

Annual Report

Chehalis BMP Evaluation Project

July 1994 through June 1995

Abstract

This is the first annual progress report for a six-year monitoring project being conducted by the Washington State Department of Ecology. The purpose of the project is to determine the effectiveness of best management practices installed in the Chehalis River basin to improve water quality and fish habitat. Accomplishments this year include: developing a detailed quality assurance plan for the project; conducting dry and wet season water quality monitoring in the Beaver/Allen Creek basin, Bunker/Deep Creek basin, the mainstem Chehalis River, and the Black River; developing a temperature monitoring plan; developing a monitoring plan and providing technical assistance for a turbidity concern on the Wishkah River; and conducting macroinvertebrate sampling on Lincoln Creek and Deep Creek.

Introduction

In the Chehalis River basin, poor water quality has been identified as a threat to the fisheries resource. In an effort to protect and enhance the fisheries, the U.S. Fish and Wildlife Service (USFWS) set up the Chehalis Fisheries Restoration Program (CFRP), which provides grants for projects to restore anadromous fish to the Chehalis basin. Types of projects funded by CFRP include habitat restoration and installation of best management practices (BMPs) to improve or protect water quality.

Water quality monitoring is essential for determining the effectiveness of BMPs and can be used to adjust and refine land treatment practices designed to control nonpoint source pollution. This was one of the conclusions of the Rural Clean Water Program (RCWP), a federally-sponsored nonpoint source control program that studied the effectiveness of BMPs to control pollution. The purpose of this CFRP-funded project is to monitor the effectiveness of the BMPs installed, and to document improvements in water quality. This report describes progress made during the first year of the proposed six-year monitoring project.

Projects are selected in consultation with USFWS. Only a few project areas were selected to demonstrate results, since trying to monitor all areas would result in too dispersed an effort. The RCWP found that detection of water quality improvements is more effective if monitoring focuses on collecting samples at a relatively high frequency and analyzing them for a small number of relevant variables. Projects for 1995-96 will be scoped in consultation with USFWS by summer 1995. An addendum to the current Quality Assurance Project Plan (QAPP) will be developed to describe 1995-96 monitoring activities. The addendum will be available in fall 1995.

Additional elements of this project are monthly ambient water quality monitoring at four stations in the Chehalis basin and coordination and technical assistance.

Water Quality Monitoring Study Design

In July 1994, USFWS and the Washington State Department of Ecology (Ecology) chose four project areas to survey water quality for BMP effectiveness: the Beaver/Allen Creek sub-basin; the Bunker/Deep Creek sub-basin; the Black River adjacent to a dairy at river mile (RM) 12.2; and the mainstem Chehalis River at RM 70, also adjacent to a dairy operation. A quality assurance project plan (QAPP) was developed and is attached as an appendix to this annual report. The QAPP describes in detail the monitoring plan for each project area, and includes a basin map and maps of the project sites:

For two of the project areas, Bunker/Deep Creek and the Chehalis River, pre-BMP monitoring was done this year and will continue in 1995-96. An evaluation of the Rural Clean Water Program recommended a minimum of two years of water quality monitoring before BMPs are initiated in order to identify critical pollutant sources and establish baseline water quality conditions. Bunker and Deep Creek were chosen because several CFRP fencing and riparian restoration projects were to take place in the Deep Creek basin, and the Bunker site is a follow-up on Ecology's Upper Chehalis River Total Maximum Daily Load (TMDL) study. The Chehalis River sites were chosen to follow up on the TMDL study and to obtain pre-BMP monitoring data on a high priority agricultural pollutant source identified in the TMDL study. A first interim report will be written for each of these project areas; the tentative dates for the release of these reports are August 1, 1995, for the Chehalis River report and September 15, 1995, for the Bunker/Deep Creek report.

This year a combination of pre- and post-BMP monitoring was done on Beaver/Allen Creek: post-BMP monitoring for work done on Allen Creek, and a continuation of pre-BMP monitoring of projects on Beaver Creek. The Beaver Creek sites were chosen for evaluation because of a high priority pollutant source identified in the TMDL study, as well as several proposed restoration projects. The Allen Creek site was chosen to follow up on fencing and riparian restoration work completed upstream in 1993 and 1994. For 1995-96, post-BMP monitoring will continue on Allen Creek and begin on Beaver Creek. An interim report is being prepared for this area which will be available October 1, 1995.

Post-BMP monitoring was done at the Black River project area. The Black River sites were chosen to determine if post-BMP water quality had improved. Water quality problems at this site were identified in Ecology's Wet Season Black River TMDL study, and the dairy impacting this site has implemented extensive BMPs. Pre-BMP monitoring has been done in both the dry and wet season by Ecology and Thurston County. A final technical report which compares pre and post findings will be available September 15, 1995. All of the reports described above can be obtained when complete by calling the project leader, Debby Sargeant, at (360) 407-6684.

In addition to the four project sites, USFWS requested temperature monitoring on a number of riparian restoration sites in the Chehalis basin. A QAPP is in development for the temperature monitoring, and will be available in spring 1995. The temperature monitoring will include hourly

monitoring of stream temperature during critical summer periods, monitoring of air temperature, an evaluation of the amount of streamside shading, and photo points of each of the sites being replanted. This work will begin in May 1995.

Beaver/Allen Creek Sub-basin

Four sites in the Beaver/Allen Creek drainage were monitored. Monitoring included four summer and ten winter sampling events. Sampling dates were:

August 31, 1994 (A.M. and P.M.)	September 13, 1994 (P.M.)
September 15, 1994 (A.M.)	November 14, 1994
December 26, 1994	January 10, 1995
January 25, 1995	January 29, 1995
February 16, 1995	February 21, 1995
March 9, 1995	March 14, 1995
March 22, 1995.	

Sampling recommendations for 1995-96 are:

- Continue with post-BMP monitoring at all sites (a major component of the BMP implementation will be completed in summer 1995 for the Beaver Creek site); and
- Discontinue summer monitoring (major nonpoint problems are associated with winter runoff events).

Bunker/Deep Creek Sub-basin

Four sites in the Bunker/Deep Creek drainage were monitored. At the mouth of Bunker Creek four summer and ten winter sampling events were conducted. Summer sampling was planned for three sites on Deep Creek but low water levels prevented sampling of Deep Creek. Sampling of Bunker Creek was done on:

August 30, 1994 (P.M.)	August 31, 1994 (A.M.)
September 14, 1994 (A.M. and P.M.)	

Winter sampling of Bunker and Deep Creek was done on:

November 14, 1994	December 27, 1994
January 10, 1995	January 25, 1995
January 29, 1995	February 16, 1995
February 21, 1995	March 9, 1995
March 14, 1995	March 22, 1995

In addition, macroinvertebrate sampling was done on Deep Creek and an unnamed tributary on April 24, 1995.

Erosion and sedimentation appears to be the major problem in the Deep Creek basin. This year's water quality data show that slight increases in nutrients and bacteria coincide with increases in turbidity levels. If the sediment problem is taken care of, this may reduce other types of pollutant loading to the creek as well. Future monitoring efforts will focus more on sediment problems.

Sampling recommendations for 1995-96 are as follows:

- Continue pre-BMP water quality monitoring, adjusting sites based on projected BMP locations;
- discontinue summer A.M.\P.M. monitoring, but continue two routine dry season surveys if possible;
- estimate substrate size in summer 1995 following EPA protocols;
- add sampling for total suspended solids during the wet season;
- install a capacitive probe and data logger on Deep Creek to determine peak flows during the wet season;
- investigate the feasibility of performing sediment-related surveys (such as residual pool depth) for Deep Creek.

Mainstem Chehalis River

Four sites on the Chehalis mainstem were monitored, including two tributaries. Five winter sampling events were conducted, sampling dates were:

November 16, 1994
November 29, 1994
January 23, 1995
January 31, 1995
March 5, 1995

Sampling recommendations for 1995-96 include continuing pre-BMP wet season monitoring.

Black River

Two sites on the Black River were monitored twice during the summer at two depths. Monitoring dates were August 30 and September 13, 1994.

During winter sampling three sites were monitored, including a tributary drainage ditch. The five winter sampling events were conducted on:

November 16, 1994 November 29, 1994
January 23, 1995 January 31, 1995
March 5, 1995

Sampling recommendations for 1995-96:

- Discontinue monitoring for 1995-96; and
- follow up post-BMP monitoring in 1996-97 to determine if the Mima Pool and the ditch at RM 12.2 are continuing to recover.

Lincoln Creek

Macroinvertebrate sampling was conducted on April 21, 1995, on two sites on the north fork of Lincoln Creek.

Ambient Monitoring

Monthly ambient water quality monitoring was done at four stations in the Chehalis basin: Dryad, Porter, Chehalis River at Prather Road, and the Black River at Moon Road. Data collected this year can be obtained by calling Brad Hopkins from Ecology's Ambient Monitoring Section, at (360) 407-6686. Ambient monitoring at all four stations will continue in 1995-96.

Technical Assistance and Coordination

Long Live the Kings and USFWS requested assistance in developing a monitoring plan for turbidity at a fish hatchery on the Wishkah River. Wishkah tributary streams flow into a salmon rearing pond at a Long Live the Kings hatchery on the Wishkah River. The tributary streams are contributing sediment to the USFWS-funded ponds, causing possible impacts such as filling in of the off-channel ponds. A QAPP was developed for turbidity monitoring and arrangements were made for lab support the QAPP is also included in the appendix to this report. A field visit was made to the site, as well as participation in a meeting of stakeholders to discuss possible actions necessary to remedy the turbidity problem. After the meeting, upland landowners and Grays Harbor County worked to cooperatively install BMPs necessary to control the sediment problem. Turbidity sampling has been cancelled this year due to the effectiveness of the BMPs installed.

In August 1994, the project leader met with staff from the Chehalis tribe to exchange information on sampling plans for 1994-95. In September 1994, the project leader accompanied the Chehalis tribal staff while sampling various sites on the Chehalis River. The Tribe was especially concerned about high fecal coliform counts at the mouth of Dillenbaugh Creek. Tribal concerns and fecal coliform results were referred to the Department of Ecology's Southwest Regional Office. The regional office determined that a tributary near the mouth of Dillenbaugh is the probable source. They are in the process of conducting additional water quality investigations to pinpoint the sources.

In the summer 1994, the project leader visited CFRP funded BMP project sites with Larry Dominguez of the USFWS. Monitoring needs were discussed for specific sites.

In the summer 1994, the project leader joined Sammy Berg of Thurston County Health and members of the Spill Response Unit at Ecology's Southwest Regional Office to look at the County monitoring sites and discuss the County's preliminary monitoring data for the Black River basin.

Before monitoring began on Beaver Creek, the project leader spoke with Thurston Conservation District staff to discuss farm plan implementation for Beaver Creek site and to inform them of the monitoring activities scheduled in the area.

In September 1994, the project leader met with Lewis Conservation District staff to discuss their monitoring project on Dillenbaugh Creek.

The project leader has had numerous contacts with landowners that live on Deep Creek. They were informed of the Ecology\USFWS monitoring project and the CFRP restoration projects going on in the basin.

Technical assistance and coordination recommendations for 1995-96:

- Continue outreach and technical assistance;
- develop a data directory for Chehalis basin water quality monitoring activities; and
- look into the possibility of doing a regular column in the Fish Ladder that describes water quality monitoring activities in the basin.

Contacts:

Debby Sargeant/
Paul Pickett Washington State Department of Ecology
 Environmental Investigations and Laboratory Services Program
 (360) 407-6684/(360) 407-6685

If you have special accommodation needs, please contact Barbara Tovrea (360) 407-6696 (voice). Ecology's telecommunication device for the deaf (TDD) number at Ecology Headquarters is (360) 407-6006.

Appendices

APPENDIX A

Chehalis River Basin Best Management Practices Evaluation Project

Final Quality Assurance Project Plan

by
Debby Sargeant

October 28, 1994

Washington State Department of Ecology
Environmental Investigations and Laboratory Services Program
Watershed Assessments Section

Approvals:

Debby Sargeant *Debby Sargeant*
Project Lead
Watershed Assessments Section

Will Kendra *Will Kendra*
Section Supervisor
Watershed Assessments Section

Bill Kammin *Bill Kammin*
Ecology Laboratory Director
Manchester Laboratory

Cliff Kirchmer *Cliff J. Kirchmer*
Ecology Quality Assurance Officer
Quality Assurance Section

Ralph S. Boomer *Ralph S. Boomer*
Project Leader
U.S. Fish and Wildlife Service

Bill Backous *Bill Backous*
Client Section Supervisor
Southwest Regional Office

1.0 Introduction

1.1 Project Description

In the Chehalis River basin, poor water quality has been identified as a threat to the fisheries resource. To protect this beneficial use, the Total Maximum Daily Load (TMDL) process is being implemented by Ecology for the Black and upper Chehalis Rivers (Pickett, 1994a; Pickett, 1994b; Coots, 1994). In both river basins, nonpoint source pollution has been identified as a source of poor water quality. Successful implementation of the Chehalis Basin TMDLs will include establishing best management practices (BMPs) to control nonpoint pollution. In an effort to enhance the fisheries resource, the U.S. Fish and Wildlife Service (USFWS) is funding installation of BMPs in the Chehalis River basin. The goal of this project is to monitor the effectiveness of the BMPs and to document improvements in water quality.

This is the first year of a proposed six year project. Funding has been acquired through USFWS for the first year of this project. For this project selected study areas will be scoped and monitored each year. Areas will be chosen where BMPs have been installed, or there are plans for installing BMPs in the next two or three years. A preference is given to study areas where there are water quality problems. Monitoring design will include pre/post monitoring, and upstream/downstream monitoring depending on site conditions. Sites at the mouth of sub-basins corresponding to TMDL study sites may also be monitored.

Ambient monitoring at two of the Chehalis River core stations will continue, at Dryad and Porter. Two core stations will be added in conjunction with this project, one on the Chehalis River at Prather Road downstream of Centralia, and the Black River at Moon Road. These stations will be monitored as part of the Ecology Ambient Monitoring Program. The four ambient stations will compliment this project by allowing long-term trend analysis on a basin-wide basis. Details of the Ambient Monitoring Program are addressed in another plan (Ehinger, 1994).

1.2 Basin Description

The Chehalis River drains an area of over 2,000 square miles in Western Washington (Figure 1), discharging to Grays Harbor near the City of Aberdeen. The study area for this project is the Chehalis River and its tributaries upstream of the Chehalis River bridge at Porter, corresponding to Water Resource Inventory Area 23. The major tributaries 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 study area lies in northwestern Lewis County, southwestern Thurston County, and eastern Grays Harbor County.

The predominant land use in the study area is agriculture. A large number of dairies are in the basin, as well as livestock rearing operations; nurseries, turf, berry, and Christmas tree farms; row-cropping; and hobby farms. Timber harvest and management activities occur throughout the basin, especially in upland areas. Most of the basin is rural. Urban areas in the study area include the cities of Centralia and Chehalis.

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.

A special condition exists for the central reach of the Chehalis River from Scammon Creek (river mile 65.8) to Newaukum River (river mile 75.2): From June 1 to September 15, dissolved oxygen shall exceed 5.0 mg/L in that reach; for the rest of the year it shall meet Class A criteria.

A special condition exists for Hanaford Creek from the mouth to the east boundary of Section 25-Township 15N-Range 2W (river mile 4.1). The special condition states that dissolved oxygen shall exceed 6.5 mg/L. From river mile 4.1 to the headwaters, the dissolved oxygen criteria shall meet Class A standards.

The beneficial uses of Class A waters include domestic, industrial, and agricultural water supply; stock watering; fish and shellfish migration, rearing, spawning, and harvesting; wildlife habitat; primary contact recreation; sport fishing, boating, and aesthetic enjoyment; and commerce and navigation.

2.0 Historical Information

Water quality problems have been identified in the Chehalis River Basin for at least 30 years. A review of the historical water quality data supported the development of a TMDL for the basin (Pickett, 1992). This study serves as a follow-up for the TMDL work done on the Chehalis River Basin, and to water quality problems identified by USFWS (Wampler *et al.*, 1993) and Pickett (1991).

3.0 Problem Description

Nonpoint pollution sources have been identified both by the Chehalis Fisheries Habitat Degradation Survey and by the TMDL Study. Successful implementation of the Chehalis Basin TMDLs will include establishing improved nonpoint source pollution controls in the basin. A necessary component of this nonpoint source control program is the evaluation of water quality and documentation of improvement.

Nonpoint source controls will be implemented in a number of ways. Several landowners are cooperating with the USFWS to fence stream corridors and restore riparian vegetation. Ecology will begin implementing the dairy waste permit program. The permit program requires that dairy operations have an approved farm plan including BMPs to protect water quality. The Lewis, Thurston, and Grays Harbor Conservation Districts provide assistance to landowners on agricultural BMPs necessary to protect water quality.

4.0 Project Objectives

Document improvements in surface water quality that may be associated with implementation of best management practices at specific project locations and at the sub-basin level. Improvements will be documented for parameters that affect dry season dissolved oxygen, and for wet season turbidity and fecal coliform levels.

5.0 Study Design

This year the following four project areas will be surveyed for BMP effectiveness: the Beaver/Allen Creek sub-basin; the Bunker/Deep Creek sub-basin; the Black River adjacent to a dairy at river mile (RM) 12.2; and the mainstem Chehalis River at RM 70 adjacent to a dairy operation. At the end of this project year the monitoring results from all sites will be evaluated, and next year's project activities will be scoped.

5.1.1 1994/1995 Sample Sites and Survey Schedule

Beaver/Allen Creek Sub-basin (Figure 2)

Four surface water sites will be sampled in this sub-basin. One site will be on Allen Creek near the mouth. The other three sites will be on Beaver Creek (one site at the mouth of the creek, and two sites upstream and downstream of a dairy farm above Allen Creek). Sampling sites will be the same for summer and winter sampling. Sites will be selected to correspond with sites from the TMDL studies.

A total of twelve weeks of sample collection will be done. Two weeks of sample collection representing the dry season are scheduled for late August and mid-September 1994. Each dry season sampling site will be monitored twice during the day, once in the morning and once in the late afternoon or evening. Ten sampling surveys representing the wet season are scheduled for November 1994 through March 1995, with sampling surveys occurring twice a month. Each site during the wet season survey will be monitored once per sampling survey. The upstream site on Beaver Creek will serve as a spatial control. Except for Allen Creek the downstream sites are being sampled prior to BMP implementation, thus this year's sampling effort will also provide a temporal control (*i.e.*, pre-BMP monitoring). Previous data exists as pre-BMP or temporal control on Allen Creek.

The Beaver/Allen Creek sites were chosen because BMPs will be installed in this vicinity within the next two years. Some BMPs have already been implemented on Allen Creek, but more are expected, and pre-BMP data are available. BMPs being installed include stream-side fencing and revegetation; and on Beaver Creek a large dairy adjacent to the creek will be doing farm planning and implementation. In addition, Beaver Creek is the most polluted stream entering the Black River (Pickett, 1994b; Coots, 1994).

Bunker\Deep Creek Sub-basin (Figure 3)

Four surface water sites will be sampled in this sub-basin: one site at the mouth of Bunker Creek, and three sites on Deep Creek. On Deep Creek, the sites will be selected to assess fencing and revegetation projects funded by USFWS under the Chehalis Fisheries Restoration Program (CFRP). The first site on Deep Creek will be above Rudolph Creek, the second site will be just below Rudolph Creek, and the third site will be downstream of a farm site implementing BMPs.

Sampling frequency and intensity will be the same as described for the Beaver/Allen Creek sub-basin. The upstream-most site will serve as a spatial control. In addition, all downstream sites are being sampled prior to BMP implementation, thus this year's sampling effort will also provide a temporal control (*i.e.*, pre-BMP monitoring).

The Bunker\Deep Creek sites were chosen because there are three stream-side sites where BMPs will be installed. There will be revegetation and fencing alongside sites on Deep Creek, and on Rudolph Creek, a tributary to Deep Creek.

Black River (River mile 12.2) (Figure 4)

During the dry season two sites will be monitored: one upstream site (Canoe Club pool), and one downstream site (Mima pool), coinciding with the TMDL survey sites. Both sites will be monitored at two depths in the surface mixed layer and the deep hypoxic layer, for a total of four sampling locations to be monitored. There will be two weeks of dry season sampling, scheduled for late August and mid-September 1994.

During the wet season three sites will be sampled at one depth: the Canoe Club pool, the Mima pool, and a site downstream of Mima Creek, again coinciding with TMDL survey sites. Five weeks of sampling will be done, once a month from November 1994 through March 1995.

Pre-BMP sampling has been done during the wet and dry season in the vicinity of the dairy operation at RM 12.2. Previous studies indicate wet season bacterial loading in this area (TCEH, 1991; Coots, 1994), as well as dry season dissolved oxygen depletion and, elevated turbidity, chloride, total phosphorus, and ammonia in the deeper pools (Pickett, 1991 and 1994).

The dairy operation at RM 12.2 was chosen to demonstrate the effectiveness of BMPs already in place. This site has a fully implemented farm plan including a lagoon to contain wastes generated over the winter. Pre-BMP data are available for comparison.

Mainstem Chehalis River (River mile 70) (Figure 5)

Four sites will be sampled during the wet season, one upstream site, two downstream sites (north of Airport and Overhanging Tree), and one sample of ditch runoff. Where possible, sites will coincide with the TMDL study sites. Five weeks of wet season sampling are scheduled, once a month from November 1994 through March 1995. The upstream-most site will serve as a spatial control. In addition, all downstream sites are being sampled prior to BMP implementation, thus this year's sampling effort will also provide a temporal control (*i.e.*, pre-BMP monitoring).

5.1.2 Wet Season Sampling Considerations

The wet season sampling goal is to monitor runoff events. The methodology used will be similar to the sampling strategy used in the Black River Wet Season TMDL Study (Coots, 1994). Daily precipitation will be monitored throughout the study at the Olympia Airport National Weather Service station. Other rain gauging stations may be used if stations are in closer proximity to sampling sites. The amount of rainfall that causes a rising hydrograph for a site (approximately 0.5 inch or more of rainfall within the previous 48 hours) will trigger a sampling event. Because of analytical restrictions at Ecology's Manchester Environmental Laboratory, sampling days will be confined to Sunday through Thursday.

Sampling will occur ten times through the months of November through March. If there is not enough rainfall during a month to trigger a sampling event, the one monthly sampling event will be scheduled towards the end of the month regardless of rainfall. Dry wet season data is necessary to develop flow concentration pairs, but the required data can be generated more efficiently when monitoring is weighted toward high flows.

5.2 Parameters

All laboratory samples will be collected as grab for analysis at Manchester Environmental Laboratory (MEL). Dissolved oxygen, temperature, pH, and conductivity will be measured in the field at all sites during each survey using a Hydrolab Multi-parameter Meter (Surveyor 2 or 3). Stream flow will be measured at tributary sites with a Marsh-McBirney meter using standard USGS methods.

Sample parameters and frequency for BMP monitoring are summarized in Table 1. The two mainstem Chehalis ambient monitoring stations will be monitored for conventional parameters including: specific conductivity, nitrate/nitrite, dissolved nitrite, ammonia, total suspended solids, dissolved oxygen, fecal coliform bacteria, dissolved ortho-phosphorus, pH, turbidity, total phosphorus, and total organic carbon. Concurrent with the collection of water samples, on-site measurements will be taken for barometric pressure, time of day, stage height for flow determination by USGS (if required), and *in-situ* temperature.

6.0 Quality Assurance

6.1 Field Sample Procedures

Field sampling and measurement procedures will follow those listed in the Watershed Assessments Section (WAS) protocols manual (Ecology, 1993), and the Puget Sound Protocols for Freshwater (Tetra Tech, 1986). All meters will be calibrated and post-calibrated in accordance with the manufacturer's instructions. Samples for laboratory analysis will be stored on ice and delivered to MEL within 24 hours of collection.

Data collected may be used for enforcement purposes; formal chain of custody procedures will be followed.

Duplicate samples will be taken and analyzed with the group of regularly scheduled samples. The number of duplicates done for each parameter will be as follows: 20 percent for BOD; 10 percent for nutrients (total phosphorus, nitrate/nitrite, ammonia, total persulfate nitrogen); 25 percent for fecal coliform; and 10 percent for turbidity. Duplicates will be taken at all stations on a rotating basis. Duplicates are defined as two samples taken from the same location at nearly the same time. The frequency of duplicate sampling as outline above is based on pairwise coefficients of variation found in Chehalis TMDL sampling (Pickett, 1994a,b).

6.2 Analytical Procedures

Analytical procedures are listed with the Data Quality Requirements in Table 2. All analyses are to be performed at the Manchester Environmental Laboratory (MEL). Quality control is exercised through MEL's Quality Assurance Manual (Ecology/USEPA 1986).

7.0 Data Reduction, Review, and Reporting

Data reduction, review, and reporting procedures are outlined in MEL's Quality Assurance Manual (Ecology/USEPA 1986).

Water quality improvements will be documented using the above and below (upstream-downstream) design, and the before and after monitoring design corrected for stream flows. Appropriate statistical tools that best evaluate the data to be collected are being assessed. Data analyses may involve a variety of parametric and/or non-parametric tests. Trend analysis techniques that may be used include box and whisker plots, cumulative frequency distributions (pre-BMP vs. post-BMP), linear trends, and seasonal correction trend model. Specific methods will be dependent upon the nature of the data and will be discussed in the interim technical report.

8.0 Schedule, Budget, Project Organization

8.1 Schedule

<u>Date</u>	<u>Milestone</u>
August 30-31, 1994	Dry season sampling event
September 12-15, 1994	Dry season sampling event
November 1994	Two wet season sampling events
December 1994	Two wet season sampling events
January 1994	Two wet season sampling events
February 1994	Two wet season sampling events
March 1995	Two wet season sampling events
March 15, 1995	Draft annual summary report submitted for internal EILS review
March 15, 1995	Draft Dairy (Black River Ranch, Blazer Bros.) Technical Report for internal EILS review
April 30, 1995	Draft Dairy Technical Report
April 30, 1995	Draft annual summary report submitted for client review
June 30, 1995	Final Dairy Technical Report
May 15, 1995	Draft Beaver\Allen-Bunker\Deep Technical Report for internal EILS review
June 30, 1995	Draft Beaver\Allen Creek Technical Report
June 30, 1995	Draft Bunker\Deep Creek Technical Report
June 30, 1995	Final annual summary report
August 30, 1995	Final Beaver\Allen Creek Technical Report
August 30, 1995	Final Bunker\Deep Creek Technical Report

8.2 Budget

The laboratory budget is shown in Table 3.

8.3 Project Organization

The roles and responsibilities of project staff are as follows:

Washington State Department of Ecology Environmental Investigations and Laboratory Services Program (EILS)

Watershed Assessments Section

- Design and implement BMP evaluation project
 - Water quality sampling, data collection, data management, analysis and reporting
- Contact: Debby Sargeant (206) 407-6684

Quality Assurance Section (QAS)

- Review/comment on Quality Assurance Project Plan
 - Provides assistance with Data Quality Objectives (DQO) assessment
- Contact: Cliff Kirchmer (206) 895-4649

Manchester Environmental Laboratory (MEL)

- Process analytical samples, analyze all samples in-house
 - Provide sample and Quality Assurance/Quality Control data
- Contact: Bill Kammin (206) 871-8801

Ambient Monitoring Section

- Water quality sampling, data collection, data management, analysis and reporting for ambient monitoring stations
- Contact: Ken Dzinbal (206) 407-6672

Southwest Regional Office

Water Quality Section

- Reviews project locations, QAPPs, and reports
- Provides information on water quality activities basin-wide
- Provides assistance with information distribution

Contacts: Diane Harvester (206) 407-6269
Bill Backous (206) 407-6271

U.S. Fish & Wildlife Service

- Partial funding of BMP evaluation project with grant
 - Reviews project locations, QAPPs, and reports
- Contact: Larry Dominguez (206) 753-9460

References

- APHA, 1992. Standard Methods for the Examination of Water and Wastewater 18th Edition. American Public Health Association, Washington DC.
- Coots, R., 1994. Black River Wet Season Nonpoint Source Total Maximum Daily Load Study. Publication No. 94-104. Ecology, EILS Watershed Assessments Section, Olympia, WA.
- Ecology/USEPA, 1986 + updates. "Quality Assurance Manual, Manchester Laboratory." Manchester Environmental Laboratory, Manchester, WA.
- Ecology, 1991. "Guidelines and Specifications for Preparing Quality Assurance Project Plans." EILS Quality Assurance Section, Manchester, WA.
- , 1993. "Field Sampling and Measurement Protocols for the Watershed Assessments Section." EILS Watershed Assessments Section, Olympia, WA.
- Ehinger, W.J., 1994 (draft). Ambient Water Quality Monitoring Quality Assurance Program Plan (QAPP). Ecology, EILS Ambient Monitoring Section, Olympia, WA.
- Pickett, P., 1991. Memo on Water Quality Problems in the Black River. Ecology, EILS Watershed Assessments Section, Olympia, WA.
- , 1992. Historical Data Sources and Water Quality Problems in the Chehalis River Basin. Ecology, EILS Watershed Assessments Section, Olympia, WA.
- , 1994a. Black River Dry Season Total Maximum Daily Load Study. Ecology, EILS Watershed Assessments Section, Olympia, WA.
- , 1994b. Upper Chehalis River Dry Season Total Maximum Daily Load Study. Ecology, EILS Watershed Assessments Section, Olympia, WA.
- Tetra Tech, 1986 + updates. Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound. Tetra Tech, Bellevue, WA.
- TCEH, 1989. Chehalis River Phytoplankton. 1991-1992. Report to the Washington State Department of Ecology. Aquatic Analysts, Portland, OR.
- Wampler, P.L., E.E. Knudsen, M. Hudson, and T.A. Young, 1993. Chehalis River Basin Fishery Resources: Salmon and Steelhead Stream Habitat Degradations. U.S. Fish & Wildlife Service, Olympia, WA.

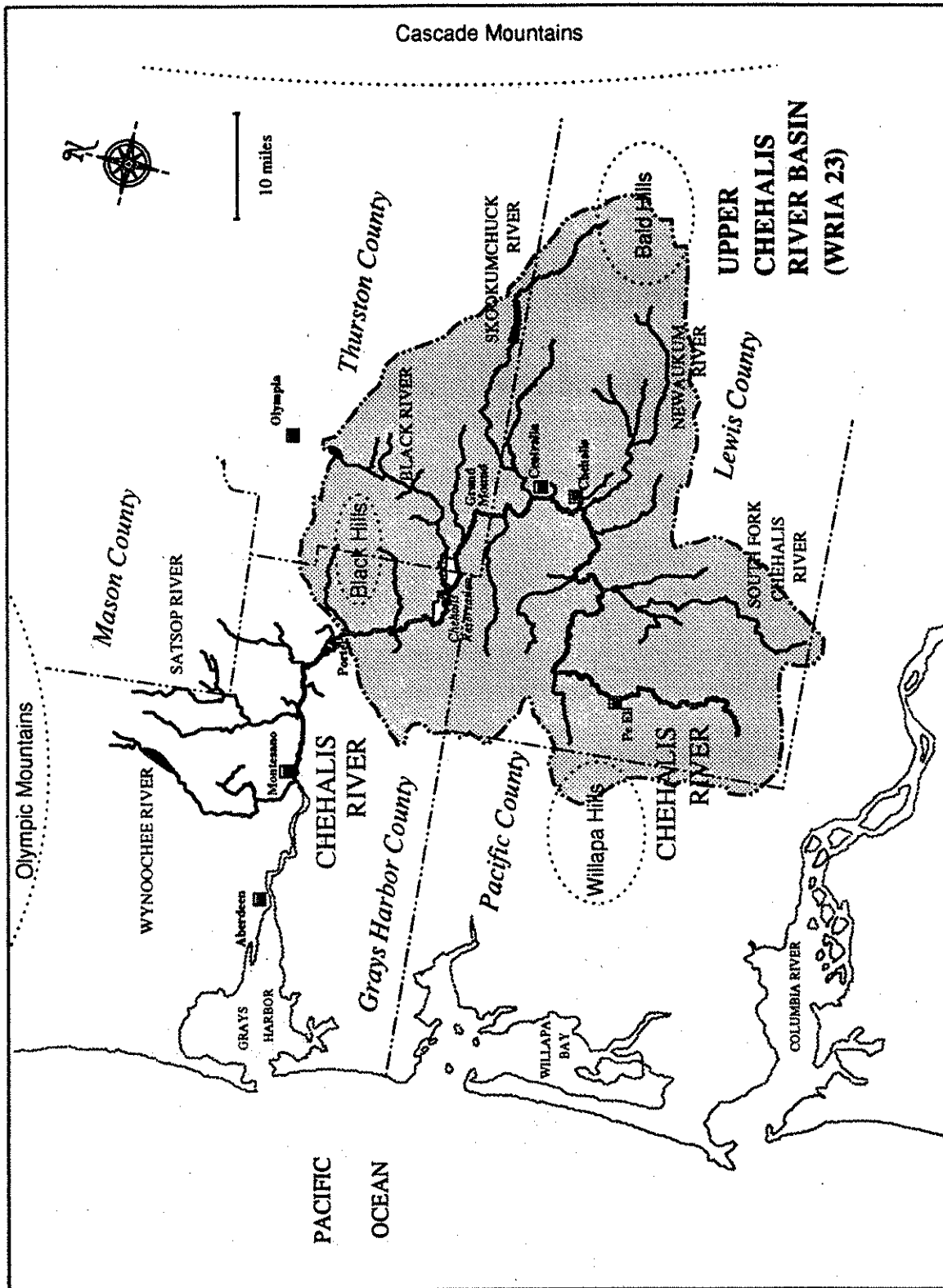


Figure 1 Upper Chehalis River System Location Map

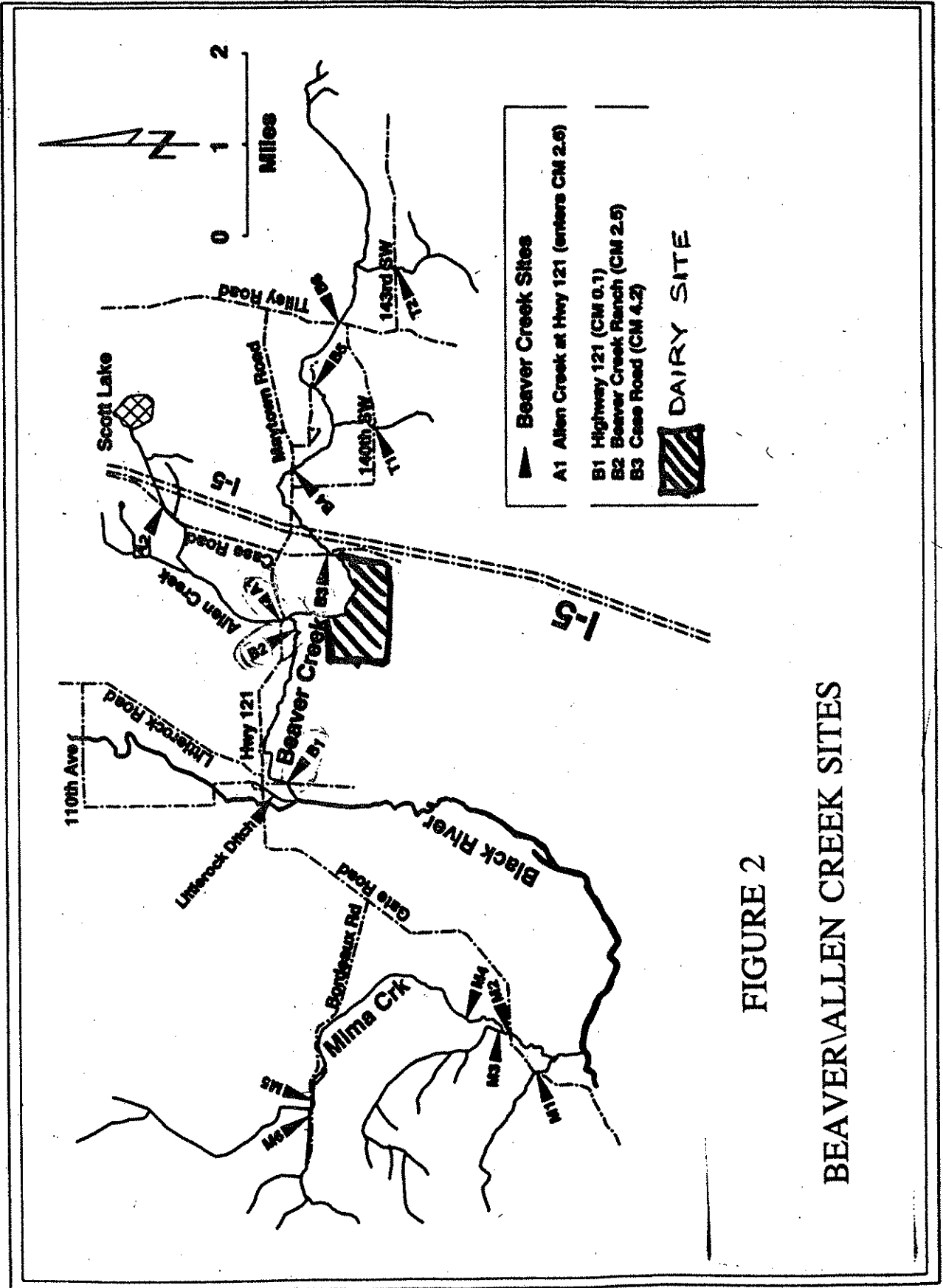


FIGURE 2

BEAVER/ALLEN CREEK SITES

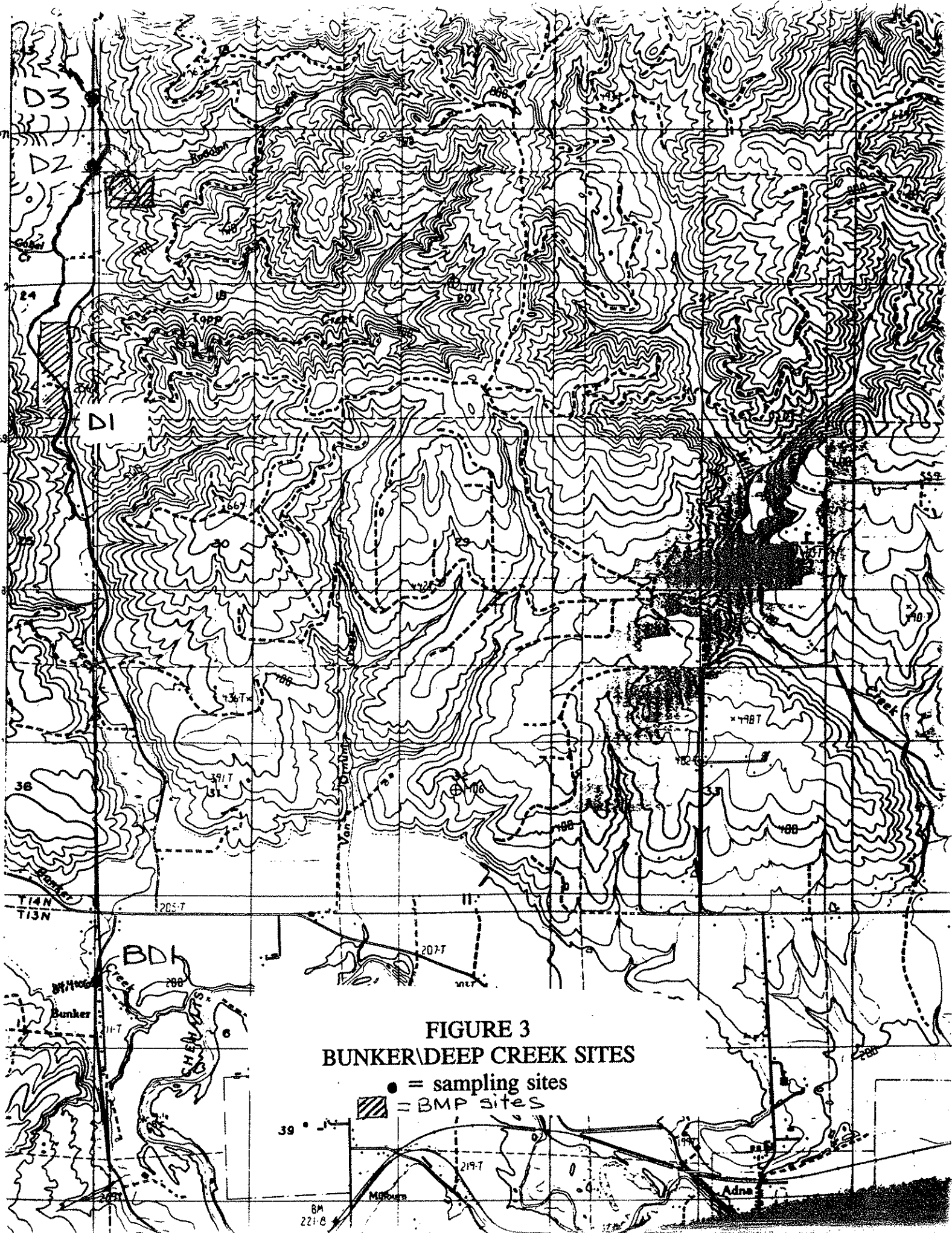
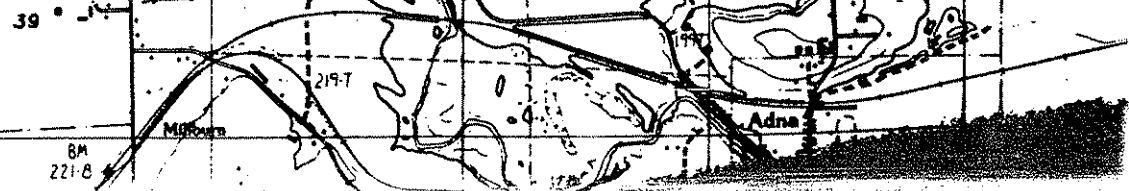
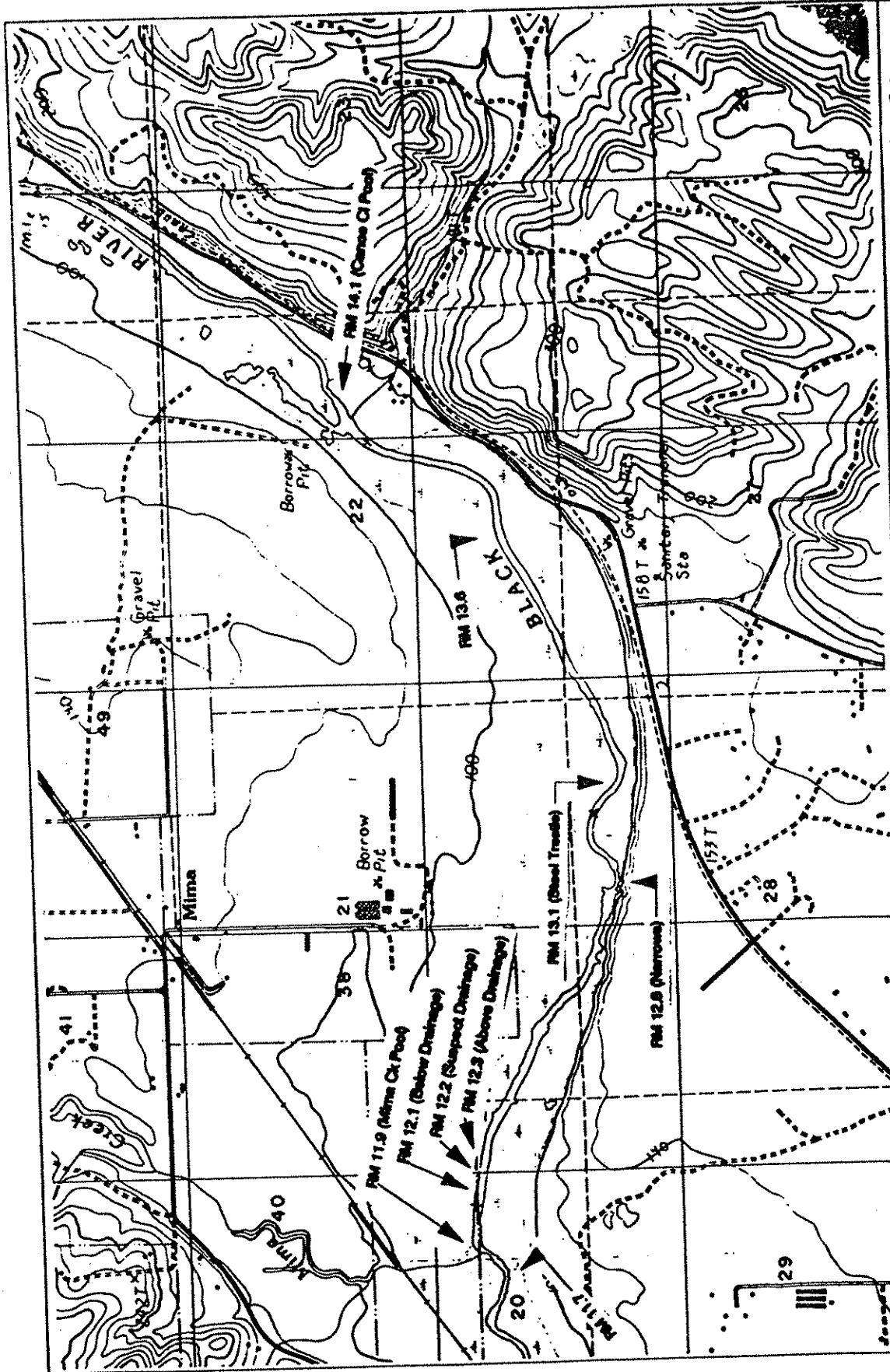


FIGURE 3
BUNKER DEEP CREEK SITES

● = sampling sites
 ▨ = BMP sites





SAMPLING SITES:
 RM: 14.1 CANOE-CLUB POOL
 RM: 11.9 MIMMA CK. POOL

FIGURE 4 BLACK RIVER STUDY AREA
 (RIVER MILE 12.2-1)

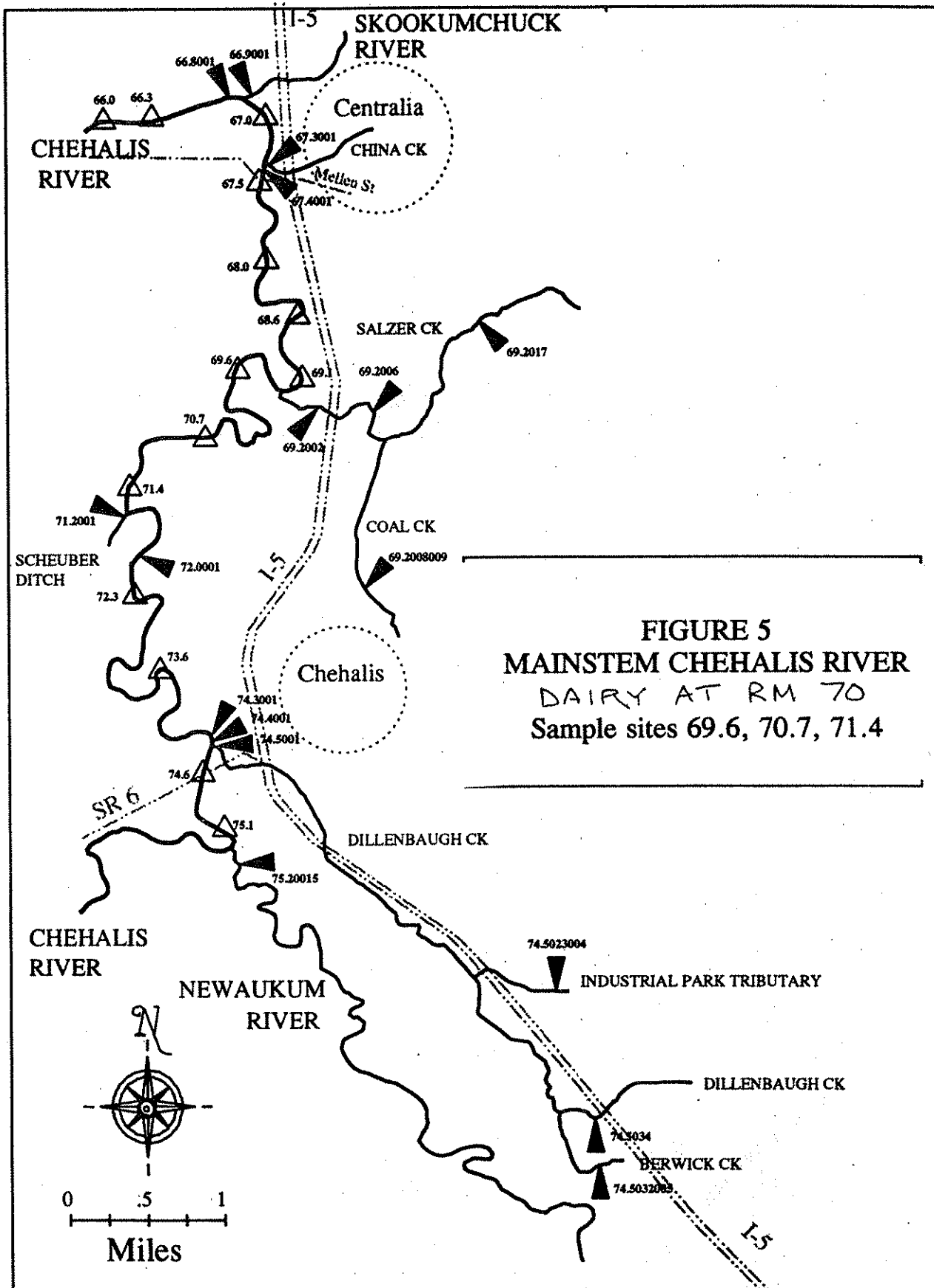


FIGURE 5
MAINSTEM CHEHALIS RIVER
DAIRY AT RM 70
Sample sites 69.6, 70.7, 71.4

TABLE 1 : PARAMETERS AND SAMPLING FREQUENCY FOR CHEHALIS BMP EVALUATION MONITORING
(Does not include duplicate samples)

SITE\SAMPLE FREQUENCY	Turbidity	NH3	NO2-NO3	TPN	TP	BOD5	TOC	FC
BEAVERVALLEN CREEK SUB-BASIN								
Dry season A.M.								
Site 1 (mouth of Beaver Ck.)	-	1	1	1	1	1	-	-
Site 2	-	1	1	1	1	-	-	-
Site 3	-	1	1	1	1	-	-	-
Site 4	-	1	1	1	1	-	-	-
Dry season P.M.								
Site 1 (mouth of Beaver Ck.)	-	1	1	1	1	1	-	1
Site 2	-	1	1	1	1	-	-	1
Site 3	-	1	1	1	1	-	-	1
Site 4	-	1	1	1	1	-	-	1
Wet season								
Site 1 (mouth of Beaver Ck.)	1	1	1	1	-	-	-	1
Site 2	1	1	1	1	-	-	-	1
Site 3	1	1	1	1	-	-	-	1
Site 4	1	1	1	1	-	-	-	1
BUNKER\DEEP CREEK SUB-BASIN								
Dry season A.M.								
Site 1 (mouth of Bunker Ck.)	-	1	1	1	-	1	-	-
Site 2	-	1	1	1	-	-	-	-
Site 3	-	1	1	1	-	-	-	-
Site 4	-	1	1	1	-	-	-	-
Dry season P.M.								
Site 1 (mouth of Bunker Ck.)	-	1	1	1	-	1	-	1
Site 2	-	1	1	1	-	-	-	1
Site 3	-	1	1	1	-	-	-	1
Site 4	-	1	1	1	-	-	-	1
Wet season								
Site 1 (mouth of Bunker Ck.)	1	1	1	1	-	-	-	1
Site 2	1	1	1	1	-	-	-	1
Site 3	1	1	1	1	-	-	-	1
Site 4	1	1	1	1	-	-	-	1
BLACK RIVER (BLACK RIVER RANCH)								
Dry season								
Site 1 (2 depths)	2	2	2	2	2	-	2	-
Site 2 (2 depths)	2	2	2	2	2	-	2	-
Wet season								
Site 1 (1 depth)	1	1	1	1	-	-	-	1
Site 2 (1 depth)	1	1	1	1	-	-	-	1
Site 3 (1 depth)	1	1	1	1	-	-	-	1
MAINSTEM CHEHALIS (BLAZER BROS)								
Wet season								
Site 1	1	1	1	1	-	-	-	1
Site 2	1	1	1	1	-	-	-	1
Site 3	1	1	1	1	-	-	-	1
Site 4	1	1	1	1	-	-	-	1

TABLE 2

DATA QUALITY OBJECTIVES FOR WATER QUALITY PARAMETERS

Parameter	Method and Reference	Precision	Bias	Required Lower Reporting Limit
Dissolved Oxygen	SM-4500-O G Ecology, 1993 Membrane electrode (Hydrolab DS3)	± .2 mg/L	NA	0.05 mg/L
	SM-4500-O C Ecology, 1993 Azide-modified Winkler Titration	+/- 0.05 mg/L	NA	0.05 mg/L
Fecal Coliform	SM-9222-D Membrane Filter	approx 95% CI as below: @ 50 cfu: 17 - 83 @ 100 cfu: 67 - 133 @ 200 cfu: 167 - 233	NA	1 cfu/100 mL
Turbidity	EPA 180.1	s= ± 0.6 @ 26 NTU s= ± 4.7 @ 180 NTU	NA	1 NTU
Conductivity	(Hydrolab DS3)	± 1% of range	NA	1 umho/cm @ 25 C
pH	(Hydrolab DS3)	± 0.2 units	NA	2-4 units
Biological Oxygen Demand (BOD5)	SM-5210-B	s = +/- 0.7 @ 2.1 mg/L +/- 26 @ 175 mg/L	NA	2.0 mg/L
Ammonia-nitrogen (NH3)	SM-4500-NH3 D (automated phenate)	s = +/- 0.005 mg/L @ 0.43 - 1.41 mg/L	-1% - +7%	0.01 mg/L
Nitrate/nitrite (NO2/3)	EPA 353.2	s= ± 0.012 @ 0.29 mg/L s=± 0.176 @ 2.48 mg/L	+6% -3%	0.01 mg/L
Total persulfate nitrogen (TPN)	SM-17-4500-NO3-F Modified			0.01 mg/L
Total Organic Carbon (TOC)	EPA 415.1	s= ± 3.9 @ 4.9 mg/L s= ± 8.3 @ 107 mg/L	+15% +1%	0.1 mg/L
Ortho Phosphate (PO4)	EPA 365.3	s= ± 0.19 @ 0.04 mg/L s= ± 0.066 @ 0.30 mg/L	+17% -13%	0.01 mg/L
Total Phosphate (TP)	EPA 365.3	s= ± 0.015 @ 0.34 mg/L	-4% - -11%	0.01 mg/L
Temperature	SM-2550-B (thermistor or alcohol filled thermometer)	+/- 0.3 degrees C	NA	0.0 C
Water Velocity	Ecology, 1993 (Marsh-McBirney model 201 velocity meter)	+/- 0.05 feet per second	NA	0.02 fps
Streamflow	Ecology, 1993	+/- 20% of value	NA	0.01 cfs

NOTES:

s - standard deviation

cfu - colony forming units

EPA - Environmental Protection Agency

RSD - relative standard deviation (standard deviation/mean)

SM - Standard Methods for the Examination of Water and Wastewater, 18th Ed. (APHA, 1992)

precision and bias estimates from SM and Ecology, 1991

APPENDIX B

Turbidity Sampling in the Wishkah River Basin

Final Quality Assurance Project Plan

by
Debby Sargeant
February 22, 1995

Washington State Department of Ecology
Environmental Investigations and Laboratory Services Program
Watershed Assessments Section

Approvals:

Debby Sargeant *Debby Sargeant*
Project Lead
Watershed Assessments Section

Will Kendra *Will Kendra*
Section Supervisor
Watershed Assessments Section

Bill Kammin *Bill Kammin*
Lab Director
Manchester Laboratory

Cliff Kirchmer *Cliff J. Kirchmer*
Ecology Quality Assurance Officer
Quality Assurance Section

Ralph Boomer *Ralph Boomer*
Project Lead
U.S. Fish & Wildlife Service

Bill Backous *Bill Backous*
Section Manager
Water Quality Program - SWRO

Abbreviated Quality Assurance Project Plan for Turbidity Sampling in the Wishkah River Basin (WRIA #22)

Project Description

History

Long Live the Kings is a private non-profit group that works toward restoring endangered stocks of salmon, they manage three hatcheries in Washington. One of the hatcheries they manage is on the east fork of the Wishkah River at river mile 26.5 in Grays Harbor County. At the hatchery, two tributaries run into a salmon rearing pond, then into the Wishkah river. Stormwater runoff from a nearby County road runs into the two tributaries. During periods of heavy rainfall while there is heavy vehicle road traffic, hatchery personnel have observed that the two tributaries have high turbidity.

The U.S. Fish & Wildlife Service (USFWS) has requested monitoring for turbidity in the two receiving streams because of potential impacts to the salmon rearing pond, a USFWS-funded project. Potential impacts of continuing siltation are: filling in of off-channel ponds and the access channel; suspended sediments at the outflow; and poor recruitment of juvenile salmonids. These impacts are in direct conflict with the objectives of the USFWS-funded project. Ecology currently has a grant with USFWS to provide technical assistance and to monitor the effectiveness of USFWS fisheries enhancement projects in the Chehalis basin.

Project Objective

To determine if road runoff during high rainfall events and heavy vehicle use causes high turbidity in the receiving streams that results in an exceedance of State Water Quality Standards for turbidity.

Project Design

Turbidity samples will be taken at seven sites (Figure 1). Three samples will be collected on each of the two tributaries and their receiving ponds, one upstream of the possible source, one downstream, and one in the receiving pond. The upstream sample will serve as the background turbidity level. One sample will be taken at the outlet of the rearing ponds to the Wishkah River. One duplicate sample will be taken during each sampling event to evaluate field precision, for a total of eight samples per event. The duplicate samples will be collected from a downstream site.

Sampling will be done when there is one inch or more of rainfall in the previous 24 hours as documented by the rainfall gauge at the hatchery, and there is use of the road by heavy vehicles such as logging trucks and gravel haulers. A total of three rain events will be sampled during the project. Sampling may occur from February through March 1995. Each rain event sampled will be a separate rain event so that event sampling will not occur on consecutive days.

Data Quality Objectives

Maximum holding time for turbidity samples is 48 hours, and the required lower reporting limit is 1 NTU. Samples will be analyzed by the Manchester lab using EPA Method 180.1. Samples will be shipped on ice to Manchester Lab as soon as possible and no later than the next working day in order to be received by the lab less than 48 hours after sampling.

The total precision for field duplicate measurements and for results from duplicate samples should not exceed 20% relative standard deviation (%RSD) for results at or above 10 times the reporting limit. For results closer to the reporting limits, precision up to 50% RSD is acceptable. Greater variability would indicate that the data is not reliable and cannot be used to meet the project objective.

The data will be used to determine if the County road is the cause of high turbidity during periods of heavy rainfall. If a problem is confirmed USFWS and Long Live the Kings will work with the County in order to find a solution.

Organization

Long Live the Kings staff person Terry Baltzell will monitor weather and road use conditions and determine if conditions for sampling are met. Terry will call the Manchester Lab before sampling; then collect and ship the samples to Manchester Lab. Procedures for taking field notes, and for collecting and preparing samples are described in Appendix A. Terry has three years experience with the Department of Natural Resources doing grab and composite sampling, and taking field notes. Sample bottles, bottle labels, and lab request forms were sent to Terry with examples of completed paperwork. Procedures will be reviewed after each sampling to determine if errors need to be corrected or procedures improved.

Total lab budget for the project is \$240, including three rain events at \$80 per rain event. The lab contact for the project is Bill Kammin.

This abbreviated QAPP will be reviewed by Ecology's Quality Assurance Section. Debby Sargeant will receive the lab results, review the data, and prepare a technical memo describing the project with an interpretation of the results including evaluation of the project objectives and data quality objectives. The draft technical memo for internal review will be done by April 15, 1995. The external review draft will be completed May 1, 1995 and the final memo will be out by May 15, 1995. Results will be sent to Larry Dominguez, U.S. Fish and Wildlife Service; Diane Harvester, Ecology's SWRO; and Terry Baltzell.

APPENDIX A

Field Sampling and Field Note Taking Procedures

Field Sampling

For turbidity sampling carry the bottle to representative point in the stream, face upstream, lower the bottle to fill, and replace the cap immediately. Carry the bottle to the shore and immediately label the bottle and place it on ice.

When doing field duplicates fill the two bottles sequentially to collect the duplicate samples.

Field Notes

Field notebooks will be used to record the following information at the site:

Date

Facility

Field Staff

Description of Site

Weather conditions including past 24 hour rainfall

Sample information

- Identification number (station ID)
- Time collected
- Analysis requested

Deviations from the sample plan with explanations

FIGURE 1

SAMPLING SITES

TRIBUTARY A

- A1: Above County Road
- A2: Below County Road
- A3: Receiving pond for tributary A

TRIBUTARY B

- B1: Above County Road
- B2: Below County Road
- B3: Receiving pond for tributary B

M26: Receiving ponds outlet to Wishkah River

