	0.00	0.00	0.00	0.0	0.0	0.00	0.00

Boundary Conditions — CHLA in µg/L, all others in mg/L

RM	SgNo	NH3N	NO23N	SRP	CHLA	UBOD	DO	Org-N	Org-P
33.8	46	0.005	5.000	0.020	0.0	0.5	2.0	0.000	0.000
44.0	47	0.005	1.600	0.020	0.0	0.5	2.0	0.000	0.000
54.2	48	0.005	2.800	0.020	0.0	0.5	2.0	0.000	0.000
59.9	49	0.005	2.900	0.025	0.0	0.5	2.0	0.000	0.000
64.2	50	0.005	1.500	0.044	0.0	0.5	2.0	0.000	0.000
67.5	51	0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
69.1	52	0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
70.1	53	0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
71.2	54	0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
72.4	55	0.050	0.005	0.080	0.0	0.5	2.0	0.000	0.000
74.6	56	0.050	0.005	0.080	0.0	0.5	2.0	0.000	0.000
77.6	57	0.005	0.840	0.016	0.0	0.5	2.0	0.000	0.000
81.0	58	0.080	0.010	0.030	0.0	0.5	2.0	0.000	0.000
90.0	59	0.080	0.010	0.030	0.0	0.5	2.0	0.000	0.000
100.5	60	0.080	0.010	0.030	0.0	0.5	2.0	0.000	0.000

Org-N = Organic Nitrogen
Org-P = Organic Phosphorus
Phyt-C = Phytoplankton Carbon

Appendix I

Table I.11 Modeled Results: TMDL Loading Capacity Alternative #1 - Summer

Surface Segments

RM Code	Seg No	Flow (cfs)	NH3N (mg/L)	NH3N (lb/day)	NO23N (mg/L)	SRP (mg/L)	CHLA (ug/L)	UBOD (mg/L)	UBOD (lb/day)	DO(Max) (mg/L)	DO(Avg) (mg/L)	DO(Min) (mg/L)	DO-Bkgd (mg/L)	Org-N (mg/L)	Org-P (mg/L)
33.8	1	197.7	0.108	115.0	1.370	0.314	1.2	3.3	3555.6	10.50	8.80	7.10	-0.02	0.150	0.020
39.5	2	182.2	0.127	124.6	1.240	0.348	1.2	3.6	3551.6	10.63	8.93	7.23	-0.02	0.158	0.023
44.0	3	177.9	0.145	138.9	1.030	0.365	1.5	4.0	3831.8	10.61	8.91	7.21	-0.03	0.173	0.026
48.6	4	133.0	0.198	141.8	0.895	0.479	2.0	4.5	3201.3	10.70	9.00	7.30	-0.03	0.192	0.022
54.2	5	125.2	0.243	163.8	0.818	0.515	2.4	5.2	3471.9	10.52	8.82	7.12	-0.02	0.215	0.025
59.9	6	115.5	0.058	36.0	0.581	0.483	2.9	3.9	2444.2	10.41	8.71	7.01	-0.02	0.229	0.016
62.0	7	115.2	0.061	37.8	0.549	0.491	2.9	4.1	2512.3	10.42	8.72	7.02	-0.03	0.234	0.015
64.2	8	113.9	0.072	44.3	0.488	0.505	2.9	4.3	2625.0	10.45	8.75	7.05	-0.08	0.242	0.015
66.5	9	114.3	0.083	50.9	0.473	0.511	2.9	4.5	2757.3	10.26	8.56	6.86		0.248	0.015
67.5	10	61.8	0.011	3.8	0.120	0.001	3.4	2.0	675.5	10.31	8.61	6.91		0.154	0.019
68.1	11	61.4	0.009	3.0	0.108	0.002	4.1	2.2	717.4	10.47	8.77	7.07		0.162	0.020
68.6	12	61.1	0.007	2.5	0.105	0.004	4.5	2.2	727.1	10.52	8.82	7.12		0.164	0.020
69.1	13	59.9	0.008	2.4	0.086	0.007	4.2	2.2	699.9	10.51	8.81	7.11		0.159	0.019
69.6	14	57.7	0.008	2.6	0.029	0.010	3.7	2.1	636.9	10.41	8.71	7.01		0.149	0.018
70.1	15	58.2	0.008	2.7	0.039	0.013	3.7	2.0	633.0	10.27	8.57	6.87		0.145	0.017
70.7	16	58.8	0.009	2.8	0.055	0.017	3.4	2.0	617.4	10.05	8.35	6.65		0.138	0.016
71.2	17	60.1	0.010	3.1	0.067	0.020	3.2	1.9	608.4	9.80	8.10	6.40		0.131	0.015
71.7	18	61.4	0.011	3.6	0.078	0.023	2.7	1.8	591.8	9.67	7.97	6.27		0.123	0.013
72.4	19	62.5	0.012	4.1	0.054	0.025	2.5	1.8	599.0	9.61	7.91	6.21		0.121	0.013
73.0	20	62.1	0.013	4.4	0.067	0.027	2.4	1.8	595.2	9.61	7.91	6.21		0.119	0.012
73.6	21	61.5	0.014	4.7	0.080	0.028	2.2	1.8	589.5	9.59	7.89	6.19		0.118	0.012
74.1	22	60.5	0.015	5.0	0.090	0.028	2.1	1.8	586.4	9.58	7.88	6.18		0.118	0.012
74.6	23	59.2	0.017	5.3	0.100	0.029	1.9	1.8	573.8	9.59	7.89	6.19		0.117	0.011
76.0	24	37.7	0.020	4.0	0.164	0.030	2.6	1.6	324.8	8.74	7.94	7.14	0.05	0.091	0.013
77.6	25	37.7	0.020	4.0	0.199	0.023	2.4	1.6	330.9	9.01	8.21	7.41	0.04	0.095	0.014
79.3	26	41.1	0.026	5.8	0.158	0.024	1.9	1.6	345.2	9.07	8.27	7.47	0.03	0.083	0.013
81.0	27	45.0	0.033	7.9	0.122	0.025	1.5	1.6	378.0	9.17	8.37	7.57	0.02	0.080	0.013
82.7	28	45.6	0.035	8.7	0.126	0.025	1.3	1.6	385.5	9.19	8.39	7.59	0.01	0.079	0.013
84.5	29	46.2	0.038	9.5	0.131	0.025	1.0	1.6	395.5	9.24	8.44	7.64	0.00	0.078	0.013
86.5	30	46.9	0.040	10.2	0.134	0.025	0.9	1.6	414.2	9.27	8.47	7.67	0.00	0.079	0.014
88.1	31	40.5	0.049	10.6	0.130	0.028	0.8	1.6	355.5	9.46	8.66	7.86	-0.01	0.075	0.015
90.0	32	41.2	0.051	11.4	0.133	0.028	0.7	1.7	379.4	9.62	8.82	8.02		0.078	0.016
92.1	33	42.1	0.055	12.4	0.130	0.027	0.6	1.8	399.0	9.68	8.88	8.08		0.078	0.016
94.4	34	43.1	0.058	13.5	0.126	0.027	0.5	1.8	420.1	9.57	8.77	7.97	0.00	0.079	0.017
97.1	35	37.8	0.061	12.4	0.138	0.026	0.4	2.1	421.3	9.81	9.01	8.21		0.094	0.020
100.5	36	23.5	0.078	9.9	0.186	0.025	0.4	2.5	320.1	10.03	9.23	8.43		0.092	0.004
103.0	37	21.2	0.086	9.8	0.201	0.025	0.4	2.9	334.5	10.20	9.40	8.60		0.108	0.004
106.4															

Subsurface Segments

RM Code	Seg No	Flow (cfs)	NH3N (mg/L)	NH3N (lb/day)	NO23N (mg/L)	SRP (mg/L)	CHLA (ug/L)	UBOD (mg/L)	UBOD (lb/day)	DO(Max) (mg/L)	DO(Avg) (mg/L)	DO(Min) (mg/L)	DO-Bkgd (mg/L)	Org-N (mg/L)	Org-P (mg/L)
66.5	38		0.072		0.555	0.472	2.9	4.1		8.10	7.40	5.70		0.231	0.014
67.5	39		0.012		0.442	0.003	3.5	1.8		4.69	3.99	2.29	-0.16	0.141	0.018
68.1	40		0.014		0.437	0.003	4.1	2.1		5.33	4.63	2.93	-0.17	0.159	0.020
68.6	41		0.005		0.643	0.005	4.5	1.8		5.74	5.04	3.34	-0.08	0.135	0.018
69.1	42		0.006		1.180	0.007	4.3	2.0		5.78	5.08	3.38	0.02	0.142	0.018
69.6	43		0.010		0.162	0.003	4.1	2.2		7.61	6.91	5.21		0.166	0.020
70.1	44		0.007		0.140	0.008	4.0	2.1		6.95	6.25	4.55	0.24	0.155	0.018
70.7	45		0.010		0.178	0.008	3.9	2.1		6.29	5.59	3.89	0.32	0.164	0.019
71.2															

DO-Min = Diurnal Minimum DO DO-Bkgd = Difference from background results

Shaded areas - below the water quality criteria.

Appendix I

Table I.12 Modeled Results: TMDL Loading Capacity Alternative #1 - Fall

Surface Segments

RM	Seg	Flow	NH3N		NO23N	SRP	CHLA	UBOD		DO(Max)	DO(Avg)	DO(Min)	DO-Bgd	Org-N	Org-P
Code	No	(cfs)	(mg/L)	(lb/day)	(mg/L)	(mg/L)	(ug/L)	(mg/L)	(lb/day)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
33.8	1	197.7	0.156	166.1	1.430	0.332	0.2	3.1	3278.8	11.40	10.00	8.60		0.119	0.014
39.5	2	182.2	0.177	173.7	1.320	0.367	0.1	3.3	3257.2	11.60	10.20	8.80		0.123	0.017
44.0	3	177.9	0.195	186.8	1.110	0.385	0.2	3.7	3496.5	11.50	10.10	8.70		0.134	0.019
48.6	4	133.0	0.258	184.8	1.010	0.505	0.2	4.0	2828.9	11.60	10.20	8.80		0.137	0.013
54.2	5	125.2	0.295	198.9	0.940	0.541	0.3	4.5	3033.7	11.40	10.00	8.60		0.153	0.014
59.9	6	115.5	0.095	58.9	0.722	0.510	0.4	3.1	1934.2	11.17	9.77	8.37		0.159	0.004
62.0	7	115.2	0.092	56.8	0.686	0.516	0.5	3.2	2009.8	11.05	9.65	8.25		0.166	0.004
64.2	8	113.9	0.096	58.6	0.624	0.528	0.7	3.5	2140.5	10.83	9.43	8.03		0.176	0.004
66.5	9	114.3	0.099	60.9	0.607	0.533	0.8	3.7	2277.2	9.09	8.69	8.29		0.184	0.005
67.5	10	61.8	0.023	7.8	0.364	0.038	0.0	0.6	196.3	8.80	8.40	8.00	-0.01	0.040	0.002
68.1	11	61.4	0.024	8.0	0.343	0.038	0.0	0.6	211.3	8.77	8.37	7.97	-0.01	0.043	0.002
68.6	12	61.1	0.025	8.3	0.325	0.038	0.0	0.7	225.0	8.73	8.33	7.93	-0.01	0.045	0.002
69.1	13	59.9	0.027	8.6	0.286	0.039	0.0	0.7	240.6	8.79	8.39	7.99	-0.01	0.049	0.003
69.6	14	57.7	0.028	8.7	0.204	0.039	0.0	0.8	248.9	8.85	8.45	8.05		0.052	0.003
70.1	15	58.2	0.029	8.9	0.194	0.039	0.0	0.9	266.7	8.74	8.34	7.94	-0.01	0.055	0.003
70.7	16	58.8	0.029	9.2	0.183	0.039	0.1	0.9	288.1	8.62	8.22	7.82	-0.01	0.058	0.003
71.2	17	60.1	0.030	9.6	0.173	0.039	0.1	1.0	312.6	8.50	8.10	7.70	-0.01	0.061	0.004
71.7	18	61.4	0.030	9.9	0.163	0.038	0.1	1.0	337.2	8.54	8.14	7.74	-0.01	0.064	0.004
72.4	19	62.5	0.031	10.3	0.122	0.038	0.1	1.1	366.8	8.54	8.14	7.74	0.00	0.068	0.004
73.0	20	62.1	0.031	10.2	0.121	0.037	0.1	1.2	387.9	8.60	8.20	7.80	-0.01	0.072	0.005
73.6	21	61.5	0.030	10.0	0.120	0.036	0.1	1.2	407.3	8.67	8.27	7.87	-0.01	0.076	0.005
74.1	22	60.5	0.030	9.7	0.120	0.035	0.1	1.3	423.5	8.74	8.34	7.94	-0.01	0.080	0.005
74.6	23	59.2	0.029	9.3	0.120	0.034	0.2	1.4	436.7	8.89	8.49	8.09		0.085	0.005
76.0	24	37.7	0.040	8.0	0.188	0.037	0.2	1.0	211.1	9.42	8.72	8.02		0.047	0.006
77.6	25	37.7	0.040	8.1	0.217	0.029	0.2	1.1	231.4	9.77	9.07	8.37		0.057	0.008
79.3	26	41.1	0.044	9.8	0.169	0.029	0.2	1.2	263.4	9.89	9.19	8.49		0.055	0.008
81.0	27	45.0	0.048	11.7	0.127	0.029	0.2	1.3	312.6	10.03	9.33	8.63		0.060	0.009
82.7	28	45.6	0.049	12.0	0.128	0.028	0.2	1.4	333.9	10.06	9.36	8.66		0.063	0.010
84.5	29	46.2	0.050	12.4	0.130	0.028	0.2	1.4	355.7	10.11	9.41	8.71		0.067	0.011
86.5	30	46.9	0.050	12.7	0.132	0.027	0.2	1.5	386.4	10.12	9.42	8.72		0.072	0.012
88.1	31	40.5	0.059	12.8	0.126	0.030	0.2	1.5	335.8	10.44	9.74	9.04		0.069	0.013
90.0	32	41.2	0.060	13.3	0.128	0.029	0.2	1.6	363.8	10.61	9.91	9.21		0.074	0.014
92.1	33	42.1	0.062	14.0	0.125	0.028	0.2	1.7	387.6	10.66	9.96	9.26		0.076	0.015
94.4	34	43.1	0.064	14.8	0.121	0.028	0.2	1.8	413.1	10.48	9.78	9.08		0.078	0.016
97.1	35	37.8	0.065	13.2	0.134	0.026	0.3	2.1	417.3	10.70	10.00	9.30		0.094	0.020
100.5	36	23.5	0.082	10.4	0.182	0.026	0.3	2.5	318.9	11.00	10.30	9.60		0.092	0.003
103.0	37	21.2	0.088	10.0	0.198	0.025	0.3	2.9	334.5	11.10	10.40	9.70		0.108	0.004
106.4															

Subsurface Segments

RM	Seg	Flow	NH3N		NO23N	SRP	CHLA	UBOD		DO(Max)	DO(Avg)	DO(Min)	DO-Bgd	Org-N	Org-P
Code	No	(cfs)	(mg/L)	(lb/day)	(mg/L)	(mg/L)	(ug/L)	(mg/L)	(lb/day)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
66.5	38		0.090		0.679	0.493	0.8	3.4		7.85	7.45	7.05	-0.15	0.169	0.004
67.5	39		0.016		0.658	0.034	0.0	0.3		3.75	3.35	2.95	0.00	0.024	0.001
68.1	40		0.016		0.658	0.034	0.0	0.3		4.19	3.79	3.39	-0.01	0.024	0.001
68.6	41		0.013		0.813	0.031	0.0	0.3		4.41	4.01	3.61	-0.01	0.022	0.001
69.1	42		0.015		1.330	0.031	0.0	0.5		4.43	4.03	3.63	-0.01	0.030	0.002
69.6	43		0.024		0.394	0.038	0.0	0.6		6.08	5.68	5.28	-0.01	0.040	0.002
70.1	44		0.026		0.332	0.038	0.1	0.7		5.70	5.30	4.90	-0.02	0.048	0.002
70.7	45		0.025		0.381	0.038	0.1	0.6		4.64	4.24	3.84	-0.01	0.043	0.002
71.2															

DO-Min = Diurnal Minimum DO DO-Bkgd = Difference from background results

Shaded areas are below the water quality criterion.

Appendix I

Table I.13 EUTRO5 Loading and Boundary Conditions - TMDL Altenative #2

Point Source Loads — Flow in cfs, Loads in lb/day

RM	SgNo	Flow	NH3N	NO23N	SRP	Phyt-C	UBOD	DO	Org-N	Org-P
33.8	1	11.9	0.32	15.89	2.76	14.35	128.2	589.5	2.76	0.00
33.8	1	0.0	7.44	0.00	2.22	0.00	44.4	0.0	8.89	0.00
33.8	1	1.6	0.04	0.71	0.13	0.26	31.9	70.6	1.46	0.17
44.0	3	1.8	0.27	1.64	0.60	0.29	35.9	77.5	1.43	0.23
44.0	3	5.0	3.28	102.58	1.67	0.06	242.3	188.5	3.43	7.78
44.0	3	30.0	7.59	152.66	4.36	8.08	355.4	1292.3	28.75	2.42
48.6	4	0.2	0.10	0.09	0.06	0.03	4.0	8.6	0.28	0.04
54.2	5	0.7	0.15	7.16	0.21	0.44	11.7	37.7	0.80	0.12
54.2	5	1.2	161.54	36.35	49.68	1.98	581.5	48.2	8.83	8.24
59.9	6	0.5	0.18	0.32	0.13	0.08	10.0	21.5	0.80	0.16
66.5	9	45.6	1.23	88.15	4.67	39.78	368.3	2185.3	20.63	1.23
66.5	9	6.6	213.23	154.24	312.74	9.38	355.4	284.3	73.57	0.00
66.5	9	3.4	109.85	148.66	101.24	7.14	183.1	117.2	0.00	68.65
66.5	9	0.7	22.62	14.62	179.42	0.14	37.7	26.4	0.00	0.00
74.1	22	0.3	0.01	0.35	0.08	0.10	2.4	12.9	0.23	0.16
74.6	23	21.5	0.58	3.01	1.85	1.62	173.7	926.2	20.49	0.69
77.6	25	1.0	0.03	2.39	0.34	0.16	8.1	43.1	1.80	0.23
82.7	28	0.1	0.00	0.05	0.03	0.09	0.8	4.3	0.20	0.01
86.5	30	7.0	0.18	6.31	0.18	1.01	54.1	288.6	3.90	0.40
97.1	35	7.0	0.19	3.35	0.57	1.50	56.5	339.2	8.07	3.96
103.0	37	0.2	9.69	13.35	2.09	0.03	96.9	0.0	0.50	0.43
103.0	37	20.0	0.54	9.69	0.54	3.45	161.5	990.8	12.38	0.00
68.1	40	0.0	0.00	0.00	0.00	0.00	0.0	0.0	0.00	0.00
68.6	41	0.0	0.00	0.00	0.00	0.00	0.0	0.0	0.00	0.00
69.1	42	0.1	0.00	0.03	0.01	0.01	3.6	4.3	0.20	0.03
69.1	42	0.0	0.00	0.00	0.00	0.00	0.0	0.0	0.00	0.00
70.7	45	0.0	0.00	0.00	0.00	0.00	0.0	0.0	0.00	0.00

Boundary Conditions — CHLA in µg/L, all others in mg/L

RM	SgNo	NH3N	NO23N	SRP	CHLA	UBOD	DO	Org-N	Org-P
33.8	46	0.005	5.000	0.020	0.0	0.5	2.0	0.000	0.000
44.0	47	0.005	1.600	0.020	0.0	0.5	2.0	0.000	0.000
54.2	48	0.005	2.800	0.020	0.0	0.5	2.0	0.000	0.000
59.9	49	0.005	2.900	0.025	0.0	0.5	2.0	0.000	0.000
64.2	50	0.005	1.500	0.044	0.0	0.5	2.0	0.000	0.000
67.5	51	0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
69.1	52	0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
70.1	53	0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
71.2	54	0.005	2.600	0.022	0.0	0.5	2.0	0.000	0.000
72.4	55	0.050	0.005	0.080	0.0	0.5	2.0	0.000	0.000
74.6	56	0.050	0.005	0.080	0.0	0.5	2.0	0.000	0.000
77.6	57	0.005	0.840	0.016	0.0	0.5	2.0	0.000	0.000
81.0	58	0.080	0.010	0.030	0.0	0.5	2.0	0.000	0.000
90.0	59	0.080	0.010	0.030	0.0	0.5	2.0	0.000	0.000
100.5	60	0.080	0.010	0.030	0.0	0.5	2.0	0.000	0.000

Org-N = Organic Nitrogen

Org-P = Organic Phosphorus

Phyt-C = Phytoplankton Carbon

Appendix I
Table I.14 Modeled Results: TMDL Capacity Alternative #2 - Summer

Surface Segments

RM	Seg	Flow	NH3N		NO23N	SRP	CHLA	UBOD		DO(Max)	DO(Avg)	DO(Min)	DO-Bkgd	Org-N	Org-P
Code	No	(cfs)	(mg/L)	(lb/day)	(mg/L)	(mg/L)	(ug/L)	(mg/L)	(lb/day)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
33.8	1	201.8	0.189	205.4	1.610	0.558	1.3	3.5	3781.5	10.50	8.80	7.10	-0.02	0.150	0.051
39.5	2	186.3	0.229	229.7	1.520	0.619	1.4	3.8	3822.1	10.63	8.93	7.23	-0.02	0.158	0.060
44.0	3	182.0	0.264	258.7	1.310	0.649	1.6	4.2	4145.5	10.60	8.90	7.20	-0.04	0.173	0.067
48.6	4	137.1	0.371	273.9	1.260	0.850	2.2	4.8	3558.3	10.69	8.99	7.29	-0.04	0.191	0.080
54.2	5	129.3	0.454	316.1	1.180	0.907	2.6	5.6	3878.1	10.50	8.80	7.10	-0.04	0.213	0.092
59.9	6	119.6	0.330	212.5	0.954	0.905	3.1	4.5	2923.8	10.36	8.66	6.96	-0.07	0.225	0.095
62.0	7	119.3	0.372	239.0	0.896	0.915	3.1	4.8	3077.1	10.35	8.65	6.95	-0.10	0.229	0.101
64.2	8	118.0	0.433	275.1	0.807	0.933	3.0	5.2	3278.6	10.37	8.67	6.97	-0.16	0.235	0.109
66.5	9	118.4	0.488	311.1	0.756	0.937	2.9	5.5	3506.5	10.12	8.42	6.72		0.239	0.115
67.5	10	61.8	0.011	3.8	0.120	0.001	3.4	2.0	672.2	10.30	8.60	6.90		0.153	0.019
68.1	11	61.4	0.009	3.0	0.108	0.002	4.1	2.2	717.4	10.47	8.77	7.07		0.162	0.020
68.6	12	61.1	0.008	2.5	0.105	0.004	4.4	2.2	727.1	10.51	8.81	7.11		0.164	0.020
69.1	13	59.9	0.008	2.4	0.086	0.007	4.2	2.2	699.9	10.51	8.81	7.11		0.159	0.020
69.6	14	57.7	0.009	2.6	0.028	0.010	3.7	2.1	636.9	10.41	8.71	7.01		0.150	0.018
70.1	15	58.2	0.009	2.7	0.039	0.013	3.7	2.0	633.0	10.27	8.57	6.87		0.146	0.017
70.7	16	58.8	0.009	2.8	0.054	0.017	3.4	2.0	620.6	10.05	8.35	6.65		0.139	0.016
71.2	17	60.1	0.010	3.1	0.067	0.020	3.2	1.9	611.6	9.80	8.10	6.40		0.132	0.015
71.7	18	61.4	0.011	3.6	0.078	0.023	2.7	1.8	595.1	9.67	7.97	6.27		0.124	0.014
72.4	19	62.5	0.012	4.1	0.054	0.025	2.6	1.8	602.4	9.61	7.91	6.21		0.121	0.013
73.0	20	62.1	0.013	4.4	0.067	0.026	2.4	1.8	598.6	9.61	7.91	6.21		0.120	0.012
73.6	21	61.5	0.014	4.7	0.080	0.028	2.2	1.8	589.5	9.59	7.89	6.19		0.118	0.012
74.1	22	60.5	0.015	4.9	0.090	0.028	2.2	1.8	586.4	9.59	7.89	6.19		0.119	0.012
74.6	23	59.2	0.017	5.3	0.100	0.029	2.0	1.8	577.0	9.59	7.89	6.19		0.117	0.011
76.0	24	37.7	0.020	4.0	0.164	0.030	2.6	1.6	326.8	8.74	7.94	7.14	0.05	0.091	0.013
77.6	25	37.7	0.020	4.0	0.200	0.023	2.4	1.6	332.9	9.01	8.21	7.41	0.04	0.095	0.014
79.3	26	41.1	0.026	5.8	0.159	0.024	1.9	1.6	347.5	9.07	8.27	7.47	0.03	0.084	0.013
81.0	27	45.0	0.033	7.9	0.122	0.025	1.5	1.6	380.4	9.17	8.37	7.57	0.02	0.081	0.013
82.7	28	45.6	0.035	8.7	0.127	0.025	1.3	1.6	388.0	9.19	8.39	7.59	0.01	0.079	0.013
84.5	29	46.2	0.038	9.5	0.131	0.025	1.1	1.6	398.0	9.24	8.44	7.64	0.00	0.078	0.013
86.5	30	46.9	0.040	10.2	0.135	0.025	0.9	1.7	416.7	9.27	8.47	7.67	0.00	0.080	0.014
88.1	31	40.5	0.049	10.6	0.131	0.028	0.8	1.6	357.7	9.46	8.66	7.86	-0.01	0.076	0.015
90.0	32	41.2	0.051	11.4	0.134	0.028	0.7	1.7	381.6	9.62	8.82	8.02		0.079	0.016
92.1	33	42.1	0.055	12.4	0.131	0.028	0.6	1.8	401.3	9.68	8.88	8.08		0.079	0.016
94.4	34	43.1	0.058	13.5	0.127	0.027	0.5	1.8	422.4	9.57	8.77	7.97	0.00	0.080	0.017
97.1	35	37.8	0.061	12.4	0.138	0.026	0.4	2.1	421.3	9.81	9.01	8.21		0.094	0.020
100.5	36	23.5	0.078	9.9	0.186	0.025	0.4	2.5	320.1	10.03	9.23	8.43		0.092	0.004
103.0	37	21.2	0.086	9.8	0.200	0.025	0.4	2.9	334.5	10.20	9.40	8.60		0.108	0.004
106.4															

Subsurface Segments

RM	Seg	Flow	NH3N		NO23N	SRP	CHLA	UBOD		DO(Max)	DO(Avg)	DO(Min)	DO-Bkgd	Org-N	Org-P
Code	No	(cfs)	(mg/L)	(lb/day)	(mg/L)	(mg/L)	(ug/L)	(mg/L)	(lb/day)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
66.5	38		0.432		0.826	0.866	3.0	5.0		8.94	7.24	5.54		0.223	0.104
67.5	39		0.012		0.442	0.003	3.4	1.8		5.68	3.98	2.28	-0.17	0.141	0.018
68.1	40		0.014		0.437	0.003	4.0	2.1		6.33	4.63	2.93	-0.17	0.159	0.020
68.6	41		0.005		0.643	0.005	4.4	1.8		6.74	5.04	3.34	-0.08	0.135	0.018
69.1	42		0.006		1.170	0.007	4.3	2.0		6.83	5.13	3.43	0.07	0.142	0.018
69.6	43		0.010		0.162	0.003	4.1	2.2		8.61	6.91	5.21		0.166	0.020
70.1	44		0.007		0.140	0.008	4.0	2.1		7.95	6.25	4.55	0.24	0.155	0.019
70.7	45		0.010		0.177	0.008	3.9	2.1		7.29	5.59	3.89	0.32	0.164	0.019
71.2															

DO(Min) = Diurnal Minimum DO   DO-Bkgd = Difference from background results   Shaded areas are below the water quality criteria

Appendix I

Table I.15 Modeled Results: TMDL Loading Capacity Alternative #2 - Fall

Surface Segments

RM	Seg	Flow	NH3N		NO23N	SRP	CHLA	UBOD		DO(Max)	DO(Avg)	DO(Min)	DO-Bkgd	Org-N	Org-P
Code	No	(cfs)	(mg/L)	(lb/day)	(mg/L)	(mg/L)	(ug/L)	(mg/L)	(lb/day)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
33.8	1	201.8	0.276	299.9	1.640	0.577	0.2	3.4	3651.1	11.40	10.00	8.60		0.114	0.045
39.5	2	186.3	0.321	322.0	1.540	0.638	0.2	3.7	3661.6	11.60	10.20	8.80		0.117	0.053
44.0	3	182.0	0.355	347.9	1.340	0.669	0.2	4.0	3939.7	11.40	10.00	8.60		0.127	0.060
48.6	4	137.1	0.488	360.3	1.300	0.876	0.2	4.5	3322.1	11.60	10.20	8.80		0.128	0.070
54.2	5	129.3	0.563	392.0	1.240	0.933	0.3	5.1	3571.7	11.40	10.00	8.60		0.142	0.081
59.9	6	119.6	0.419	269.8	1.030	0.931	0.5	3.9	2524.5	11.12	9.72	8.32		0.147	0.084
62.0	7	119.3	0.444	285.2	0.981	0.939	0.6	4.1	2646.7	10.98	9.58	8.18		0.152	0.090
64.2	8	118.0	0.483	306.9	0.902	0.956	0.8	4.5	2833.9	10.75	9.35	**7.95**	-0.18	0.162	0.098
66.5	9	118.4	0.516	329.0	0.863	0.958	0.9	4.8	3028.4	8.98	8.58	8.18		0.169	0.106
67.5	10	61.8	0.014	4.6	0.354	0.038	0.0	0.5	151.4	8.82	8.42	8.02	0.01	0.017	0.002
68.1	11	61.4	0.015	4.9	0.334	0.038	0.0	0.5	164.6	8.79	8.39	**7.99**	0.01	0.019	0.002
68.6	12	61.1	0.016	5.2	0.318	0.038	0.0	0.5	177.0	8.74	8.34	**7.94**	0.00	0.020	0.002
69.1	13	59.9	0.017	5.5	0.279	0.039	0.0	0.6	190.6	8.80	8.40	**8.00**	0.00	0.021	0.003
69.6	14	57.7	0.018	5.7	0.198	0.039	0.0	0.6	197.9	8.87	8.47	8.07		0.023	0.003
70.1	15	58.2	0.020	6.1	0.189	0.039	0.0	0.7	213.7	8.76	8.36	**7.96**	0.01	0.024	0.003
70.7	16	58.8	0.021	6.6	0.179	0.039	0.1	0.7	233.3	8.63	8.23	**7.83**	0.00	0.025	0.003
71.2	17	60.1	0.022	7.1	0.170	0.039	0.1	0.8	255.7	8.51	8.11	**7.71**	0.00	0.026	0.004
71.7	18	61.4	0.023	7.6	0.161	0.038	0.1	0.8	278.7	8.54	8.14	**7.74**	-0.01	0.028	0.004
72.4	19	62.5	0.024	8.2	0.121	0.038	0.1	0.9	305.6	8.54	8.14	**7.74**	0.00	0.030	0.004
73.0	20	62.1	0.025	8.5	0.120	0.038	0.1	1.0	324.4	8.60	8.20	**7.80**	-0.01	0.031	0.005
73.6	21	61.5	0.026	8.7	0.120	0.037	0.1	1.0	344.4	8.68	8.28	**7.88**	0.00	0.033	0.005
74.1	22	60.5	0.027	8.8	0.120	0.035	0.1	1.1	358.4	8.74	8.34	**7.94**	-0.01	0.035	0.005
74.6	23	59.2	0.028	8.9	0.120	0.034	0.2	1.2	373.0	8.89	8.49	8.09		0.037	0.006
76.0	24	37.7	0.040	8.0	0.188	0.037	0.2	1.0	211.1	9.42	8.72	8.02		0.047	0.006
77.6	25	37.7	0.040	8.1	0.218	0.029	0.2	1.2	233.5	9.77	9.07	8.37		0.057	0.008
79.3	26	41.1	0.045	9.8	0.169	0.029	0.2	1.2	265.6	9.89	9.19	8.49		0.056	0.008
81.0	27	45.0	0.049	11.8	0.128	0.029	0.2	1.3	312.6	10.03	9.33	8.63		0.060	0.009
82.7	28	45.6	0.049	12.1	0.129	0.028	0.2	1.4	336.4	10.06	9.36	8.66		0.064	0.010
84.5	29	46.2	0.050	12.4	0.131	0.028	0.2	1.4	358.2	10.11	9.41	8.71		0.067	0.011
86.5	30	46.9	0.050	12.7	0.133	0.027	0.2	1.5	388.9	10.12	9.42	8.72		0.072	0.012
88.1	31	40.5	0.059	12.8	0.127	0.030	0.2	1.6	338.0	10.44	9.74	9.04		0.070	0.013
90.0	32	41.2	0.060	13.3	0.129	0.029	0.2	1.7	366.1	10.61	9.91	9.21		0.075	0.014
92.1	33	42.1	0.062	14.0	0.126	0.028	0.2	1.7	392.2	10.66	9.96	9.26		0.077	0.015
94.4	34	43.1	0.064	14.8	0.123	0.028	0.2	1.8	417.7	10.48	9.78	9.08		0.079	0.016
97.1	35	37.8	0.065	13.2	0.134	0.026	0.3	2.1	417.3	10.70	10.00	9.30		0.094	0.020
100.5	36	23.5	0.082	10.4	0.182	0.026	0.3	2.5	318.9	11.00	10.30	9.60		0.092	0.003
103.0	37	21.2	0.088	10.0	0.198	0.025	0.3	2.9	334.5	11.10	10.40	9.70		0.108	0.004
106.4															

Subsurface Segments

RM	Seg	Flow	NH3N		NO23N	SRP	CHLA	UBOD		DO(Max)	DO(Avg)	DO(Min)	DO-Bkgd	Org-N	Org-P
Code	No	(cfs)	(mg/L)	(lb/day)	(mg/L)	(mg/L)	(ug/L)	(mg/L)	(lb/day)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
66.5	38		0.463		0.924	0.886	0.9	4.3		**7.73**	**7.33**	**6.93**		0.155	0.095
67.5	39		0.009		0.649	0.034	0.0	0.3		**3.77**	**3.37**	**2.97**	0.02	0.011	0.001
68.1	40		0.009		0.648	0.034	0.0	0.3		**4.22**	**3.82**	**3.42**	0.02	0.011	0.001
68.6	41		0.008		0.808	0.031	0.0	0.2		**4.43**	**4.03**	**3.63**	0.01	0.010	0.001
69.1	42		0.009		1.330	0.031	0.0	0.5		**4.45**	**4.05**	**3.65**	0.01	0.017	0.002
69.6	43		0.014		0.384	0.038	0.0	0.5		**6.11**	**5.71**	**5.31**	0.02	0.018	0.002
70.1	44		0.017		0.325	0.038	0.0	0.6		**5.72**	**5.32**	**4.92**	0.00	0.021	0.002
70.7	45		0.016		0.372	0.038	0.1	0.5		**4.67**	**4.27**	**3.87**	0.02	0.019	0.002
71.2															

DO-Min = Diurnal Minimum DO DO-Bkgd = Difference from background results Areas below the water quality criterion are shown in bold