LOWER YAKIMA RIVER SUSPENDED SEDIMENT TMDL

USEPA Submittal Document

DEPARTMENT OF ECOLOGY
State of Washington

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VOLUME 1

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SULPHUR CREEK ENTERING THE LOWER YAKIMA RIVER

WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

Prepared by the Washington Department of Ecology

August 1998

LOWER YAKIMA RIVER SUSPENDED SEDIMENT TMDL

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VOLUME III

ADDITIONAL INCLUSIONS

LOWER YAKIMA RIVER SUSPENDED SEDIMENT TMDL

Fact Sheet

Washington State Department of Ecology
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Developed pursuant to 40 CFR 130.7 and the Federal Clean Water Act

WATERBODY SEGMENTS:

WA-37-1010 Yakima River	Mouth to Toppenish Creek (RM 80.4).
WA-37-1020 Yakima River	Toppenish Creek (RM 80.4) to Sunnyside Dam Bridge (RM 103.8).
WA-37-1040 Yakima River	Sunnyside Dam Bridge (RM 103.8) to the Naches River (RM 116.3).
WA-37-1012 Snipes Creek	All
WA-37-1014 Spring Creek	All
WA-37-1024 Granger Drain	All
WA-37-1030 Sulphur Creek	All
WA-37-1047 Wide Hollow Creek	All
WA-37-1048 Moxee Drain	All

TMDL PARAMETERS:	APPLICABLE RULES:
Turbidity	WAC 173-201A-030(2)(c)(vi)
DDT (and metabolites)	WAC 173-201A-040(3)

SOURCES COVERED BY THIS TMDL:

Allocation Type	Source Description
LA	Nonpoint source from agricultural activities during the normal irrigation season.

PROBLEM ASSESSMENT:

Suspended sediment and persistent pesticide loads from irrigated agricultural areas of the lower Yakima River basin have long been recognized as serious impairments to water quality. The effects of soil erosion on the landscape, and the effects of sediment and dichlorodiphenyl-trichloroethane (DDT) on aquatic resources have been the focus of numerous activities by several agencies.

However, few of these past actions have been coordinated between agencies or systematically directed within the basin. As a result, the basin-wide effectiveness of these actions in alleviating suspended sediment and DDT problems has not been documented. In addition, *The Yakima River Basin Water Quality Plan* (Yakima Valley Council of Governments, 1995) and water quality evaluations by the US Geological Survey (USGS) and Ecology have indicated that beneficial uses are still impaired by sediment and sediment-borne pollutants like DDT from irrigation returns. Consequently, several reaches of the lower Yakima River and several of its tributaries do not meet numerous state water quality criteria and federal guidelines.

Ecology has determined that turbidity, suspended sediment and DDT are the priority water quality impairments in the lower Yakima River basin. Ecology has undertaken a TMDL process to control suspended sediment as the primary cause of the turbidity standard violations, and a major source of DDT transport in the lower basin during the irrigation season. Ecology believes that the control of suspended sediment generation and transport during the irrigation season will result in far-reaching water quality and fish habitat improvements in the Yakima.

TECHNICAL DOCUMENTS:

Surface-Water-Quality Assessment of the Yakima River Basin, Washington: Analysis of Available Water-Quality Data through 1985 Water Year; Rinella, J.F., S.W. McKenzie, and G.J. Fuhrer, 1992a; USGS Open File Report 91-453, Portland, OR.

Surface-Water-Quality Assessment of the Yakima River Basin, Washington: Pesticide and other Trace-Organic-Compound Data for Water, Sediment, Soil, and Aquatic Biota, 1987-91; Rinella, J.F., S.W. McKenzie, J.K. Crawford, W.T. Foreman, P.M. Gates, G.J. Fuhrer, and M.L. Janet, 1992b; USGS Open File Report 92-644, Portland, OR.

Persistence of the DDT Pesticide in the Yakima River Basin Washington; Rinella, J.F., P.A. Hamilton, and S.W. McKenzie, 1993; US Geological Survey Circular 1090, U.S. Government Printing Office, Washington D.C.

Yakima River Basin Water Quality Plan, Volumes I-IV; Yakima Valley Conference of Governments, 1995, Yakima, WA.

A Suspended Sediment and DDT Total Maximum Daily Load Evaluation Report for the Yakima River; Joe Joy and Barbara Patterson, 1997; Washington Department of Ecology, Publication No. 97-321, Olympia, WA.

THE TMDL:

The project area for this TMDL is the Yakima River drainage from the confluence of the Yakima and the Naches Rivers, at the city of Yakima, to its mouth at Richland, WA, excluding those drainages and tributaries on the Yakama Indian Reservation. Of the three mainstem waterbody segments within this reach WA 37-1010 is listed on the 1996 303(d) list as impaired due to turbidity. This TMDL addresses this turbidity listed segment and is being submitted as a preventative TMDL for turbidity on the other two mainstem segments, WA 37-1020 and WA 37-1040. Also addressed herein are the mainstem Yakima River segments, WA-37-1010 and WA-37-1020, six drains and tributaries within the project area, WA-37-1012, Snipes Creek; WA-37-1014, Spring Creek; WA-37-1024, Granger Drain; WA-37-1030, Sulphur Creek; WA-37-1047, Wide Hollow Creek; and WA-37-1048, Moxee Drain, all of which are on the 1996 303(d) list for DDT. All of these segments listed for DDT are being addressed for chronic aquatic toxicity criterion. In addition, this submittal will serve as a preventative TMDL for DDT, chronic aquatic toxicity criterion, on segment WA-37-1040 on the mainstem Yakima River.

This TMDL will reduce turbidity and DDT by implementing actions that reduce the erosion and transport of suspended sediment (TSS) from irrigated agricultural lands within the project area during the irrigation season. TSS is being addressed through the state turbidity standards because of the strong correlation found between turbidity and TSS in the lower Yakima River. A strong relationship was also shown to exist between DDT and TSS. The details of these relationships are discussed in the TMDL "Evaluation Report" contained within this submittal document.

Using the correlation between TSS and turbidity in the TMDL project area, it was determined that the mainstem Yakima River will meet turbidity standards, as listed in WAC 173-201A-030(2)(c)(vi), if the major drains and tributaries contributing sediment to the river were allocated a maximum of 25 NTU where they enter the Yakima River. Twenty five NTU equates to a load allocation of 56 mg/L TSS and has been determined to be the maximum turbidity allowable to protect aquatic health. Background turbidity will be measured just above the project area. Compliance points will be established at several sites within the project area and in the lower reaches of the river, below the influence of the last major drain.

A margin of safety (MOS) is a required component of a TMDL load allocation. This TMDL assessment and allocation complied with the MOS requirement in the following ways:

- The State of Washington turbidity criterion was applied to the entire lower Yakima irrigation project rather than drain by drain.

- The proposed targets of 56 mg/L TSS and 25 NTU are more protective than USEPA guidance of 100 mg/L TSS, and are based on harm to local sensitive species of concern.
- The SMPTOX3 model simulations of contaminant loading (both of TSS and DDT) assume the 90th percentile flow and concentration which are conservative assumptions since no relationship was found between flow and concentration (for either TSS or DDT). Upstream concentrations of DDT and TSS in the DDT model calibration were based on data collected 20 miles upstream of Granger Drain at the Yakima River above Ahtanum Creek. Two large diversion structures occur within those 20 miles that could reduce DDT and TSS concentrations.

Reductions in suspended sediment, and thus in DDT and turbidity, in drains and tributaries will progress over a 15 year period with established targets set at 5 year increments. A major element of the first 5 year target is that all drains and tributaries within the project area comply with the 90th percentile turbidity target of 25 NTU at their mouths. Meeting this target will bring the mainstem into compliance with State turbidity standards.

At 10 years all points within basin tributaries and drains will comply with the 90th percentile target of 25 NTU. Meeting DDT chronic aquatic toxicity criteria of 1 ng/L DDT will eventually require a correlative TSS of 7 mg/L. Because the possible variability of the DDT/TSS correlation at lower sediment concentrations the correlation will be re-evaluated at the 10 year mark.

The 15 year target includes having all drains and tributaries meeting the 7 mg/L TSS target (or its modified form) and complying with state chronic aquatic toxicity criteria for DDT.

Background levels of DDT in the mainstem Yakima River above the TMDL project area have not been shown to exceed chronic toxic aquatic criteria, however the pesticide has been found to be present. A preliminary assessment of the upper Yakima Basin has been initiated by Ecology in preparation for a future TMDL process.

Much of the main stem of the Yakima River included in this TMDL is within or borders on the Yakama Indian Reservation. TSS in the lower Yakima River is influenced by flows from drains and tributaries on reservation lands. The success of meeting the targets for the mainstem as set out in this TMDL is predicated on the assumption that the Yakama Nation and USEPA will achieve similar sediment load restrictions on drains and tributaries within the reservation boundaries.

Public Participation:

A public participation and educational program has been, and continues to be, conducted within the watershed. This includes public workshops, educational displays, informational presentations, mailings, Ecology's participation in the Tri-County Water Resource Agency, the Yakima River Watershed Council, the Interagency Council and representation in the Roza-Sunnyside Valley Irrigation District Board of Joint Control Work Group. Fact sheets inviting participation and comment on the TMDL process and the proposed TMDL implementation strategy have been distributed to interested public at numerous venues. Ecology has dedicated two full time technical assistance specialists to actively work in the community, educating growers and other stakeholders on water quality regulations, TMDL implementation requirements and pollution prevention practices. (see Section 3, Public Involvement)

Implementation:

Implementation of this TMDL will involve major changes in irrigation water management in the lower Yakima River Basin. Conservation Districts and associated Natural Resource Conservation Service offices are active within the TMDL project area. North Yakima Conservation District, South Yakima Conservation District and Benton Conservation District all have ongoing projects designed to promote and facilitate "best management practices" (BMP) implementation, including conversion of furrow irrigated lands to sprinkler or drip. These agencies are administering the distribution of cost-share funds available through the USDA EQIP Program to facilitate the conversions. Other funding sources are continually being sought. (see Section 4, Summary Implementation Plan)

The Roza-Sunnyside Valley Irrigation District Board of Joint Control (BOJC) has instituted major policy changes to address water quality issues in the lower Yakima River Basin. Changes include requiring the piping of field runoff discharges to drains and tributaries; meeting acceptable water quality parameters for waters leaving farm fields; requiring permits for farm return water discharges to drains; and maintaining buffer zones along waterways including livestock exclusion and no-till zones. The BOJC has accepted the TMDL target turbidity levels of 25 NTU as the maximum allowable for return flows to drains and canals within the irrigation project. The newly adopted policies will be enforced by the Roza and the Sunnyside Valley irrigation districts. The BOJC is also seeking funding sources to assist local growers in irrigation conversion projects. Roza-Sunnyside BOJC is taking a leadership roll in implementing the practices necessary to make the Lower Yakima Suspended Sediment TMDL a success. (see Appendix 7)

Ecology has initiated a Yakima Watershed Agriculture Water Quality Education Program that will provide technical assistance and grower referrals to agencies involved in BMP implementation. The Dept. of Ecology will increase its presence in the project area, following up complaints and making referrals to Conservation Districts and irrigation districts. Ecology will issue enforcement actions when efforts to achieve compliance through other means fail. (see Appendix 9)

Monitoring:

The Lower Yakima Basin is geographically divided into several drainages. Four of these drainages, Moxee Drain, Granger Drain, Sulphur Creek and Snipes/Spring Creek are major contributors of suspended sediment to the lower Yakima River. At several sites in each of these drainages one or more public entities, other than Ecology, is conducting regular water quality monitoring for a number of parameters, including suspended solids and turbidity. North Yakima, South Yakima and Benton Conservation Districts and the Roza-Sunnyside Joint Board of Control are conducting this monitoring under Centennial Clean Water Fund, 319 Clean Water Fund and local funding. Ecology will help facilitate continuation of these monitoring activities and incorporate the efforts into the TMDL plan. Ecology is currently conducting monthly ambient monitoring on the Yakima River at the upper and the lower end of the TMDL project area. Ecology will also, with the cooperation of the Yakama Nation where applicable, establish one to three additional monitoring sites on the mainstem Yakima within the project area to measure compliance with the TSS allocations established.

As implementation proceeds Ecology will assess the effectiveness of the existing monitoring effort, identify gaps, facilitate coordination between entities and supplement the monitoring as necessary to comply with the TMDL Monitoring Plan. As TMDL target dates and allocations are neared, monitoring methodology, including TSS/turbidity and TSS/DDT correlations, in the mainstem and tributaries will be evaluated and adjusted as necessary to insure that TMDL goals are met. (see Section 5, Monitoring Plan)

Section 2 - Evaluation Report

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A Suspended Sediment and DDT Total Maximum Daily Load Evaluation Report for the Yakima River

July 1997
Publication No. 97-321
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Addendum to:

A Suspended Sediment and DDT Total Maximum Daily Load Evaluation Report for the Yakima River

Items contained in this addendum reflect changes in the "Evaluation Report" which have occurred since it was published in July of 1997. These changes are the result of comments received during the public comment period. Comments and the applicable responses are contained within this submittal document.

Title: It was noted that this report was specific to the "lower" Yakima River and the title should reflect the specificity. The title should be changed to read "*A Suspended Sediment and DDT Total Maximum Daily Load Evaluation Report for the Lower Yakima River*"

Page 68, Table 14: Change Table 14 to reflect the TSS limits as being less than 56 mg/L for Wide Hollow Creek, Ahtanum Creek, and DID #7.

Page 77, 5 years (2002), first bullet: Add the words "*for the 90th percentile*" to read "*Yakima River main stem will comply with the turbidity target of not more than a 5 NTU increase for the 90th percentile between the confluence of the Yakima and Naches Rivers (RM 116.3) and the Kiona gage at Benton City (RM 30).*"

Page 77, 5 years (2002), first bullet: Add a second sentence to read, "*Use of the 90th percentile frequency in the turbidity compliance target for the main stem will be evaluated.*"

August 26, 1998

Section 3 - Public Involvement

Section 3 - Public Involvement

Items abridged from this section include:

- **Lower Yakima TMDL Mailing List**
- **Granger Drain News**
- **Granger Town Meeting announcement (English and Spanish)**
- **1998 Tri-Cities Sportsmen Show flyer**
- **Comment Period extension notice**
- **Letter to Mailing List recipients**
- **1997 Central Washington Sportsmen Show program**
- **Educational Service District #123 bulletin**

LOWER YAKIMA RIVER SUSPENDED SEDIMENT TMDL

Public Involvement

In developing this TMDL Ecology has followed a process intended to allow and encourage public participation and at the same time educate groups and individuals within the Lower Yakima Watershed on pertinent WQ issues.

A mailing list has been developed over the duration of this project which, to date, includes over 400 names of individuals, organizations, businesses and governmental agencies. Many of the listed entities, such as the Yakima River Watershed Council, the Yakima Watershed Information Office, grower organizations, irrigation districts and environmental organizations have successive mailing lists. We believe that information dissemination goes far beyond the scope of Ecology's TMDL list.

The TMDL mailing list was and continues to be developed by giving individuals the opportunity to "sign up" for inclusion at public workshops; public meetings (Conservation Districts/NRCS board meetings, irrigation district board meetings); booths at regional fairs; displays at recreational shows, grower conferences and agricultural education seminars; and during numerous presentations to groups throughout the area.

To date, three mailings have been made to all current addresses on the list. The first mailing included an announcement of the release and availability of the TMDL Evaluation Report, a copy of the Executive Summary of the report and an information sheet on the TMDL. The second mailing provided an updated information sheet and announced a deadline for comments on the Evaluation Report and the TMDL process. The third mailing announced an extension of the comment period deadline.

The Dept. of Ecology held a public workshop in the city of Granger on May 14, 1996, specifically to inform the local public and government officials about this project and the TMDL process. Over 2200 notices of the workshop were mailed to area residents and advertisements were put in local media. This primary effort to involve the public resulted in a disappointing turnout. The strategy of public involvement was changed to a program of including the TMDL message in other public meetings which included the target audiences. TMDL presentations and informational announcements were and continue to be included in numerous grower educational seminars and conferences sponsored by entities other than Ecology. TMDL information was also included in a general watershed education program developed by the Yakima Watershed Local Action Team lead.

In conjunction with Ecology's Yakima Watershed Agriculture Water Quality Education Program, developed in late 1997, over 3300 brochures discussing

TMDL issues and Best Management Practices have been distributed to growers, conservation districts, irrigation districts and ag-chemical dealers.

A Yakima Watershed internet web page has been created by Ecology with links to Yakima TMDL information including the Executive Summary of the Evaluation Report and an informational report.
(http://www.wa.gov/ecology/cro/yrblat/index.htm)

A continuing effort has been made to educate and encourage participation in the TMDL process. Numerous presentations to groups and the media have, and continue to be given. A chronology of public, private and media events in which TMDL information has been disseminated follows:

1/27/95	TMDL presentation and discussion with the Yakama Indian Nation environmental managers.
2/7/95	Watershed workshop in Granger for agriculturists, with discussions on the TMDL project and upcoming activities. (Public meeting)
4/95	TMDL and Yakima River pollution presentation to the water quality committee of the Yakima River Watershed Council.
4/4/95	Yakima River sediment and TMDL presentation to the Environmental Education Workshop Group with the Educational Service Districts #105 and #123.
4/4/95	Yakima River suspended sediment and TMDL presentation to the Kittitas, Yakima and Benton County vocational agricultural teachers group.
4/4/95	Meeting with WSU Extension Service in Yakima County to discuss coordination of the Yakima River TMDL project and related riparian activities with local 4H projects.
4/13/95	TMDL presentation in Prosser to area agriculture teachers from Educational Service Districts #105 and #123.
4/13/95	Public phone-in radio talk show interview on Yakima Valley station KUTI on TMDL issues and implications.
5/95	Meeting with WSU Extension and Kittitas-Yakima RC&D to discuss potential rolls in this TMDL process.
5/4/95	Yakima River TMDL project and pollution presentation to the Roosevelt Elementary School math and science teachers.
5/8/95	Presentation to Lewis and Clark Middle School students on the TMDL project and water quality issues in the Yakima Basin.
5/25/95	Lewis and Clark Middle School field trip to lower Yakima River to observe suspended sediment pollution problems.
6/23/95	TMDL presentation to Central Region Office of the Dept. of Ecology.
7/5/95	Wapato High School field trip to lower Yakima River to observe suspended sediment pollution problems.
7/9/95	TMDL presentation to the Water Quality Committee of the Yakima River Watershed Council.

8/95	Presentation of TMDL issues and implications to the Yakima River Joint Board of Control. (Kennewick ID, Kittitas ID, Roza ID, Sunnyside Division, Yakima Tieton ID, Cascade ID, Ellensburg Water Company, City of Yakima)
8/25/95	Presentation of TMDL issues and implications to the Sunnyside Valley Irrigation District Board of Directors. (Public meeting)
9/95	Instructional seminar on ground truthing of land use and irrigation practices for Educational Service Districts #105 and #123.
9/21-31/95	Central Washington State Fair in Yakima, Dept. of Ecology booth and TMDL display.
9/23/95	TMDL poster display and information booth at the Granger Water Day fair.
10/95	Presentation to Selah High School Students on Yakima River pollution and the TMDL.
11/14/95	Presentation to area school teachers at Educational Service District #105 on TMDLs and land use and irrigation ground-truthing.
1/19-24/96	Tri-Cities Sportsmen's Show display booth on the Yakima River TMDL.
1/26/96	Presentation to the League of Women Voters on the Yakima River TMDL.
2/8/96	Presentation to the Kittitas County Conservation District on the Yakima River TMDL.
2/13/96	Presentation to the Tri-County Water Resources Agency (Kittitas, Yakima and Benton Co. Commissioners representation) on the Yakima River TMDL.
2/16-18/96	Yakima Sportsmen's Show display booth on the Yakima River TMDL.
4/18/96	Yakima River TMDL presentation to the Governor's Council on Environmental Education.
5/14/96	Town meeting and TMDL workshop in Granger.
7/9/96	Interview on TMDL issues for local Yakima television.
7/10/96	Yakima River water quality presentation to the Water Quality Committee of the Yakima River Watershed Council.
7/29/96	Yakima River water quality and TMDL presentation to Wapato High School students.
7/30/96	Yakima River TMDL presentation given to the Conservation Advisory Group of the Yakima River Basin Water Enhancement Project.
8/2/96	TMDL television interview given to KNDU news.
8/7/96	TMDL television interview given to KAPP news.
8/7/96	One half hour television news program on TMDLs, water quality and partnerships in the Yakima watershed on station KAPP.
8/13/96	News Release on the public release of the TMDL Evaluation Report for the Lower Yakima River.
9/24/96	Yakima River TMDL presentation given to Bureau of Reclamation - Yakima Project staff.

10/4/96	Presentation and update to the Tri-County Water Resources Agency (Kittitas, Yakima and Benton Co. Commissioners representation) on the Yakima River TMDL.
10/9/96	Granger Waterfest, TMDL and Yakima River information booth.
11/6/96	TMDL presentation to the Washington Apple Commission.
11/15/96	Presentation to the Tri-County Board of Commissioners on the Yakima River TMDL and Ecology's Local Action Team.
11/18/96	TMDL presentation to the Yakima County Commissioners.
12/30/96	Interview on TMDL issues for local Yakima television.
1/17-19/97	Tri-Cities Sportsmen's Show display booth on the Yakima River TMDL.
1/31/97	Update of TMDL project to the Yakima River Joint Board of Control. (Kennewick ID, Kittitas ID, Roza ID, Sunnyside Division, Yakima Tieton ID, Cascade ID, Ellensburg Water Company, City of Yakima)
2/4/97	Presentation on the Lower Yakima TMDL project to the Richland Rod & Gun Club.
2/20/97	Presentation on the Lower Yakima TMDL project to the Department of Ecology Joint Management Team in Lacey.
2/21-23/97	Yakima Sportsmen's Show display booth on the Yakima River TMDL.
5/13/97	Presentation on the Lower Yakima TMDL project to the Roza-SVID Joint Board of Control.
5/14/97	TMDL and water quality presentation to Mabton High School students.
5/23/97	One hour call-in radio talk show and interview on Spanish language station KDNA in Granger on the lower Yakima River TMDL and water quality issues.
6/8/97	TMDL presentation to the Master Watershed Stewards class.
8/13-20/96	Media interviews about the Lower Yakima TMDL on the release of the TMDL Evaluation Report. (Television-KNDO, KIMA, KAPP and KNDU; radio- KIT, KNOA and KEPR; newspapers-Yakima Herald Republic, Tri-Cities Herald, Capital Press and Toppenish Review; magazines- Washington CEO and Water Environment & Technology).
10/14/97	Presentation and information exchange on the Yakima TMDL with the Yakama Reservation Irrigation District Board of Directors.
10/21/97	Presentation and distribution of the Yakima River TMDL Evaluation Report to the Roza/SVID Board of Joint Control Work Group.
11/12/97	Lower Yakima TMDL literature distribution at a Kittitas County Conservation District growers meeting.
11/20/97	Presentation of the TMDL process and overview of the Lower Yakima TMDL to the Washington State Water Resources Association annual conference in Leavenworth.

1/22-23/97	Provided a booth and poster display for the Hop Growers Convention in Yakima highlighting the Yakima River TMDL and Ecology's Agricultural Water Quality Education Program.
1/16-18/98	Tri-Cities Sportsmen's Show display booth on the Yakima River TMDL.
1/26-2/11/97	Participated with Roza/SVID Board of Joint Control and WSU Extension in 8 landowner meetings designed to educate growers on the TMDL, water quality issues, irrigation district policy changes designed to address WQ problems and irrigator responsibilities in erosion control.
2/12/98	Presented TMDL and WQ issues at a combined irrigation district coordinating meeting in Kittitas Co.
2/27-29/98	Yakima Sportsmen's Show display booth on the Yakima River TMDL
3/31-4/1/98	Provided poster display on Yakima TMDL for the Non-point Pollution Conference in Wenatchee.
5/12/98	TMDL presentation to the Columbia Basin Anglers in Kennewick, WA.
7/15/98	Slide show presentation to Ecology director and the media on the Yakima TMDL project.
7/16/98	Yakima TMDL presentation to Moxee area hop growers.
7/27/98	Interview with KNDU television on Yakima River pollution and implementation planning.

WASHINGTON STATE DEPARTMENT OF ECOLOGY

News Release

FOR IMMEDIATE RELEASE:
August 13, 1997

CONTACT:

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Lower Yakima River Pollution Addressed in New Report

Yakima, WA -- A long-awaited report on pollution in the lower Yakima River has been released by the Washington State Department of Ecology, signaling major changes in water management for many farmers in the Yakima River basin. The report identifies sediment and the associated pesticide DDT as the river's biggest pollution problems. It details the amount and sources of sediment and DDT released to the river during the irrigation season, and sets limits and a schedule for reducing those pollutants. The goal is to restore the quality of the lower Yakima River water so that it meets state water quality standards.

"The most obvious sign of pollution in the lower Yakima is the muddy water entering the river at the mouths of irrigation return drains and tributaries," said Chris Coffin, Yakima River water quality project coordinator.

"Our sampling indicates tens of thousands of tons of top soil are eroded from valley farms during the irrigation season. The soil is carried down the drains and ends up in the Yakima River. That's bad for agriculture and it's bad for the fishery that we're trying to restore in the river.

"Sediment from farmland also carries with it residual amounts of the banned pesticide DDT. Tissue samples of bottom fish in the lower Yakima have among the highest concentrations of DDT in the nation," Coffin said.

The new report is called *A Suspended Sediment and DDT Total Maximum Daily Load Evaluation Report for the Yakima River*. "Total Maximum Daily Loads" are estimates of the amount of specific pollutants that a body of water can safely take in without threatening the beneficial uses of the water such as stock water, irrigation, fishing, swimming and aesthetic enjoyment.

Sediments and "suspended solids" harm the respiratory systems of fish and aquatic insects. Particles can also settle and clog spawning gravel or suffocate fish eggs. Muddy water makes it difficult for fish to migrate and find food.

Ecology, Yakama Indian Nation and several other state, federal and local agencies now will be working together with area growers to identify the best and most cost-effective ways to reduce soil erosion and runoff from farms.

"We are looking to the community for participation and support as we develop effective pollution controls," Coffin added. "Public comment and involvement is an essential ingredient in the success of this project. Ecology and the other agencies will provide guidance and help farmers to implement new, less polluting irrigation practices."

According to the report, most of the sediment is eroded from farmland by poor irrigation water management and is carried back to the river through the irrigation return drains. One of the early recommendations is for growers to convert to sprinkler and drip irrigation where appropriate to eliminate tail water runoff and the resulting top soil erosion. Other options are also being explored.

For a copy of the executive summary of the report or a fact sheet on the Total Maximum Daily Load process on the Yakima River, contact Chris Coffin at (509) 454-7860.

WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

A Suspended Sediment and DDT Total Maximum Daily Load Evaluation Report for the Yakima River

Executive Summary

July 1997
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Executive Summary

Purpose and Approach

The lower Yakima River basin is located in south-central Washington State. It is one of the most intensively irrigated and agriculturally diverse areas in the United States. Suspended sediment and persistent pesticide loads from irrigated agricultural areas of the lower Yakima River basin have long been recognized as serious impairments to water quality. Recent water quality evaluations by the US Geological Survey (USGS) have indicated that some improvements have been made, but beneficial uses are still impaired by sediment and sediment-borne pollutants like DDT from irrigation returns (Rinella *et al.*, 1992b, 1993). Consequently, several reaches of the lower Yakima River and several of its tributaries do not meet numerous state water quality criteria and federal guidelines (Ecology, 1994a, 1995). As a result, these water bodies have been placed on the Washington State's 303(d) list.

The Clean Water Act directs Ecology to perform a total maximum daily load (TMDL) analysis for contaminated waters on the 303(d) list. Ecology had determined that turbidity and DDT represent key water quality impairments on the 303(d) list in the lower Yakima River basin. In response, Ecology conducted a TMDL study to evaluate controls of suspended sediment, the primary cause of the turbidity criteria violations, and a major source DDT transport in the lower basin during the irrigation season. Ecology believes the control of suspended sediment generation and transport during the irrigation season will result in far-reaching water quality and fish habitat improvements in the Yakima Basin.

In addition, the TMDL needed to be coordinated with the Yakama Indian Nation (YIN) since the Yakama Indian Reservation covers over forty percent of basin, but is outside of the state's jurisdiction. The Yakama Indian Nation and Ecology joined in a data-sharing and cooperative monitoring agreement for the project. Like Ecology, the YIN and the US Environmental Protection Agency (USEPA) share similar Clean Water Act and TMDL responsibilities on the Yakama Indian Reservation. They are developing plans, and are undertaking actions to address suspended sediment loads in drains and tributaries from the Reservation. Ecology, the YIN, and the USEPA will continue to coordinate their efforts to improve water quality in the Yakima River

The TMDL evaluation project was undertaken in two phases by the Environmental Investigations and Laboratory Services (EILS) program at Ecology. Phase I tasks included:

- water quality monitoring,
- a historical data review,
- suspended sediment criteria development based on beneficial use impairments, and

- ranking of subbasins relative to their suspended sediment problems.

Phase I results focused work for Phase II. The main objective of Phase II was to recommend suspended sediment reduction targets to protect aquatic life in the main stem and in tributaries of the lower Yakima project area. Targets were to be based on relationships between suspended solids and Washington State criteria for turbidity and DDT. Tasks during Phase II included:

- additional turbidity and suspended sediment monitoring to establish TMDL control and compliance sites,
- a comparison of turbidity results between agency laboratories,
- additional pesticide data collection in major return drains,
- development of a suspended sediment mass balance for the lower Yakima basin during the 1995 irrigation season, and
- establishment of cooperative working relationships with tribes, federal agencies, conservation districts, and other groups in the lower basin.

Additional data were obtained from the USGS, US Bureau of Reclamation (USBR), the YIN, and the North and South Yakima Conservation Districts. Monitoring and evaluation focused on drains and tributaries in the most heavily irrigated areas of the lower Yakima. Data evaluation, jurisdictional issues, and the TMDL strategy were discussed with, and reviewed by technical staff from the Ecology Central Regional Office (CRO), Region 10 of USEPA, and the YIN Environmental Protection Program.

Findings

Flow, Turbidity and TSS

The Yakima River and Naches River serve as irrigation supply water for approximately 339,200 acres of cropland in the lower Yakima Valley. From 50% to 100% of the water delivered to the lower basin from the Naches River and upper Yakima River is diverted for irrigation and hydropower generation during the irrigation season (Molenaar, 1985). In some past years, nearly all water was diverted out of the main stem at the Sunnyside Dam. This became a concern among fishery and water resource managers. Diversion limits were placed in 1994, so that at least 300 cubic feet per second (cfs) must spill over the dam to the lower river. The lower basin slowly recovers some of the water diverted for irrigation through surface and subsurface returns. Many irrigation return drains and tributaries enter the river from the project area and the Yakama Indian Reservation. Most of the returning water contains elevated levels of suspended sediments, pesticides, nutrients, bacteria, and oxygen demanding substances. Several small municipalities and industrial sources also discharge into the river, but supply a fairly small cumulative volume (10 cfs) during the irrigation season.

Two very different irrigation season flow regimes were monitored during 1994 and 1995. Irrigation diversions were severely limited in 1994 because water availability for irrigation was the lowest on record. The 1995 season saw normal water availability. Water availability and use had a direct impact on suspended sediment loading from tributaries and irrigation return drains. Tributaries and drains associated with lands with senior water rights (*i.e.*, only minor reductions in water use) maintained elevated TSS concentrations and turbidities both years. For example, the median turbidities at Moxee Drain and Granger Drain exceeded 50 NTU, the level at which displacement of salmonids can occur, in 1994 and 1995. However, tributaries and return drains from lands affected by lower water use in 1994 resulted in lower mean TSS concentrations and turbidities. In 1994, Sulphur, Spring, and Snipes creeks had median turbidities below 25 NTUs. Salmonid feeding and growth are affected at turbidities above 25 NTUs. In 1995, the median turbidities of Sulphur Creek and Spring Creek were above 25 NTU, while the 90th percentile turbidities for Sulphur, Spring, and Snipes creeks exceeded 50 NTU. In turn, main stem concentrations of TSS and turbidity increased between 1994 and 1995 as TSS loading from tributaries increased. Median and 90th percentile turbidities at main stem sites monitored in 1994 remained below 25 NTU. In 1995, 90th percentile turbidities of the four sites below the Yakima River at Parker exceeded 25 NTU. In both years, turbidity increased by more than 5 NTUs between the confluence of the Yakima and Naches River and Benton City.

A TSS loading balance was calculated from the data collected during the 1995 irrigation season. The cumulative impact of tributary and drain loadings on reaches of the lower Yakima River was clearly seen. For example, in the later part of the irrigation season, the Moxee Drain TSS load (35 tons/day) exceeded the Naches River's load (27 tons/day), even though the average water volume of the Naches River was 14 times that of Moxee Drain. Granger Drain contributed an average 60 tons of TSS /day. The TSS load from Sulphur Creek was 110 tons/day, and Spring and Snipes Creeks' combined TSS load was 46 tons/day. The combined TSS load from the Yakama Reservation drains and tributaries was 75 tons/day. Approximately 1.5 tons/day came from municipal or industrial sources. Ungaged tributaries and instream sources also accounted for substantial loads during the irrigation season.

Using 1994 and 1995 monitoring data generated in this TMDL evaluation, a regression was developed of turbidity as a function of TSS. The following linear regression equation was based on 646 data pairs from river, canal, drain, and tributary sites with TSS concentrations less than 1000 mg/L:

$$\log_{10} \text{Turbidity} = 0.871 * \log_{10} \text{TSS} - 0.145$$

The equation had a coefficient of determination (r^2) of 0.956, which means 96% of the data variability is explained by the TSS data. Such a high correlation is somewhat unusual, but it may be because a ratio turbidimeter was used for all analyses, and because the geographic and seasonal scope of the data was more focused than other studies of this kind.

Pesticides

Nonionic pesticides have been used extensively on the agricultural crops of the Yakima Valley since at least the 1950s. In general, the organochlorine compounds, such as DDT, dieldrin, and endosulfan, have been the most frequently detected pesticides in basin waters, sediments, and biota due to their persistence in the environment and heavy use in the past. Concentrations of total DDT in the water were highest in the early 1970s. In the mid-1970s and early 1980s, DDT was not detected in samples routinely collected by the USGS, most likely because of the higher detection limit. Samples collected by USGS during the NAWQA survey indicate that DDT is still present in the main stem at concentrations above criteria. There is some indication that t-DDT burdens in fish tissues are declining, although there are not enough data to confirm this trend. Fish in the lower Yakima River still have one of the highest concentrations of DDT in the country (Rinella *et al.*, 1993). These findings resulted in a Washington State Department of Health advisory in 1993 recommending that people eat fewer bottom fish from the lower basin (Department of Health, 1993).

In 1995, whole water samples were analyzed for 46 pesticides at Granger Drain, Spring Creek, Sulphur Creek, and the Yakima River at Euclid Bridge as part of the TMDL evaluation. Organochlorine, organophosphate, and nitrogen-containing pesticides were frequently detected at all sites. Total DDT was detected above the human health and aquatic life chronic toxicity criteria at all sites on three or more sampling dates. The t-DDT samples analyzed had concentrations from 0.004 µg/L to 0.357 µg/L, and a median of 0.0083 µg/L. The median concentration, and most sample results, were similar to what has been reported in recent years for these sites. However, one sample collected at Granger Drain contained 0.357 µg/L t-DDT. It was twice the previously highest concentration of t-DDT detected since 1968.

Additional pesticides detected in water at concentrations above criteria or guidelines were: azinphos-methyl, chlorpyrifos, malathion, diazinon, and propargite. Both azinphos-methyl and chlorpyrifos are highly toxic insecticides used on many fruit and vegetable crops. Preventing seasonal entry of these newer pesticides into basin waters deserves further investigation.

The t-DDT concentrations in the small mouth bass and carp tissue samples collected in 1995 from the Yakima River at Euclid exceeded the Ecology screening guideline by an order of magnitude. The bass sample had a higher concentration than bass previously analyzed in the lower basin, and the carp sample was at the higher end of the range of values observed. Dieldrin was also detected in the bass and carp samples at concentrations exceeding the 0.7 µg/kg screening guideline by an order of magnitude.

The carp sample's 15 μg/kg total chlordane concentration exceeded the human health screening level of 8.3 μg/kg. Total PCBs (polychlorinated biphenyls) in both the carp and bass also exceeded the screening guideline for human health risk. Other pesticides detected, but below guideline concentrations, were: heptachlor expoxide, hexachlorobenzene, and trifluralin.

The three largescale sucker composite samples collected from the Yakima River at Euclid in 1995 contained from 2.276 μg/kg to 3.728 μg/kg t-DDT. Dieldrin and total PCB concentrations in the 1995 samples also exceeded wildlife guidelines. These data indicate that pisciverous wildlife are still likely at risk from exposure to t-DDT, dieldrin, and other pesticides in Yakima River fish.

Using 1995 monitoring data generated in this TMDL evaluation and previous USGS and Ecology data a regression was developed of t-DDT as a function of TSS. The best linear regression equation based on 71 data pairs from river and tributary sites with detectable t-DDT concentrations (expressed as nanograms per liter, or ng/L) was:

$$\log_{10} \text{t-DDT} = 0.953 * \log_{10} \text{TSS} - 0.820$$

The equation had a coefficient of determination (r^2) of 0.747. Data collected in 1995 were not significantly different from previously collected data, and tributary data were not significantly different from main stem data, so all data were grouped. Other pesticides either had too few data, or no significant association with TSS was found.

Total Maximum Daily Load Recommendations

Since suspended sediment and DDT are two of the most significant pollutants in the Yakima River Basin, it is necessary to set nonpoint source reduction targets through load allocations in the study area. Three approaches were used to recommend TSS and DDT targets and nonpoint source load allocations for the Yakima River and its tributaries in the study area:

1. ***Turbidity criterion*** -Using the correlation of TSS concentrations to turbidity values, TSS targets on the main stem Yakima River will be based on the turbidity standard of 5 NTU above background.
2. ***Fisheries (aquatic biota) support*** - Using the narrative criteria to protect aquatic life, a 25 NTU turbidity or 56 mg/L TSS target will apply to irrigation return drains and tributaries as a fish health threshold consistent with the scientific literature.
3. ***Pesticides criteria*** - Based on the correlation of TSS to t-DDT, long-term TSS reduction goals will be set for return drains and tributaries to achieve the t-DDT water quality criterion for protection of aquatic life from chronic toxicity. Targets to meet human health criteria will be assessed as progress to the aquatic life criterion is made.

The TMDL-related activities include re-evaluation work and further target development. The targets based on aquatic community effects should be met in 15 years so that an evaluation of ways to meet DDT human health criteria can be done within 20 years. Limiting DDT uptake by aquatic organisms may require an entirely different approach, but that will be difficult to know until substantial reductions in TSS and associated DDT loadings are accomplished. These are necessary components of the phased-TMDL approach. The effectiveness of individual control measures to reduce soil erosion in irrigated agricultural areas is fairly well understood, but the overall effectiveness of all measures implemented in the basin, and the rate at which they will be adopted under current economic and political conditions is uncertain. The scheduling of targets and TMDL-related activities are proposed as follows:

5 years (2002)

- Yakima River main stem will comply with the turbidity target of not more than a 5 NTU increase between the confluence of the Yakima and Naches Rivers (RM 116.3) and the Kiona gage at Benton City (RM 30).
- All drains and tributaries within the project area will comply with the 90 th percentile turbidity target of 25 NTU at their mouths, especially Moxee Drain, Granger Drain, Sulphur Creek, and Spring Creek.
- The efficacy of using TSS load targets for tributaries and drains where the 25 NTU target is not representative of total load reductions will be evaluated.
- Agreements between the State of Washington, Yakama Indian Nation, and the U.S. Environmental Protection Agency that sets load allocations for the Yakama Reservation, and management of basin water quality will be completed.

10 years (2007)

- The mouths of all tributaries and drains, and all points within all basin tributaries and drains will comply with the 90 th percentile turbidity target of 25 NTU.
- The 7 mg/L TSS target developed to meet the DDT chronic aquatic toxicity criterion will be re-evaluated using additional data and historical pesticide use analysis.
- Target controls and a strategy to meet the DDT human health criteria in fish and water will be developed.
- Yakima River main stem will comply with the turbidity target of not more than a 5 NTU increase between the confluence of the Yakima and Naches Rivers and the Van Geisan Road bridge at West Richland (RM 8.4).

15 years (2012)

- All tributaries and drains, and the Yakima River main stem will comply with the 1 ng/L DDT chronic aquatic toxicity criterion by the 7 mg/L TSS target or its modified form (see 10 year);
- A control strategy to meet DDT human health criteria using TSS or other targets will be established.

20 years (2017)

- The DDT human health criteria in fish and water will be met.

TSS reductions necessary to meet the turbidity TMDL targets were estimated from the 1994 and 1995 data. Main stem TSS concentrations in both years would have required reductions of approximately 50% to stay within the 5 NTU limit at Kiona. The main stem loading would be adequately reduced to meet the 5 NTU limit if project area and Yakama Reservation tributaries complied with the recommended 25 NTU target. The TSS load from project area tributaries and drains to the Yakima River would have been reduced by approximately 207 tons/day in 1995. The 25 NTU target will require the largest return drains to reduce TSS loads 13% to 93% in an irrigation season with normal water availability, like 1995. Under conditions of limited water availability like in 1994, some of these same return drains would have easily meet the target while others would still have needed reductions of 25% to 90%.

Based on the regression equation, the turbidity-related TMDL target of 56 mg/L TSS at mouths of drains could reduce t-DDT concentrations to 7 ng/L. That would reduce t-DDT loading to the Yakima River by more than 66%. The 7 mg/L TSS target for compliance with the 1 ng/L aquatic toxicity criterion for DDT will require substantial reductions of TSS loads in most tributaries --from 30% to 99%. However, model simulation results suggest the 1 ng/L DDT criterion might not be attained in the river, even if the TSS concentrations in the drains were reduced to the 7 mg/L TSS target. Background t-DDT residuals carried in the river from upstream or in resuspended sediment would become the dominant sources of t-DDT in the lower Yakima River. These inputs could continue to cause DDT concentrations to exceed the criterion. Instream and out-of-basin sources are more difficult to predict and control, and could likely prevent complete water quality compliance in the main stem.

The TSS to t-DDT regression developed from data collected to date shows a greater variability in the lower region of the regression where TSS concentrations are less than 70 mg/L. DDT data are lacking for the lower TSS concentration range. Therefore, as more DDT samples are collected from return drains and tributaries that approach compliance with the interim turbidity TMDL target of 25 NTU (56 mg/L TSS), the regression can be re-calculated.

The suspended sediment and turbidity reductions recommended in the TMDL evaluation provide direction to Ecology for planning, funding, and executing specific actions in priority subbasins. Ecology will hold public workshops in cooperation with conservation and agricultural outreach agencies to discuss all aspects of the TMDL with local growers, water purveyors, and other interested parties in the lower Yakima River basin. At that time, implementation plans and schedules for these recommendations (or alternatives that meet water quality standards, protect fish health and habitat, and protect designated uses) will be formulated.

Implementation of the TMDL will remove turbidity, DDT, DDE, and DDD from the list of contaminants impairing water quality in the lower Yakima River and several of its tributaries. Other pesticide and nutrient-caused impairments on the 303(d) list may be eliminated by implementing this TMDL. For example, future monitoring may show that concentrations of endosulphan, heptachlor, endrin and other chlorinated pesticides similar to DDT are reduced by measures set-up for suspended sediment and DDT removal.

The YIN and USEPA have similar Clean Water Act responsibilities on the Yakama Indian Reservation. They are developing plans, and are undertaking actions to address suspended sediment loads in drains and tributaries from the Yakama Reservation. Ecology, the Yakama Indian Nation, and the USEPA will continue to coordinate their efforts to improve water quality in the Yakima River. Some TSS load allocations in the lower Yakima River will need to be negotiated between these governments and agencies as part of the public process.

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Lower Yakima River Water Quality Project — *Update*

Introduction

The Yakima River drainage is one of the most important recreational, cultural, agricultural, fishery, and visually stunning resources in the state. But the Yakima River is seriously threatened by pollution. High suspended solids, turbidity, DDT and other pesticides, high temperatures, and other kinds of pollution have been documented for several decades in the lower Yakima. If these pollutants are not soon controlled, all or most of the benefits we now enjoy from the Yakima River will certainly be lost.

With the publication of a new report about the lower Yakima River, the Washington State Department of Ecology has reached an important milestone in a process to restore water quality in the lower Yakima River from the mouth of Naches River at the city of Yakima, downstream to the Columbia River. The report details the amount and sources of several pollutants in the lower Yakima and prescribes limits and a schedule for reducing those pollutants to return water quality in the Yakima to state standards.

Since an overwhelmingly high percentage of the pollution in the lower Yakima comes from erosion of soil from farms, many growers will need to make significant changes in irrigation practices and irrigation water management. Sediment from farmland, including pesticides that adhere to the sediment particles, must be reduced 75% to 95% in some of the major drains and tributaries to meet targets outlined in the Ecology report. Doing so will result in far-reaching water quality improvements in the Yakima basin.

Ecology is asking growers in the Yakima basin and other members of the community to work with us to identify the best and most cost-effective methods of reducing erosion of soil and runoff into the river. Numerous other local, state, federal and tribal agencies are working with Ecology to provide guidance and to help growers implement new, less polluting practices.

A muddy plume of irrigation return water enters the Yakima River at Granger Drain.

Facts about TMDLs

❖Surface waters can assimilate pollutants to some extent through a natural process of self-purification. The amount of pollutants that a body of water can assimilate without violating state water quality standards is called loading capacity. TMDLs are usually equal to a waterbody's loading capacity, with a safety margin to allow for error and impacts from unknown sources.

❖Loading capacities and TMDLs are based on water quality data. Ecology uses historical and current data to determine loading capacities and TMDLs. Mathematical modeling to simulate critical conditions of stream flow and pollutant loading is often used to determine a TMDL.

❖A TMDL can be developed for part of a body of water, like one section of a river, or for a watershed that includes numerous rivers, lakes, and streams.

❖The number and kinds of pollutants covered by a TMDL varies.

Targets and Goals

The new report is called *A Suspended Sediment and DDT Total Maximum Daily Load Evaluation Report for the Yakima River* (*TMDL Evaluation Report*). Although the title is a mouthful, the bottom line is less complicated. The *TMDL Evaluation Report* sets targets for amounts of sediment and pesticides in the river that must be met during the irrigation season. Two different targets were set: one for turbidity, or cloudiness, of water, and one for pesticides (DDT). Because we know that both DDT and turbidity have a direct mathematical correlation to total suspended solids (or TSS, the eroded particles suspended in water) in the lower Yakima, the targets are expressed in terms of reduced TSS. Attaining these target reductions is the next challenge in the process of meeting water quality standards in the Yakima River.

Background turbidity from the upper reaches of the river basin will be measured at Harrison Bridge, above Selah, and Nelson Bridge, one mile northwest of Yakima on the Naches River. Results will be compared to samples taken down stream, at the Kiona Bridge at Benton City. This will allow us to measure the effect of irrigation returns on turbidity in the mainstem of the lower Yakima. Targets to meet water quality standards require that turbidity will increase no more than 5NTU between Harrison Bridge and Kiona Bridge. (An NTU, or nephelometric turbidity unit, is a measurement of the light scattering ability of suspended particles in water.)

Since suspended solids from eroded agricultural soils carry attached DDT and other pesticides into the water, a target reduction of DDT in the river will be achieved by limiting suspended solids. The *TMDL Evaluation Report* identifies needed TSS reductions at various drain, tributary and mainstem sites in order to meet existing state water quality standards for rivers and lakes.

Washington Water Quality Standards

Standards for Washington's surface waters are found in Chapter 173-201A WAC, *Water Quality Standards for Surface Waters of the State of Washington. Water Quality Standards* has three main elements:

❖All waterbodies in the state are assigned to one of five waterbody classes. Classification is based on the expected beneficial uses of each waterbody.

❖An antidegradation policy, which states that existing beneficial uses of all waters of the state will be maintained.

❖Water quality criteria, which are estimated concentrations of pollutants above which harmful effects on aquatic life or human health are observed. Specific criteria are set to support the uses described for each class of waterbody.

Total Maximum Daily Load

Ecology is using a *Total Maximum Daily Load (TMDL)* process to address impaired water quality in the lower Yakima River. Total Maximum Daily Loads are estimates of the amount of specific pollutants that a waterbody can "safely" take up without threatening the beneficial uses of a waterbody.

The Total Maximum Daily Loads are used to protect water quality by setting a limit on the amount of specific pollutants that may be discharged to the river.

Total Maximum Daily Load Report

Ecology published the *TMDL Evaluation Report* in July, 1997. The report is based on data from both Phase I and Phase II of the project. The report:

❖provides an estimate of how much suspended sediment is currently being discharged to the lower Yakima River during the irrigation season;

❖details how total suspended solids measurements correlate to concentrations of DDT and turbidity;

❖provides an estimate of how much suspended sediment the Yakima River can take up and still meet state water quality standards for turbidity and DDT — the Total Maximum Daily Load; and

❖provides targets for reducing suspended sediments from drains and tributaries that are needed to meet water quality standards in the mainstem Yakima River.

State Water Quality Standards and the Lower Yakima

The Department of Ecology sets standards to protect the quality of lakes, rivers, and other surface waters in Washington. The standards identify the beneficial uses of each waterbody, such as use for domestic water supply, irrigation, recreation, navigation and fish habitat. The standards then specify criteria that must be met to protect those beneficial uses.

The lower Yakima River is classified as a Class A waterbody. Class A waters must meet or exceed the requirements for all or substantially all uses including domestic, industrial and agricultural water supply; stock watering; salmonid and other fish migration, rearing, spawning and harvesting; wildlife habitat; recreation; sport fishing; boating and esthetic enjoyment.

Due to pollution associated with suspended sediment, water quality in the Yakima is not meeting standards for Class A waters and the beneficial uses of the river are threatened. The sediment entering the Yakima River is primarily eroded soil carried to the river via irrigation return drains or tributaries affected by irrigation runoff. Other sources of the suspended solids pollution are sand and gravel mining, urban runoff, erosion from construction sites, road building, forestry practices and natural causes.

Suspended Solids are the Link to Other Yakima River Pollution

Suspended solids degrade water quality in many ways. Suspended particles impair fish and aquatic insect respiration. Particles can also settle and clog spawning gravel or suffocate fish eggs.

As bad as these effects are, however, the striking plumes of discolored water entering the Yakima River from irrigation return drains and tributaries are also a symptom of other problems. Less visible kinds of pollution are linked directly to the suspended sediments. The less visible problems include turbidity and pesticides.

Pesticides

Numerous pesticides in Yakima River water and bottom sediments pose a threat to both animals and people. The problem pesticides include DDT that enters the Yakima River attached to suspended soil particles.

Even though agricultural use of DDT was banned in 1972, DDT makes up the bulk of the pesticides sampled. That is because, unlike pesticides used today which break down relatively quickly, DDT takes a long time to break down in the environment. DDT attached to soil particles decades ago when it was commonly used. It remains there today along with other more recently applied pesticides.

Turbidity

The relationship between turbidity, or water clarity, and suspended solids is easy to imagine. Suspended matter in the water is the source of the cloudy, muddy-looking plumes that are so apparent where irrigation drains and some tributaries enter the clearer Yakima. Turbidity reduces light penetration and can interfere with natural productivity in the river. Turbidity also makes it more difficult for fish to move and find food.

Valuable top soil is eroded from a Yakima Valley hop field. The fine soil particles will move with the irrigation runoff becoming suspended and bottom sediment in the tributaries and the mainstem of the Yakima River.

How We Got Here

Phase I

The US Geological Survey, US Bureau of Reclamation, Yakama Indian Nation, Washington State Department of Ecology, and others have been sampling water quality in the lower Yakima River for several decades. Most of those studies were reviewed in the extensive *Yakima River Basin Water Quality Plan* prepared by the Yakima Valley Conference of Governments. Many of the studies reviewed in *the Yakima River Basin Water Quality Plan* clearly indicated that Washington's state water quality standards were not being met in the Lower Yakima.

Because studies showed that state water quality standards were not being met, the federal Clean Water Act required Ecology to list the lower Yakima River as an *impaired waterbody*. Once the lower Yakima was listed as an impaired waterbody the Clean Water Act further required Ecology to determine Total Maximum Daily Loads for that part of the river.

The first phase of the lower Yakima Total Maximum Daily Load process was completed in 1994. Ecology evaluated historical water quality data from many sources. In addition, Ecology increased its own sampling in the Yakima River and some tributaries to verify water quality problems and to more clearly identify sources of the pollutants found in the river.

Ecology's 1994 sampling confirmed that water quality standards were not being met. Ecology's sampling also reinforced conclusions in *the Yakima River Basin Water Quality Plan* that erosion from agricultural areas was the primary source of water pollution in the lower Yakima River.

Phase II

In 1995, Ecology further intensified its studies of pollution in the lower Yakima River. The 1995 studies helped to clarify how suspended solids pollution is related to DDT and turbidity in the Yakima River ecosystem.

The 1995 studies included Granger Drain and other Yakima River sub-basins that receive large volumes of irrigation return waters. *The Yakima River Basin Water Quality Plan* identified irrigation returns as the primary source of suspended solids and sediment-related pollution in the Yakima. According to the report, most of the sediment is eroded from farmland by rill, furrow and other irrigation practices and carried to the river via return drains and tributaries. Growers are being urged to convert to sprinkler and drip irrigation, where appropriate, and to eliminate tail water runoff and its resulting top soil erosion. Correctly managed, sprinkler and drip irrigation systems also can help conserve water and reduce the need for fertilizers. Other alternatives for better irrigation water management are also being explored.

— continued next page

How We Got Here (continued)

Phase II Study Data

Data from the Yakima River Phase II studies were used to determine the Yakima River's assimilative capacity, or Total Maximum Daily Load. The data also reinforced how agricultural water management and irrigation practices affect water quality in the Yakima River.

Continuing the Yakima River TMDL Process

The *TMDL Evaluation Report* sets the stage for those actions that must follow. Since the pollutants of concern in the lower Yakima River are primarily from agricultural runoff, Washington State University, local conservation districts, the Natural Resources Conservation Service and other agencies are already working, both alone and with Ecology, to help irrigators to convert to more environmentally sound irrigation practices.

How you can participate

Ecology wants the Yakima Valley community to lead in shaping the solutions and setting the schedules that will be used to reduce pollution in the lower Yakima River. Over the past two years, Ecology has provided opportunities for the Yakima Valley community to learn more about the water quality improvement process and to voice their interests and opinions.

Ecology is eager to continue that process by meeting with others to describe the lower Yakima water quality project, and discuss the quality of the water in the river. Speakers are available to address larger groups and staff are available to meet with small groups or individuals. Ecology is also helping to organize water quality projects for students and volunteers in the lower Yakima River Valley.

Ecology maintains a mailing list of people and groups interested in the lower Yakima project. Everyone on the mailing list receives informational publications and notices of upcoming public events related to the Yakima River TMDL project as they become available.

Simple tools, such as this Imhoff Cone, can be used by irrigators to demonstrate top soil loss from irrigated agricultural lands.

Who to Contact

Chris Coffin is Ecology's coordinator for the lower Yakima River TMDL project. Please call or write to Chris if you have questions or comments, would like to be placed on the project mailing list, or would like to make arrangements for a speaker.

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Section 4 -
Summary Implementation Plan

Section 4 - Summary Implementation Plan

LOWER YAKIMA RIVER SUSPENDED SEDIMENT TMDL

Summary Implementation Strategy

This TMDL, the Endangered Species Act and watershed planning activities in the basin have focused attention on the resources provided by the Yakima River, illustrated the interrelationships between the many uses of the watershed and have brought a broad and diverse collection of groups together to work on issues. Implementation of this nonpoint TMDL involves the participation of several of these organizations and agencies. Many projects currently underway or proposed by these groups relate directly to sediment reduction and improving watershed conditions. There is a high level of cooperation and communication between project participants and other interested groups. Several groups, such as the Yakima River Watershed Council, the Interagency Council, the Roza-Sunnyside Board of Joint Control Work Group and the Tri-County Water Resource Agency have formed within the basin to promote discussion, disseminate information, and provide comment to current and proposed projects and planning. All are working within the Yakima Watershed on water related issues. The Bureau of Reclamation, Yakama Indian Nation, local Conservation Districts, Washington State University Cooperative Extension, Natural Resource Conservation Service, local irrigation districts, Educational Service Districts and the Dept of Ecology all have ongoing projects within in the watershed aimed at improving the resource.

Three interrelated areas of irrigation water management are critical to successfully controlling sediment transport from Yakima Valley agricultural fields to the Yakima River: (1) **developing modern and efficient delivery systems** which will allow on-demand or near on-demand water delivery to the farm fields; (2) careful **on-farm management of irrigation water and the conversion of furrow irrigation systems to drip or sprinkler irrigation methods**; and (3) **management of sediment laden tail-water runoff** in agriculture return drains. In each of these areas there are practices that will aid in reducing erosion and sedimentation. In many cases, the same practices being implemented in Yakima Basin water conservation projects will provide sediment loading reductions as a co-benefit. Sediment reduction in the lower Yakima River is and will continue to be addressed in each of these three areas.

- **Water Delivery Modernization**

  YRBWEP

  The Congressionally authorized Title XII-Yakima River Basin Water Enhancement Project (YRBWEP) was implemented to achieve several specific goals including improving the reliability of water supply for irrigation, improving the efficiency of water delivery and use, and improving water quality and fish habitat. Many of the resources made available for this project are being directed to irrigation districts to develop modernization plans and the associated feasibility studies for delivery system upgrades. In some districts system modernization will include upgrading farm turnouts to allow water to be delivered to fields as needed to satisfy specific crop requirements, in an on-demand basis. On-demand water delivery facilitates or improves the functionality of drip and sprinkler systems which makes conversion to these methods more attractive to irrigators. Several of the irrigation districts within the TMDL project area, including Sunnyside and Roza Irrigation Districts, are participating in the YRBWEP process and are in the process of upgrading their delivery systems.

Roza Irrigation District Closed Conduit Project

The Roza Irrigation District is midway through a project to install closed conduit water delivery systems throughout the district. To date, approximately 28,000 acres, or 39% of the irrigated project area, has been converted to metered, pressurized pipe delivery. Conversion has been progressing at 1200 to 2000 acres per year and Roza has proposed to double that rate. Piped, pressurized systems will facilitate on farm conversion of furrow irrigated ground to more efficient methods and provide an opportunity for accurate measurement of water delivery. This project is scheduled to continue through the year 2010 and beyond.

Modernization Education

Many smaller irrigation districts throughout the TMDL project area and the region often lack staffing, budget or time to attend the modernization clinics and workshops necessary to stay informed on the changing techniques of water delivery. Major conferences are offered in distant locals such as Denver or Southern California making participation difficult. Problems and solutions associated with water delivery, water conservation and water quality often go unheard or unheeded because of the lack of ready technical assistance or knowledge of the issues. The Department of Ecology, the Bureau of Reclamation and the local Resource Conservation and Development office are collaborating on a project to provide delivery system modernization education to irrigation districts in the Central Washington region. This project will bring educators and consultants from the Irrigation Training and Research Center at California Polytechnic State University to the Yakima area. One or two day classes will be offered locally, on a periodic basis, to irrigation district personnel. This will not only avail state of the art information to the participants but it will create a point of information exchange between the districts. This project is funded for startup with the first class tentatively scheduled in October of 1998.

- **Water Management and Conversion of furrow to drip and sprinkler.**

As indicated in the TMDL "Evaluation Report", 1994 was a very lean water year. Water reductions were in effect for all of the prorated (junior water rights) water users within the Yakima Basin. Water was used conservatively and carefully managed throughout the prorated areas to prevent wasteful runoff and excessive deliveries. **During the 1994 irrigation season the major drains and tributaries targeted in this TMDL were nearly achieving the TMDL target turbidity levels.** Some agricultural lands had been taken out of production during this water shortage but those were primarily annual row crops normally irrigated using furrow irrigation. **This indicated that if irrigation water in the lower Yakima Valley were properly managed, using conservation practices, and furrow irrigated grounds were converted to non-erosive methods the 5 year TMDL turbidity targets could be met at the mouths of the tributaries.**

The conversion of furrow irrigated agricultural lands to sprinkler or drip will have the single largest effect on reducing agricultural sediment transport in the lower Yakima Basin. When properly managed, sprinkler and drip irrigation have little to no tail water runoff, thus eliminating most top soil erosion and the resulting suspended sediment in agricultural return drains. Drip irrigation has been found to be very adaptable to many of the crops which traditionally used furrow techniques and which have also been responsible for a high percentage of the sediment load. Research and the personal experience of local growers have shown increases in productivity and the ease of application of fertilizer and pesticides after converting to drip systems for certain crops. The quantity of fertilizer needed for some crops have been reduced by 50% when using fertigation techniques associated with drip irrigation. These benefits make conversion to drip and sprinkler very attractive to many growers. Several agencies and groups within the TMDL area have ongoing projects to promote and facilitate conversion of furrow irrigated lands. Funding and technical assistance are being made available to growers and educational opportunities dealing with water quality and water conservation issues are increasing in scope and frequency.

Moxee Drain Project

The North Yakima Conservation District (NYCD) is very active in the Moxee Drain sub-basin promoting and securing funding for the conversion of furrow to drip irrigation on hop fields. Because of the combination of frequent tillage and the traditional furrow irrigation techniques, hop fields have experienced high rates of erosion and caused excessive sediment loads in the tributaries and drains. Conversion of hop fields to drip will reduce sediment load delivery by 100% as tailwater runoff is eliminated. Of the 19,000 acres of irrigated lands in the Moxee Basin before 1993, hops (7400 acres) and grapes (175 acres) comprised essentially all of the furrow irrigated lands. Within the last 5 years, since the NYCD has begun the Moxee Drain Project, approximately 50% of all of the acreage originally under furrow irrigation has been converted to drip or sprinkler. Another 23% of the furrow irrigated lands have been committed for conversion by landowners as cost share funds become available. At current and projected funding levels NYCD predicts that 90+% of the acreage originally under furrow will be following BMP irrigation methods (sprinkler or drip) in the next 5 years. Additional cost share funding will increase the rate of this change. As an important component of the implementation of this TMDL, Ecology will support the NYCD in the completion of this project.(see Appendix 1, Moxee Drain Project)

Monitoring of Moxee Drain by NYCD, ongoing since 1994, has shown a reduction in sediment levels (see Appendix 2, Moxee Drain report). It is fully expected that sediment loads will continue to decrease as more lands are converted to drip, buffer zones along drains are established and the Roza-SVID Board of Joint Control begins enforcement of new tail-water return policies

Granger Drain

Granger Drain has been the subject of intensive study and sediment improvement projects since 1991. The South Yakima Conservation District, Natural Resource Conservation Service (NRCS) and Washington State University Cooperative Extension have been conducting irrigation workshops, water quality monitoring, developing irrigation demonstration projects and assisting growers in converting irrigated lands from furrow to drip. In the last year within this drainage, over 1000 acres of formerly furrow irrigated lands have been converted to drip and sprinkler. The number of converted acres continues to rise and in-drain sediment loads continue to decrease.(see Appendix 3, Granger Drain HUA; also see BOJC Policy Statement at Appendix 7). Ecology considers this sub-basin critical in the implementation of this TMDL and will continue to support and promote the activities in this area necessary to reduce sediment loads.

Snipes/Spring Creeks

The Benton Conservation District is working within the Spring Creek and Snipes Creek drainages on a project to reduce sediment and nutrient transport to the Yakima River (also see BOJC Policy Statement at Appendix 7). A primary emphasis of the BCD project is to assist growers in the conversion of furrow irrigated ground to drip. Also within the scope of this effort are irrigator workshops, stream restoration projects and water quality monitoring. Ecology is supporting this project and will continue to assist with funding and resources when possible. (see Appendix 5, Spring Creek Water Quality and GIS Mapping Project)

Sulphur Creek

South Yakima Conservation District and the NRCS are active in the Sulphur Creek sub-basin developing demonstration projects to show the benefits and feasibility of alternative methods of irrigation to furrow systems. They are also distributing cost share money and offering technical assistance in this area to growers converting from furrow systems. Similar to Granger Drain and Snipes/Spring Creeks, the BOJC is applying their new improvement policies to Sulphur Creek.

Wide Hollow Creek

This drainage was listed for DDT and included on the 1996 303(d) list due to excursions beyond criteria found during the USGS NAWQA study in the late 1980s. At that time the lands drained by Wide Hollow Creek were of mixed uses including rangeland, irrigated agricultural, suburban, urban and light industrial. Fruit orchards, pastures and row crops were the primary agricultural uses through the mid '70s and into the '80s, with furrow irrigation employed as a common but diminishing practice. In the last two decades this area has experienced intensive growth and the agricultural uses have increasingly given way to urban and suburban development throughout the drainage. Row crop acreage has been reduced to minimal numbers and most of the remaining orchards and pasture lands now use sprinkler irrigation as their primary technique. These changes are expected to reduce suspended sediment and DDT transport in the waterbody. Because this waterbody flows through residential areas and past several schools and parks, there is growing interest in developing volunteer monitoring projects in the drainage. Ecology will assist in promoting and facilitating these projects. Also, the North Yakima Conservation District is developing plans for riparian restoration projects within the watershed and the Educational Service District 105 is working with local schools to develop the waterbody as a salmon spawning stream. These are all positive signs for future improvement in water quality. This waterbody will be included in future monitoring to confirm compliance with TMDL goals.

Polyacrylamide

As an interim solution to on-farm erosion and the associated suspended sediment load from furrow irrigated lands the local Conservation Districts in the TMDL project area and Washington State University Cooperative Extension have begun a campaign to promote the use of the water additive, polyacrylamide. This polymer, added to irrigation water at the head of the furrow, has been shown to dramatically decrease the amount of soil moved off the farm during irrigation. Reduction of 90 to 95% of non-treated sediment loads have been observed. While this fix is seen as temporary it is an important tool in the reduction of sediment while growers convert irrigation systems to drip and sprinkler.(see Appendix 4, Polyacrylamide)

Roza-Sunnyside Board of Joint Control

A significant contribution to the implementation of this TMDL comes from the Roza-Sunnyside Valley Irrigation District Board of Joint Control (BOJC). These two irrigation districts, united by the formation of a joint board in 1996, are the primary water purveyors in the TMDL project area. This year the BOJC has taken a major step in addressing water quality in the lower Yakima Basin by adopting new policies which will change the way tail water and agricultural drains are managed. Changes include irrigator requirements to pipe field runoff discharges to drains and tributaries; meet acceptable water quality parameters for waters leaving fields; obtain permits to discharge to irrigation project waterways; maintain buffer zones along waterways including fencing out livestock and no-till zones; and participate in water user awareness programs. The BOJC has accepted the TMDL allocated turbidity levels of 25 NTU as the maximum allowable for return flows to drains and canals within the irrigation project. **This includes Granger Drain, Snipes/Spring Creeks, and Sulphur Creek.** Growers will be given 1 to 2 seasons to adapt to the new policy changes and formulate farm compliance plans while being offered education, technical assistance and funding incentives to convert to drip or sprinkler systems or construct water treatment structures. After that time the BOJC will begin enforcement of the policies (See Appendix 7). Ecology will develop referral procedures with BOJC to insure that all out of compliance irrigators are reached. Ecology will continue to support and encourage the efforts of the BOJC.

- **Management of sediment in tail water and drains**

Sedimentation Basins

The BOJC constructed 2 experimental sedimentation basins in 1997. The goal of the basins is to remove farm soil from drains before the water is returned to delivery canals or the Yakima River. While one of these original basins was found to be undersized and the other poorly designed, pre and post monitoring showed they were trapping 80% of the sediment load moving down the drain. The larger of these 2 basins removed an average of 6 tons of sediment per day from the drain system. Two new, larger sedimentation basins have been constructed in 1998 to replace the originals. These will be monitored through the irrigation season and if found to be effective others basin sites will be considered. These basins are considered an interim tool until on-farm fixes are implemented. They also serve as an effective demonstration to irrigators on the severity of the sediment problem. Ecology is helping fund the construction of these basins.

In 1997, the BOJC initiated a water quality monitoring project, including hiring a water quality specialist and technician, building a water lab, and designing an ambitious sampling and monitoring program. This project will be used to monitor and track reductions in sediment loads as implementation of management practices proceed and as necessary to identify pollution sources for referral or corrective action. Ecology will collaborate on monitoring projects with all the involved agencies, providing and sharing resources as available.(see Appendix 8, BOJC WQ Monitoring Plan)

- **Further incentives**

Recent legislation, HB 1557, provides tax exemptions for property improvements used for water quantity or water improvements. By working with Conservation Districts and installing approved, less polluting irrigation systems, the corresponding increase in property values will not increase taxation values. This is seen as another incentive, encouraging growers to move to drip irrigation systems.

- **Other projects**

Ecology has initiated the scoping and funding process to begin an assessment of the upper Yakima Watershed, specifically in Kittitas County agricultural areas, in preparation for nonpoint TMDL Evaluations on 303(d) listed waters. This assessment will look specifically at suspended sediment, turbidity and pesticides. The project is scheduled to begin in the late summer of 1998.

The US Forest Service is formulating a project to address 303(d) listed waterbodies on the National Forest. These listings deal primarily with flow and temperature issues but other pollutants will be tied in where they occur. Ecology has been meeting with the USFS to coordinate activities.

Ecology has initiated a Yakima Watershed Agriculture Water Quality Education Program that will provide technical assistance and grower referrals to agencies involved in BMP implementation. The Dept. of Ecology will increase its presence in the project area following up complaints and making referrals to Conservation Districts and irrigation districts.

All of the above listed programs, projects and incentives will be employed to implement this TMDL. Progress toward the TMDL targets, as out lined in the TMDL "Evaluation Report", will be monitored and adjustments in implementation practices will be made as necessary. A "Detailed Implementation Plan", as required by the USEPA/Ecology MOA will be developed in the next year and submitted to EPA as part of this TMDL submittal.

Schedule for monitoring and evaluation of TMDL effectiveness. Ecology will begin or facilitate full scale monitoring in the year 2000 as described in the enclosed Monitoring Strategy. Monitoring data collected by local entities will also be used as a supplement. Current ongoing monitoring by these local entities now provides data for annual trend analyses of changes in suspended sediment loads in all of the major drainages. An annual trend analysis will be continued to track achievement of the above stated targets. Based on annual results, adaptive management strategies will be developed as needed.

Section 5 - Monitoring Strategy

Section 5 - Monitoring Strategy

LOWER YAKIMA RIVER SUSPENDED SEDIMENT TMDL

Monitoring Strategy

Monitoring is a required component of the TMDL process. Monitoring allows direct evidence of target compliance or control measure effectiveness. It also can provide the data necessary to modify or adjust targets in specific situations. The TMDL schedule contains elements requiring monitoring for both compliance, and target re-evaluation and development

Turbidity and TSS monitoring will be necessary to check progress with the turbidity criterion compliance along the main stem Yakima River. Compliance monitoring requires establishing a background turbidity site, and at least one compliance check point at the Kiona gage at Benton City (RM 29.9). Ecology proposes establishment of three more sites to ensure turbidity compliance within the reach: 1) the abandoned Parker railroad trestle below the Sunnyside Dam (RM 103.7); 2) a site between the mouths of Granger Drain and Toppenish Creek (approximately RM 81); and 3) Euclid bridge (RM 55). Any mainstem monitoring at sites on or bordering the Yakama Reservation will be carried on in cooperation with the Yakama Nation. Full scale monitoring as outlined in this plan will be initiated in the two years preceding the five-year target date. Until that time, ambient monitoring by Ecology on the mainstem will proceed on a monthly basis. Background turbidity and TSS will be measured at 2 sites, at Harrison Bridge on the Yakima River (RM 121.2) and at Ramblers Park Bridge on the Naches River (RM 3.7). From data gathered at these sites the theoretical mixed TSS and turbidity will be calculated. Monthly ambient monitoring has already been initiated at these sites.

The TMDL monitoring and evaluation concluded that most TSS effects from irrigated agriculture are observed by Yakima mainstem RM 29.9, the Kiona gage at Benton City. However, West Richland at Van Giesen bridge (RM 8.4) could be an alternative compliance site since it would place controls on the entire lower main stem except for the Kennewick Irrigation District return via the Amon Wasteway (RM 2.1). Sampling will be expanded or moved to West Richland as progress is made upstream of Benton City. Data will be used to ensure that water quality improvements are transferred downstream by the year 2007. Amon Wasteway will be evaluated and will be monitored as part of the assessment. If it is considered a significant TSS input, it will be placed under the same reduction schedule as the returns and tributaries upstream.

Drains and tributaries will be monitored at locations used for the TMDL evaluation unless more appropriate sites are chosen. To the extent possible, tributaries and drains will be sampled for TSS and turbidity at the same time as main stem sites. Continuous discharge monitoring stations will be established at the water quality monitoring sites or instantaneous discharge measurements will be obtained at the time samples are collected.

Monitoring will be conducted every two weeks during the irrigation season (*i.e.*, usually between March 20 and October 20). This will normally provide 15 data points per site to calculate 90th percentile values for control and compliance checks. Sampling order should follow upstream to downstream. Sample timing will be roughly synchronized with discrete blocks of water by evaluating gage data or calculating river time of travel (Hubbard *et al.*, 1982).

A depth integrating sampler will be employed for sampling at main stem sites at three or more points along the cross-section. Sulphur Creek, Spring Creek, Granger Drain and Moxee Drain will also be sampled at multiple points along the site cross-section. The smaller drains require only one depth integrated grab sample. A ratio turbidimeter will be used to continue to check the TSS to turbidity relationship.

Pesticide samples will be collected in conjunction with turbidity and TSS samples, especially in the priority drains and tributaries as turbidity and TSS levels are reduced. Main stem sample collection will continue as well. Historically, the peak concentrations of DDT and other organochlorine pesticides occur in June and July, so samples will be collected at that time. Analytical quantification limits must be at or below the chronic aquatic life criteria for the DDT metabolites and dieldrin.

Monitoring of organophosphorus pesticides detected in the TMDL "Evaluation Report" will continue to document any further water quality problems related to their use. Sampling periods will occur during periods of application to crops.

Of the several drainages in the Lower Yakima Basin within the jurisdiction of the State of Washington, four of these, Moxee Drain, Granger Drain, Sulphur Creek and Snipes/Spring Creek are major contributors of suspended sediment to the lower Yakima River. At several sites in each of these drainages one or more public entities, other than Ecology, is conducting regular water quality monitoring for a number of parameters, including suspended solids and turbidity. North Yakima, South Yakima and Benton Conservation Districts and the Roza/Sunnyside Valley Irrigation District Joint Board of Control are conducting monitoring, currently funded under local support, Centennial Clean Water Fund and 319 Clean Water Fund grants. Monitoring resources need to be coordinated so that data collected by other agencies and groups are useful to the TMDL effort and vice versa. Ecology will support efforts to coordinate monitoring, and be a key participant in developing data quality standards, data storage and exchanges, geographical information system (GIS) coverages, and cooperative monitoring agreements.

The North Yakima Conservation District includes the areas drained by Moxee Drain. NYCD has been sampling for turbidity and sediment at several sites in the drain since 1994. This monitoring project is in conjunction with the NYCD's ongoing project to educate growers and facilitate the conversion of furrow irrigated lands to drip or sprinkler. The monitoring program is funded through a Centennial Clean Water Grant and is budgeted through the irrigation season of 1999. (see Appendix 1, Moxee Watershed Plan and Assessment)

South Yakima Conservation District is conducting a sampling and monitoring program at 18 sites in the Sulphur Creek Drainage and 2 additional sites in the Giffin Lake Drainage. This project has been underway since 1997 and is funded through December 1999 under a 319 Clean Water Fund grant. The purpose of the project is to monitor reductions in sediment and nutrient transport in the return drains as irrigation conversion progresses. SYCD is facilitating demonstration projects in this drainage which emphasize alternatives to furrow irrigation. Partnering with SYCD, the Natural Resource Conservation Service is providing cost share money as incentives for farmers to switch from furrow irrigation techniques.

Benton Conservation District is continuing its monitoring program at 6 sites on Spring and Snipes Creeks for several parameters, including suspended sediment and turbidity. This monitoring is the continuation of a project originally funded and undertaken to track sediment loads associated with furrow irrigation and measure improvements attributable to changes in irrigation practices.

Roza-SVID Board Joint of Control (BOJC) has undertaken a monitoring program in the Granger Drain, Sulphur Creek and Spring/Snipes Creek drainages. Twenty-seven sites are being monitored on a biweekly or monthly basis for several parameters including flow, turbidity and TSS. This is an ongoing project initiated in 1997. Also, BOJC is working with the Bureau of Reclamation and Ecology to establish a permanent monitoring site with building and instrumentation near the mouth of Granger Drain. When completed, this will provide continual monitoring and data collection for a number of parameters. (See Appendix 7, BOJC)

Section 6 - Public Comments

Section 6 - Public Comments

Roza-Sunnyside Board of Joint Control
P.O. Box 810 ■ Sunnyside, WA 98944 ■ (509) 837-5141 ■ FAX: (509) 837-8541

April 20, 1998

Chris Coffin
TMDL Coordinator
Department of Ecology
15 West Yakima Ave., Suite 200
Yakima, WA 98902

Dear Mr. Coffin:

The Roza-Sunnyside Board of Joint Control (Board) requests your consideration of the comments listed below relative to the Department of Ecology (Ecology) draft report No. 97,321. A Suspended Sediment and DDT Total Maximum Daily Load Evaluation Report for the Yakima River.

We first compliment Ecology and its authors on preparing a report that is based on the use of good data sets and analyses techniques. For example, the report has sections on quality assurance and quality control stating its quality assurance goals and the assessment of differences between integrated and grab samples. The authors also made good use of historical data in an effective manner.

Specific technical comments and suggestions that we believe could strengthen the report, remove uncertainties, and allow for some additional scenarios are as follows:

1. Page 77, 5 year (2002), first bullet – We suggest the following alternate wording: "Yakima River main stem will comply with the turbidity target of not more than a 5 NTU increase for the 90th percentile between the confluence of the Yakima and Naches Rivers (RM 116.3) and the Kiona gage at Benton City (RM 30)." This addition is consistent with your discussion of the turbidity criterion on pages 65 and 66 of the draft report. We also note your discussion is with reference to the "irrigation season". Is it intended a different criterion applies for the non-irrigation season?
2. Page 78, 5 year (2002), second bullet – The Board has no specific recommendation to replace the percentile value, now set at 90. However, we suggest that when we analyze the data for 2002, we may wish to amend this value and/or this method of setting a target, such as "the discharge weighted mean for ____ percentile of the time shall not exceed 25 NTU".
3. Page 78, 5 year (2002), third bullet – The Board suggest adding to the current wording to read as follows: "The efficacy of using TSS load targets for

tributaries and drains where the 25 NTU target is not representative of total load reductions will be evaluated, such as is likely to occur where there are significant reductions in flow due to changing irrigation methods." It is the goal of the Board to minimize runoff from each farm by encouraging the use of drip and sprinkler irrigation methods and to consider reuse of return flow. The use of reregulating reservoirs along the main canals will also reduce the use of these drainage ways to return operational spill to the Yakima River. These efforts will likely result in much reduced flows from drains into the Yakima River. These efforts have two very significant benefits to the TMDL targets and aquatic organisms in the basin.

a) Less water is diverted for irrigation, and
b) With less return flow the load of TSS and DDT will be significantly reduced. As we understand the Clean Water Act and the TMDL process, if the loads of TSS or DDT were met and the turbidity levels were exceeded, this would be preferred to meeting the turbidity target but exceeding the TSS or DDT load target.

4. Page 78, 10 years (2007), first bullet – The Board wonders why this target is desirable if concentrations are being met where the water enters the Yakima River main stem.
    a) The enforcement of the 25 NTU at all points within a sub-basin removes certain options of encouraging water reuse available to the Board and its member districts. It would seem that if the system can meet its goal, the boards should be allowed as much management flexibility as possible.

5. Page 78, 10 years (2007), second bullet – The Board agrees that the 7 mg/L TSS target needs to be evaluated. This is especially true because background TSS measured values exceeded the proposed targets for the Kiona gage when 1995 conditions were 9 and 14 NTU at background and Kiona respectively (18 and 30 mg/L TSS).

6. The monitoring section of the report, pages 79 and 80, is well done. What is missing is a specific, recommended program and implementation timeline. If other agencies collecting water-quality data are expected to work with Ecology in meeting the stated TMDL targets, they need to have, at a minimum, the turbidity and TSS values associated with background and the Kiona gage now. Having these data would allow Ecology and agencies assessing their data to determine if incremental steps are likely to result in meeting the stated targets. Alternatively, if data is not collected until 2002 and assessed in 2003, it will be 2004 (half way to 2007) before we find out how we are doing.

In addition to the above technical comments, the following general observations are provided:

1. The title of your report suggests the entire Yakima River system is addressed. The text is limited to the river basin below the confluence of the Yakima and Naches Rivers. The report title should be revised to conform with Ecology's intent with respect to basin planning (see further comments below regarding Ecology – EPA Memorandum of Agreement).

2. The relationships of the recommended target TMDLs to the states' overall water quality management program for the lower Yakima River Basin should be described in sufficient detail to enable implementing agencies to understand the "big picture". It is recognized that the Yakima TMDL studies preceded the October 29, 1997 Memorandum of Agreement between Ecology and EPA regarding implementation of Section 303(d) of the Federal Clean Water Act. However, this Agreement, which is now operative, sets forth a uniform, statewide planning process to be followed in developing water quality management plans. In general terms this process appears to be:

- A watershed approach to water quality management is to be followed; the state is divided into 23 Water Quality Management Areas (WQMA); the Upper and Lower Yakima WQMAs represent two of the 23 geographical areas.
- Point and nonpoint source problems and needs are to be addressed by WQMA on a cyclical, sequential basis; developing and implementing TMDLs is only one aspect of a WQMA program.
- A five step/five year program which includes the following activities is to be conducted in each WQMA: Year 1 – Scoping; Year 2 and 3 – Data Collection and Analysis; Year 4 – Develop WQMA Plan of Action, and Year 5 – Implementation.
- The Agreement schedule indicates the products of Year 4 and Year 5 activities are to be submitted to EPA for approval in Year 5. Provision is made that TMDLs may be completed on a basis other than a 5-Year watershed cycle.
- The final WQMA Plan of Action must include (1) a TMDL strategy, (2) a waste discharge permit strategy, and (3) a nonpoint source strategy.
- In Year 6, Ecology is to initiate a repeat of the 5-Year cycle.

The draft lower Yakima River TMDL report was issued July 1997 and prior to the Ecology – EPA Agreement. Discussion beginning on page 77 (TMDL Priorities and Schedule) summarizes 5, 10, 15 and 20-year targets/goals. The final TMDL report should clarify whether a WQMA plan is being prepared for the lower Yakima River basin in response to the Ecology – EPA Agreement and, if so, the timing for development of the Plan of Action, EPA approval and the implementation schedule for TMDL activities. The Board has adopted policies and initiated activities on the assumption the TMDL targets will be adopted as Ecology – EPA water quality criteria within the current year (1998).

Your consideration of the above comments will be appreciated as you prepare the final report. Should you have questions, please advise. Also, the Board would welcome an Ecology presentation of the adopted program and implementation strategy following issuance of the final TMDL report.

Sincerely,

James W. Trull

James W. Trull
Treasurer

(9804DOE-gf)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, Washington 98101

APR 10 1998

Reply To
Attn Of: OW-134

OPTIONAL FORM 99 (7-90)

FAX TRANSMITTAL	# of pages ► 4
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NSN 7540-01-317-7368 5099-101 GENERAL SERVICES ADMINISTRATION

Chris Coffin, TMDL Coordinator
Department of Ecology
15 W. Yakima Avenue, #200
Yakima, WA 98902

Dear Mr. Coffin:

The U.S. Environmental Protection Agency, Region 10 (EPA) appreciated working with the Washington Department of Ecology (Ecology) and the Yakama Indian Nation in developing the Lower Yakima River Study-A Suspended Sediment and DDT Total Maximum Daily Load Evaluation Report for the Yakima River, July 1997 (study). We believe that it is through such efforts that governments and regulatory agencies can work together to achieve common clean water goals. We also concur with the "jurisdictional language" included on the bottom of page 7 and the top of page 8. It was the intent of this collaborative effort to work together to address water quality concerns in the Lower Yakima Basin, not to establish jurisdictional claims. EPA will continue working with the Yakama Indian Nation to address these pollutants originating from waters within the reservation.

EPA also commends Ecology's ongoing efforts to work with irrigators and others in the basin to implement controls to address turbidity, total suspended sediments/solids and t-DDT in the Lower Yakima River and its tributaries.

Relative to the referenced study and a subsequent TMDL, we offer the following comments:

1. It was noted in the study that the turbidity standard in the Lower Yakima River had to be met at all points in the river, not just at Kiona. However, project modeling showed that under certain simulations, the 25 NTU at the mouth of tributaries would not achieve the 5 NTU over background. Would you please clarify what may be an inconsistency in the study?

2. The TSS modeling (p.70) uses the 90th percentile TSS concentrations for the two drains that were below the 56 mg/l target. The fourth sentence in the second paragraph on page 71 states that these drains will be expected to remain below the target. This is consistent with both the modeling and the State's anti-degradation policy. However, the sentence is buried in the document and this expectation is not clearly displayed elsewhere. To clearly define the levels that cannot be exceeded in order. We recommend that the numerical targets for these drains be clearly specified in the final TMDL submittal.

3. A "margin of safety" (MOS) is a required element of any TMDL. Ecology implicity applied MOSs at various points in the study but does not clearly define which MOSs were used and when they were applied. EPA requests that Ecology add a paragraph to the study or the accompanying TMDL fact sheet that defines how all of the MOSs were applied.

4. In the second paragraph on page 3 of the Introduction, Ecology indicates that "Implementation of the TMDL will remove turbidity, DDT, DDE and DDD from the list of contaminants impairing water quality in the Lower Yakima River and several of its tributaries." (Note: total DDT=t-DDT=DDT+DDD). Table 2 on page 10 identifies the specific §1996 303(d) list of contaminants for each water body in the Lower Yakima Basin. With the exception of t-DDT for the Yakima River, EPA agrees that the TMDL will address TSS/turbidity and t-DDT for aquatic life as defined in Table 2. Because modeled simulations show that the chronic aquatic toxicity criterion might not be attained in the Yakima River at the proposed reduced TSS concentration loadings from the tributaries and return drains (see page 74), EPA's position is that the Yakima River remain listed for t-DDT for aquatic life. If future monitoring and subsequent model simulations show that control measures will result in meeting the t-DDT criterion for aquatic life in the mainstemYakima River, it need not be listed for this parameter and beneficial uses.

It is EPA's position that the Yakima River segments and applicable tributaries remain on the State's §303(d) list for t-DDT for human health protection. Although this TMDL is the first step in addressing t-DDT for all beneficial uses, too many uncertainties exist at this point in time for the assessment to conclude that the t-DDT criterion can be achieved.

It should be noted that the TMDL also addresses TSS/trurbidity in the Yakima River, water body segments WA-37-1020, and WA-37-1040, as well as almost all, if not all of the tributaries included in the study area. These water bodies are clearly impacted, if not impaired by TSS/turbidity. For these water bodies, EPA would consider the TMDL as preventative in nature.

In the following table we have identified the specific 1996 §303(d) listed water bodies and respective pollutants that we believe have been addressed by the Lower Yakima River TMDL Study.

WATER BODY SEGMENT NUMBER	NAME	1996 §303(d) LISTED PARAMETER ADDRESSED BY THE TMDL STUDY
WA-37-1010	Yakima River from Mouth to Toppenish Creek	turbidity
WA-37-1012	Snipes Creek	DDT*
WA-37-1014	Spring Creek	DDT*
WA-37-1024	Granger Drain	DDT*, 4-4' DDE*, 4-4' DDD*
WA-37-1030	Sulphur Creek	DDT*, 4-4' DDE*, 4-4' DDD*
WA-37-1047	Wide Hollow Creek	DDT*, 4-4' DDE*, 4-4' DDD*
WA-37-1048	Moxee Drain	DDT*, 4-4' DDE*, 4-4' DDD*

* establishes TMDL at criterion for aquatic life protection

5. EPA recommends that Ecology summarize, in its TMDL fact sheet, its reasons for using TSS as a surrogate measure for turbidity and t-DDT. Ecology should also provide a statement explaining the following: (1) how the diminutive contributions from point sources; (i.e., the waste load allocations) will be maintained at the current discharge concentrations, (2) that the load allocations for the nonpoint sources are applied to all pollutant-contributing agriculture sources within each tributary, and (3) that load allocations are set to achieve the turbidity targets at the mouth of each tributary.

6. Based on the October 29, 1997, MOA between the Ecology and EPA regarding "The Implementation of § 303(d) of the Federal Clean Water Act" a "Summary Implementation Plan" must be included as part of the TMDL submittal package. EPA recommends that the summary implementation and subsequent implementation efforts focus on those tributaries/return drains contributing the greatest pollutant loading; (i.e., Granger and Moxee drains). EPA also suggests that the summary implementation plan include data sources which indicate that the pollution reduction targets will be achieved using conventional soil and water conservation practices for irrigated agriculture. See page 67.

7. Throughout the study, it appears that Ecology uses the terms TSS, total suspended sediments, suspended sediments and total suspended solids interchangeably. Please clarify if this were Ecology's intention. If not, please define the differences in the terms.

Again, we wish to express our appreciation to Ecology for the effort that has gone into this study. Should you have questions regarding these comments, please contact Alan Henning at (206) 553-8293.

Sincerely,

Tim Ha

Timothy Hamlin, Manager
Water Quality Unit

cc: Joe Joy
Moses Squeochs

March 6, 98

Dear Mr. Coffin,

I'm a landowner, (11 acres) bordering the Naches River across from Gleed. I keep several horses on my land it is a non irrigated parcel. I keep my horses away from the river with fences. I've noticed what I think are very destructive patterns along the Yakima River near Granger where they have a public park. Just below the bridge there is a cattle ranch the fences go into the river, cattle are allowed to go into the river. This destroys the riparian ~~area~~ zone and put fecal material into the river. How can this be legal? I beleive this is not uncommon. Also I feel there are wasteful irrigation practices along the Naches and Yakima River.

Thank You for the opportunity to comment

Marco Polo

[illegible]

540 Basalt
Naches WA 98937

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PM
19 MAR
1998

TMDL Coordinator
WA Dept of Ecology
15 W. Yakima Ave #200
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RECEIVED
1998
DEPARTMENT OF ECOLOGY
CENTRAL REGION OFFICE

American Rivers

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APR 20 1998
DEPARTMENT OF ECOLOGY
CENTRAL REGION OFFICE

Received faxed copy on 4/10/98
C. Coffin

April 9, 1998

Chris Coffin, Lower Yakima River TMDL Coordinator
Washington Department of Ecology
Central Regional Office
15 West Yakima Avenue, Suite 200
Yakima, WA 98902

Re: Proposed TMDL for the Lower Yakima River

Dear Mr. Coffin:

American Rivers is a national not-for-profit membership organization founded in 1973, with its principle place of business in Washington, D.C., and regional offices in Seattle, Washington, and Phoenix, Arizona. Its mission is to protect and restore North American rivers and their associated watersheds and ecosystems, and to foster a stewardship ethic in the public for river conservation.

The Northwest office of American Rivers, working in the states of Washington, Oregon, and Idaho, houses the organization's Endangered Salmon Project. The focus of its efforts on behalf of endangered Northwest salmon is the improvement of in-river conditions for salmon spawning, rearing and migration. The disastrous effects of dams, and water diversions and withdrawals on salmon life cycle needs are at the center of its work.

A. American Rivers Has a Special Interest in the Yakima Basin

American Rivers has a special interest in the Yakima River Basin. It has been included on the organization's annual list of the 10 Most Endangered Rivers in North America twice in the past several years because it exemplifies the water quality and allocation problems of many rivers in the arid West.

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By my representation, American Rivers serves as a member of the Board of the Yakima River Watershed Council and of its Executive Committee. The Council is a group of business, agricultural, government, Tribal, and environmental interests whose mission is to collaborate on a watershed plan for the Yakima River Basin. We have contributed to the Council's drafting of a consensus watershed plan, which is still taking shape.

As Co-Director of American Rivers' Northwest Regional office, I was appointed by the Secretary of the Interior to represent environmental interests on the Secretary's Conservation Advisory Group (CAG). The CAG was created by the Congress in Title XII of P.L. 103-434 (October 31, 1994), the Yakima River Basin Water Enhancement Project (hereinafter YRBWEP), to advise the Secretary on implementation of YRBWEP. *Id.* at §1203(c). The purpose of the legislation is to improve fish and wildlife habitat, water quality, wetlands, instream flows, and the reliability of water supply for irrigation through water conservation projects and voluntary water transfers in the Yakima Basin. *Id.* at §1201.

B. Summary of Efforts to Restore Yakima River Fish and Flows

And there is no question that it needs improvement. The Yakima's wild coho, summer chinook and sockeye salmon are now extinct, and the surviving fish hover at between 1% and 2% of their original numbers.[1] Yakima steelhead are proposed for listing under the Endangered Species Act,[2] and agricultural development has literally poisoned the fish that remain, threatening their human and animal predators. The Yakima is found on the Clean Water Act's list of "water quality impaired" water bodies for an array of pollutants;[3] and the U.S. Geological Survey reports that Yakima River fish

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[1] H.R. Rep. No. 644, 103rd Cong., 2d Sess. 14 (1994).
[2] *Id.*
[3] Wash. Department of Ecology, *1994 Section 303(d) List* 48-51 (May 9, 1994)(e.g., DDT, 4,4-DDE, PCB-1254, PCB-1260, Dieldrin, Endosulfan, Malathion, Temperature, Dissolved Oxygen, Chlorine, Ammonia-N), and again in 1996 (e.g., temperature, pH, fecal coliform, turbidity, ammonia-N, DDT, 4,4'-DDE, 4,4'-DDD, PCB-1254, PCB-1260, Endosulfan, Heptachlor, Heptachlor Expoxide, Parathion, Endrin, Aldrin, Dieldrin (5/31/96); and 1998 (draft)(e.g., all of the above and copper)

have among the highest concentrations of DDT in the Nation, commonly exceeding toxicity standards for aquatic life and fish predators by as much as 10 times EPA-recommended levels.[4] Soil eroded from agricultural land is the major source of these pollutants, particularly in the lower 110 miles of the river where farming is intensive and mainstream flow is dominated by agricultural runoff.[5]

Several forces converged in the late 1970s to set the stage for recovering the Yakima's once bountiful anadromous fish resource. In 1979, the Congress created the Yakima River Basin Water Enhancement Project (YRBWEP) to study water needs of the Basin.[6] Congress enacted the Northwest Power Planning and Conservation Act a year later, creating the Northwest Power Planning Council and its energy and fish planning authorities.[7] The Council targeted the Yakima River Basin for major restoration efforts,[8] and at least $70 million in public funds are going to construct fish ladders and screens at irrigation diversion dams to implement Phase I of the YRBWEP, authorized by the Congress in 1984.[9]

Phase II of YRBWEP, enacted in 1994,[10] and which created the CAG, authorizes some $150 million for acquisition of water rights, water conservation projects, and other strategies to improve river flows for anadromous fish and water quality.[11] And in 1996, the Bonneville Power Administration began construction of a multi-million dollar fish supplementation facility to boost salmon production in the Yakima.[12]

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[4] *U.S. Geological Survey Circular 1090, Persistence of the DDT Pesticide in the Yakima River Basin Washington* 13, 16-17 (1993).
[5] *Id.* at 11.
[6] H.R. 644 at 12.
[7] Pub. L. No. 96-501, 94 Stat. 2697 (December 5, 1980).
[8] H.R. 644 at 14.
[9] *Id.* at 12; Pacific Northwest Region Bureau of Reclamation, *On Course for the 90's* 24 (undated).
[10] Pub. L. No. 103-434, 108 Stat. 4550 (October 31, 1994).
[11] *Id.*
[12] Lester, David, *A Hatchery of Hope*, Yakima Herald-Republic, June 20, 1996 at 1A, 2A.

If these public funds are to have been well spent, and water is to be available to recover anadromous fish and water quality, the basin must be closed to new appropriative rights, a flow regime must be established for the Yakima mainstem and its tributaries, illegal diversions must be stopped, and current water users in the basin must adhere to the best available technologies for conveyance and application of agricultural water and the use of industrial and municipal supplies. The Yakima River has been notorious for "paper" water rights and wasteful irrigation practices for almost 100 years;[13] with millions in public funds and the Yakima's salmon in the balance, the public can no longer afford such private extravagance.

One of CAG's principle endeavors, on which its members spent over two years and which was just completed, was preparing a Yakima Basin Conservation Plan. That Plan, signed by the managers of the two largest irrigation districts in the Yakima Basin on behalf of the irrigation community, as well as by representatives of the Yakama Indian Nation, the State Department of Fish & Wildlife, Washington State University Agricultural Extension Service, and American Rivers on behalf of the environmental community, further details the serious flow problems in the Yakima River basin. For the lower Yakima River, corresponding to the area encompassed by the proposed TMDL (although the TMDL takes in the lower river to RM127.9, whereas the area referred to in the CAG Basin plan as the lowerYakima Subarea ends at RM 103.8, from Sunnyside Diversion Dam to the confluence with the Columbia River.), CAG states:

> The Yakima River from Prosser Diversion Dam to the mouth is the passage corridor for all salmonid species moving to and from all upstream areas. Streamflows and water quality in this reach have the potential to influence anadromous fish production in the entire Yakima River basin.
>
> In addition to passage, salmonid fish use of the river downstream from Prosser Diversion Dam includes fall chinook spawning, incubation, and rearing and overwintering of spring chinook and steelhead. . . .
>
> At times, water quality, particularly high water temperatures, makes much of the lower Yakima River unsuitable for salmonids, acting as a barrier to both upstream and downstream migration. During July and August, water temperature can exceed 75 degrees Fahrenheit . . . which constitutes at least a partial thermal block to late summer spawning runs of adult anadromous fish and movement of rearing and migrating juveniles (BPA 1990).

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[13] *See, e.g.*, Washington State Experiment Station, Bulletin 61, *A Report on Irrigation Conditions in the Yakima Valley, Washington* 12-17 (1904); U.S. Department of Agriculture, Bulletin 188, *Irrigation in the Yakima Valley* 21-23(1907); Whitley, Edward C., Washington Pacific Northwest Quarterly, *National Irrigation in Yakima Valley* 100 (April, 1951); *United States v. Ahtanum Irrigation District*, 236 F.2d 321, 341 (9th Cir. 1956).

> Lichatowich et al. (1995) theorized that at higher flows, a complex floodplain and localized inflow of cool water from the hyporheic zone would have mitigated the natural warming of the lower river in summer. Further, regional patterns of hyporheic flow appear to be critical to rivers of the high desert of the Columbia plateau such as the Yakima River where late summer instream temperatures may be too high for salmonids. Relative to surface temperatures, ground water from the hyporheic zone is cool in the summer and warm in the winter. The up welling zones provide cool refuge for salmonids on hot summer days and exhanges [sic] winter growth by keeping the water warm and some habitats ice free.[14]

The lower Yakima River was listed in 1996 and is proposed for listing again in 1998 by the Department of Ecology as out of compliance with water quality standards because, among other things, instream flows are too low to support the designated uses of the standards for salmonid spawning, rearing, migration and harvest. In those listings, Ecology states in part: [15]

> [L]ow summer flows below Sunnyside Diversion Dam are a problem in most years because all but about 200 cfs of the Yakima River flow above Sunnyside is diverted out of thousands of cfs at RM 103.8. And the flows below the Prosser Division Dam at RM 47 are usually 50 to 200 cfs *when 800-1000 cfs is needed for spawning and rearing . . . . These flows also severely hinder up migration of adult salmon and out migration of smolts causing high mortalities* (emphasis added).

C. The Need for Setting a Flow Regime that will Support the Designated Uses of the Lower Yakima River and an Implementation Schedule Could not be More Critical

With these facts in mind, we turn to the current state of water rights applications in the Yakima basin. Applications for water rights are still accepted, processed and granted by the Department of Ecology in the Yakima Basin despite the fact that:

- Yakima steelhead have been proposed for listing by the NMFS as endangered species;
- The mainstem Yakima and many of its tributaries are listed under the Clean Water Act as flow impaired;

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[14] Draft Basin Conservation Plan for the Yakima River Basin Water Conservation Program, Report to the Secretary of the Interior (June 25, 1997) at 4-33.

[15] Impaired and Threatened Waterbodies Requiring Additional Pollution Controls, ECY#WQ-R-95-84, at 287, 292.

- Hundreds of millions of dollars have been and/or are proposed to be spent by federal and state governments to increase instream flows for anadromous fish restoration in the Yakima River.

Currently there are hundreds of applications for surface and groundwater permits pending before the Department of Ecology, totaling well over 1,300 cfs. The Declaration of Rachael Paschal Re: Pending Applications, submitted in Yakama Indian Nation v. Department of Ecology, PCHB No. 93-157, et al., on February 12, 1998, details these applications from the Department of Ecology's Water Rights Application Tracking System. There is considerable scientific evidence that verifies that large areas of the Yakima Basin's groundwater aquifers are in hydrologic continuity with surface water of the River, including those aquifers from which the pending water rights would be drawn (as well as those contested in the above styled case). *See, e.g.,* Ring, T., *Review of Literature Pertinent to Impacts of Further GroundwaterDevelopment Black Rock-Moxee Study Area, Washington*, (June 2, 1993)(and submitted to the PCHB in *Yakama Indian Nation v. Department of Ecology*, 93-157, *et al*). *See also Den Beste v. PCHB*, 81 Wn.App. 330, 33-334 (1996).

Despite the condition of and interrelationship among impaired and substandard flows, temperature, and other pollution in the Yakima river, and the critical status of salmon in the lowerYakima River, a part of the river particularly crucial to *all* anadromous fish in the basin, the Department of Ecology has ignored the flow listing in this TMDL. Indeed, instead of addressing the flow issues in the TMDL, it continues to grant rights to groundwater that is hydraulically connected to Yakima river surface waters, which will result in further depletion of this critical habitat.

D. American Rivers Opposes Approval of the TMDL Because it Does Not Address the Flow Listing for the Lower Yakima River

We thus object to the approval of this TMDL because it did not take into account a flow regime for the Yakima River. Our objections to the failure to address the flow listing in this TMDL rest on:

1. The obvious and critical needs presented by the facts above to stop the continued hemorrhage of water from the river and to reallocate water to instream flows through enforcement against illegal diverters and the implementation of far more efficient water use technology in the basin;

2. The impossibility of solving the listed pollution problems of the lower Yakima River to which this TMDL is currently addressed without at the same time setting a flow regime so that the pollutant assimilative capacity is known and fixed, and not a moving and ever-shrinking target; and

3. The fact that the solution for reducing TSS loads, and hence other pollutant loads to the river, is the same for flow, *viz.*, much more efficient and environmentally sound application of water to irrigated crop land. The failure to include flow in this TMDL is destined to result in greater consumptive use of water in the basin and *more* damage to the River's instream flow resources if new water rights are not stemmed, and water that no longer needs to be diverted from the river because of improved irrigation practices to reduce TSS loading is not dedicated to the Washington Trust Water Rights Program for instream flows.

It makes no sense to spend hundreds of millions of taxpayer dollars to increase flows in the Yakima River to recovery the anadromous fishery unless these is a mechanism in place to stop the grant of more water rights, to assess and set an instream flow regime for the basin, to shut down illegal diversions, and to vastly improve the efficiency of agricultural and other water use in the basin.

As fully acknowledged in the TMDL Evaluation Report that is the subject of these comments, there is an integral relationship between flow and pollutant loading to the river (e.g., "the river under high flow conditions in April to June may have enough dilution to assimilate the reduced tributary loads from Granger Drain"),[16] but if neither Ecology or EPA incorporates flow into the instant TMDL, there will be no way ever to calculate the extent of TSS or other pollutant load that can be delivered to the river from point and non-point sources, and hence no way for users ever finally to comply with load limits.

One example serves to illustrate the problem. The Snyderville Basin sewer district outside of Salt Lake City discharges into East Canyon Creek, Utah. The district's discharge permit is among the most stringent in the state. But as Utah continues to allocate more and more water out of East Canyon Creek upstream of the sewer district, the creek's water quality is worsening as a direct result of decreased flows. Because of the worsening water quality, the state's water quality department intends to require the sewer district to switch from biological to chemical treatment at a cost of $10 million dollars. And water allocation from the Creek continues without consideration of its impacts on water quality *or the economic consequences to the Snyderville Basin sewer district.*

The same is true here. The basin must be closed to more water withdrawals (including exempt wells), and a stable flow regime set for the Yakima Basin (based on the life cycle needs of salmonids as required state water quality standards). If this is not done immediately, not only will water quality standards continue to be violated because of low flows (and will be ever worsening), but it will be impossible for irrigation districts and farmers ever to rest assured that their efforts in improving irrigation practices will

[16] *A Suspended Sediment and DDT Total Maximum Daily Load Evaluation Report for the Yakima River* (July 1997) 70 (DOE Publication No. 97-321). See also, e.g., pp. 62, 66.

correct the TSS and other pollutant problems in the Yakima River. Indeed, they will in all probability be subject to ever more stringent controls in the future.

Finally, and this is probably the single most important point, if that amount of water that no longer must be diverted from the river to deliver consumptive crop needs is not dedicated to instream flows, and thus is still available to be used to irrigate, the result will be increased agricultural consumption of water in the Yakima basin. Thus, as irrigation districts and farmers make improvements in water deliveries and application, the corresponding efficiencies must be translated into reduced diversions, with the difference being permanently dedicated to instream flows through the Washington Trust Water Rights Program. To miss that opportunity with the implementation of this TMDL is to miss it forever. Those water "savings" must be calculated as irrigation improvements are made, and accounted for in the Trust Water Rights Program, or the savings will be lost.

In conclusion, we object to a TMDL process that addresses only numeric pollutant violations. A plan to implement water conservation measures while not addressing the flow listing in its TMDL makes no sense. Instead of protecting the saved water instream to address the flow listings, the result will be an *increase* in the consumptive use of water. First, the more efficient application of water results in increased water uptake by plants. Second, if not protected for restoring flows, the "saved" water will be used to increase irrigated acreage, *both* results clearly *aggravating* instead of mitigating the instream flow deficit *and* water quality problems. Thus, the failure to include flow in this TMDL is likely further to jeopardize the continued existence of salmonids proposed for listing under the Endangered Species Act, i.e., bull trout and steelhead.

E. General Recommendations for a Flow TMDL

A TMDL to restore instream flows would (1) set seasonal instream flow regimes that fully support the designated uses for which the stream is listed (e.g., salmonid spawning, rearing, migration and harvest); (2) stem new withdrawals or diversions having further flow impacts on the listed reaches until a flow regime supporting designated uses is attained, and more water is available for allocation; (3) implement universal water use metering and reporting; (4) promote the best available conveyance and on-farm application technologies, as well as the best technology for other water uses, through education and low interest loans, grants, and other sources of public funding; and (5) protect the saved water for attainment of the seasonal instream flow regime.

Such a framework can be used to satisfy both flow impaired listings under the Clean Water Act, as well as to satisfy the consultation provisions of Section 7 of the Endangered Species Act, 16 U.S.C. §1536.

Below we discuss the general framework for a flow TMDL that could easily be adopted to the Yakima and other flow-listed stream reaches in the state of Washington.

An appropriate interim flow regime could, given the wealth of data already available on lower Yakima mainstem flow requirements, quickly be established for this reach of the river. See, e.g., the submission of American Rivers to the Department of Ecology in support of the lower Yakima flow listings for 1996, and the Draft Report on Biologically-Basin Flows for the Yakima River Basin, Report to the Secretary of the Interior (SOAC, February 20, 1998).

The remaining flow TMDL framework elements we discuss below are suggested ways to implement the interim flow regime. Protocols for monitoring the interim regime and arriving at a more permanent flow regime for the river are in the SOAC report. See also, e.g., *Instream Flows to Assist the Recovery of Endangered Fishes of the Upper Colorado River Basin* (National Biological Survey, Report 24, July 1994); Castleberry, Cech, Erman, Hankin, Healey, Kondolf, Mangel, Hohr, Moyle, Nielsen, Speed and Williams, *Uncertainty and Instream Flow Standards*, Fisheries, Vol. 21, No. 8, 20-21 (August 1996).

F. Specific Recommendations for the Flow Component of the Lower Yakima TMDL and Its Implementation

1. The TMDL is a Seasonal Flow Regime

A flow TMDL must begin by defining a flow regime for flow-impaired rivers that will assure support of salmonid life cycle needs. Defining an instream flow regime is analogous to establishing a Total Maximum Daily Load (*i.e.*, maximum pollutant load that a water body can assimilate while still meeting water quality standards) for water bodies not meeting water quality standards because of pollution discharges. In other words, for the flow restoration plan, the states will define the flows needed to support uses designated in water quality standards (e.g., salmonid migration, rearing, spawning, and harvest) and then proceed to restore instream flows to that level.

A phased approach to restoring flows is appropriate.[17] First, an interim flow regime will be defined based on existing information. The second phase would include additional studies conducted in cooperation with state fishery agencies and tribes to refine the initial flow regime to assure that the anadromous fish use designation is met.

In Washington, water quality regulations require full support of salmonid migration, rearing, spawning, and harvest in Class AA rivers. Other states designate coldwater biota as the use. EPA describes this regulatory concept of "full support" of cold water biota (including salmon) as water that is able to "support thriving, sustainable populations of species which would normally occur in coldwater absent water

[17] In cases where there is uncertainty, EPA recommends a phased approach which includes implementation of controls based on best professional judgment, monitoring, and a schedule for revisiting the goals of the "TMDL" and the adequacy of controls. U.S. EPA, *Guidance for Water Quality-based Decisions: The TMDL Process*, 15 (April 1991).

column/habitat degradation. . . . Full confirmation would include attainment of applicable numeric criteria and the presence of a biological community representative of what one might expect for that given ecosystem." Thus, instream flows must be at least sufficient to protect and restore salmonid habitat to meet all lifecycle needs and to restore ecosystem functions of the river needed to support aquatic life.

2. Implementation Measures

A. Antidegradation

The states are required under the antidegradation provision of their water quality standards to prevent any further deterioration of water quality.[18] Where a state has determined that existing diversions and withdrawals impair beneficial uses, as many have on their 303(d) lists, permitting any additional withdrawals or diversions would violate the antidegradation provision.

In Washington, the prohibition against depletion of flow-impaired waters is also found in the state's water code. It provides that water may not be appropriated unless the state finds "that there is water available for appropriation . . . and will not impair existing rights or be detrimental to the public welfare."[19] This provision prohibits appropriation from flow-impaired streams because (1) the state's finding on its 303(d) list that water quality standards are not met due to depletion of instream flows demonstrates that there is not water available for additional diversion; and (2) allowing further depletion of stream flows would be contrary to the public interest by exacerbating water quality violations.

In addition, the Water Resources Act's policy requires "that a flow sufficient to support game fish and food fish populations be maintained at all times in the streams of this state."[20] This provision applies equally to groundwater withdrawals and surface water diversions.[21] Consequently, under this policy no additional groundwater or surface water rights may be issued from flow impaired water bodies.

ACTION ITEMS:

(1) All applications for surface diversions from and ground water withdrawals in hydraulic continuity with flow-impaired reaches will be denied, unless and until there is clear evidence that flows have been restored to a level that meets water quality criteria and fully supports instream uses, plus a margin of safety.

[18] WAC 173-201A.070 ("Existing beneficial uses shall be maintained and protected and no further degradation which would interfere with or become injurious to existing beneficial uses shall be allowed.")
[19] RCW 90.03.290
[20] RCW 75.20.050.
[21] RCW 90.44.060.

(2) States may, however, consider applications for change in place and type of use of existing water rights. For instance, a change application from surface water diversion for agricultural use to ground water domestic uses may be permitted provided that such a transfer does not deplete instream flows or impair water quality.

(3) States should will consider basin closure as a more efficient means to guard against further depletion of instream flows than the current practice of case-by-case denials of permit applications.

B. Metering and reporting:

Water use metering and reporting water use to the water quality authority should be required in all flow-impaired basins. In Washington, it is required under the State's water resources laws and is a critical first step in remedying 303(d) flow-impairment. Metering and reporting will promote voluntary compliance with water rights by assisting growers in measuring and controlling their water use. In addition, it will provide the states with information essential to assuring that water uses comply with water rights and in assembling accurate and complete data about water use for flow restoration efforts.

Washington law authorizes the Department of Ecology to require metering of *all* surface water diversions and ground water withdrawals.[22] And, Ecology *must require* metering of diversions from all waters in which salmonid stocks are rated as depressed or critical as determined by the Washington Department of Fish and Wildlife or where the water being diverted exceeds one cubic foot per second.[23]

ACTION ITEMS:

Develop plan for implementing water use metering and reporting for surface water, groundwater, and exempt wells.

Option 1:

Install measuring devices on all water uses within a specified timeline not to exceed six months, starting first with larger water uses. Define the specifications for water measurement devices for various uses. Appoint a stream patrolperson or water master to assure installation of measurement devices and to record water use. Identify funding sources to be used for installation and maintenance of measuring devices. Funding for the stream patrol person could come from states, other agencies, county government, water users, or any combination of these sources.

Option 2:

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[22] RCW 90.03.360 (surface water metering authorized and required in some circumstances); RCW 90.44.020 (surface water statute, RCW 90.03, applies equally to ground water regulation).
[23] RCW 90.03.360.

Same as option 1, but instead of appointing stream patrolperson, require each water user to take daily water use measurements and report these measurements to the state water quality authority.

Option 3:

Require installation of telemetered devices such that water use measurements would be transmitted to directly to state water quality authority which would maintain and monitor these data.

C. Restore instream flows

1. Assure all water use is legal

The states will evaluate water use information to assure that water uses comply with water rights. Whenever a state finds illegal water use, it will bring immediate enforcement action.

2. Implement water conservation

The prohibition of wasteful water use is a fundamental tenet of the prior appropriation doctrine. This principle has been adopted into Washington's water resources laws. Washington is permitted to appropriate water only for beneficial uses.[24] Beneficial use is limited to reasonable use without waste.[25] And the State has recognized that wasteful use of water is prohibited by law.[26] Thus, Washington has the authority to limit water use to that which is efficient.

In addition, Washington's water quality standards rules require that activities that generate nonpoint sources of pollution shall be conducted so as to comply with water quality standards which includes water withdrawals and diversions.[27] As nonpoint sources, water withdrawals and diversions must employ best management practices to achieve attainment of water quality standards. Best management practices are considered a subset of the "AKART" requirement that all known, available, and reasonable methods of prevention, control, and treatment be employed to remedy water quality standards

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[24] RCW 90.03.010 (Water rights may be acquired "only by appropriation for a beneficial use"); 90.03.290 (Ecology may appropriate only upon finding "that there is water available for appropriation for a beneficial use.")

[25] *See, Ecology v. Grimes*, 121 Wn.2d 459, 471 (1993).

[26] *See, e.g.*, RCW 90.03.005 (Based on the tenet of water law which precludes wasteful practices in the exercise of rights to the use of water, the department of ecology shall reduce the practices the maximum extent practicable . . . ."); RCW 90.44.110 and 90.44.120 (prohibiting the wasteful use of groundwater); RCW 90.54.020(6) and RCW 90.54.180 (Ecology shall encourage public and private entities to implement water conservation.)

[27] WAC 173-201A-160(3).

violations. It follows that in addressing designated use impairment caused by water use, best management practices would dictate that all known, available and reasonable methods of water delivery and application be employed to conserve water and minimize water use.

ACTION ITEMS:

(1) Develop water conservation actions and timeline for implementation.

The states will develop and implement a water conservation plan that will define specific measures (facilities and management practices) to improve the efficiency of water transportation and delivery and that will reduce water use consumption and define a timeline for implementing these measures. The states may draw from the expertise of the growers and other agencies and organizations including the Bureau of Reclamation, the Natural Resources Conservation Service, and the Cooperative Extension Services.

Though more efficient conveyance and on-farm application may not reduce consumptive water use, such efficiency measures may increase flows at critical times and in important places. For each proposed measure, the states will define the estimated cost and the projected volume and extent (river miles) of the increase in stream flows. The plan will consider increased stream flows that could be achieved in the following categories:

-- Water Transportation and Delivery: The state water quality authority will investigate opportunities to improve stream flows in the river through installing the most efficient water delivery and irrigation system (e.g., piped as opposed to open ditches, replacing flood irrigation with sprinkler or drip irrigation, switching to ground water pumping instead of surface diversions.)

-- Irrigation Management Practices: The state water quality authority will investigate practices that assure that the quantity and timing of water application is need-based as determined by soil moisture levels and water requirements of crops. Measures may include system to provide timely information about soil moisture levels, precipitation, evapotranspiration rates for area and crop requirements. The timing/scheduling of water application should be based on this information to minimize water use.

-- Reduced consumptive water use: The state water quality authority will explore opportunities to reduce consumptive water use (e.g., dry year fallowing, switching to crops well suited to the area's meteorological regime, acquisition of water rights).

(2) Use public and private funding sources

The states will identify and secure public funding to the greatest extent possible to aid in implementing conservation measures for the benefit of instream flows. These sources include:

-- Bureau of Reclamation. The Bureau has various funding programs through the Small Reclamation Projects Act of 1956 which provides loans and grants for rehabilitation of on-farm irrigation systems and for fish and wildlife enhancement.

-- U.S. Department of Agriculture. The Department of Agriculture's Natural Resources Conservation Service has various programs that provide funding and financing for conservation planning and implementation including the Conservation Operations Program, the Resource Conservation and Development Program, and the Cooperative River Basin Studies Program, the Watershed Protection and Flood Protection Act, the Agricultural Conservation Program, and the Water Bank Program.[28]

-- Cooperative Extension Service. The Cooperative Extension Service, which is comprised of the Extension Service, state governments, and land-grant universities, assists farmers and others to develop and apply the latest irrigation practices and technology.

In Washington, additional state sources include:

-- Referendum 38 funds (RCW 43.99E and WAC 173-170). Referendum 38 authorizes available funding to public bodies operating agricultural water supply facilities to assist in improving their efficiency of water use.

-- Centennial Clean Water Fund (RCW 70.146 and WAC 173.95). Funding may be used to help local communities meet water quality, health and safety requirements. Grants are available for planning, research, monitoring, and education involving nonpoint, ground water and fresh water projects.

Private funding sources may include nonprofit organizations that specialize in acquiring land and/or water for the protection of natural resources and ecosystems such as the Trust for Public Lands, the Oregon Water Trust, the Nature Conservancy, and the soon-to-be-established Washington Water Trust. To the extent that public funding sources or private non-governmental organization contributions are not sufficient to implement required measures, the growers and other water users will need to share a portion of the cost.

(3) Dedicate saved water to instream flows.

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[28] For a more detailed description of the programs, see *Wash. Dept. of Ecology, Irrigation and Water Use Efficiency Demonstration Project*, Appendix B, July 1992.

All of the net water savings achieved under the water quality flow restoration framework water will be dedicated to instream use through state law. In Washington, this can be accomplished through the trust water rights program in accordance with RCW 90.38.

The trust water rights program guidelines establish criteria for determining what proportion of saved water should be dedicated to instream flows. A flow restoration TMDL should follow the same principles. Namely, instream flow improvements achieved through reductions in consumptive water use will be protected instream from the point of diversion to the mouth of the river in question. In addition, instream flow gains achieved through increased efficiency should be protected in the affected reach (from the point of diversion to the point where the flows would have returned to the river through surface or subsurface flows.) *See, e.g., WA Trust Water Rights Guidelines* for discussion of technically how this may be accomplished.

3. Acquire water

Where funds are available, opportunities to acquire water from willing sellers should be pursued to the greatest extent possible. Public and private funding sources should be identified. Potential sources will include those listed above under water conservation.

Water acquired by state or federal agencies will be permanently dedicated to instream rights. Water acquired that would have otherwise been consumptively used should be protected instream from the point of diversion to the mouth of the river. The portion of the acquired water right that would have otherwise returned to the river through return flows (surface and subsurface), should be protected in the affected reach (from the point of diversion to the point where the flows return to the River). *See, e.g., WA Trust Water Rights Guidelines.*

4. Condition existing water rights

To the extent that flows cannot be restored by implementing the strategies discussed above, the states must impose conditions on existing rights that limit water use so that flows are restored to levels sufficient to support designated uses. Such an adjustment would be the flow analogy to rewriting NPDES permits to meet the load allocation defined in the Total Maximum Daily Load.

State authority to take this action derives from the Clean Water Act. The United States Supreme Court has held that the states' authority to protect water quality is not limited by existing water rights. It explained that states are not limited in the "controls that may be imposed on users who have obtained, pursuant to state law, a water allocation."[29] The Court noted that Congress in enacting the Clean Water Act explained

[29] *Jefferson County PUD No. 1 v. Washington Department of Ecology*, 114 S.Ct. 1900, 1915 (1994)

"[t]he requirements [of the Act] may incidentally affect individual water rights."[30] As the Court clearly stated, the state may limit the use of existing rights holders if necessary to meet water quality standards.

The states' authority to take administrative action to limit water use to protect the fishery is also found in the public trust doctrine. The doctrine provides a basis for state action in protecting the trust resources of navigation, fisheries, water quality, and recreation, and it is not limited by a prior appropriators' right to water.[31] In other words, under the public trust doctrine the state may reallocate water to protect instream flows for the fishery or other public trust resources.

ACTION ITEM:

(1) Quantify instream flow shortfall, that is, the difference between instream flows that can be restored through acquisition of water, water conservation and other measures and the flows required to fully support designated uses as defined above.

(2) Allocate this shortfall equitably among existing water users under a schedule phased in over time.

3. Assuring Implementation

Each measure in the water quality flow restoration plan should be specific, assigned to accountable parties, and backed up by a mechanism to aid enforcement, such as an order, consent decree, or conditioned funding.[32] The states will define a time frame for implementation of controls and attainment of water quality standards; upon a failure to implement measures or meet water quality goals, enforcement action will follow.

The states' implementation and enforcement authority is derived from the Clean Water Act and the state water pollution control statute. Under the Clean Water Act Section 505, the both citizens and the state may enforce water quality standards limitations. *U.S. Dept. of Energy v. Ohio*, 112 S.Ct 1627 (State considered "citizen" CWA § 505 and as such may enforce provisions of the CWA). In addition, states such as Washington have abundant authority under their water pollution control act, RCW 90.48, to set water quality standards,[33] prohibit pollution of state waters,[34] to bring an

[30] *Id.*
[31] Ralph W. Johnson, *Water Pollution and the Public Trust Doctrine*, 19 Environmental Law 485 (1989).
[32] *EPA Guidance for Water Quality-Based Decision: The TMDL Process*, April 1991, EPA 440/4-91-001 at 22.
[33] 90.48.260
[34] 90.48.080

enforcement action to carry out the statute's provisions,[35] and to enforce the water quality program through penalties, emergency powers, and criminal sanctions.[36]

The implementation measures required in the flow restoration plan are also enforceable by EPA. "Whenever the [EPA] Administrator finds that any person is in violation of section 1311, 1312, 1316, 1317, 1318, 1328, 1345, he [or she] shall issue an order requiring such person to comply with such section or requirement."[37] Section 1313 (CWA § 303) which sets forth water quality standards and the requirement to set TMDLs is included by reference whenever 1311 (CWA § 301) is listed.[38]

And given the intersection between the Clean Water Act and the Endangered Species Act for this TMDL, and the conference and/or consultation requirements of the latter federal statute, a flow component to this TMDL is not only a practical, but also a legal necessity.

4. Public Participation

Every TMDL includes public notice and consultation at important decision points. The public participation plan should reflect a sincere effort to bring growers and other water users, agencies, and other interested parties together to develop the most innovative, expedient, and equitable solutions to achieve fully water quality standards in flow-limited basin. Through collaboration, the flow restoration plan has the potential to restore fish habitat in rivers throughout the Northwest. And, with consultation with the National Marine Fisheries Service incorporated into the TMDL process in ESA basins, the flow restoration plan may satisfy at least the water component of any ESA recovery plan. For the lower Yakima, DOE and NMFS already have the product of a number of flow recommendations made by stakeholders' groups, referenced above (including IFIMs on which the listing was based by Parametrix and by the U.S. Fish & Wildlife Service); See also *A 20/20 Vision For a Viable Future of the Water Resource of the Yakima River Basin* (Draft of October 1997)(Yakima River Watershed Council)(recommending a 700 cfs minimum flow for the lower river).

5. Monitoring Plan

Any monitoring plan must (1) assess implementation of control measures, (2) require measurement and reporting of water use, (3) measure instream flows in the river channel, and (4) assess the adequacy of flows to restore stream health to a level that provides full support for salmonid uses by developing parameters to measure response and health of the river, define timeline to evaluate these parameters and to revise flow goal and measures accordingly.

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[35] 90.48.037

[36] 90.48.260

[37] 33 U.S.C. §1319(3).

[38] *See Jefferson County PUD No. 1 v. Dept. of Ecology*, 114 S.Ct 1900 (1994) at 1909.

G. Conclusion

We appreciate having the opportunity to comment on this proposed TMDL, and request that you incorporate a flow component in it before seeking approval from EPA.

Sincerely,

Katherine P. Ransel

The Yakima Valley Audubon Society is people dedicated to the enjoyment and preservation of the natural world. Through birding, education and conservation activities in our community, we raise awareness and promote the cause of global environmental protection.

April 9, 1998

Chris Coffin
Lower Yakima River TMDL Coordinator
Washington Department of Ecology Central Regional Office
15 West Yakima Avenue, Suite 200
Yakima, WA 98902

RE: Proposed TMDL for the Lower Yakima River

Dear Mr. Coffin,

Yakima Valley Audubon Society (YVAS) is one of 26 Washington Chapters of the National Audubon Society whose membership equals 550,000. YVAS, representing over 400 Yakima watershed families dedicated to the enjoyment and preservation of the natural work, appreciates the opportunity to submit some brief comments on Washington Department of Ecology's (Ecology) final draft of <u>A Suspended Sediment and DDT Total Maximum Daily Load Evaluation Report for the Yakima River</u>.

While the TMDL's for suspended sediment and DDT are quite warranted in the lower Yakima River, and we endorse Ecology's TMDL strategies for eradicating these pollutants from the Yakima River, we also believe a TMDL for flow is necessary. In addition to suspended sediment, DDT and other parameters, the Yakima River is also listed on the 1998 proposed 303(d) list as an impaired water body due to flow impairments. Flow must be addressed in the Lower Yakima River in order to achieve an ecologically balance river system in the lower Yakima River, and provide the opportunity for native salmonid stock recovery. Not only is surface water flow of importance to provide adequate and quality water for migrating salmonids, but flow from the hyporheic zone also provides critically important cool water temperatures so important in the high desert country of the Columbia plateau during summer migration periods. There is vast information available about lower Yakima River flows during irrigation season and the correlation low flows have on the poor water quality of the Yakima River.

Currently, as you know, there are many federal and state government programs proposed to help increase flows for anadromous fish restoration by purchasing water rights at a proposed million dollar cost. Ironically, Ecology still accepts applications for water rights permits. So, while on one side some increased flow might be

YAKIMA VALLEY AUDUBON SOCIETY
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Yakima, Washington 98907

obtained through instream flow purchasing "rights" programs, on the other, there is nothing being done to stop diverting or extracting (wells) additional flow by granting more water right permits. The result of this cycle will only mean the Yakima River will remain on the 303(d) list as an impaired water body even after all efforts to improve suspended sediment, DDT, and other parameters have been implemented and addressed.

The TMDL Federal Advisory Committee (FACA) for EPA has recently been discussing outstanding issues, including instream flows in TMDL development, for recommendations to EPA's TMDL's program. We encourage Ecology to note that this advisory committee, in their March 2, 1998 draft committee report, submitted the following: " . . . water quality standards nonattainment resulting from flow modification is within the scope of the Clean Water Act, important to water quality standards attainment, and therefore very relevant to the TMDL program." The committee goes on to say: "Water rights are generally governed by State law and it is beyond the Committee's charge...to review these laws or to suggest changes in water rights laws or procedures. However, the Committee felt that where impairments are due to flow alterations, either alone or in combination with other sources of impairment, they must be addressed by the TMDL program. "

While I am neither a hydrologist, water rights expert or scientist, basic logic tells me that a flow TMDL is actually the first logical step to take in working towards attainment of Clean Water Act requirements for the Yakima River. We know a flow TMDL needs to be set for the Yakima River that meets salmonid life-cycle needs and request Ecology take on this task and incorporate our request into what they submit to EPA for approval.

Thank you for providing Yakima Valley Audubon Society the opportunity to provide comments on Ecology's proposed TMDL.

Sincerely,

Brenda McMurray

Brenda McMurray
President
Yakima Valley Audubon Society

Section 7 - Responsiveness Summary

Section 7 - Responsiveness Summary

LOWER YAKIMA RIVER SUSPENDED SEDIMENT TMDL

Responsiveness Summary

Comments from the Roza-Sunnyside Joint Board of Control:

#1. Page 77, 5 year (2002), first bullet - We suggest the following alternate wording: "Yakima River main stem will comply with the turbidity target of not more than a 5 NTU increase for the 90th percentile between the confluence of the Yakima and Naches Rivers (RM 116.3) and the Kiona gage at Benton City (RM 30)." This addition is consistent with your discussion of the turbidity criterion on pages 65 and 66 of the draft report. We also note your discussion is with reference to the "irrigation season". Is it intended a different criterion applies for the non-irrigation season?

Response: Agree to change wording. Also, it is true, Ecology does not intend to apply the TMDL targets and criteria outside of the irrigation season when it submits the TMDL to the USEPA.

#2. Page 78, 5 year (2002), second bullet - The Board has no specific recommendation to replace the percentile value, now set at 90. However, we suggest that when we analyze the data for 2002, we may wish to amend this value and/or this method of setting a target, such as "the discharge weighted mean for ____ percentile of the time shall not exceed 25 NTU".

Response: We can add a statement to the amended first bullet of the five year schedule: "Use of the 90th percentile frequency in the turbidity compliance target for the main stem will be evaluated."

#3. Page 78, 5 year (2002), third bullet - The Board suggest adding to the current wording to read as follows: "The efficacy of using TSS load targets for tributaries and drains where the 25 NTU target is not representative of total load reductions will be evaluated, such as is likely to occur where there are significant reductions in flow due to changing irrigation methods." It is the goal of the Board to minimize runoff from each farm by encouraging the use of drip and sprinkler irrigation methods and to consider reuse of return flow. The use of reregulating reservoirs along the main canals will also reduce the use of these drainage ways to return operational spill to the Yakima River. These efforts will likely result in much reduced flows from drains into the Yakima River. These efforts have two very significant benefits to the TMDL targets and aquatic organisms in the basin.

a) Less water is diverted for irrigation, and
b) With less return flow the load of TSS and DDT will be significantly reduced. As we understand the Clean Water Act and the TMDL process, if the loads of TSS or DDT were met and the turbidity levels were exceeded, this would be preferred to meeting the turbidity target but exceeding the TSS or DDT load target.

Response: We should keep this a general statement in the technical report, and not get tied to specific management approaches. The management approaches can be discussed in the implementation strategy.

#4. Page 78, 10 years (2007), first bullet - The Board wonders why this target is desirable if concentrations are being met where the water enters the Yakima River main stem.

a) *The enforcement of the 25 NTU at all points within a sub-basin removes certain options of encouraging water reuse available to the Board and its member districts. It would seem that if the system can meet its goal, the boards should be allowed as much management flexibility as possible.*

Response: Ecology, USEPA and the Yakama Nation decided that the TMDL evaluation would not "second guess" fish habitat issues in the Yakima basin in terms of which "drains" or "creeks" qualified as habitat, or how far up a stream network habitat should be protected. The Yakima Enhancement Project, endangered species determinations, and other fish habitat protection legislation and agreements should guide local entities and Ecology where aquatic habitat and agricultural uses interface.

#5. Page 78, 10 years (2007), second bullet - The Board agrees that the 7 mg/L TSS target needs to be evaluated. This is especially true because background TSS measured values exceeded the proposed targets for the Kiona gage when 1995 conditions were 9 and 14 NTU at background and Kiona respectively (18 and 30 mg/L TSS).

Response: Comment noted.

#6. The monitoring section of the report, pages 79 and 80, is well done. What is missing is a specific, recommended program and implementation timeline. If other agencies collecting water-quality data are expected to work with Ecology in meeting the stated TMDL targets, they need to have, at a minimum, the turbidity and TSS values associated with background and the Kiona gage now. Having these data would allow Ecology and agencies assessing their data to determine if incremental steps are likely to result in meeting the stated targets. Alternatively, if data is not collected until 2002 and assessed in 2003, it will be 2004 (half way to 2007) before we find out how we are doing.

Response: Under Ecology's 5-year Water Quality Management Approach, monitoring by Ecology would be most intense in the two years prior to the target compliance date (e.g., 2000 and 2001 for the year 2002 targets). Ecology's Central Regional Office (CRO) has been requesting monitoring support in the lower Yakima River basin from Ecology's Environmental Investigations and Laboratory Services (EILS) Program since the 1995 water year. In addition, the CRO has been involved in coordinating monitoring with other agencies in the lower Yakima, and they have been involving EILS in the process as well. It is anticipated that as Ecology moves further into the implementation and monitoring phases of this TMDL, coordination of activities between the involved entities will increase. This will include the sharing of data in as close to "real time" as possible. The logistics of the gathering and dissemination of data have been and continue to be discussed among agencies and stakeholders within the Yakima Basin.

#1. (Page 3) The title of your report suggests the entire Yakima River system is addressed. The text is limited to the river basin below the confluence of the Yakima and Naches Rivers. The report title should be revised to conform with Ecology's intent with respect to basin planning (see further comments below regarding Ecology – EPA Memorandum of Agreement).

Response: The title should be changed to: "...for the Lower Yakima River"

#2. The relationships of the recommended target TMDLs to the states' overall water quality management program for the lower Yakima River Basin should be described in sufficient detail to enable implementing agencies to understand the "big picture". It is recognized that the Yakima TMDL studies preceded the October 29, 1997 Memorandum of Agreement between Ecology and EPA regarding implementation of Section 303(d)'of the Federal Clean Water Act. However, this Agreement, which is now operative, sets forth a uniform, statewide planning process to be followed in developing water quality management plans. In general terms this process appears to be:

- *A watershed approach to water quality management is to be followed; the state is divided into 23 Water Quality Management Areas (WQMA); the Upper and Lower Yakima WQMAs represent two of the 23 geographical areas.*
- *Point and nonpoint source problems and needs are to be addressed by WQMA on a cyclical, sequential basis; developing and implementing TMDLs is only one aspect of a WQMA program.*
- *A five step/five year program which includes the following activities is to be conducted in each WQMA: Year 1 – Scoping; Year 2 and 3 – Data Collection and Analysis; Year 4 – Develop WQMA Plan of Action, and Year 5 – Implementation.*
- *The Agreement schedule indicates the products of Year 4 and Year 5 activities are to be submitted to EPA for approval in Year 5. Provision is made that TMDLs may be completed on a basis other than a 5-Year watershed cycle.*
- *The final WQMA Plan of Action must include (1) a TMDL strategy, (2) a waste discharge permit strategy, and (3) a nonpoint source strategy.*
- *In Year 6, Ecology is to initiate a repeat of the 5-Year cycle.*

The draft lower Yakima River TMDL report was issued July 1997 and prior to the Ecology – EPA Agreement. Discussion beginning on page 77 (TMDL Priorities and Schedule) summarizes 5, 10, 15 and 20-year targets/goals. The final TMDL report should clarify whether a WQMA plan is being prepared for the lower Yakima River basin in response to the Ecology – EPA Agreement and, if so, the timing for development of the Plan of Action, EPA approval and the implementation schedule for TMDL activities. The

Board has adopted policies and initiated activities on the assumption the TMDL targets will be adopted as Ecology – EPA water quality criteria within the current year (1998).

Response: Your assumption is correct. The Lower Yakima River TMDL process was well under way before the MOA with USEPA was negotiated. Project funding and resources had already been allocated and directed towards the preparation of this submittal. In order to maintain continuity in the process and a consistency of efforts already begun in this high priority basin, a decision was made to proceed with this TMDL on its original time line.

Planning for a phased start up tying TMDL activity to the five year WQMA cycle, Endangered Species Act salmon recovery planning and other local watershed planning efforts is ongoing. As of this writing, while the EPA/Ecology MOA is agreed upon by the involved parties, funding for the outlined TMDL activities has not been approved by the WA State Legislature, leaving the implementation and fate of the agreement in limbo.

USEPA Region X Comments:

#1. It was noted in the study that the turbidity standard in the lower Yakima River had to be met at all points in the river, not just at Kiona. However, project modeling showed that under certain simulations, the 25 NTU at the mouth of the tributaries would not achieve the 5 NTU over background. Would you please clarify what may be an inconsistency in the study?

Response: The model simulations (Figure 24) of the river's failure to meet the turbidity target are examples of 10th percentile extreme conditions that may be encountered. The target is to be met for the 90th percentile background TSS concentration. All parameters were set at or above the 90th percentile target values (e.g. 1995 background TSS, discharges from the major drains, and assumptions about sedimentation rates). The point of the exercise was to show that both high flow and low flow extreme conditions could occur, and additional measures of protection will be helpful to ensure compliance with the targets (e.g. Yakama Nation participation, Moxee Drain compliance, ungaged and unknown source identification).

#2. The TSS modeling (pg. 70) uses the 90th percentile TSS concentrations for the two drains that were below the 56 mg/L target. The fourth sentence in the second paragraph on page 71 states that these drains will be expected to remain below the target. This is consistent with both the modeling and the State's anti-degradation policy. However, the

sentence is buried in the document and this expectation is not clearly displayed elsewhere. To clearly define the levels that cannot be exceeded, we recommend that the numerical targets for these drains be clearly specified in the final TMDL submittal.

Response: We will change Table 14 to reflect the TSS limits as being less than 56 mg/L for Wide Hollow Creek, Ahtanum Creek, and DID #7.

#3. A "margin of safety" (MOS) is a required element of any TMDL. Ecology implicitly applied MOSs at various points in the study, but does not clearly define which MOSs were used and when they were applied. EPA requests that Ecology add a paragraph to the study or the accompanying TMDL fact sheet that defines how all of the MOSs were applied.

Response: A lower Yakima TMDL assessment complied with the margin of safety requirement in the following ways:

- The State of Washington turbidity criterion was applied to the entire lower Yakima irrigation project rather than drain by drain.
- The proposed targets of 56 mg/L TSS and 25 NTU are more protective than USEPA guidance of 100 mg/L TSS, and are based on harm to local sensitive species of concern.
- The SMPTOX3 model simulations of contaminant loading (both of TSS and DDT) assume the 90th percentile flow and concentration which are conservative assumptions since no relationship was found between flow and concentration (for either TSS or DDT). Upstream concentrations of DDT and TSS in the DDT model calibration were based on data collected 20 miles upstream at the Yakima River above Ahtanum Creek. Two large diversion structures occur within those 20 miles that could reduce DDT and TSS concentrations.

#4. FIRST PARAGRAPH. In the second paragraph on page 3 of the Introduction, Ecology indicates that "Implementation of the TMDL will remove turbidity, DDT, DDE and DDD from the list of contaminants impairing water quality in the lower Yakima River and several of its tributaries." (Note: total DDT= t-DDT = DDT + DDE + DDD). Table 2 on page 10 identifies the specific 1996 303(d) list of contaminants for each water body in the lower Yakima Basin. With the exception of t-DDT for the Yakima River, EPA agrees that the TMDL will address TSS/turbidity and t-DDT for aquatic life as defined in Table 2. Because the modeled simulations show that the chronic aquatic toxicity criterion might not be attained in the Yakima River at the proposed reduced TSS concentration loadings from the tributaries and return drains (see page 74), EPA's position is that the Yakima River remain listed for t-DDT for aquatic life. If future monitoring and subsequent model simulations show that control measures will result in meeting the t-DDT criterion for aquatic life in the mainstem Yakima River, it need not be listed for this parameter and beneficial uses.

Response: This model simulation may need further explanation. The SMPTOX3 model simulation shown in Figure 26 on page 74 indicates a loading of

4+ ng/L t-DDT in the mainstem Yakima at "East Toppenish Drain". This simulation was used to demonstrate that reducing DDT loading to meet the 1 ng/L chronic toxic aquatic criteria in the tributaries of the lower Yakima listed in the diagram would not cause an increase of DDT in the mainstem. It is fairly obvious in the simulation by the line representing "7 mg/L TSS Targets on All Tribs." that DDT concentrations would not increase as compliant tributary loads entered the river. If mainstem background were set at 1 ng/L DDT or less in Figure 26, the simulation would show that the river would meet the criterion under the TMDL target. This simulation was not intended to be indicative of background levels of DDT entering the lower Yakima TMDL project area, as perhaps may be incorrectly inferred from the diagram. The mainstem DDT loading of 4+ ng/L indicated at East Toppenish Drain is not representative of the background concentrations in the mainstem above the TMDL project area.

The mainstem monitoring site and sampling event from which the concentration of 4+ ng/L was derived is located on the Yakima River, below the confluence of Moxee Drain and Wide Hollow Creek, both sources of DDT delivery to the Yakima River. This sampling event, conducted by Joseph Rinella and Stuart McKenzie of the USGS in June of 1989, was used in the simulation because it is part of the most complete data set available for the SMPTOX3 model calibration. In personal conversations with Joseph Rinella and Stuart McKenzie (July and August, 1998) and as included in the USGS Open-File Report 92-644, "SURFACE-WATER-QUALITY ASSESSMENT OF THE YAKIMA RIVER BASIN, WASHINGTON: PESTICIDE AND OTHER TRACE-ORGANIC-COMPOUND DATA FOR WATER, SEDIMENT, SOIL, AND AQUATIC BIOTA, 1987-91" (included in this submittal document), it was indicated that during the monitoring period of late June 1989, Moxee Drain was showing high levels of DDT and typically high loads of suspended sediment. As demonstrated in the Evaluation Report and supported by Rinella and McKenzie, the occurrence of DDT in the waters of the Yakima has a strong correlation with agricultural sediments held in suspension in the water column. It is the opinion of Rinella and McKenzie that the exceedance of chronic toxic aquatic criteria (1 ng/L) in the mainstem for DDT at this site was probably the result of suspended sediment and the associated DDT coming primarily from Moxee Drain.

This is further supported by monitoring data from the mainstem Yakima and the Naches River above the project area during the same period of late June 1989. As also indicated in the USGS Open–File Report 92-644, monitoring sites upstream from the project area, i.e., the Yakima River at Cle Elum, the Yakima River at Umtanum Creek and the Naches River near north Yakima, did not show evidence of exceeding chronic toxic aquatic criteria for DDT.

Moxee Drain and Wide Hollow Creek are within the TMDL project area and are being addressed in the TMDL implementation plan. Projects are already underway to significantly reduce irrigation runoff and erosion in the Moxee drainage. It is fully expected that as the sediment contribution from Moxee Drain is reduced so will DDT levels in the mainstem be reduced.

Two reaches upstream of the TMDL project area on the mainstem Yakima River are listed on the 1996 303(d) list for DDT concentrations in fish tissue. The presence of the pesticide has been documented in the water column, however, as mentioned earlier, water column and suspended sediment loading has not been shown to exceed chronic toxic aquatic criteria. Ecology is continuing to work on the issue of background DDT concentrations with the scheduling of a TMDL effort in the upper Yakima River basin, specifically addressing sediment and DDT. An assessment is scheduled to begin in July of 1998. Similar to the lower Yakima project, implementation of on-farm improvements and coordination with the local agricultural community has already begun in the upper Yakima Basin. Work performed in the upper basin should help alleviate transport downstream if it is occurring.

#4, SECOND PARAGRAPH. It is EPA's position that the Yakima River segments and applicable tributaries remain on the State's 303(d) list for t-DDT for human health protection. Although this TMDL is the first step in addressing t-DDT for all beneficial uses, too many uncertainties exist a this point in time for the assessment to conclude that the t-DDT criterion can be achieved.

Response: We concur with EPA. We are submitting this TMDL to address chronic aquatic toxicity criterion for DDT and metabolites, not human health criteria. However, Ecology believes that the implementation strategy and schedule in this TMDL will allow us to free the lower Yakima River from all but background sources of DDT within the next fifteen years. Only after DDT from irrigated agriculture is significantly controlled can the complexity of tissue burdens and human health assessments of DDT be reasonably addressed. Ecology is advocating a legacy pollutant approach with scheduled monitoring and assessments. Steady and reasonable progress implementing the TMDL will lead to attainment of human health protection within 20 years.

#5. EPA recommends that Ecology summarize in its TMDL fact sheet its reasons for using TSS as a surrogate measure for turbidity and t-DDT. Ecology should also provide a statement explaining the following: (1) how the diminutive contributions from point sources; (i.e., the waste load allocations) will be maintained at the current discharge concentrations, (2) that the load allocations for the nonpoint sources are applied to all pollutant-contributing agriculture sources within each tributary, and (3) that load allocations are set to achieve the turbidity targets at the mouth of each tributary.

Response: Ecology is using turbidity criteria as a surrogate to control TSS. Ecology (following initial work by USGS in the basin) also demonstrated a strong link between TSS and DDT in intensively irrigated areas of the lower Yakima basin. TSS is the focus of the TMDL because it better describes suspended sediment from eroded soils, the real pollutant Ecology is trying to control.

(1) The water balance and TSS balance demonstrated that point sources were not an issue. This is a nonpoint source TMDL; no waste load allocations will be necessary.
(2) Load allocations will be made to sub-basins, not individual agricultural sources.
(3) The load allocation compliance points are clearly stated in the report on pages 77 and 78.

#6. Based on the October 29, 1997, MOA between the Ecology and EPA regarding "The Implementation of 303(d) of the Federal Clean Water Act" a "Summary Implementation Plan" must be included as part of the TMDL submittal package. EPA recommends that the summary implementation and subsequent implementation efforts focus on those tributaries/return drains contributing the greatest pollutant loading; (i.e., @ Granger and Moxee drains). EPA also suggests that the summary implementation plan include data sources which indicate that the pollution reduction targets will be achieved using conventional soil and water conservation practices for irrigated agriculture. See page 67.

Response: Comment noted. See the Summary Implementation Plan.

#7. Throughout the study, it appears that Ecology uses the terms TSS, total suspended sediments, suspended sediments and total suspended solids interchangeably. Please clarify if this were Ecology's intention. If not, please define the differences in the terms.

Response: Yes, for the purposes of this report, the terms are synonymous.

Response to the comments of Marco Yolo:

The concerns you bring up in your comments will be addressed by the implementation of this TMDL. Recommended "best management practices" will include fencing livestock from waterways, maintaining buffer zones along waterways and minimizing the impact of stock watering on riparian areas.

Response to the comments of American Rivers:

The lower Yakima River is listed on the 303(d) for inadequate instream flow. Pesticides, turbidity and suspended sediment in the lower Yakima River, also of major concern, are the specific targets of this TMDL. The primary sources of these pollutants and their effect on the beneficial uses in the waterbodies of the lower Yakima Basin are well documented and relatively easy to demonstrate. These are pollutants that can be controlled through proper irrigation water management without the integration of a specific flow regime. Cooperative efforts of Conservation Districts, NRCS, irrigation districts, grower groups and individual irrigators are already implementing many of the practices necessary to control these pollutants. Also, sediment load allocations for the lower Yakima River, as described in the "Evaluation Report", are the result of monitoring and data analysis conducted over what was considered a low water and an average water year. This study took into consideration a wide variability in flow regime.

Water conservation, measurement of water diversions and deliveries, illegal diversion of water, biologically based flow regimes and confirmation or denial of water right claims are all issues being addressed in one or more venues other than this TMDL project. Further, it is projected that impaired flow along with temperature issues in the Yakima Basin will be given high priority and addressed as an important component in responding to Endangered Species Act listings in this area. Ecology believes that addressing impairment due to low flow is not a necessary component in this TMDL.

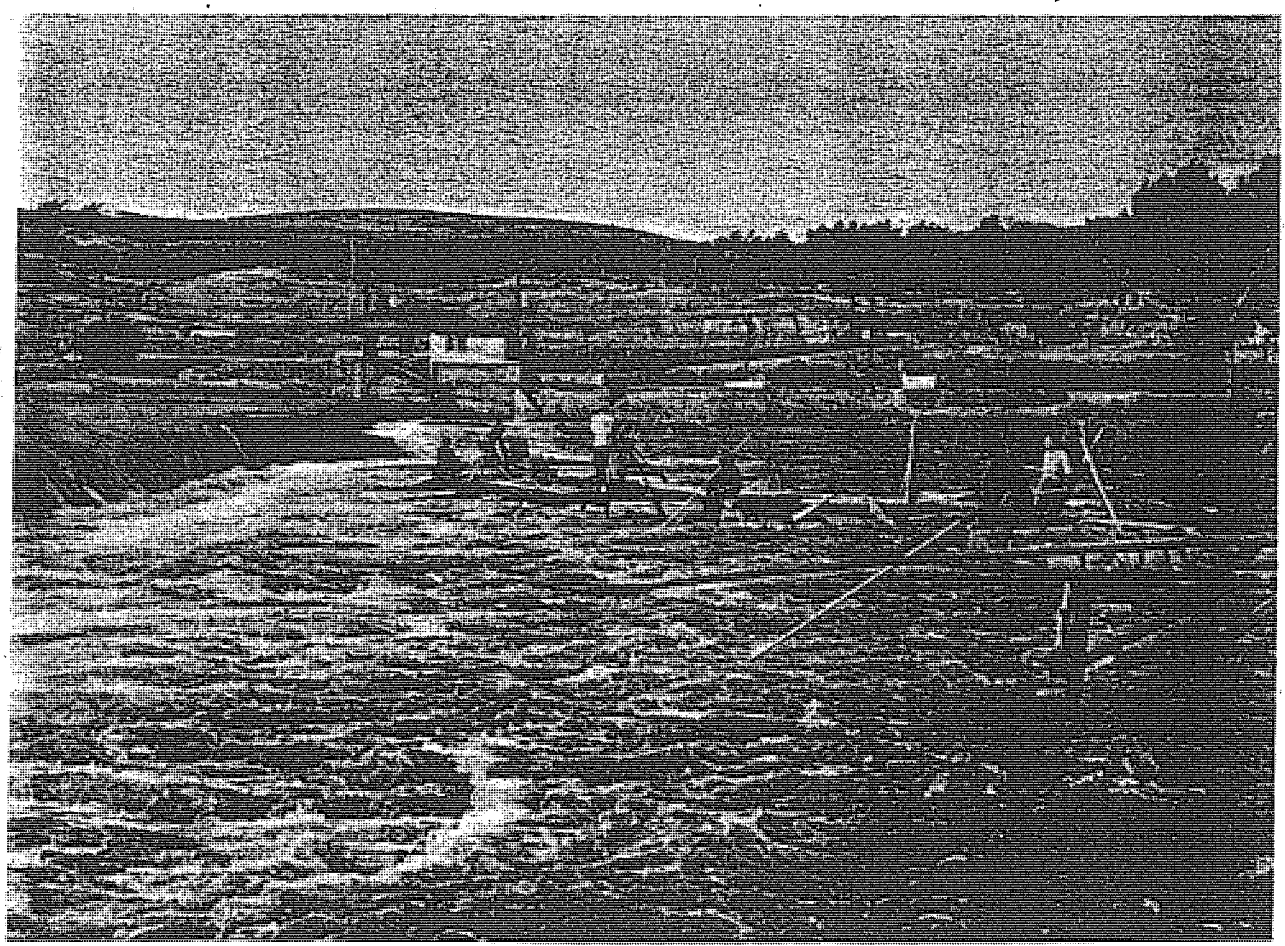
Response to the comments of The Yakima Valley Audubon Society:

The response to your comments is much the same as our preceding response to the American Rivers comments. Ecology agrees that flow issues in the lower Yakima River need to be addressed, however, we do not believe that the success of implementing this proposed Suspended Sediment TMDL necessitates the integration of a TMDL on flow.

Appendix 1

Appendix 1

MOXEE WATERSHED
WATERSHED PLAN AND
ENVIRONMENTAL ASSESSMENT
FOR MOXEE WATERSHED YAKIMA COUNTY, WASHINGTON



SEPTEMBER 1994

PREPARED BY: NORTH YAKIMA CONSERVATION DISTRICT
AND SOIL CONSERVATION SERVICE, USDA

FACT SHEET

Project Information

PROJECT NAME	Moxee Watershed Plan and Environmental Assessment
Total $	$ 5,132,500
Location of Project	Yakima County, Washington 5th Congressional District
Authorization	Public Law 83-566, 68 Stat. 666 as amended (16 U.S.C.1001 et. seq.)1954
Background	The goal of the Moxee Watershed Project is to increase the percentage of Fall Chinook Salmon egg-to-fry survival from 27 percent to 57 percent for the 21.2 mile Parker Reach of the Yakima River. The project goal will be achieved by reducing sediment discharge from the Moxee Drain by 4,100 tons per year. This is a 70 percent reduction in sediment discharge to the Yakima River. This reduction in sediment delivery will be achieved by converting 4,550 acres of furrow irrigated cropland, primarily hops, to trickle irrigation systems. Irrigation water management, as well as nutrient and pesticide management, will also be achieved for these converted acres. On-farm irrigation efficiencies will be improved by 40 percent on acres converted from furrow to trickle.

Economic and financial data

Costs

Project Purposes	Total Traditional cost share		Annual O&M
	Non-Fed	Federal	Non-Fed
Watershed Protection	35	65	
Total Costs	$1,750,000	$3,382,500	$5,000

Benefits

Average annual benefits on-site	Number of direct beneficiaries on-site	off-site
$1,227,500	44	21.2 miles of habitat

Benefit-to-Cost Ratio

2.5:1 @ 8% (authorized rate)
2.5:1 @ 8% (current rate)

Budget Data

Funding Schedule	1st	2nd	3rd	4th	5th	6th	7th
Federal Funds	$1,738,750	$893,750	$532,750	$92,250	$82,500	$21,250	$21,500
Non-Federal Funds	$995,800	$464,200	$108,500	$87,500	$81,000	$6,500	$6,500

Period of Analysis and Project Life

25 years

Environmental Problems

The project will double the egg-to-fry survival of Fall Chinook Salmon in the 21.2 mile Parker Reach of the Yakima River.

Six acres of the 836 acres of wetlands will be lost with project implementation.

The loss will be mitigated by the sponsors providing $17,500 to the State of Washington Fish and Wildlife Department, habitat restoration and land acquisition program.

On-farm irrigation efficiency will increase 40 percent on acres converted to trickle irrigation systems.

Other Significant or Controversial Issues

The Yakama Indian Nation strongly supports the project. The Parker Reach is a historical fishing site.

Evidence of Unusual Congressional or Local Interest

Representative Inslee has indicated support for the project. Local producers are ready to sign 28 contracts covering 1,879 acres. These contracts would commit 1.2 million dollars of PL83-566 funds immediately.

Moxee Watershed Plan / Environmental Assessment

September, 1994
Yakima County, Washington

Sponsors and Responsible Agencies:

North Yakima Conservation District

Soil Conservation Service, USDA

Cooperating Entities:

Environmental Protection Agency (EPA)

Washington State Department of Ecology (DOE)

Washington State Conservation Commission (CC)

Agricultural Stabilization and Conservation Service, USDA (ASCS)

Yakama Indian Nation (YIN)

Washington State Department of Fish and Wildlife

United States Geological Survey (USGS)

U.S. Dept. of the Interior, Bureau of Reclamation (BOR)

Bonneville Power Administration (BPA)

Yakima County Commissioners

Washington State University, Cooperative Extension Service

Yakima Valley Conference of Governments

Washington Hop Growers

Washington Hop Commission

Moxee Irrigation District (MID)

Roza Irrigation District (RID)

Moxee Watershed Agricultural Producers

Contact person: North Yakima Conservation District
Michael Tobin 1606 Perry, Suite F
Yakima, WA 98902

PROJECT GOAL

The goal of the Moxee Watershed Project is to increase the percentage of Fall Chinook Salmon egg-to-fry survival from 27 percent to 57 percent for the 21.2 mile Parker Reach of the Yakima River.

PROJECT ABSTRACT

The project goal will be achieved by reducing sediment discharge from the Moxee Drain by 4,100 tons per year. This is a 70 percent reduction in sediment discharge to the Yakima River. Currently, the equivalent of 10 dump truck loads of sediment is being deposited onto the spawning gravel of the Parker Reach each day during the irrigation season. With project, the equivalent number of loads will be reduced to 3 per day. This reduction in sediment delivery will be achieved by converting 4,550 acres of furrow irrigated cropland, primarily hops, to trickle irrigation systems. Irrigation water management, as well as nutrient and pesticide management, will also be achieved for these converted acreage.

The project will improve salmon reproduction in 21.2 miles of the Yakima River by doubling the Fall Chinook egg-to-fry survival. Erosion, sediment, and tailwater will be eliminated from the 4,550 acres which will be converted to trickle irrigation systems. Water quality in the Parker Reach of the Yakima River will be improved by reducing the amount of nutrients and pesticides carried by sediment. The health and welfare of the homeless, migrant laborers, and Native Americans camping along the river utilizing the water and resident fish will be improved. On farm irrigation efficiencies will be improved by 40 percent on acres converted from furrow to trickle irrigation systems. On farm inputs and operating cost will be reduced with project implementation. Total project cost is $5,132,500. Total PL83-566 cost is $3,382,500.

STATEMENT OF NON DISCRIMINATION

WATERSHED AGREEMENT
between the
NORTH YAKIMA CONSERVATION DISTRICT
(referred to herein as sponsors)
State of Washington
and the

Soil Conservation Service
United States Department of Agriculture
(Referred to herein as SCS)

Whereas, application has heretofore been made to the Secretary of Agriculture by the sponsors for assistance in preparing a plan for works of improvement for the Moxee Watershed, State of Washington, under the authority of the Watershed Protection and Flood Prevention Act (16 U.S.C. 1001-1008); and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to SCS; and

Whereas, there has been developed through the cooperative efforts of the sponsors and SCS a plan for works of improvement for the Moxee Watershed, State of Washington, hereinafter referred to as the Watershed Plan/Environmental Assessment, which plan is annexed to and made a part of this agreement;

Now therefore, in view of the foregoing considerations, the Secretary of Agriculture, through SCS, and the sponsors hereby agree on this plan and that the works of improvement for this project will be installed, operated, and maintained in accordance with the terms, conditions, and stipulations provided for in this watershed plan and including the following:

1. Cost-sharing rate for the establishment of enduring land treatment practices is 65 percent of the average cost of installing the enduring practices in the selected plan for the unit. The estimated total financial assistance cost for enduring practices is $4,567,500.

2. The SCS will assist the sponsors in providing technical assistance to land owners or operators to plan and install land treatment practices shown in the plan. Percentages of technical assistance costs to be borne by the sponsors and SCS are as follows:

Works of improvement	Sponsors (percent)	SCS (percent)	Estimated technical assistance cost ($)
Land treatment practices	40	60	325,000

3. The sponsors will obtain applications from owners of not less than 40 percent of the land in the furrow irrigated area, indicating that they will carry out the planned land treatment measures. These applications will be obtained before the first long term contract is executed.

4. The sponsor will obtain agreements with landowners or operators to operate and maintain the land treatment practices for the protection and improvement of the watershed.

5. The sponsors and SCS will each bear the cost of project administration that each incurs, estimated to be $10,000 and $230,000, respectively.

6. The costs shown in this plan are preliminary estimates. Final costs to be borne by the parties hereto, will be the average costs incurred in the installation of works of improvement or an approved variation.

7. This agreement is not a fund-obligating document. Financial and other assistance to be furnished by SCS in carrying out the plan is contingent upon the fulfillment of applicable laws and regulations and the availability of appropriations for this purpose.

8. A separate agreement will be entered into between SCS and sponsors before either party initiates work involving funds of the other party. Such agreements will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

9. This plan may be amended or revised only by the mutual agreement of the parties hereto, except that SCS may deauthorize or terminate funding at any time it determines that the sponsor has failed to comply with the conditions of this agreement. In this case, SCS shall promptly notify the sponsor in writing of the determination and the reasons for the de-authorization of project funding , together with the effective date. Payments made to the sponsors or recoveries by SCS shall be in accord with the legal rights and liabilities of the parties when project funding has been deauthorized. An amendment to incorporate changes affecting a specific measure may be made by mutual agreement between SCS and the sponsor having specific responsibilities for the measure involved.

10. No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this plan, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

11. The program conducted will be in compliance with the nondiscrimination provisions as contained in the Titles VI. and VII. of the Civil Rights Act of 1964, as amended, the Civil Rights Restoration Act of 1987 (Public Law 100-259) and other nondiscrimination statutes, namely, Section 504 of the Rehabilitation Act of 1973, Title IX of the Education

Amendments of 1972, the Age Discrimination Act of 1975, and in accordance with regulations of the Secretary of Agriculture (7CFR-15, Subparts A&B) which provide that no person in the United States shall, on the grounds of race, color, national origin, age, sex, religion, marital status, or handicap be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity receiving Federal financial assistance from the Department of Agriculture or any agency thereof.

12. **Certification Regarding Drug-Free Workplace Requirements (7CFR 3017.Subpart F.)**

By signing this watershed agreement, the sponsors are providing the certification set out below. If it is later determined that the sponsors knowingly rendered a false certification, or otherwise violated the requirements of the Drug-Free Workplace Act, the SCS, in addition to any other remedies available to the Federal Government, may take action authorized under the Drug-Free Workplace Act.

Controlled substance-means a controlled substance in Schedules I through V of the Controlled Substances Act (21 U.S.C. 812) and as further defined by regulation (21 CFR 1308.11 through 1308.15);

Conviction-means a finding of (including a plea of nolo contender) or imposition of sentence, or both, by any judicial body charge with the responsibility to determine violations of the Federal or State criminal drug statues;

Criminal drug statute-means a Federal or non-Federal criminal statute involving the manufacturing, distribution, dispensing, use, or possession of any controlled substance;
Employee-means the employee of a grantee directly engaged in the performance of work under a grant, including: (i) all direct charge employees; (ii) all indirect charge employees unless their impacts or involvement is insignificant to the performance of the grant; and, (iii) temporary personnel and consultants who are directly engaged in the performance of work under the grant and who are on the grantee's payroll. This definition does not include workers not on the payroll of the grantee (e.g., volunteers, even if used to meet a matching requirement; consultants or independent contractors not on the grantees payroll; or employees of subrecipients or subcontractors in covered workplaces).

Certification:

(A) The sponsors certify that they will or will continue to provide a drug-free workplace by:
  (1) Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the grantee's workplace and specifying the actions that will be taken against employees for violation of such prohibition;
  (2) Establishing an ongoing drug-free awareness program to inform employees about:
    (a) The danger of drug abuse in the workplace;
    (b) The grantee's policy of maintaining a drug free workplace;
    (c) Any available drug counseling, rehabilitation, and employee assistance programs; and
    (d) The penalties that may be imposed upon employees for drug abuse violation occurring in the workplace.

(3) Making it a requirement that each employee to be engaged in the performance of the grant be given a copy of the statement required by paragraph (1);

(4) Notifying the employee in the statement required by paragraph (1) that, as a condition of employment under the grant, the employee will--

(a) Abide by the terms of the statement; and

(b) Notify the employer in writing of his or her conviction for a violation of a criminal drug statute occurring in the workplace no later than five calendar days after such conviction;

(5) Notifying the SCS in writing, within ten calendar days after receiving notice under paragraph (4)(b) from an employee or otherwise receiving actual notice of such conviction. Employers of convicted employees must provide notice, including position title, to every grant officer or other designee on whose grant activity the convicted employee was working, unless the Federal agency has designated a central point for the receipt of such notices. Notice shall include the identification number(s) of each affected grant;

(6) Taking one of the following actions, within 30 calendar days of receiving notice under paragraph (4)(b), with respect to any employee who is so convicted--

(a) Taking appropriate personnel action against such an employee, up to and including termination, consistent with the requirements of the Rehabilitation Act 1973, as amended; or

(b) Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency.

(7) Making a good faith effort to continue to maintain a drug-free workplace through implementation of paragraphs (1),(2),(3),(4),(5), and (6).

B. The sponsors may provide a list of the site(s) for the performance of work done in connection with a specific project or other agreement.

C. Agencies shall keep the original of all disclosure reports in the official files of the agency.

13. **Certification Regarding Lobbying (7 CFR 3018) (applicable if this agreement exceeds $100,000).**

(1) The sponsors certify to the best of their knowledge and belief that:

(a) No Federal appropriated funds have been paid or will be paid, by or on behalf of the sponsors, to any persons for influencing or attempting to influence an officer or employee of an agency, Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment or modification of any Federal contract, grant, loan, or cooperative agreement.

(b) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form - LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(c) The sponsors shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

(2) This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

14. **Certification Regarding Debarment. Suspension and Other Responsibility Matters - Primary Covered Transaction (7 CFR 3017).**

(1) The sponsors certify to the best of their knowledge and belief, that they and their principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency.

(b) Have not within a three year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State, or local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or local) terminated for cause or default.

(2) Where the primary sponsors are unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this agreement.

NORTH YAKIMA CONSERVATION DISTRICT:

by R E Cornelius Sr.

R.E. CORNELIUS,SR. - Board Chair

15180 Rutherford Road, Yakima, WA	98903	10/14/94
Address	Zip Code	Date

The signing of this plan was authorized by a resolution of the Board of Supervisors of North Yakima Conservation District and adopted at a meeting held

on Sept. 20 1994.

1606 Perry Street, Yakima, WA	98902	
Address.	Zip Code	Date

Karl R. Boss 10-14-94

Secretary Date

SOIL CONSERVATION SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE

Approved by: Lynn Brown
LYNN A. BROWN
State Conservationist

Date: 10/17/94

WATERSHED PLAN / ENVIRONMENTAL ASSESSMENT
FOR MOXEE WATERSHED
YAKIMA COUNTY, WASHINGTON

SUMMARY

Project Name: Moxee Watershed

County: Yakima **State:** Washington

Sponsor: North Yakima Conservation District

Description of recommended plan:

Implement on farm trickle irrigation systems, nutrient management, pesticide management, and irrigation water management on 4,550 acres of furrow irrigated cropland. Implementing this action will reduce sediment to the Yakima River by 70 percent which will increase the egg-to-fry survival of Fall Chinook Salmon from 27 percent to 57 percent in the Parker Reach of the Yakima River..

Resource Information:

Size of Watershed	97,680 acres
Irrigated Cropland	19,880 acres
Wetlands	836 acres
Dry Cropland	2,700 acres
Rangeland	75,100 acres

Land ownership:
Private-74.7 percent State/Local-3 percent Federal-22.3 percent

Number of farms: 791 **Average farm size:** 51 acres
Note: data obtained from ASCS records, they include only farms on record.

Prime and unique farmland	15,000 acres
Number of minority farmers	1
Number of limited resource farmer	5
Estimated number of contracts	44

Project Beneficiary Profile:

The off-site benefit area, Parker Reach of the Yakima River, is historically one of the significant Chinook Salmon spawning areas of the Yakima River. This reach of the river is the eastern boundary of the Yakama Indian Nation reservation. Tribal members continue to fish this reach. The riparian vegetation is in excellent condition for the most part. The riparian areas with tall black cottonwoods provide a popular location for homeless and migrant workers to reside.

The watershed is adjacent to the city of Yakima , population 57,660. The area is primarily farmland with clusters of rural residential communities. The average farm size for the county is 380 acres. Yakima Counties per capita income is $14,494, (the 32nd lowest level in the state with the state average being $18,775). Moxee City, population 825, is the largest community within the watershed's boundaries.

Sixteen percent (16 percent) of the population in the watershed is Hispanic. The majority of this population is farm laborers, not landowners; They rely on the farms within the watershed for their employment. Other minority groups make-up less than 3 percent of the population. Hops and orchards are the primary economic crops in the watershed having an average value of over $3,000 per acre.

Wetlands:
836 acres

Flood Plains:
4,954 acres

Highly erodible cropland:
9,750 acres

Threatened or Endangered species:
Bald Eagle

Cultural Resources:
Inventory available at SCS Yakima Field Office.

Cost
The total project cost is $5,132,500

Other Impacts:
Increase on-farm irrigation efficiencies 40 percent and reduced on-farm inputs and production cost.

Environmental values changed or lost:

Wooded flood plain - none

Wetlands - Potential loss of 6 acres.

Cultural Resources - none

Wildlife habitat - no negative effect.

Fish Habitat - Reducing sediment discharge from the Moxee Drain will decrease the sediment in the spawning gravel doubling the Fall Chinook Salmon egg-to-fry survival rate. The sediment reduction will also assist in lowering stream temperatures.

Prime farmland - Project will provide adequate protection on 4,550 acres.

Major Conclusions:
Good quality spawning habitat is a limiting factor for Fall Chinook Salmon in the Yakima River system. As the percentage of sediment in the spawning gravel increases fry survival decreases. The Moxee Drain has been identified as the contributor to the sediment problem in the Parker Reach of the Yakima River system. The Moxee Drain delivers 5,200 tons of sediment each year. The majority of the sediment impacting the spawning area originates in the furrow irrigated lands of the Moxee watershed. Ninety five percent of the total season sediment loading occurs during the irrigation season. The furrow irrigated acres producing hops are the major sediment contributor. Converting 4,550 acres of furrow irrigated cropland, primarily hops, to trickle systems with irrigation, pest, and nutrient management will reduce sediment delivery 4,100 tons per year. This will reduce the fine sediment in spawning gravel from 30 percent to 15 percent which will double Fall Chinook Salmon egg-to-fry survival in the Parker Reach of the Yakima River.

Areas of Controversy:

The project has broad public support. Over 40 percent of the problem area has been offered for land treatment contracts by the persons controlling the land. In response to plan development, the Yakama Indian Nation has initiated sediment studies in Parker Reach. This will provide baseline data and monitor the effectiveness of project implementation.

INTRODUCTION

The Moxee Watershed is proposed to improve the egg-to-fry survival of Fall Chinook Salmon in the Parker reach of the Yakima River. The NYCD requested assistance from the Soil Conservation Service in order to implement their five year Hydrologic Unit Area Plan. A PL83-566 Plan has been developed.
The identified problem is impaired spawning due to sedimentation. The furrow irrigated land primarily hops, has been identified as the sediment source. Several alternatives were evaluated. Trickle irrigation systems provided the basis for the National Economic Development plan. The supporting documentation includes numerous studies from U.S.G.S. and Washington State Department of Ecology. The Washington State Department of Fish and Wildlife and the Yakama Indian Nation biologist have been involved in the plan development. Broad public input has been solicited throughout the process.

PROJECT SETTING

The Moxee Watershed project is located within the Moxee Hydrologic Unit #17030003-120. The watershed is outlined on the project map located in Appendix D. The north boundary of the watershed is the Yakima Ridge. Rattlesnake Ridge is the southern boundary. The eastern border is in the Blackrock area. Water drains westerly to the Yakima River which makes up the western boundary. The Moxee Drain and Birchfield Drain provide the drainage for the watershed. The Parker Reach of the Yakima River is identified on the project map. Appendix D.

The watersheds climate lends itself well to intense irrigated agriculture. The average summer temperature is 68 degrees. The average maximum temperature is 82 degrees. Average annual precipitation is 7 to 8 inches of which 30 percent falls during the growing season. Wind in the area is from the west-northwest with an average high wind speed of 8 miles per hour in the spring. Daytime humidity ranges about 40 percent and 75 percent of days are sunny during the summer. All of these factors provide the project area with a minimum 163 day growing season.

The Moxee Watershed has been filled with material that was deposited by normal stream activity and glacial outwash. These areas include low terraces and flood plains. Representative soils that formed in recent alluvium are those in the Esquatzel, Weirman, Ashue, Wenas, Toppenish, and Umapine series. Extensive areas are mantled by loess underlain by lake sediment that was deposited during glacial flooding in the late Pleistocene. This sediment occurs at elevations of as much as 1,000 feet. Warden soils are formed in loess overlying lake sediment.

Major soil series in the project area are Esquatzel, Umapine, Warden, and Willis Silt Loams ranging from 0 percent to 15 percent on irrigated lands with associated rangelands greater than 15 percent slope. The project area can be classified as a rural farming community with single family residences. There is no major industry in the watershed that is not related to agricultural production or harvest. There are two small communities in the watershed. They are Terrace Heights and the City of Moxee.

Land holders within the watershed include the United States Army (18,240 acres), Bureau of Land Management (3,500 acres), Washington Department of Natural Resources (2,880 acres), and private land ownership (73,060 acres).The principal land uses and future land uses are specialized agriculture and "bedroom communities" to Yakima. The "bedroom communities" are expected to grow at a steady rate and occupy marginal agricultural lands. The specialized crops of hops, vineyards, and orchards occupy a large amount of prime farmland and are expected to remain. Other crops of importance include hay and wheat production. There is a significant rangeland acreage.

The Parker Reach between Moxee Drain outlet and Zillah is a broad braided section of the Yakima River with excellent riparian habitat in most areas. Tall black cottonwood trees provide shade for the river and a large number of migrant workers and homeless families which camp along the river. The reach is a traditional fishing area for members of the Yakama Nation. The cover photo is a 1950's era picture of Native Americans fishing below the Sunnyside Dam.

WATERSHED PROBLEMS AND OPPORTUNITIES

The Moxee Drain, one of the contributing agricultural drains to the Yakima River, is recognized by the USGS, National Water Quality Assessment team as a major source of sediments and associated contaminants in the Yakima Basin. Approximately 43 tons of sediments per day are discharged into the Yakima River during the irrigation season.

The Parker Reach of the Yakima River is classified as Class A (excellent) surface water according to state water quality standards. The general characterization of the water quality of this class is that it shall meet or exceed the requirements for all or substantially all uses identified in WA 173-201-045 (2) (b). One of these characteristic uses is for salmonid migration, rearing, spawning, and harvesting. In fact, the Yakima River does not meet the Class A standards and has been identified as an impaired waterbody in Ecology's Nonpoint Source Pollution Assessment and Management Plan.

Two of the primary problems encountered by fish populations are sedimentation and high temperature. Excessive sediment loading is known to be one of the primary limiting factors for production in the Parker Reach. When sediment loading in spawning gravel exceeds 20 to 30 percent a significant increase in the mortality of incubating eggs occurs due to suffocation and /or encasement. Most of the Parker Reach is known to contain sediment levels well in excess of the recommended threshold for even marginal salmon production. Successful spawning occurs in a few relatively high gradient riffles with sediment levels at the lower end of the scale.

Sediments also directly or indirectly reduce salmon production by : 1) causing gill abrasions which result in fungal infections among juvenile fish, 2) reducing primary productivity by limiting light penetration, 3) impacting juvenile salmonid food supply by reducing aquatic invertebrate species, 4) binding to pesticides, heavy metals, and other deleterious substances, which are then transported more readily to the Yakima River from agricultural drains, and 5) causing significant increases in stream temperatures due to greater absorbance and retention of solar radiation. Total suspended sediment (TSS) concentration is positively correlated to elevated water temperature. The threshold water temperature for juvenile salmonids is 68 degrees F. Low flow, high water temperature, and high TSS combine to produce adverse smolt survival conditions.

The Yakima River currently supports valuable populations of Spring and Fall Chinook Salmon. Wild spawning Spring Chinook Salmon are now extinct in the Parker Reach. Although lower Yakima River Fall Chinook received a "healthy" status rating from the Washington State Department of Fish and Wildlife, there is no surplus production to provide harvest (stock is just maintaining itself). Seventy-eight percent of the lower Yakima Fall Chinook Salmon spawn in the Parker Reach. At a minimum improvements in factors affecting fish production is needed to prevent a decline to "depressed" status. Significant improvement in limiting factors will be required to produce Fall Chinook Salmon runs capable of supporting harvest.

Figure I identifies the impact of sediment on the percentage of egg-to-fry survival of Fall Chinook Salmon. Significant increases in survival occur as the percentage of sediment is decreased down to the 10 percent sediment level. The Washington Department of Fish and Wildlife as well as tribal fishery specialist estimate sediment to be in the range of 30 percent. At this level, studies have given a range of percent emergence from around 10 percent up to 40 percent. The source of these sands is the Moxee watershed.

The Moxee Watershed has been identified by North Yakima Conservation District (NYCD), Soil Conservation Service (SCS) and acknowledged by Washington State Department of Ecology (DOE) and United States Geological Survey (USGS) as a significant contributor of pollutants to the Yakima River. The Yakima River Basin Water Quality Plan developed by the Yakima Valley Conference of Governments and approved by Washington State, Department of Ecology also identifies this watershed as a problem area. NYCD and SCS have identified the problem source area in the Moxee Valley as being the furrow irrigated croplands and the inadequate return flow management facilities. Ninety-five percent of the sediment loading occurs during the irrigation season.

The watershed sends 5,200 tons of sediment to the Yakima River each year. Also, 368,000 pounds of nitrogen, 14,000 pounds of phosphorous, and 70,000 pounds of potassium are lost with the sediments. These materials are part of the 19,700 acre feet of irrigation return flow discharged each year into the Moxee Drain.

SCOPE OF ENVIRONMENTAL ASSESSMENT

This section addresses resources concerns identified in the project planning process. These concerns have come from initial natural resource concerns of NYCD. Additional concerns have been developed from multi-entity involvement of resource related agencies such as SCS, USGS, and Washington Department of Fish and Wildlife as well as concerns of watershed producers and the general public through public meetings. Table A, identifies those concerns, degree of concern and degree of significance to decision making.

FALL CHINOOK
EGG-TO-FRY SURVIVAL

FIGURE I

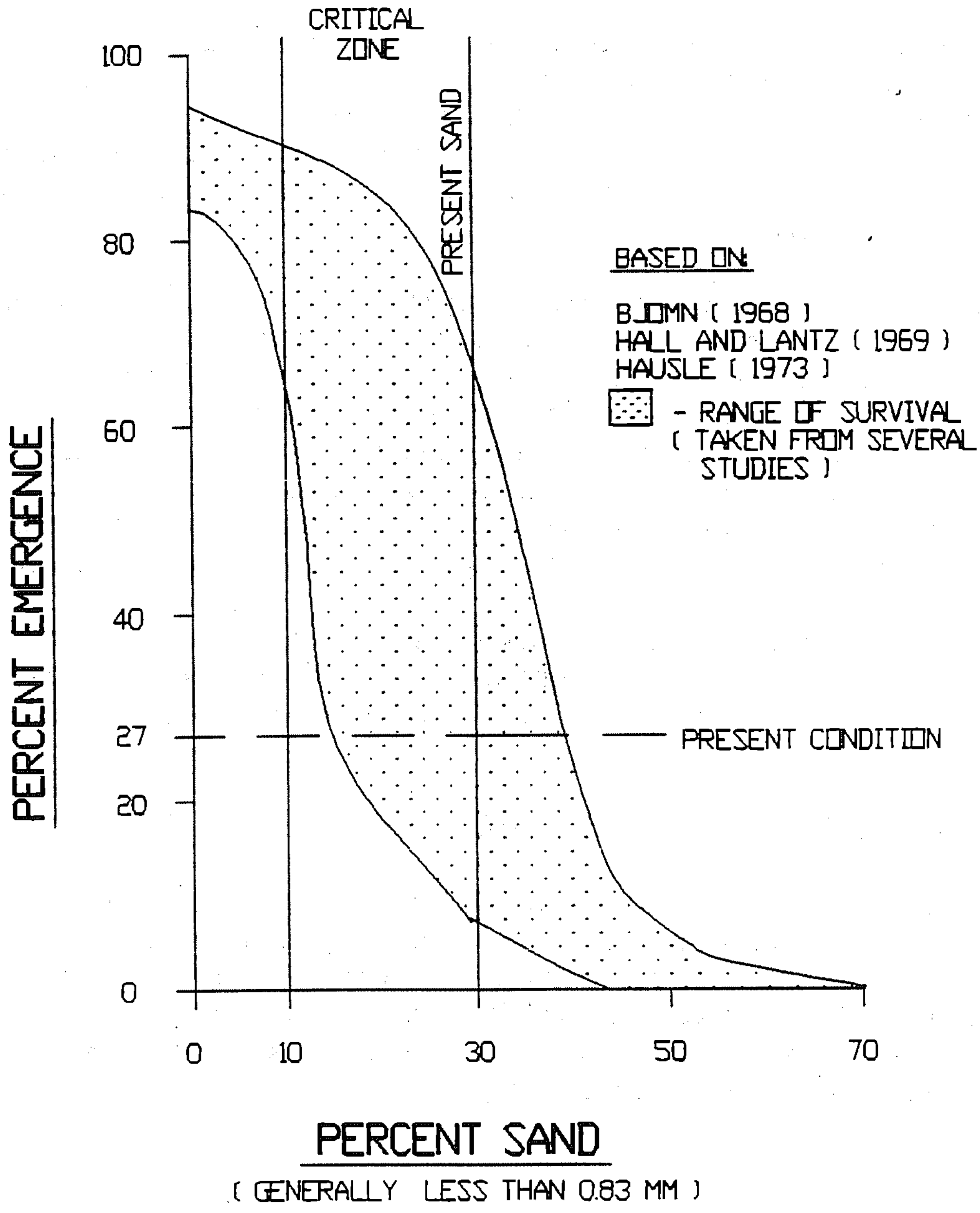


FIGURE I- COMPOSITE INVERSE RELATIONSHIP BETWEEN PERCENTAGE OF FINE SANDS IN GRAVELS AND EGG-TO-FRY SURVIVAL OF SALMONID EGGS DEPOSITED IN REDDS. (FROM CEDARHOLM AND SALO 1979)

TABLE A
Identified Concerns

CONCERNS	DEGREE OF CONCERN	DEGREE OF SIGNIFICANCE TO DECISION MAKING	REMARKS
Water Resources			
surface water quality	high	high	High nutrient and sediment loading
surface water quantity	med	med	Moxee Drain flows year round
ground water quality	medium	low	Nutrients Lost through deep percolation
ground water quantity	medium	low	Very few irrigation wells
sedimentation	high	high	Impacts spawning egg-to-fry survival
flood plains	medium	low	No change expected
wetlands	low	low	
riparian areas	medium	medium	Excellent along Parker Reach
fish habitat	high	high	Spawning affected by sediment
wildlife habitat	medium	medium	Cover limiting factor
threatened and endangered species	medium	medium	Bald Eagles pass through watershed
cultural resources	medium	medium	Possible unknown sites
economics	medium	medium	Watershed Is Ag Based
visual quality	low	low	
air quality	low	low	
social effects	medium	medium	Homeless, immigrants and Native Americans use Parker Reach
natural areas	low	low	
wild and scenic rivers	N.A.	N.A.	Not present in this project

September 30, 1994

1/ High - Must be considered in the analysis of alternatives
Medium - May be affected by some alternative solutions
Low - Consider, but not too significant
None - Need not be considered in the analysis

FORMULATION AND COMPARISON OF ALTERNATIVES:

Formulation process

Four alternative methods of achieving the goal of reducing the quantity of sediment in the spawning gravel of Parker Reach were evaluated.

(1) A large sediment pond near the mouth of the Moxee Drain.
(2) On farm sediment ponds with tailwater recovery.
(3) Furrow mulch systems.
(4) Converting furrow to trickle system.

The large sediment basin proved to be impractical because of space requirements. Smaller structures could not be properly maintained.

On-farm sediment ponds with tailwater recovery systems filled with sediment in one irrigation in some situations. They proved to be impractical.

Furrow mulch systems were quite effective as a sediment reducing mechanism. Currently 20 percent of the furrow irrigated ground is mulched. Expansion is limited because of labor requirements needed to properly stage straw.

Water quality, sedimentation, fish habitat, economics, and water conservation were considered with each alternative.

Grower input, public meetings, and demonstrations were also used to identify public concerns and determine what alternatives should be considered.

The sponsors, with assistance from the public, Washington State Department of Fish and Wildlife and Tribal Fishery representatives worked together to establish the 57 percent egg-to-fry survival goal (figure 2). Due to the wide variation in survival response to the percent sand in gravel, it was determined a 70 percent reduction in sediment would insure achieving the project goal.

FALL CHINOOK
EGG-TO-FRY SURVIVAL

FIGURE II

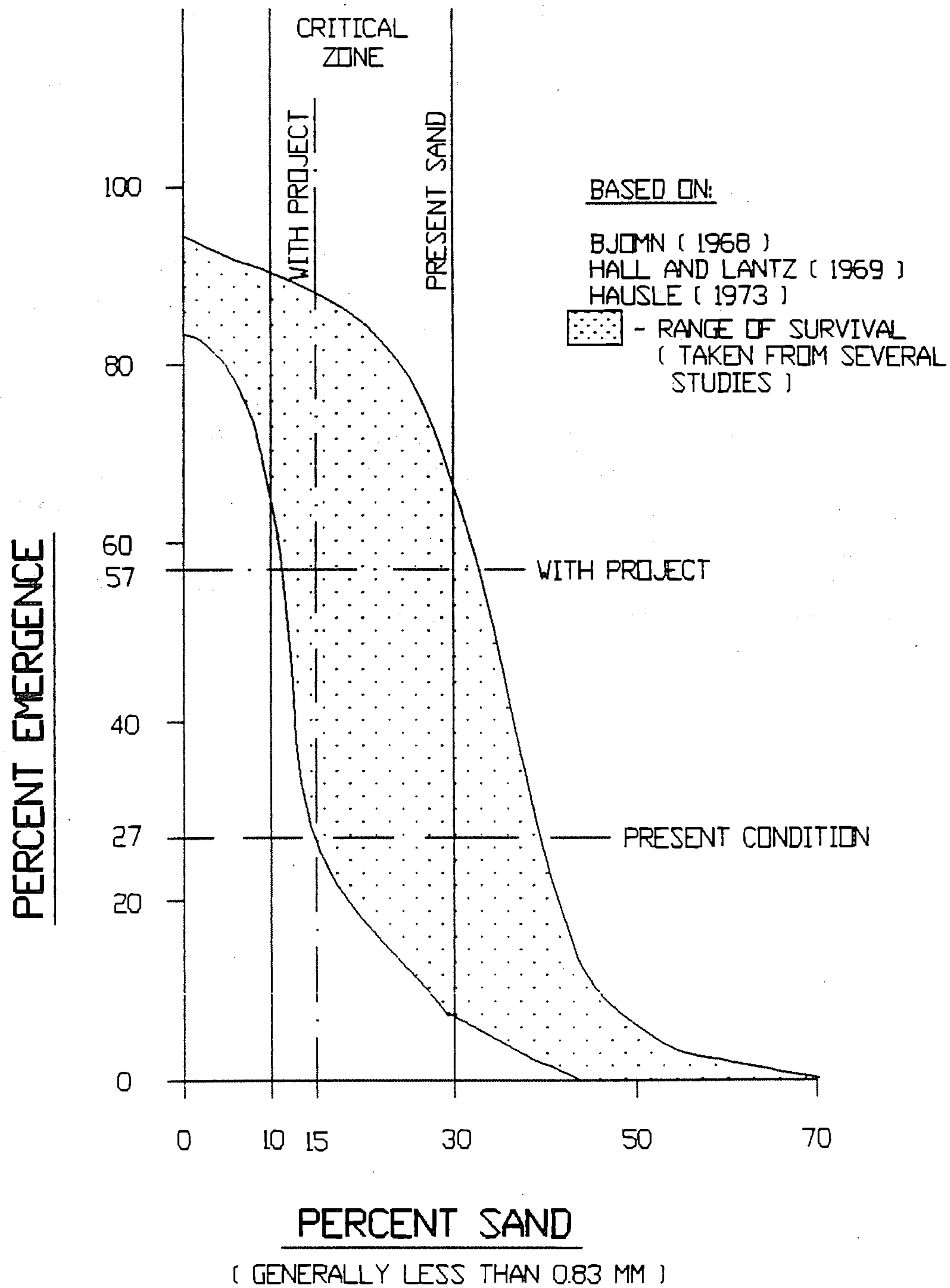


FIGURE II- COMPOSITE INVERSE RELATIONSHIP BETWEEN PERCENTAGE OF FINE SANDS IN GRAVELS AND EGG-TO-FRY SURVIVAL OF SALMONID EGGS DEPOSITED IN REDDS. (FROM CEDARHOLM AND SALO 1979)

Description of alternative

In the future without project alternative, competition for a limited supply of water will continue. Five thousand two hundred tons of sediment will be delivered to the Yakima River. Spawning areas of the Parker Reach will be impacted by sand. High runoff events in some winters on the Yakima River will effectively "wash" the gravel removing the sands. However, before the migration of the Fall Chinook Salmon, sediments from Moxee Drain will deteriorate the quality of the spawning area.

The capitol requirement of trickle irrigation system will restrict implementation without project action.

Effects of alternative

Conversion from furrow to trickle satisfies environmental concerns, provides a mechanism for water conservation for the producers, and meets the project goal of improving the survival of Fall Chinook Salmon egg-to-fry at the 4,550 acre producer participation rate.

Recent producer acceptance of the trickle systems has simplified the alternative development process. A limited number of trickle systems were installed in the Yakima Valley during the past 15 years. However, various problems restricted wide application of these systems. The technology introduced in the past three years has changed producers perception of these systems. Trickle systems are now viewed as the system of the future. The systems not only use less water, eliminate off-site water quality and ground water concerns, but also improve the ease of management. In addition, production costs are reduced, labor hours are reduced significantly, and managerial flexibility is enhanced.

SUMMARY AND COMPARISON OF CANDIDATE PLAN

EFFECTS	WITHOUT PROJECT	ALTERNATIVE (NED)
MEASURES	--------	Trickle Systems On 4,550 ACRES with IWM, and pesticide management
PROJECT INVESTMENT	$0	$5,132,500
NATIONAL ECONOMIC DEVELOPMENT ACCOUNT		
Beneficial annual		$1,277,500
Adverse annual		$ 486,000
Net beneficial		$ 791,500
On-site savings in water		Not quantified
Maintaining productivity for the evaluation period		"
Maintaining productivity for future generations		"
Off-site sediment damage reduction		"
Increase fish and wildlife values		"
Off-site savings in water		"
ENVIRONMENTAL QUALITY ACCOUNT		
Sediment to Parker Reach Yakima	5,200 tons	1,100 tons
Runoff of farm applied nutrients		
Nitrogen	368,000 lbs.	80,000 lbs.
Phosphorus	14,000 lbs.	3,000 lbs.
Potassium	70,000 lbs.	15,000 lbs.
Return flows	19,700 acre-ft.	4,300 acre-ft.
Surface water quality		Converting to trickle systems will decrease sediment 4,100 tons.
Surface water quantity		Irrigation return flows will be reduced from 19,700 to 4,300 acre ft.
Ground water quality		Trickle systems will significantly reduce deep percolation.
Ground water quantity		No significance effect.
Sedimentation		Sediment to spawning areas will be reduced from 5,200 tons per year to 1,100 tons per year.
Flood plains		No adverse effect.
Riparian areas		No adverse effect.
Fish habitat		Sediment reduction in spawning gravel will double egg-to-fry survival.
Wetlands		Potential loss of 6 acres
Wildlife habitat		Reduced cultivation will improve on-farm upland habitat.
Threatened and endangered species		Increased survival of Fall Chinook Salmon.

OTHER SOCIAL EFFECTS

Impact on disadvantaged persons	Improved water quality. Assist migrants and homeless and camping along Parker Reach.
Impact on rural development	Reduce impact of short water years.
Nuisance/safety effects	Quality of resident fish will be improved.
Health effects	Quality of resident fish will be improved.
Social well-being	Quality of resident fish will be improved.

REGIONAL ECONOMIC DEVELOPMENT ACCOUNT

Regional annual beneficial effect	$1,277,500
Regional annual adverse effect	$ 169,000
Rest of U.S.	$ 317,000

Note: Interest Rate 8 percent period of analysis 25 years - Price Base 1994

Risk and uncertainty

There is limited data as to the expected response of the egg-to-fry survival to reductions in sediment. The conservation district has already received verbal commitments for 60 percent of the furrow irrigated acres. Based on experience in the county, the remaining participation will be easily achieved. Water right issues may effect disposition of water made available by increased efficiency. There is reduced risk from pesticides attached to sediment.

Rationale for plan selection

Converting furrow irrigated lands to trickle systems will provide a means for producers of reducing water requirements. These systems require less water, there is no tailwater, or sediment. The producers can utilize the systems for both fertilization and pest control applications in precise amounts. The number of tillage operations is greatly reduced and managerial flexibility is increased. The alternative meets the project goal. It is environmentally sound and is widely accepted by producers. The potential loss of 6 acres of wetland is being mitigated. The 40 percent increase in irrigation efficiency is the deciding force for most producers because of water shortages in recent years. Severe economic losses occur proportionately with water shortages. Converting to trickle will result in on farm water savings benefit of $260 per acre. Savings in nutrient application cost will be $21 per acre. These benefits are equivalent to a 10% increase in production.

A total of 836 acres of wetlands occur within the proposed project area. Approximately 692 acres of these wetlands are located along the flood plain of the Yakima river. These wetlands are associated with water tables from the river and are not expected to be influenced by the projects conversion of furrow irrigated cropland to drip irrigated cropland. The croplands planned for conversion to trickle irrigation all occur on a natural bench above the flood plain of the Yakima River where a majority of the wetlands occur.

The National Wetland Inventory Maps (NWI) identify approximately 144 acres of wetlands that occur above the flood plain and on the bench where project implementation is expected to take place. Of these 144 acres, approximately 116 acres are identified on the (NWI) as either excavated, drains, irrigation ditches, diked, or impounded, artificial wetlands. Field investigations in the project area tie most of the remaining 28 acres of wetlands to pump back system, irrigation ditch overflow systems, drainage ditch systems, or ponds formed from leakage from main canals.

The four main types of artificial wetlands in the project area are:

* Irrigation water delivery canals
* Ponds from canal leakage or pumping systems.
* Deeply incised irrigation drain ditches.
* Shallow irrigation drain ditches.

On-farm, tailwater wetlands do not normally occur in or around the furrow irrigated hops fields. Tailwater is normally ditched or piped back to drain ditches.

Artificial wetlands associated with irrigation canals and water delivery systems are not expected to be impacted by implementation of the project. The canals are charges with water between early April and early October and dry other times of the year. These water conveyance systems are required to run at or near capacity in order to function (supply water to delivery points) properly. This is not expected to change significantly with project implementation. Ponds and seeps formed from leakage from fully charges canals are not expected to be altered by the project. Ponds used for irrigation or pump back systems are not expected to change with project implementation.

An inventory of the artificial wetlands associated with the drainage ditches in the project area identify two main types of irrigation drain ditches.

The first type are at the bottom of deeply incised, V-shaped, (excavated) ditches. Depth of these ditches ranges from 10 to 25 feet deep. Based on length measured from the NWI maps and width observations in the field these types of wetlands comprise 4.54 acres. These acres do no include the main Moxee or Birchfield drains which are also deeply incised ditches. Conversion of hop fields from furrow to drip is not expected to greatly alter the size of these artificial wetlands nor reduce their value significantly. Water that occurs in these drainage ditches comes from canal overflows, leakage from surrounding canals and runoff from on-farm irrigation systems. When tailwater is eliminated as hop fields are converted from furrow to trickle irrigation, the wetlands associated with these deeply incised drainage ditches will not be significantly altered. Depth to water in these ditches will be affected but not enough to significantly affect wetland plant composition and or functions.

The second type of drains are ditches that are not deeply incised. Depth of these ditches is usually less than 5 feet deep. These type of wetlands comprise approximately 8.97 acres in the project area. Water in this type of ditch also comes from canal leakage, ditch overflows, and on-farm irrigation runoff. Considering the shallow depth of these drains it is expected that implementation of the project will affect these wetlands. On-farm water savings from rill to trickle conversions in hops field in the project area will reduce flow in drains by approximately 60%. The project plans to implement Best Management Practices on 65% of the rill irrigated lands. The maximum estimated acres of wetlands that can be expected to have a significant reduction in wetland values, be reduced in size or function, or be eliminated altogether due to project implementation is (8.97 X 65%) = 5.83 acres. (6 acres).

The overall positive benefits of reduced sediment on Fall Chinook Salmon habitat and spawning areas in the Yakima River is the primary objective of the project. Reducing the sediment into the Yakima River system also reduces additions of farm chemicals entering the river. This includes currently used agricultural chemicals and older banned chemicals like DDT and its derivatives. Wetlands along the Yakima River will also benefit from the reduction of sediment and chemicals entering the drainage systems within the project area.

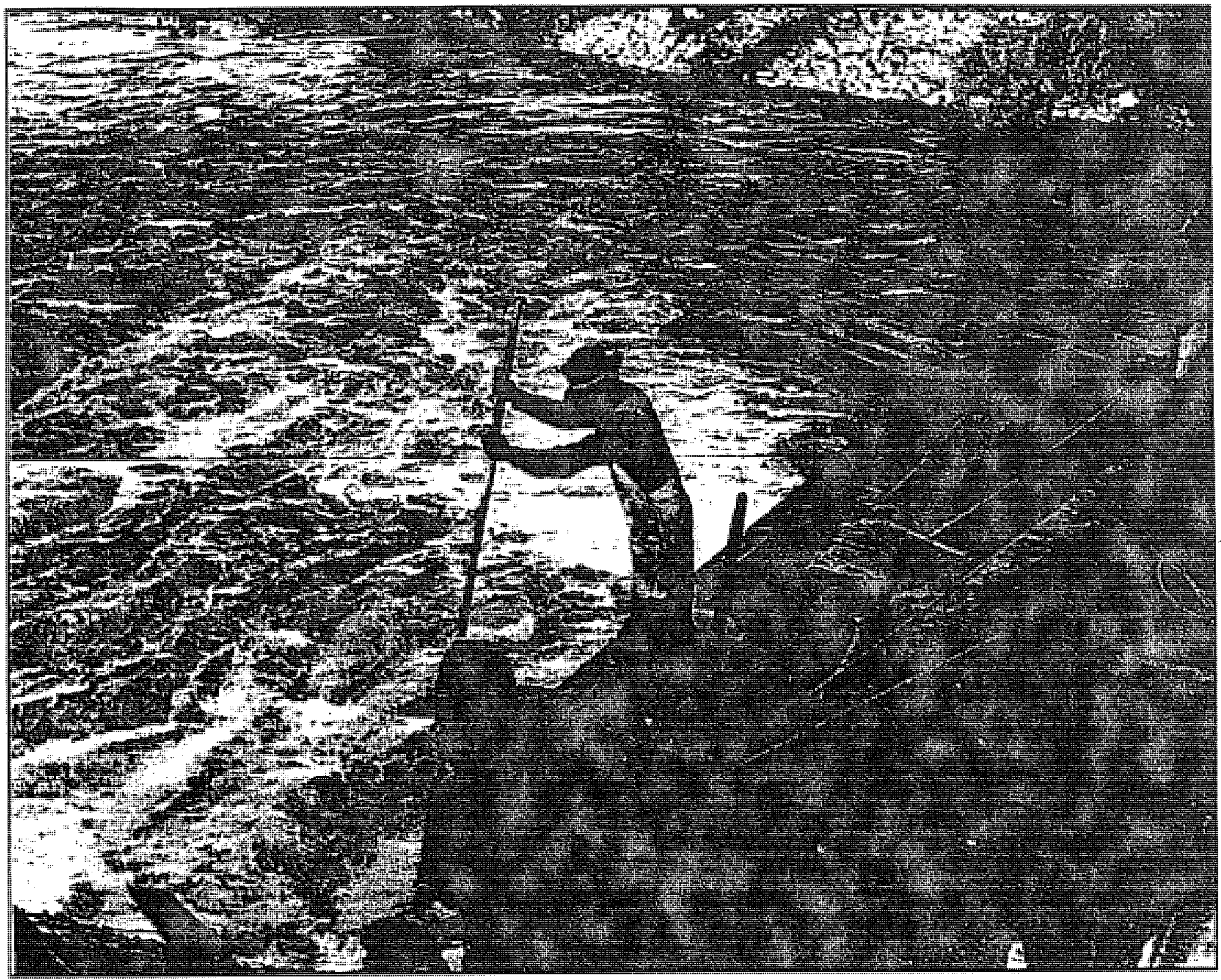
The cumulative and immediate project benefits to off-site aquatic, and wetland habitats is estimated to outweigh the minimum loss of habitat within the project area. The six acre wetland loss is being mitigated.

CONSULTATION AND PUBLIC PARTICIPATION

The list of participating agencies and individuals is included in the reference list. A public meeting was held August 3, 1994. No adverse comments to the project were made. There is broad public support. NYCD has been implementing an information, education program in the watershed for several years. Interagency comments and responses are included in Appendix A.

There were two main areas of concern. The first issue is potential off-site water savings. The draft plan discussed off-site water savings effects and benefits. Since the project does not have any guarantee to assure those benefits references to off-site water savings have been deleted.

The second issue was wetlands. The draft plan did not specifically identify wetland effects. A wetland section has been added to the recommended plan. There will be a six acre loss of wetlands. (less than 1%). A mitigation plan consisting of providing $17,500 to the Washington State Fish and Wildlife's habitat restoration and land acquisition account was developed by NYCD, SCS and the U.S. Fish and Wildlife Service. NYCD has assumed responsibility for providing these funds.



Native Americans Fishing at Sunnyside Dam in Parker Reach Circa 1953

(Photo courtesy - Jack Whitnall Collection)

Purpose and Summary

The primary purpose of the Moxee Watershed Project is to increase the percentage of Fall Chinook Salmon egg-to-fry survival from 27 percent to 57 percent for the 21.2 mile Parker Reach of the Yakima River.

Measures to be installed

Trickle irrigation systems will be installed on acreage that is currently furrow irrigated. Other practices may be used on small areas where trickle systems are not feasible. Accelerated technical assistance for conservation planning and application on cropland private lands will be furnished by SCS and NYCD. SCS and NYCD will be responsible for certification of proper measure installation, providing funds for cost-sharing, and administering the project (except for obtaining necessary landrights, permits and licenses).

NYCD will encourage development and installation of conservation farm plans on all land within the watershed. They will provide leadership through an aggressive education and sales program to encourage application of land treatment measures necessary for the success of this plan. NYCD has responsibility for locally coordinating accelerated installation of cropland treatment under PL83-566 with concurrent activities under Agricultural Stabilization and Conservation Service (ASCS) Special Project Funding authorities. NYCD will approve all conservation plans, determine eligibility for cost-sharing, and assist landowners and operators with operation and maintenance plans.

Mitigation features

There is a potential of losing six acres of artificial wetlands with project implementation. The sponsors will mitigate this potential loss by providing the Washington State Department of Fish and Wildlife $17,500 for Habitat Restoration and land acquisition. This mitigation action was developed jointly with SCS, NYCD and the U.S. Fish and Wildlife Service.

Permits and compliance

Installation of the works of improvement will be in full compliance with all laws and policies of the federal, state, and local government. No federal permits are required; however, individual landowners and or operators will secure local, county, or state permits as required for installation of project measures. In addition, compliance with the Water Resource Council's designated environmental statues is shown in Appendix C.

Costs:

The estimated total installation cost is $5,132,500 which includes financial assistance for establishing land treatment measures, technical assistance for accelerating conservation planning and application, and project administration. The total assistance for establishing conservation land treatment measures on cropland is $4,567,500 The cost-share rate is approximately 65 percent for PL83-566 and 35 percent for other than PL83-566 funds. The total estimated other than PL83-566 costs are estimated at $1,732,560.

The total estimated PL83-566 cost of accelerating technical assistance for planning and applying land treatment measures on cropland is $325,000. Technical assistance costs for conservation planning and application include the direct cost of soil conservationists, engineers, or other technicians for information, conservation planning, surveys, investigations, and design and preparation of plans and specifications.

Project administration includes all administrative costs associated with the installation of planned measures, including the costs of LTC administration, review of conservation plans, and supervision of measure application. The SCS and the sponsors will each bear project administration costs which they incur. These costs are estimated as follows:

PL83-566	SCS	$230,000
other than PL83-566	NYCD	$ 10,000
	Total	$240,000

All costs in this plan are planning estimates. Final costs to be borne by each party will be based upon the average cost or actual cost not to exceed the average cost associated with installation and/or management of each land treatment measure. Installation of accelerated land treatment measures will be pursued in a systematic manner beginning the first year and carrying through the project installation period. During the first two years of project installation, most land treatment activity will be confined to information, promotion, and development of conservation plans. All cost shared measures will have been installed at the end of 5 years with 2 years contracted management practices following.. Table B shows the anticipated expenditure of funds by fiscal year.

TABLE B - Installation Schedule

PL83-566 MOXEE WATERSHED, WA.

Year	PL83-566 Installation Cost	Technical Assistance	Project Admin.	Total PL83-566	Other Installation and Project Admin.	Other Technical Assistance	TOTAL Other
1995	$1,575,000	$48,750	$115,000	$1,738,750	$963,300	$32,500	$995,800
1996	$787,500	$48,750	$57,500	$893,750	$431,700	$32,500	$464,200
1997	$472,500	$48,750	$11,500	$532,750	$76,000	$32,500	$108,500
1998	$61,250	$19,500	$11,500	$92,250	$74,500	$13,000	$87,500
1999	$61,250	$9,750	$11,500	$82,500	$74,500	$6,500	$81,000
2000	$0	$9,750	$11,500	$21,250	$0	$6,500	$6,500
2001	$0	$9,750	$11,500	$21,500	$0	$6,500	$6,500
TOTAL	$2,957,500	$195,000	$230,000	$3,382,500	$1,620,000	$130,000	$1,750,000

Responsibilities for installation:

Installation of land treatment measures is the responsibility of individual landowners and/or operators.

Installation and financing

Project measures will be installed by individual owners and operators under contracts beginning in 1994, between the individual owners or operators and the Soil Conservation Service. Technical and financial assistance, in addition to that already available in the watershed, will be provided under Public Law 83-566. Financial cost-sharing assistance for project measures will be provided (1) on the basis of cost effectiveness, (2) at a rate amended, (3) policy statements of the Secretary of Agriculture and the Chief of the Soil Conservation Service, and (4) in accordance with sound fiscal management of financial assistance under the Public Law 83-566. The Washington Department of Fish and Wildlife will utilize the $17,500 wetland mitigation funds.

Contracting

All cropland treatment measures receiving PL83-566 cost-sharing assistance for installation will be installed in accordance with provisions of a conservation contract between SCS and individual landowners and/or operators for measures installed on land which these individuals own or control. The 44 contracts will be for a period of not less than 3 years nor more than 7 years in length. The contracts will continue for at least two years following the installation of the final cost-share item. Land treatment measures will be included in each conservation contract on the basis of their cost effectiveness. Non cost-shared measures will be required as a condition for cost-share assistance where such measures are necessary for the planned project. Non cost-shared practices may be applied concurrently with cost-shared practices.

Cost-share payments will be made by SCS after an eligible unit of the conservation measure has been completed and certified. The participant must file a claim for payments.

All contracting or arrangements for installation of measures are the responsibility of individual landowners and/or operators. All works of improvement will be installed in accordance with the applicable local, State, and Federal regulations with specific reference to standards and specifications of the SCS. All land disturbed by construction activities will be shaped and vegetated. Plant selection will be made during the installation phase in consideration of season, soil type, adjacent vegetation, and sponsor preferences.

Landrights

Landowners and/or operators have responsibility for obtaining any permits, landrights, licenses, or water rights needed to perform planned work.

Other agencies

The ASCS will continue to provide funding for eligible measures through the Agricultural Conservation Program (ACP) contingent upon appropriation of funds for this purpose. The Yakama Tribe is doing both habitat and population evaluations in the Parker Reach which is complimentary to the NYCD sediment monitoring program in the Moxee Drain. Other State and Federal agencies are continuing on-going water quality studies. The Washington State Department of Fish and Wildlife will utilize the habitat restoration and land acquisition funds for the project's wetland mitigation.

Cultural resources

A cultural resources survey of the watershed indicated that there are no cultural resources of national register significance. In the event that archaeological and historical properties are discovered during the installation of measures, the procedures in SCS's General Manual, Title 420, Part 402 (October 1983) as amended, will be utilized.

Financing

Project installation costs allocated to PL83-566 funds will be paid from funds appropriated under authority of PL83-566, 83rd congress, 68 Stat. 666, as amended. NYCD, organized under Washington State Law, is empowered to enter into agreements and contracts, to sue and to be sued, and to carry out soil and water conservation programs. NYCD and landowners and operators have participated in cost-sharing decisions. They have given assurance that their portion of the estimated costs for installing land treatment measures, land rights, and project administration will be borne by individual landowners or operators with such assistance as may be available from state or county funds, or from ASCS through applicable provisions of the Rural Development Act of 1972.

Conditions for providing assistance

This plan does not constitute a financial document for obligation of PL83-566 or other funds. Financial or other assistance furnished by SCS in carrying out the plan is contingent upon appropriation of funds for this purpose. Any practices not considered to be an annual practice such as terraces, grassed waterways, etc., and which were previously installed with cost-sharing under Federal programs, will not qualify for accelerated financial assistance under the project unless they have exceeded the normal useful life with proper maintenance. In addition, any specific land treatment activity described in this plan, will not receive PL83-566 cost-share assistance in any year that comparable cost-share assistance is available under existing programs in the watershed.

Operation and maintenance

The operation, maintenance, and replacement of measures will be the responsibility of the landowner. An operation and maintenance (O&M) agreement will be executed prior to signing a project agreement in accordance with the O&M plan which will be prepared during project design. The average annual cost for operation and maintenance is $5,000.

Inspection and reviews

Active contracts are to be reviewed annually on the land and with the cooperators to assess current conditions and progress in carrying out the plan/schedule of operations. The final review of a contract must be made with the cooperator at least 90 days before the contract expires. Reviews are to be made by an SCS employee.

Even though SCS employees may visit a farm or ranch under contract one or more times during a year, the annual review should be the occasion for careful evaluation of the cooperator's needs and problems and the status of his contract and operations. Following are some of the areas which should be checked and findings recorded.

(1) Maintenance of practices previously applied.
(2) Application of practices scheduled in the current year.
(3) Need for changes in time schedule or practices.
(4) Adequacy of applied conservation practices in relation to erosion control achieved.
(5) Determine whether land under contract is still under the cooperator's control.

TABLE 1- Estimated Installation Cost

MOXEE WATERSHED, WA.
(Dollars) 1/

			Estimated cost (dollars)1/		
Installation Cost Item	Unit	Number Total	Public Law 83-566 Funds Total	Other Funds Total	Total
Land treatment-Accelerated Evaluation Unit					
Irrigation system, Trickle 3/,4/,5/	acre	4,550	2,957,500	1,610,000	4,567,500
Technical Assistance			195,000	130,000	325,000
Subtotal-Accelerated			3,152,500	1,740,000	4,875,000
Project Administration			230,000	10,000	240,000
TOTAL PROJECT			3,382,500	1,750,000	5,132,500

September 1994

1/ Project price base April 1994
2 / Federal agency responsible for assisting in installation of works of improvement
3/ Irrigation nutrient, and pesticide management required with trickle systems, cost included in on-farm operation cost.
4/ Other practices may be substituted on some minor acreage
5/ Includes $0 of Public Law 83-566 funds and $17,500 of other funds for wetland mitigation measures.

TABLE 4 - Estimated Average Annual NED Cost

MOXEE WATERSHED, WA.
(Dollars) 1/

Evaluation Unit	Project Outlays: Amortization of Installation Costs	Project Outlays: Operation maintenance, and replacement cost	TOTAL
Land Treatment Accelerated	481,000	5,000	486,000
GRAND TOTAL	481,000	5,000	486,000

September 1994

1/ Price Base 1994, amortized over 25 years at a discount rate of 8 percent.
2/ Cost for technical assistance to install associated measures and financially assisted accelerated land treatment in this evaluation unit are included.

TABLE 5a - Estimated Average Annual Watershed Protection Damage Reduction Benefits

MOXEE WATERSHED, WA
(Dollars) 1/

Item	Damage Reduction benefit average annual - agriculture - related
On-site reduced cost Land voiding and depreciation 3/ Water conservation 2/ Maintaining productivity 3/ Other reduced cost operation cost	 1,180,000 97,500
Sub-Total	1,277,500
Off-site/Public Water Conservation Maintaining productivity for future generations 3/ Fish and wildlife 3/ Water conservation 3/	
GRAND TOTAL	**1,277,500**

September 1994

1/ Price base 1994.

2/ 40 percent increase in on-farm efficiency. In water short years increased efficiency will allow more normal production. Water should be available for downstream use in years with average or above water supply.

3/ Benefits exist but they have not been monetarily evaluated

TABLE 6 - Comparison of NED Benefits and Cost

MOXEE WATERSHED, WASHINGTON
(Dollars) 1/

Evaluation Unit	Agriculture-related Damage Reduction	Average Annual Benefits 2/	Average Annual Costs 3/	Benefit Cost ratio
Land Treatment-acres	1,227,500	1,227,500	486,000	2.5:1
TOTAL	1,227,500	1,227,500	486,000	2.5:1

September 1994

1/ Price base 1994.
2/ From Table 5a
3/ From Table 4

LIST OF PREPARERS
PL83-566 MOXEE WATERSHED

Name	Present Title (time in job)	Education (degree)	Experience Other Titles (Licenses)
Ken King	Manager-6	YVCCA WSU	SCS-ENG TECH-16 SCS-208 W/Q PROJECT PLANNER-1 CSM W/Q PROJECT LEADER-3 SCS-IWM PROJECT I SCS-COLORADO RIVER SALINITY CONTROL PROJECT A2-3
Michael Tobin	Resource Con-6	YVCCA WSU-BS	DELIVERY/PRODUCTION PROMOTION AG.MECH. AG. EQUIPMENT-3
Jackie Whitnall-Craven	Secretary	YVCCA	SECRETARY / 6 SELAH IRRI. DIST SECRETARY - BOISE CASCADE /1
Ray Wondercheck	D.C. YAKIMA F.O.	UN-BS	SCS-D.C.-NEBRASKA-2 AGRON.D.C.-ARIZONA-6
Larry Edmonds	Ag. Econ.	OSU-BS	SCS-23
Larry Cooke	Environmental Spec.-2	BS-NAT. RES.MGT.	D.C.-14 SOIL CON.-2 CERT.SOIL CON.PEST TECH-2 CONES I

The Watershed plan and environmental assessment has been reviewed and concurred in by state staff specialists having responsiblity for engineering, soils, agronomy, range conservation, biology, forestry, geology, and water quality.

The West National Technical Center (WNTC) has reviewed and concurred on the technical aspects of the plan and environmental assessment.

REFERENCES

The Moxee Watershed Plan has been developed utilizing information contained in the following reports.

Final report for the "Moxee/Naches Water Quality Project" prepared by NYCD.

Final report for the "Moxee BMP Implementation and Demonstration Project" prepared by NYCD.

Ref-38 "Comprehensive Water Conservation Plan" prepared by Moxee Irrigation District.

"Yakima River Basin Management Plan" prepared by Yakima Valley Council of Governments.

"Nonpoint Source Pollution Assessment and Management Plan-1989" prepared by Washington Department of Ecology.

Field Inventories by SCS.

Maps and cooperator list by ASCS.

NAWQA reports and datum (national water quality assessment) by USGS.

During the development of this information the following individuals have assisted the NYCD board of supervisors in developing this information.

Max Linden, Department of Ecology, NPS Pollution Supervisor Central Region Office.

Kahle Jennings, Department of Ecology, 319
Coordinator, Olympia.

Rich Van Horn, Hop Growers of Washington, President
Ann George, Hop Growers of Washington, Manager
Brian Miller, ASCS, Executive Director.
Richard Halverson, ASCS County Committee.
Mary Ann Bonny, ASCS
Jean Allen, ASCS
Onni Perala, Bureau of Reclamation, Boise
Don Schram, Bureau of Reclamation, Yakima Project Office.
Thomas Ley, WSU Cooperative Extension, Prosser
Marc Desmarais, Fowler Ditch Company, President/farmer
Lee Gamache, Moxee Irrigation District, President/farmer
Montgomery Irrigation

The following producers have provided input into the development of the plan:

Roy Farms	Jeff Gamache Farms	Harris Farms
Desserault Ranch	Van Horn Farms	Desmarais Ranch
East Valley Farms	Sundquist Orchards	Albert Mulford
Larry Hattrup	Wes Den Beste	Steve Den Beste
Fred Den Beste	Lyle Brulotte	Firewater Ranch
Morrier Ranch	Charron Farms	GLD Farms
Fred Lenseinge	Cascade Hop Ranch	Loftus Ranches

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APPENDIX A: CONSULTATION WITH OTHER AGENCIES

1. State of Washington, Department of Ecology
2. U.S. Department of Interior, Fish and Wildlife Service
3. Washington State University, Cooperative Extension.

Frank

rec'd 10/3

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
3601 W. Washington • Yakima, Washington 98903-1164 • (509) 575-2800

September 30, 1994

Lynn A. Brown
Soil Conservation Service
Rock Pointe Tower II, Ste 450
W. 316 Boone Ave
Spokane WA 99201-2348

SUBJECT: Comments on Moxee Watershed Draft Plan and Assessment Report Dated August 12, 1994

The following comments are offered for your consideration:

1. The operation and maintenance agreements should contain wording to the effect that water saved through conservation cannot be used to add new areas of irrigation. The saved water is to remain in the conveyance system, storage, or the river system. If possible, the plan should include a way to measure the areas irrigated before and after drip system installation.

2. If possible, the plan should include a means to measure improvements in water use efficiency. This project presents a unique opportunity to contribute to the body of research concerning buried drip irrigation systems.

Thank you for the opportunity to comment.

Sincerely,

Timothy D. Reierson

Tim Reierson
Water Resources Program

940937ska

NYCD and SCS Response to Department of Ecology:

Concern 1:

The Moxee Watershed Plan has been formulated to improve habitat of Parker Reach of the Yakima River for Fall Chinook Salmon. Reducing sediment and the associated nutrients and pesticides seventy percent will allow the egg-to-fry survival rate of these salmon to double. The project will reduce sediment to the Yakima River 4,000 tons each year. References to off-site water savings have been removed.

Farms in the Moxee Watershed have experienced critical irrigation water shortages in recent years. The increase in irrigation efficiency will assist producers to meet the water requirements of existing crops. Project benefits have been claimed for this improved efficiency. PL83-566 funds will not be used to bring new acreage into production. All land treatment contracts require the producers obtain all necessary permits be acquired. The plans also require the produce meet all state and federal laws and regulations.

The disposition of water in irrigation district canals is a matter of concern between the irrigation districts and the State. The Moxee Watershed conservation contracts require on-farm irrigation water management, nutrient management, and pesticide management. Additional requirements for the disposition of water not delivered to the farm is beyond program and contract limitations. References to off-site water savings have been deleted from the plan.

Concern 2:

We will relay your interest in water use efficiency to Bob Stevens, WSU. WSU is in a better position to respond to this research issue than SCS of NYCD.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
3704 Griffin Lane SE, Suite 102
Olympia, Washington 98501-2192
(206) 753-9440 FAX: (206) 753-9008

SEP 30 1994

SEP 30 1994

September 27, 1994

Lynn A. Brown, State Conservationist
Soil Conservation Service
Rock Pointe Tower II, Suite 450
W. 316 Boone Ave.
Spokane, WA 99201-2348

Dear Mr. Brown:

This is in response to your August 15, 1994, letter regarding the draft Moxee Watershed Plan and Environmental Assessment (Plan). The emphasis of the draft Plan is to convert 5,250 acres of furrow irrigated hops and vineyards to buried trickle irrigation systems. The stated goals of the draft Plan are to conserve irrigation water, improve water quality of irrigation return flows to the Yakima River, protect ground water quality, and enhance Yakima River stream flows. The U.S. Fish and Wildlife Service (Service) provides the following comments and recommendations for your consideration.

The Service supports the draft Plan and concurs with the potential water quality benefits which would accrue from implementing the proposed measures. However, we believe there are two issues that need to be addressed more fully in the final Plan. These issues include the impacts of the proposed plan on existing wetland resources and the fate of any water conserved due to improved irrigation efficiency.

As noted on page 26 of the draft Plan, the majority of the 838.85 acres of wetlands in the watershed are located downstream of the furrow irrigated area. The National Wetland Inventory maps included in the draft Plan identify many wetlands in and near drainageways. With full implementation of the draft Plan, irrigation tailwater moving through the drainageways would be reduced from the current 18,860 acre-feet to 2,500 acre-feet (page 30 of draft Plan). The large reduction in return flows would have some adverse impacts on wetlands located in, or associated with, the drainageways downstream of the proposed project. We assume many of these drainageways and associated wetlands would receive no tailwater once the buried trickle irrigation systems are installed. This may eliminate some of these wetlands. Reducing the hydrology to other wetlands could reduce their size, change their plant composition, and/or change their functions.

The potential for negative effects to wetlands from the tailwater reduction is mentioned on page 30 of the Plan. However, other references to wetlands in the Plan either indicate there would be no negative impacts or there would be positive effects due to reduced sedimentation. While the Service agrees that reducing erosion and pollutant runoff would have potential beneficial effects on wetlands, negative impacts could also accrue with plan implementation.

As you are probably aware, wetlands are an important component of the landscape. They serve several functions including water quality improvement, groundwater recharge, recreation, and wildlife habitat. Many efforts are being made to protect, restore, and maintain these important areas. Also, various laws, initiatives, and policies, designed to protect wetlands, such as Executive Order 11990 and Section 404 of the Clean Water Act, are now in place. Therefore, wetland losses due to the proposed plan implementation should be avoided and minimized, where practicable, and any unavoidable losses should be fully compensated by replacement wetlands. This would ensure that these important areas continue to provide valuable functions and can assist the proposed Watershed Plan in achieving its goals of improving the water quality of the Yakima River and the groundwater.

The final Plan should identify the type, location, and size of wetlands which would no longer receive tailwater flow following implementation of the Plan. It should identify the same information for wetlands which would receive reduced flows following Plan implementation. The final Plan should also address how impacts to wetlands could be avoided and minimized, and how any remaining losses would be compensated. This should include a mitigation plan which details the location of mitigation sites, specific information on how wetlands would be created or restored, a monitoring plan, success criteria, and a contingency plan should the success criteria not be met.

The draft Plan states that the water conservation achieved as a result of the proposed project would enhance flows in the Yakima River (pages 24 and 25 of the draft Plan). While the proposed project would result in land on the affected area being irrigated with a small fraction of the volume of water currently used, it is unclear what regulatory mechanism or incentive would be used to ensure that the conserved water is left in the river to enhance flows. For example, it is not clear whether the water rights of those participating in the plan would be reduced as a result of the water conservation or whether any conserved water would be available for appropriation by junior water right holders. If water rights are not reduced or the conserved water is withdrawn by others, then no benefits to the river may occur. The final Plan should address this issue because it may negate the potential to enhance flows in the Yakima River, as claimed in the draft Plan.

We appreciate the opportunity to provide these comments for the draft Moxee Watershed Plan and Environmental Assessment. If you have any questions regarding these comments, please contact Don Haley or Dave Kaumheimer at our Moses Lake office (509-765-6125).

Sincerely,

for Nancy J. Gloman
David C. Frederick
State Supervisor

dh/jmc
c: FWS, Portland (Jay Watson)
WDFW, Yakima (Ted Clausing)
EPA, Seattle (Dick Clark)
North Yakima Conservation District, Yakima (Mike Tobin)
Yakama Indian Nation, Toppenish (Jerry Meninick)

NYCD and SCS response to United States Department of the Interior, Fish and Wildlife Service:

Wetland concern

A description of wetland effects has been added to the Rationale for Plan selection section. Potentially, six acres of artificial wetlands located in small tailwater channels could be lost as the tailwaters are eliminated from the converted fields. The Washington State Department of Fish and Wildlife's habitat restoration and land acquisition program will receive about $17,500 from NYCD to mitigate the habitat. This mitigation plan was agreed to by SCS, NYCD and U.S. Fish and Wildlife Service.

Water Conservation Concern:

References to off-site water savings have been removed.

Frank

COOPERATIVE EXTENSION

Washington State University

WSU Prosser

Rt. 2, Box 2953-A
Prosser, WA 99350-9687
509-786-2226 / FAX 509-786-4635

October 3, 1994

Mr. Lynn A. Brown
State Conservationist
Soil Conservation Service
Rock Pointe Tower II, Suite 450
W.316 Boone Avenue
Spokane, WA 99201-2348

Dear Lynn:

On behalf of Washington State University I would like to thank you for the opportunity to provide input into the proposed project "Moxee Watershed Draft Watershed Plan and Environmental Assessment" prepared by the North Yakima Conservation District and Soil Conservation Service. Although I have had several conversations with your field staff in both Yakima and Spokane, I would like to provide a few written comments.

I strongly support the conversion of furrow irrigated hops to buried drip systems. This conversion has the potential to significantly improve water use efficiency and prevent surface water quality degradation. Buried drip also has the potential to reduce groundwater contamination with nutrients such as nitrate.

As I have indicated to you staff, I also support the implementation of management tools that will help assure maximum benefit from the proposed buried drip systems. Although we have only a small data base to help develop guidelines, research on the management of buried drip systems is ongoing. I would suggest that soil samples be used to develop a baseline for nutrient management. There are still several questions to be answered with regards to the optimum sampling procedure for buried drip. I believe that we will develop a method in the near future. Petiole sampling should be implemented to allow the producer to monitor the nitrogen supply to the crop. Individual producers will need to develop their own data base under their management conditions.

I would strongly recommendation that an educational program be considered as part of this watershed plan. Buried drip irrigation systems must be managed properly if the water savings and groundwater protect benefits are to be realized. Those of us at WSU-Prosser working with buried drip systems would be willing to help put together this type of educational effort. I believe that it is important for producers to have a good working knowledge of how the system is designed to work and how miss management can lead to problems. I would be glad to help either SCS or NYCD put this training together.

Once again, I strongly support this effort and am pleased to work with your staff to increase the return on investment. If I can be of any additional assistance please let me know.

Sincerely,

Robert G. Stevens
Extension Soil Scientist

cc.
Rob McDaniel
Frank Easter
Renu D. Arjal
Jeff Graham

NYCD and SCS response to WSU concerns:

WSU's recommendation has been added to the land treatment contract specifications.

We agree with the importance of an education program. NYCD's current HUA information, education program will be used for program implementation. WSU's involvement will be gladly received.

APPENDIX C - COMPLIANCE OF THE RECOMMENDED PLAN WITH WRC-DESIGNATED ENVIRONMENTAL STATUTES

Moxee Watershed, Washington

FEDERAL POLICY	COMPLIANCE
1. Archaeological and Historical Preservation Act, 16 USC 469, et seq.	full comp.
2. Clean Air Act, as amended, 42 USC 1857h-7, et seq.	N/A
3. Clean Water Act(Federal Water Pollution Control Act), 33 USC 1251, et seq.	full comp.
4. Coastal Zone management Act, 16 USC 1451, et seq.	N/A
5. Endangered Species Act, 16 USC 1531, et seq.	full comp.
6. Estuary Protection Act, 16 USC 1221, et seq.	N/A
7. Federal Water Project Recreation Act, 16 USC 460-1(12), et seq.	N/A
8. Fish & Wildlife Coordination Act, 16 USC 661, et seq.	full comp.
9. Land & Water Conservation Fund Act, 16 USC 4601-4601-11, et seq.	N/A
10. Marine Protection, Research & Sanctuary Act, 33 USC 1401, et seq.	N/A
11. National Environmental Policy Act, 42 USC 4321, et seq.	full comp.
12. National Historic Preservation Act, 16 USC 470a, et seq.	full comp.
13. Rivers & Harbors Act, 33 USC 403, et seq.	N/A
14. Watershed Protection & Flood Prevention Act, 16 USC 1001, et seq.	full comp.
15. Wild & Scenic Rivers Act 16 USC 1271, et seq.	full comp
16. Farmland Protection Policy Act, 7 USC 4201, et seq.	full comp.

a. Full Compliance- Having met all requirements of the Statute for current stage of planning (either pre-authorization or post authorization).
b. Not Applicable- No requirements for the Statute compliance for the current stage of planning.

APPENDIX C
INVESTIGATION AND ANALYSIS - ENDANGERED SPECIES

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES WHICH MAY OCCUR WITHIN THE VICINITY OF THE PROPOSED MOXEE WATERSHED RESOURCE INVENTORY PROJECT NEAR YAKIMA, IN YAKIMA COUNTY, WASHINGTON
(T12N I; T13N I)
FWS Reference: 1-3-94-SP-482
LISTED
Bald eagle (Haliaeetus leucocephalus) - wintering bald eagles may occur in the vicinity of the project from about October 31 through March 31.
Major concerns that should be addressed in the biological assessment of project impacts to bald eagles are:
1. Level of use of the project area by bald eagles.
2. Effect of the project on bald eagles primary food stocks and foraging areas in all areas influenced by the project.
3. Impacts from project construction and implementation (e.g., increased noise levels, increased human activity and/or access, loss or degradation of habitat) which may result in disturbance to eagles and/or their avoidance of the project.

PROPOSED
none
CANDIDATE
The following candidate species may occur in the vicinity of the project:
Bull trout (Salvelinus confluentus)
Ferruginous hawk (Buteo regalis)
Loggerhead shrike (Lanius ludovicianus)
Western sage grouse (Centrocercus urophasianus phaios)

FEDERAL AGENCIES' RESPONSIBILITIES UNDER SECTIONS 7(a) AND 7(c) OF THE ENDANGERED SPECIES ACT OF 1973, AS AMENDED

SECTION 7(a) - CONSULTATION/CONFERENCE

Requires:

1. Federal agencies to utilize their authorities to carry out programs to conserve endangered and threatened species:

APPENDIX C - INVESTIGATION AND ANALYSIS - OTHER STUDIES

The majority of the formulation of the watershed plan occurred during the Moxee Drain BMP Implementation Demonstration Project completed September 1993. The table of contents of the completion report is included.

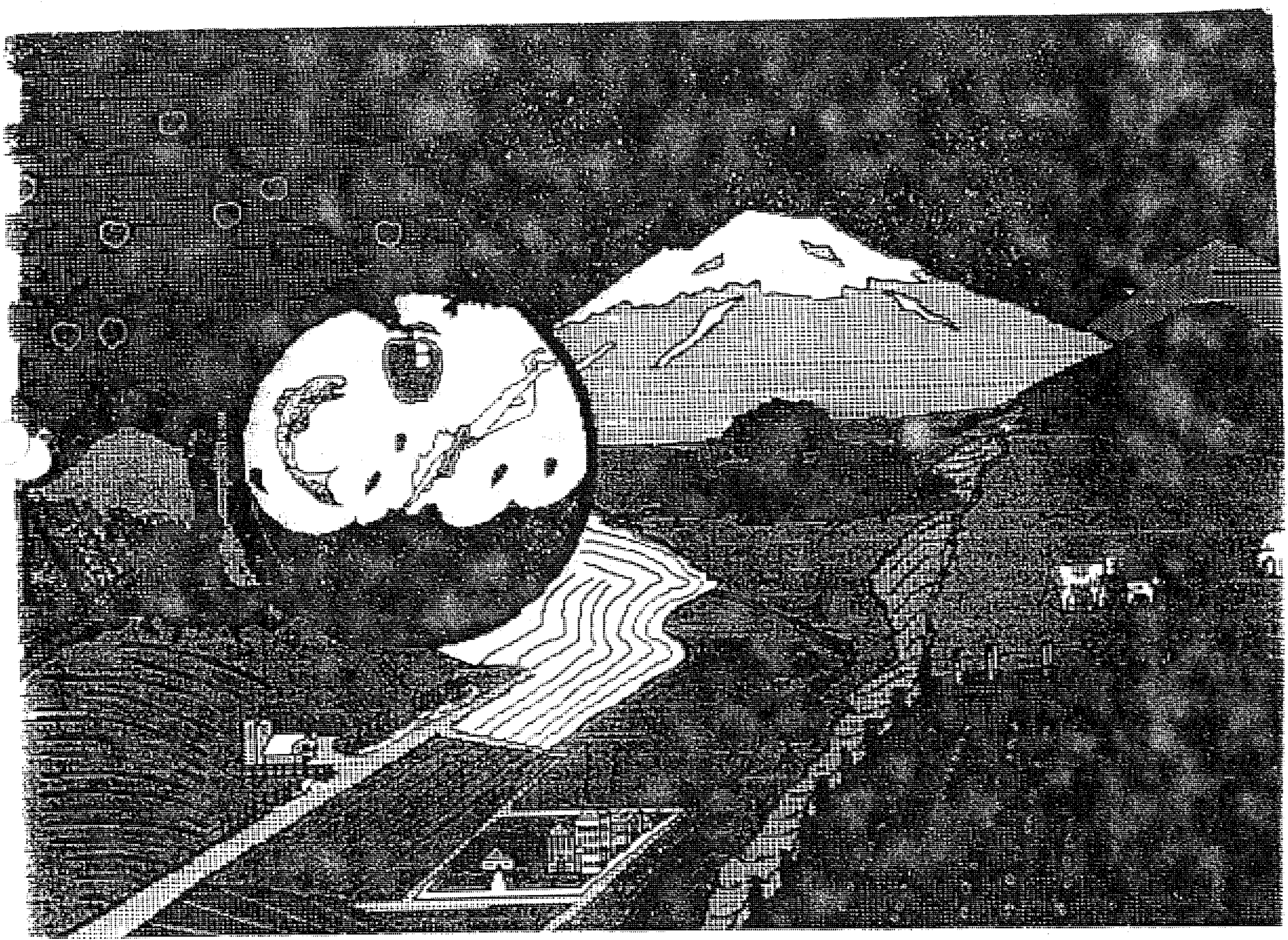
This study was followed by the Moxee Drain Irrigated Agriculture BMP Implementation Project 1994-1998 which is underway now. This Plan included treating 4,550 acres of furrow irrigated ground. PL83-566 has been used as the vehicle to implement this on-farm treatment section of the Project.

The Moxee/Naches Water Quality Project 1989-1991 Table of Contents is also included.

MOXEE DRAIN IRRIGATED AGRICULTURE

BMP IMPLEMENTATION PROJECT
1994 - 1998

Revised: August 1993



Sponsored By:

North Yakima Conservation District

MOXEE DRAIN IRRIGATED AGRICULTURE
BMP IMPLEMENTATION PROJECT
Work Plan
Revision August, 1993

DESCRIPTION

The Moxee Drain carries the primary return flow of surface water to the Yakima River from the entire Moxee Hydrologic Unit. The Moxee Drain has been identified in the Washington Department of Ecology publication "Nonpoint Source Pollution Assessment and Management Program", dated October 1989. The Yakima River, in this area, has been identified as a "Threatened Waterbody."

The Moxee Hydrologic Unit has been identified by NYCD, SCS and acknowledged by Ecology and USGS as a significant contributor of pollutants to the Yakima River. The Moxee area is also identified in the same context in the Yakima River Basin Management Plan currently being developed by the Yakima County Council of Governments. (May be an approved plan by the time this application is reviewed).

The North Yakima Conservation District (NYCD) and Soil Conservation Service (SCS) have identified the primary problem area, in the Moxee Valley, as being the furrow irrigated cropland and the inadequate return flows management facilities.

NYCD, in three previous Moxee projects, has documented the problem areas identified above. In the first project 1988-1989, funded by a Conservation Commission Water Quality Grant, a partial inventory of water quality problems was developed and a program of building a rapport with Moxee water users was carried out. In the second Project 19891991 innovation of a cultural practice (furrow mulching), completely new to the area, was demonstrated by NYCD. The Project was very successful in many ways and is documented in the Project completion report. The third project was designated by NYCD Supervisors to demonstrate the almost completed "Moxee BMP Implementation and Demonstration Project"(319). This project area was selected to model, on a small scale, the pros and cons of a Hydrologic Unit Treatment Demonstration Project. An interim report and subsequent water monitoring of this Project indicates a very large degree of success in regard to water quality improvement, in local producer's participation and in NYCD's capabilities to sponsor and administer these natural resource related activities.

In recent years a great deal of study and analysis has been done on the Moxee basin by DOE, USGS, NYCD, BOR and WSU Extension. NYCD has agreed to sponsor and administer a multi-entity involvement Project to implement BMP's utilizing the following concepts; hydrologic unit treatment; conservation districts capabilities; voluntary incentive cost-share programs; intensive technical assistance to land users; cooperative activities between many natural resource oriented entities.

Results, both pro and con, from this Implementation Project would be directly applicable to other problem areas of the Yakima River Basin such as Wilson Creek, Sulfur Creek, Granger Drain etc., all of which have been identified as water quality problem areas. The results of Hydrologic Unit Planning would be applicable, at least in context, to most any other small watersheds of the United States, particularly where irrigation is involved.

DETAILED TASK DESCRIPTIONS

TASK 1: WATER QUALITY/WATER CONSERVATION PLANNING (ON-FARM)

Irrigated Land

NYCD will provide supervision, coordination, employee training and farm plan approval throughout the proposed Project. All SCS standards and specifications will be adhered to in all planning activities.

All Farm Plans will be reviewed by the DOE/NYCD liaison person as was done in the recent 319 Demonstration Project.

Two types of Farm Plans will be developed, Long Term Agreements and Annual Plans, as defined by SCS and ASCS. Group Plans (Pooling Agreements) may be developed when and where this approach is appropriate.

All Farm Plans will emphasize water quality improvement Best Management Practices (BMP's), however all BMP's relating to protecting the resource base will be incorporated into the Farm Plans. Consideration will also be given to ground water effects. Ground water problems will be pursued when encountered.

Farm Plans will identify problems, alternative solutions, selected BMP's and funding sources for implementation and schedule of implementation.

It will be the goal of NYCD to revise and/or develop Farm Plans for 1,500 acres of irrigated farm land each year, beginning in fiscal year 1994.

Existing SCS Farm Plans will be updated, modified or redeveloped as appropriate. As the Farm Plans are developed they will be incorporated into the SCS, Yakima Field Office Farm Plan files.

Non-Irrigated Land

Dryland acreage in the Project Hydrologic Unit is approximately 78,250 acres. NYCD, with SCS assistance, will develop, modify or update Farm Plans on dryland as appropriate and in accordance with the current Farm Bill criteria. For Project purposes, these plans will be readdressed or developed with water quality and erosion control BMP's emphasis.

At least sixty percent of the dryland will be addressed in these Farm Plans (Range Plans) which is approximately 56,662 acres.

DRYLAND OWNERSHIP	Acres
U.S. ARMY (YTC)	18,240
BLM	3,500
DNR	2,880
PRIVATE	50,930

Other Lands

Two Farm Plan folders will be developed for Yakima County. One will address County Jurisdictions of the Health Department and one will address public work's jurisdictions. These two plans will identify water quality related problem areas and recommend the appropriate BMP Implementation.

If Project planning activities encounter water quality related problems in the metropolitan areas of Moxee City and Terrace Heights, a Farm Plan folder similar to the County folder will be developed for each of them.

Washington State Department of Transportation is currently planning for highway improvements and modifications within the Project area. NYCD will coordinate all applicable Project activities with the Highway Department and make appropriate recommendations when and where water quality concerns may be applicable.

TASK 2: WATER QUALITY/WATER CONSERVATION BMP IMPLEMENTATION (ON-FARM)

The Moxee Hydrologic Units (H.U.) consists of approximately 97,930 acres located in the East Central portion of Yakima County. The entire H.U. drains into the Yakima River at the Southerly end of Union Gap.

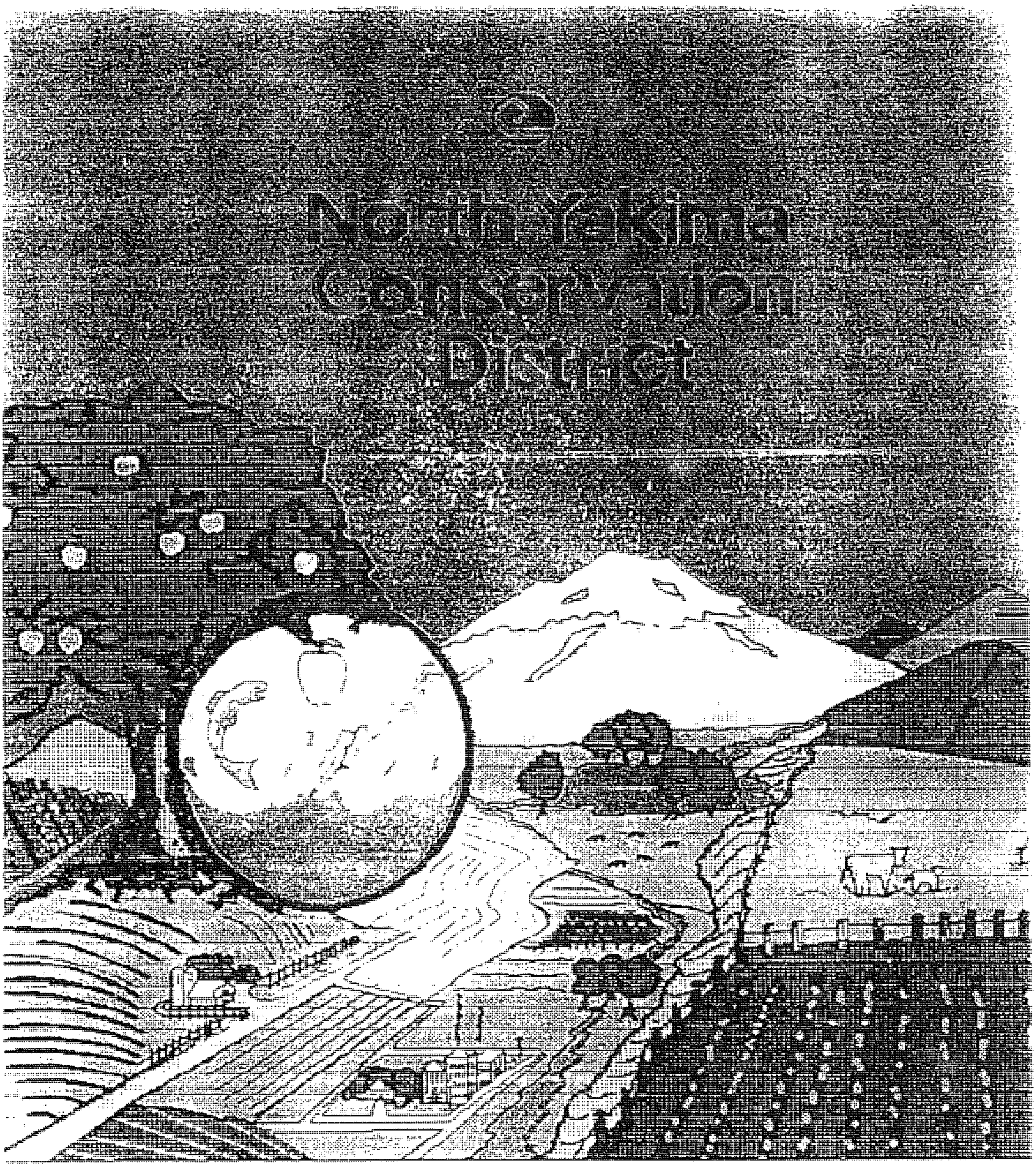
The total acreage consists of:

Irrigation District Land ----------	14,980 acres
Deep Well Irrigated Land ------	4,700 acres
Dry Cropland ----------------------	2,700 acres
Dry Rangeland --------------------	75,550 acres

It is the goal of the Project to implement BMP's on 65% of all H.U. land with emphasis being placed in the following order:

		BMP Implementation Goal
1.	Furrow irrigated Land (approx 7,000 acres)	4,550 acres
2.	Tailwater management systems (approx. 70 farm units)	45 each
3.	Other irrigated land (7,980 acres)	5,187 acres
4.	Dry cropland (2.700 acres)	1,755 acres
5.	Rangeland (75,550)	49,108 acres

Two Cost-Share, Voluntary Incentive Programs, will be utilized to stimulate farmer participation and BMP implementation. ASCS will initiate a "Special Project" designation for the H.U. and planning emphasis will be directed towards Long Term Agreements, utilizing the current ACP handbook of Yakima County Practices and cost-share rates.



MOXEE DRAIN BMP IMPLEMENTATION
DEMONSTRATION PROJECT

COMPLETION REPORT

September 1993

1.0 Executive Summary

North Yakima Conservation District's "Moxee Drain BMP Implementation Demonstration Project" was designed to demonstrate that intensive Best Management Practice (BMP) applications would improve water quality. Working together, NYCD and the Washington State Department of Ecology were able to carry out this project. Funding for project activities was granted from the Environmental Protection Agency to implement Ecology's Clean Water Act Section 319 nonpoint pollution program.

Project design consisted of six components: Farm planning, BMP Implementation, Water Quality Monitoring, Cost-Share Program, Information and Education Program and Project Administration. These components were designed to all work together by complementing one another or to stand alone as individual activities.

Ecology's role in the project was to administer the program to NYCD, and through Ecology's Environmental Investigation Laboratory Service, assist in design and implementation of the Water Quality Monitoring Component. NYCD's role was to be responsible for the project and assure it's effective and efficient implementation and administration.

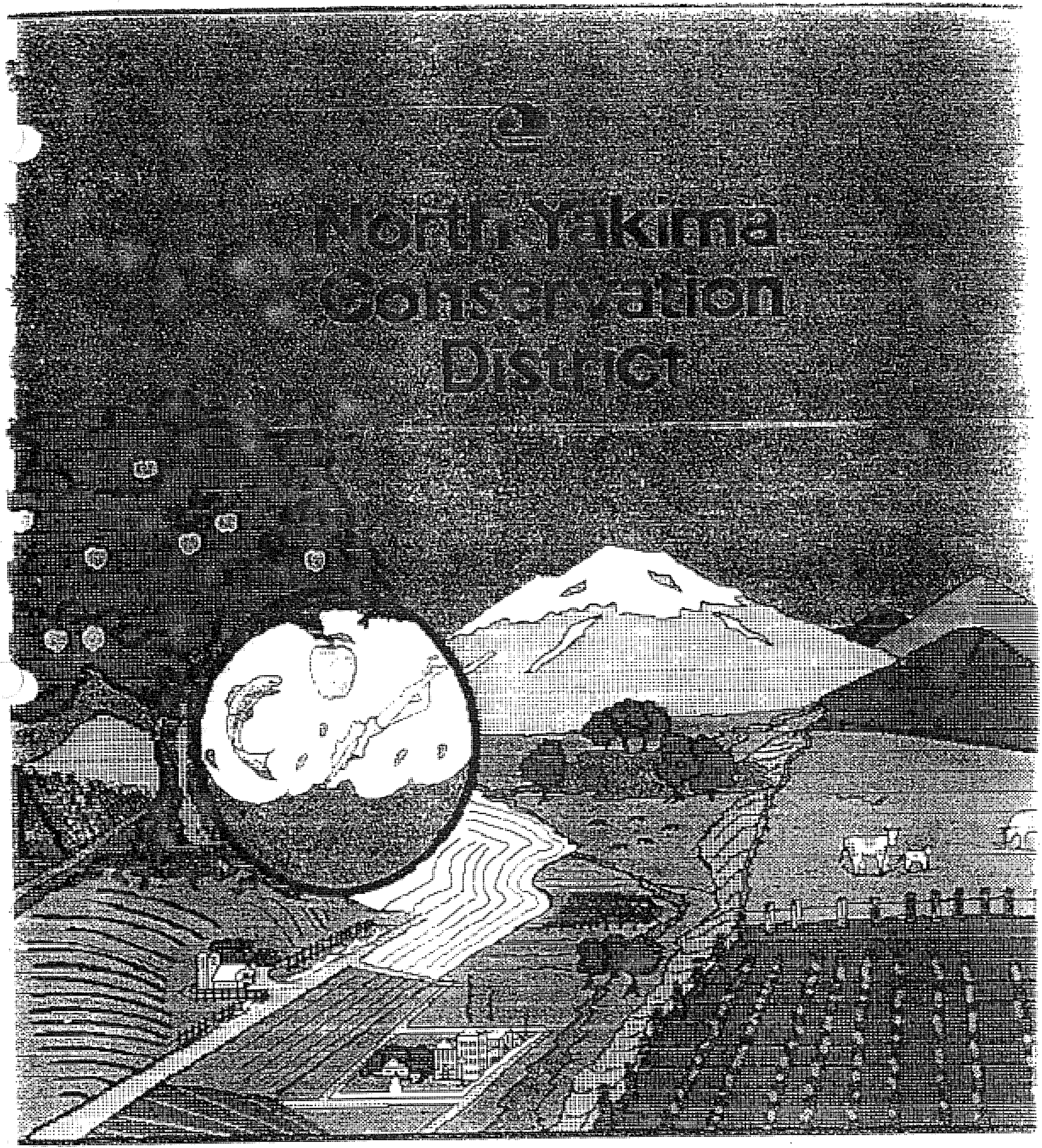
NYCD's selection of the project area was based on irrigation and cropping patterns; diversity of soil and slope; and hydraulic characteristics. This sub-basin best represented current agricultural and land uses as well as the Water Quality Problems and Impaired Uses of the Moxee Hydrological Unit.

Project highlights include 87% of irrigated land treated, 91% of individually identified BMP's implemented, and 89% producer participation. Farmer acceptance of Best Management Practices was excellent and expanded to other areas. Monitoring showed that implemented BMP's improved water quality, however, many external factors effected these results.

As a result of this project North Yakima Conservation District Board of Supervisors has taken the direction of expanding the project's concepts to the entire Moxee Hydrological Unit (#17030003-120). It is presumed that the results gained in this demonstration project can be duplicated through a multi-year, multi-agency effort toward significant improvement of water quality of the Moxee Hydrologic Unit.

Moxee Drain BMP Implementation Demonstration Project

Table of Contents Part I



FINAL REPORT

MOXEE/NACHES WATER QUALITY PROJECT

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CHAPTER 1

INTRODUCTION

BACKGROUND

Yakima County is in the South Central area of Washington State. It consists of privately owned land and land owned and managed by the USDA Forest Service, Bureau of Land Management, the Washington Department of Game, the Washington Department of Natural Resources, the Yakima Indian Nation and the Yakima Training Center.

Yakima County encompasses over 2.7 million acres. About 458,000 acres is irrigated cropland, 64,000 acres is non-irrigated cropland, and 1.5 million acres is rangeland, and grazeable woodland. The remainder is managed by various government agencies for public benefit. Irrigated farming is the main economic enterprise in the area. Major crops include apples, cherries, hops, asparagus, corn, as well as grass and legumes grown for hay.

Nearly all of Yakima County drains into the Yakima River with the Naches River being a major tributary. The far northeastern and southeastern portions of the County drain into the Columbia River. Irrigation water is the life blood of the local economy due to the dependence on it by irrigated farming. The supply of irrigation water comes primarily from the streams that receive snowmelt from the Cascade Mountains. These streams have more than ample flow early in the growing season, but the flow decreases during mid season. To supplement the flow of streams in summer and fall, a number of reservoirs have been constructed to impound water supplies. Even with these reservoirs, there is frequently a shortage of water in the tributaries of the Yakima River. Inefficient irrigation systems and the tendency to over irrigate aggravate the problems of water shortage, water quality, erosion, alkali and salt accumulation. In addition, growing industrial and metropolitan pressures on available water, contributes to water quality and quantity problems. Continued development of agricultural, industry and population growth will require additional storage capacity and implementation of water saving measures (Ref #1).

It has been shown that good irrigation water management can reduce soil erosion by 50 percent. It is also evident that inefficient use of water and degradation of water quality are directly related. Irrigated agriculture water quality issues are very complex, requiring innovative techniques to bring about meaningful water quality improvements (Ref #2). The "Water Quality Protection Needs Evaluation" (Ecology, 1987) identified improvement and rehabilitation of inefficient, leaking irrigation canals, formation of public irrigation districts from private entities (so they can qualify for direct state financial assistance), as well as implementation of Best Management Practices (BMP) as the primary means of water pollution control for irrigated agriculture.

In the past, farmers have focused on improving on-farm irrigation systems, rather than on improving the efficiency of water supply and delivery systems. One exception to this statement is the furrow irrigated fields in the Moxee Valley. Economics have worked against improving irrigation delivery systems. Maintenance of existing systems and construction costs of new systems have soared beyond the feasibility of many small irrigation companies. Presently, adequate rehabilitation financial assistance is needed. Accordingly, these are the circumstances that form the basis for this project.

PROJECT SUMMARY

The Moxee/Naches Water Quality project encompasses irrigated orchards and cropland on the south sides of the Naches River and irrigated hop fields and vineyards in the Moxee Valley. Although the two regions differ in crops produced and have unique characteristics, both areas are experiencing problems with excessive erosion and irrigation runoff rates. As a consequence, water quality was being degraded by farming activities in these areas. In July, 1989 the Washington Department of Ecology (Ecology) offered a Centennial Clean Water Fund Grant to the North Yakima Conservation District (NYCD) to fund a water quality project to decrease irrigation runoff into the Naches and Yakima Rivers, and to demonstrate Best Management practices (BMP's) in hop fields.

After irrigation companies in the South Naches River region were successfully organized into an irrigation district, funding was obtained for a preliminary engineering plan for a closed pipe irrigation water delivery system. Using a single river diversion for this system will consolidate seven gravel bar diversions currently being used in the Naches River. This proposal will also consolidate seven fish screens into one proposed screen facility, currently being planned by Bonneville Power Administration and the Bureau of Reclamation. In addition, this activity will eliminate the open irrigation canals currently draining into the Naches River.

Activities in the Moxee Valley hop fields centered on implementation of furrow mulching and surge irrigation systems demonstrations as BMP's for reduction of soil erosion. Ambient water quality monitoring of irrigation runoff water indicates a reduction in soil and particle matter movement from the demonstration areas. Additionally, updated farm plans for operators in the Moxee area were developed, and a continuous education and information effort was undertaken by the NYCD in both the Moxee and Naches project areas.

APPENDIX C - ECONOMICS

VALUE OF WATER ANALYSIS:

Each acre foot of water will produce 1.375 tons of hay. This is based on the agronomic evaluation done for a 1993 tailwater recovery analysis.

WASHINGTON ALL HAY PRICE	1993	$96.00
Prices from Washington Ag.	1992	$82.50
Statistics annual reports	1991	$81.00
	1990	$91.00
	1989	$89.50
The five year average price per ton of hay:		**$88.00**
Variable cost per ton of hay.		$32.28
Return per ton over variable cost		$55.72
Return per acre foot of water		$76.62

Hay is the lowest value crop grown in the watershed. In the long run when water shortages occur available water would be diverted from hay to other crops. Therefore, the marginal value of water, should be equal to the value of production lost minus the variable cost of producing that crop.

The value of nutrients is analyzed by using the replacement cost of the nutrients at current prices. No application charge is added s it is assumed the operators anticipate potential losses and apply nutrients accordingly.

1992 Nutrient Cost Yakima Valley	COST/LB.
Nitrogen	$ 0.30
Phosphorus	$ 0.34
Potassium	$ 0.14

Reduced sediment damages are accounted for by improved water quality.

PROJECT ANALYSIS

Convert 4,550 acres of furrow irrigation land to trickle irrigation systems. Include irrigation water management, nutrient management, and pesticide management compared to future without project action.

Positive (+)		Negative (-)	
Annual benefits	$1,277,500	Annual cost	$486,000
Net benefits	$791,500	Project cost	$5,132,500
Mitigation benefits			
Reduced return flows	15,400 acre ft.	Loss of 6 acres wetland	
Double Fall Chinook Salmon egg-to-fry survival in 21.2 miles of Parker Reach of the Yakima River.		Mitigation cost	
Improved wildlife upland habitat by reducing tillage			

ON-FARM PER ACRE ANALYSIS

Trickle Irrigation System with irrigation water management, nutrient management, and pesticide management compared to furrow irrigation system.

Positive (+)	Negative (-)
Cost-share $650	Installation cost $1,000
Increased irrigation efficiency 40 %	Possible yield reduction first year up to 20 percent
Reduced sediment delivery to Parker Reach. 9 tons per year	
Reduced fertilizer purchase - 77 lbs/acre - $21.00/acre	
Water savings $260/acre - Reduced labor	
Reduce tillage operations - 8 per year	
Increase flexibility of spraying.	
Improved upland wildlife habitat do to improved cover.	

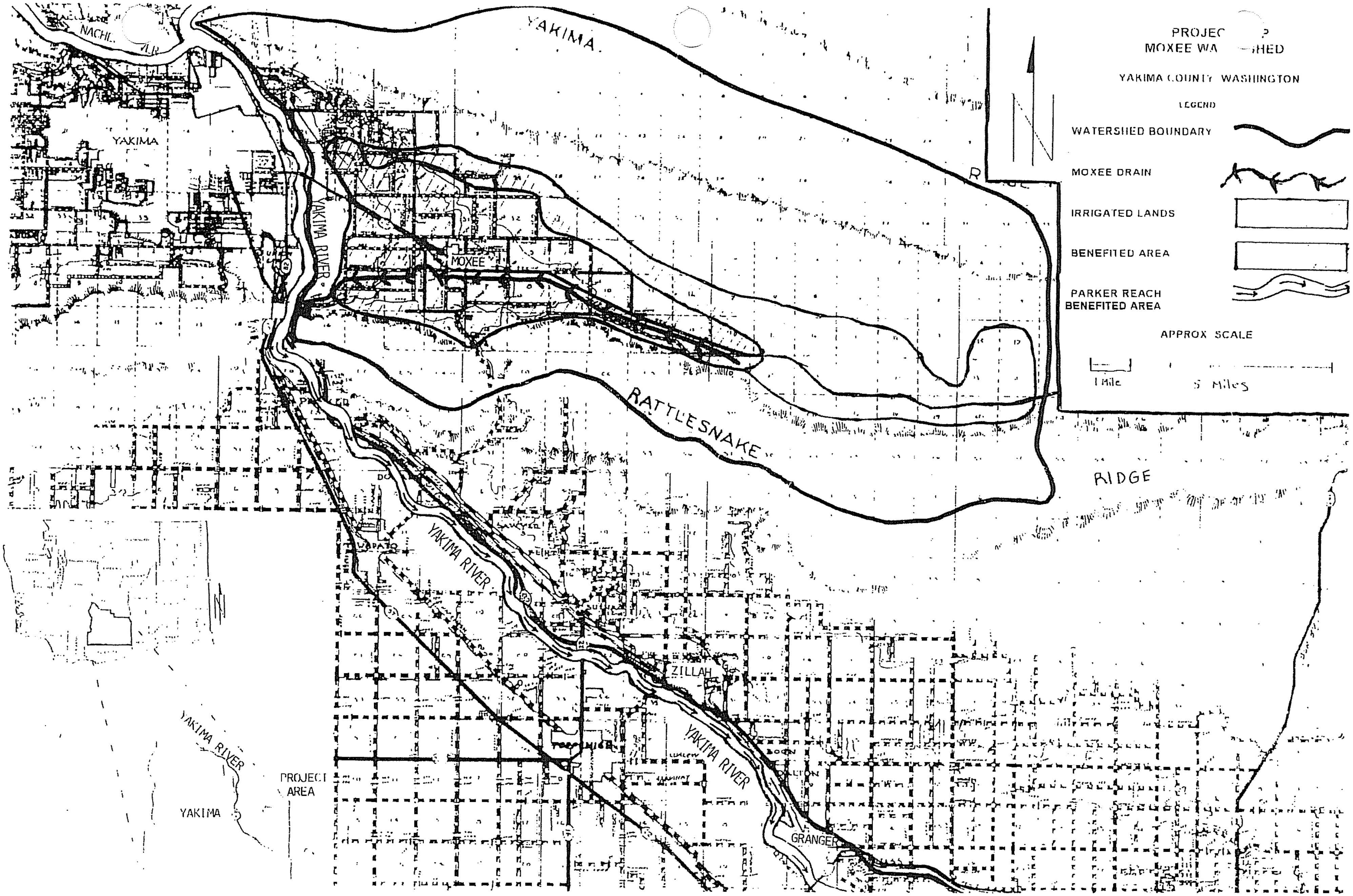
APPENDIX C - PROJECT FORMULATION

John Easterbrook of the Washington State Department of Fish and Wildlife and Bob Tuck representing the Yakama Nation assisted with evaluating the effects of sediment reduction. Streamside Management: Forestry and Fishery Interactions edited by Salo and Candy, University of Washington, 1987 was used as the documentation. An unpublished study by Tom Spofford, adjusted by Joe Sahlfeld was used to determine sediment, nutrients and water savings.

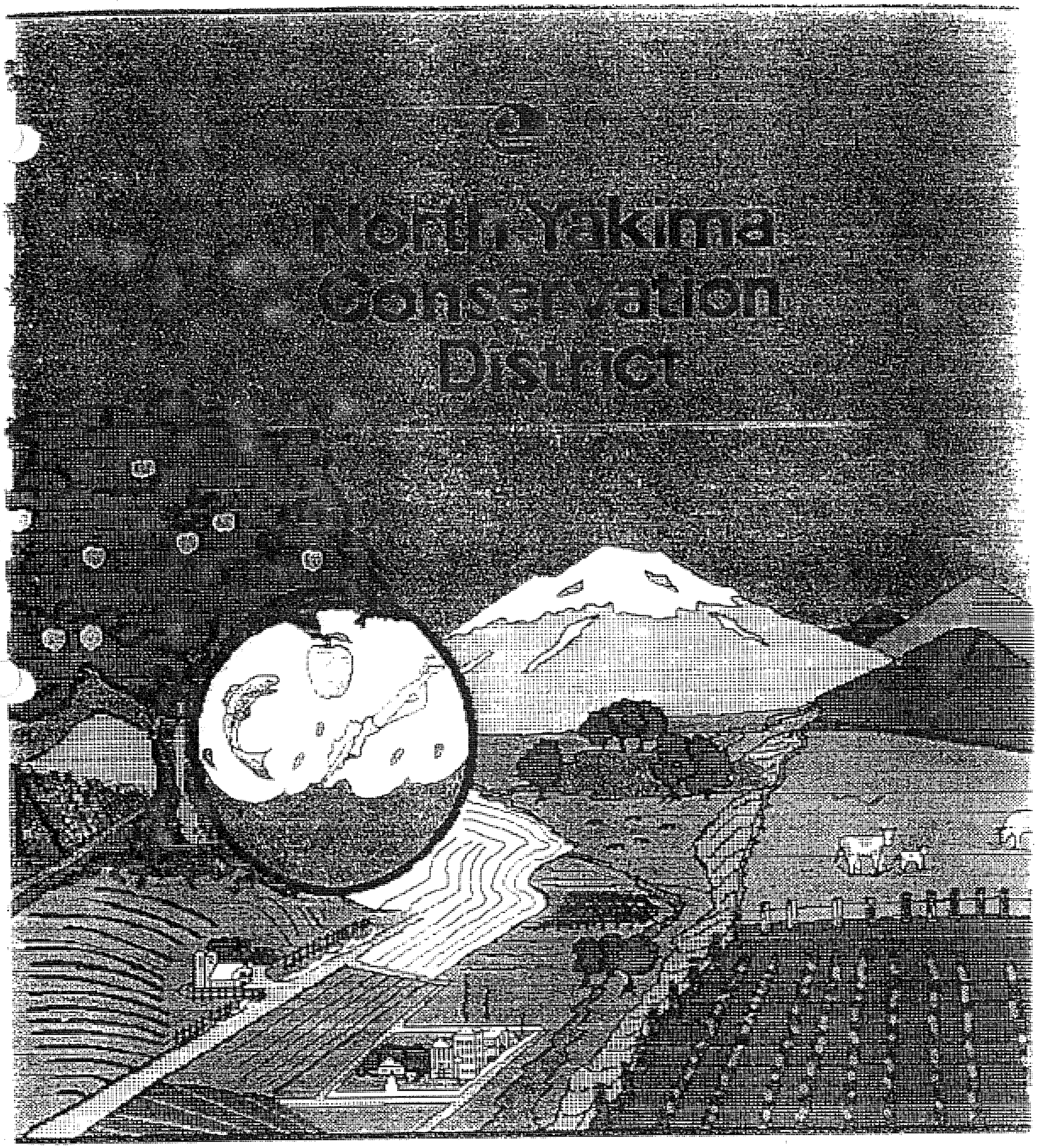
The wetland evaluation was completed by Mike Tobin and Rick Pudney using NWI surveys with field verification.

The HEP model was used for wildlife habitat evaluations.

Cost data and flat rate schedule data was based on data furnished by dealers and completed by Mike Tobin and Larry Edmonds. The public participation notebook is located in the Yakima Field Office.



PROJEC ?
MOXEE WA HED
YAKIMA COUNTY WASHINGTON
LEGEND
WATERSHED BOUNDARY
MOXEE DRAIN
IRRIGATED LANDS
BENEFITED AREA
PARKER REACH
BENEFITED AREA
APPROX SCALE
1 Mile
5 Miles
YAKIMA
RIDGE
RATTLESNAKE
RIDGE
YAKIMA
YAKIMA RIVER
MOXEE
ZILLAH
GRANGER
PROJECT
AREA



FINAL REPORT

MOXEE/NACHES WATER QUALITY PROJECT

Appendix 2

Appendix 2

Moxee Monitoring Data Report 1994

PRELIMINARY
SUBJECT TO REVISION

Moxee and Birchfield Drains

Prepared By

North Yakima Conservation District

DRAFT COPY
SUBJECT TO REVISION

MOXEE MONITORING DATA REPORT 1995

Moxee and Birchfield Drains

Prepared By:
North Yakima Conservation District

Draft Copy

MOXEE MONITORING DATA REPORT 1996

Moxee and Birchfield Drains

Prepared By:
North Yakima Conservation District

DRAFT

MOXEE MONITORING DATA REPORT 1997

MOXEE AND BIRCHFIELD DRAINS

Prepared By:
North Yakima Conservation District

LOWER YAKIMA RIVER SUSPENDED SEDIMENT TMDL

USEPA Submittal Document

DEPARTMENT OF ECOLOGY State of Washington

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VOLUME 2

Publication # 98-10-202 - Vol. 2

RETURN DRAIN TO THE SUNNYSIDE VALLEY IRRIGATION CANAL

WASHINGTON STATE DEPARTMENT OF ECOLOGY

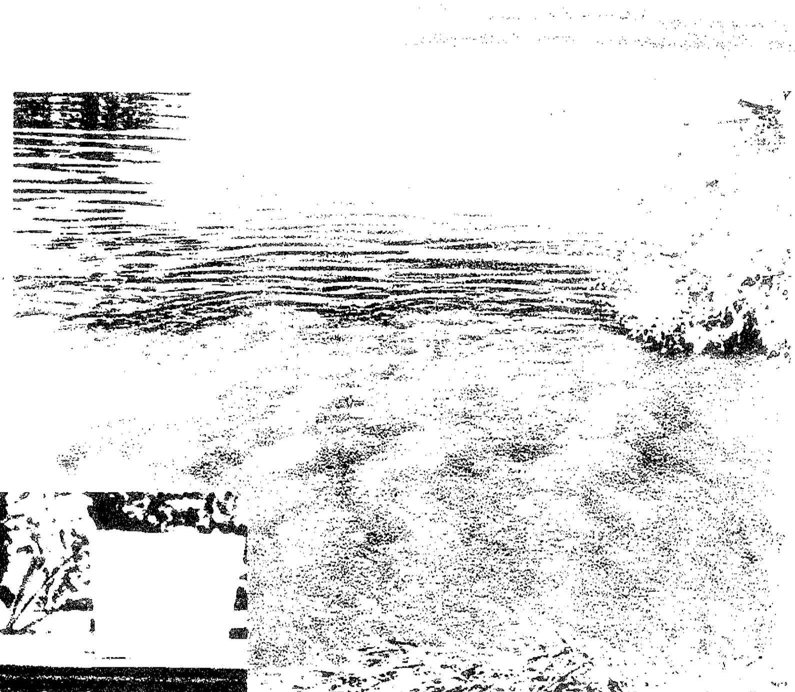
Prepared by the Washington Department of Ecology

August 1998

APPENDIX 3

Granger Drain HUA

FY 1997



Project Personnel

Robert G. Stevens, Washington State University Cooperative Extension

Alan Fulk, Natural Resources Conservation Services

Granger Drain return flow entering Yakima River

PAM NO PAM

The effect of PAM on sediment load at the end of furrow.

Producer and fieldmen observe PAM in action.

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PROJECT STAFF

Washington State University
Robert G. Stevens, *Extension Soil Scientist*
Kevin Davis, *Agricultural Research Technician*
Virginia Prest, *Technical Writer*

Natural Resources Conservation Service
Alan Fulk, *District Conservationist*
Chris Johnson, *Soil Nutrient Specialist*
Cal Aylsworth, *Soil Conservationist*

South Yakima Conservation District
Laurie Crowe, *Dairy Resource Technician*

I. Annual Accomplishments

A. Cooperation with Agencies and Organizations

This year has been a pivotal year in the effort to improve water quality in the return flows from the Granger Drain Hydrologic Unit. Although Washington State University (WSU) Cooperative Extension (CE), Natural Resource Conservation Service (NRCS) and the South Yakima Conservation District (SYCD) have been actively involved since 1991, other agencies have not taken an active role in the effort. During 1997 the Washington State Department of Ecology (Ecology), the Yakima River Watershed Council and the Board of Joint Control (BOJC) for the two local irrigation districts have all stepped up their involvement and commitment to cleaning up the return flows (see Section IX. Comments/Remarks for additional details). Endangered Species Act, Safe Drinking Water Act and Clean Water Act concerns are nearing reality in the Yakima Basin putting more pressure on local groups to make progress in their efforts to improve water quality.

The Granger Drain HUA personnel continue to work with the Yakima River Watershed Council in developing water quality strategies for the Yakima River Watershed. This citizen-based group published the first draft of their plan *"A 20/20 Vision for a Viable Future of the Water Resource of the Yakima River Basin"*. This plan addresses both water quantity and quality issues. The Granger Drain HUA water quality program has served as a model for parts of this effort.

The BOJC hired a water quality specialist and began monitoring water quality in the return flows making up the Granger Drain. The data collected in 1997 will be compared to samples taken in 1991 prior to HUA project initiation and data collected by Ecology in 1995. The BOJC is establishing water quality parameters for water leaving producer fields. This will significantly increase project personnel's ability to work with producers who in the past have not seen the need to participate.

Granger Drain HUA personnel played an active role with the local Environmental Quality Incentives Program (EQIP) working group. This effort brought significant cost share moneys to area producers to implement irrigation system improvements that will both increase irrigation efficiency and reduce soil loss through irrigation related erosion (see Section VII. Cost Share for additional details).

Granger Drain HUA personnel participated in implementation of a new WSU CE program, Master Watershed Stewards. Thirty people from diverse backgrounds were given 46 hours of training on issues/uses of the Yakima River Basin. The Granger Drain HUA was part of a field trip to look at solutions to nonpoint water quality issues. The class participants are expected to spend 50 hours in community education and watershed activities.

NRCS and SYCD personnel hosted Washington State Senate Agriculture Committee, State Conservation Commission, and Dairy Federation for an on-farm visit to local dairies. They reviewed various aspects and needs for dairy waste management planning.

Granger Drain HUA personnel presented information regarding Granger Drain HUA at the National Watershed Water Quality Project Symposium in Washington, DC (Appendix C.).

B. Impact of Informational and Education Activities

HUA personnel continued to deliver education and demonstration projects, lend technical assistance, and develop on-farm partnerships in an effort to address water quality issues in the Granger Drain HUA and the Yakima River watershed. Projects addressed nutrient loading in the soil profile, sediment loading to return flows to the Yakima River, irrigation management practices, and mapping Granger Drain area.

Nutrient Loading

Several projects addressed nutrient loading as a result of current fertilizer and animal manure application practices. Producers continue to use soil testing to determine nutrient levels in the soil but usually only in the first foot of the soil profile. Project activities continued to emphasize the potential impacts of considering nutrient levels in the entire rooting profile available for plant nutrient uptake or leaching to groundwater. Waste Management Plans were updated on 16 dairies. Seven crop producers on 20 fields adopted nutrient management changes.

Irrigation Practices/Sediment Loading

Sediment loading continued to decline as irrigation system improvements were made in the Granger Drain HUA. Rill irrigated fields have been upgraded with system improvements including installation of sprinkler systems and drip irrigation, particularly in the portions of the irrigation district that has upgraded to pressurized irrigation water delivery. The Granger Drain includes many production systems that cannot be sprinkler irrigated because it results in lower yields for a variety of reasons. Drip irrigation is a viable solution to sediment loading especially in permanent crops such as hops, grapes and tree fruits. However drip irrigation systems require a sophisticated filtering system and a change in management strategies. In many production systems, installing drip irrigation may not be possible because of cultural practices; i.e. row crop production requires plowing at a depth that would destroy the drip equipment installed in the field or drip may simply be too expensive with regards to potential crop profits.

Granger Drain personnel continued to assist crop producers with furrow/rill irrigation to implement the use of polyacrylamide (PAM). This product, when added in small amounts to irrigation water to reach 10 ppm, can reduce sediment loading to outflows by 90%. During FY97, nine crop producers representing 536 acres tried PAM for the first time with mixed success. PAM requires additional management practices to attain maximum benefit. PAM increases infiltration so the inflow rates need to be increased during the advance phase of the irrigation. If the inflows are not increased the water may not reach the end of the field in optimum time (0.25-0.40 of the total set time, advance plus soak), and the top of the field will receive considerably more water than the bottom. In addition, the best results are obtained when the inflow rate is cutback after the advance phase; this requires additional labor expenditures. Of the nine producers, eight have committed to utilize PAM in FY98. The producer, who had unsatisfactory results with PAM, did not want assistance from project personnel so it is difficult to determine the reason. There is a concern with PAM-irrigation outflows reaching the Yakima River because of potential environmental concerns. Project personnel educate producers that PAM is only needed in the advance phase to achieve maximum results.

Irrigation Water Management

Several crop producers participated in an educational program to learn Scientific Irrigation Scheduling. Cooperators received soil water monitoring devices, an irrigation scheduling software program, weekly soil water monitoring with neutron probe readings and technical assistance to assess crops' current irrigation needs and also forecast future irrigation based on historical weather data. The program was implemented to reduce energy costs, decrease outflows from the field, and reduce deep percolation as well as total soil loss from the field.

Mapping

Significant progress was made with Yakima County (Granger Drain area) to share GIS information to facilitate developing GIS data layers to look at such issues as irrigation practices in relationship to soil type and slope and cropping patterns. This effort is ongoing with an anticipated application of looking at land area available for application of dairy manure with respect to increasing dairy herd sizes.

C. Farming Practices and Land Implementation

Dairy manure is added to much of the Granger Drain HUA land, especially in annual cropping systems. It is a partnership that has been established between the dairy producers and row crop producers that results in an easy disposal system for dairy manure and relatively low priced fertilizer for row crops. The unit of measurement is number of truckloads per acre and manure is not routinely tested for nutrient content. Project personnel educated crop producers concerning 1) mineralization process in the soil and potential nitrogen inputs throughout the season; 2) the benefits of split application of fertilizer inputs timed with crop needs; 3) timing soil testing to more accurately read inputs from manure and nutrients available for crop needs; and, 4) potential nutrient levels of dairy manure, the potential advantages as well as the disadvantages in using this as a nutrient source.

Generally, dairy manure is handled by the dairy operation. Crop producers can receive the dairy manure for a nominal fee and oftentimes for free. The dairyman is actually responsible for spreading the manure on the fields, in most cases. Crop producers seldom deal with the manure other than plowing it into the soil profile. While the dairymen generally try to get a fee for their manure, it is usually to offset the equipment maintenance and transportation cost, and does not result in a profit.

The nutrient levels in the dairy manure vary widely up to 15# N per ton, depending on bedding, water content, and other parameters. This makes it very difficult to determine nutrient levels with any kind of accuracy without testing. Crop producers tend to under estimate inputs from manure and may apply additional commercial fertilizer to meet crop needs. Often, nutrient needs are determined by optimum crop yields instead of field history. While N tends to be the initial interest because of the threat for leaching of excess nitrate to groundwater, P loading is becoming a problem in surface irrigated soils. A general decrease in addition of commercial fertilizer above manure rates has been observed in recent years.

Seven dairy operations, 20 fields, participated in FY97 project focusing on manure management and nutrient loading to soil profiles. Initial soil samples were collected from twenty fields; soils were sampled in one-foot increments to a depth of four feet. Field histories, including crops, yields, manure application and commercial fertilizer applications, were collected on each field. Project personnel worked with dairymen to determine expected nutrient levels at the end of the 1997 growing season. All fields were to be sampled again in the fall of 1997 after the crop was harvested. The actual nutrient levels and the calculated nutrient levels were to be compared. In addition, two cooperators agreed to participate in an on-farm demonstration comparing strips in the field of manure and no manure. Yield and nutrient level comparisons were to be made between treatments. Project personnel were not able to obtain fall 1997 soil samples. Cooperating dairymen were reluctant to continue demonstration work because of a pending lawsuit filed against several dairymen from a local citizens group. The dairies have been put on notice that they will be sued in 1998 unless they prove that they are not polluting surface water. Project personnel hope to complete the project during FY98.

Seven dairy operations have begun some type of composting operations on their dairies. While the initial investment is expensive for equipment and labor, the composted dairy manure has several definite management advantages. A reduction in bulk by 35% significantly reduces transportation cost allowing the nutrients to be spread over a larger area. Composting also makes a more consistent material which allows the producer to have a better understanding of the nutrient content of the material that he is applying. The physical characteristics of composted manure improve the producer's ability to apply the material uniformly across the field. The composting process converts the manure to a form that can be more easily stored without offending neighbors. Additional markets can also be developed. Although composting is not the total solution to over production of nutrients for the land area available for application near the dairies, it is one of many tools that will be needed to solve the problem.

Irrigation Practices/Sediment Loading

There is a trend in the hop production region to upgrade irrigation systems to drip irrigation, but this is usually done in conjunction with a revamping of the entire system. The hop variety is changed, plant spacing is adjusted from the traditional 7X7 to 3X14, and drip irrigation is installed. It is an expensive investment, but it has shown to improve water quality 100% in terms of sediment loading because there is no surface runoff. There is still a concern about leaching of nitrates to groundwater but drip irrigation uses water more efficiently than rill (surface) irrigation and so irrigation management becomes a tool that is more marketable. EQIP funding has been targeted at this conversion because it produces the highest environmental return for the investment.

In the interim, many crop producers are utilizing PAM. It is a granular product that looks like sugar that is applied directly to the irrigation water. It has routinely shown a 90% reduction in sediment in outflows from the furrow irrigated fields. The product is relatively inexpensive at approximately $4-6 per acre. Project personnel have used PAM since its introduction in 1993, and continue to help growers with technical aspects including formulations, equipment needed, and application rates. WSU CE provided product and technical assistance to new users to introduce them to the benefits of PAM. Nine crop producers (representing 536 acres) used PAM for the first time in FY97. Producers are educated that this is only a short-term solution and long range solutions generally require system upgrades and perhaps a change in cropping practices.

D. Reduction in Nutrient Utilization

Seven dairy operations, 20 fields, participated in the FY97 project focusing on manure management and nutrient loading to soil profiles. Initial soil samples were collected from twenty fields; soils were sampled in one-foot increments to a depth of four feet. In addition, two cooperators agreed to participate in an on-farm demonstration comparing strips in the field of manure and no manure. Yield and levels of residual soil nutrients were to be used to evaluate practices. Sixteen dairies within the project area updated their manure management plans.

E. Reduction in Contaminants from Field

Many hop growers are upgrading their irrigation systems to drip. It is an expensive investment, but it has been shown to improve water quality 100% in terms of sediment loading because there is no surface runoff. There is still a concern about leaching of nitrates to groundwater but with proper management drip irrigation uses water more efficiently than rill (surface) irrigation and leaching is generally reduced. The use of drip irrigation is usually accompanied with an increased interest in irrigation scheduling.

Many producers are using PAM, a polyacrylamide. It has routinely shown a 90% reduction in sediment in outflows from the furrow irrigated fields. Nine crop producers (536 acres) used PAM for the first time in FY98.

F. Off-Site Objectives

The BOJC constructed two sedimentation basins to collect soil from return flows prior to return to the Yakima River. This soil generally comes from eroded irrigated farmland. The sedimentation basin allows particles to settle out of the water prior to returning to the Yakima River. As of September 1997 an average of 4,000 tons per week of sediment had been removed from one of the sedimentation basins during the irrigation season. The sedimentation basins also collect nutrients and chemicals that are attached to the soil particles in the return flow, effectively reducing the amounts arriving at the Yakima River. The sedimentation basins are not a long-term solution but they have allowed the BOJC to demonstrate the amount of sediment in the return flows helping producers understand the magnitude of the problem. They have used it as a teaching tool for crop producers, dairymen and other agency personnel. They have also used the information to assist in defining goals for water quality improvements and reduction in return flows coming off irrigated farmland.

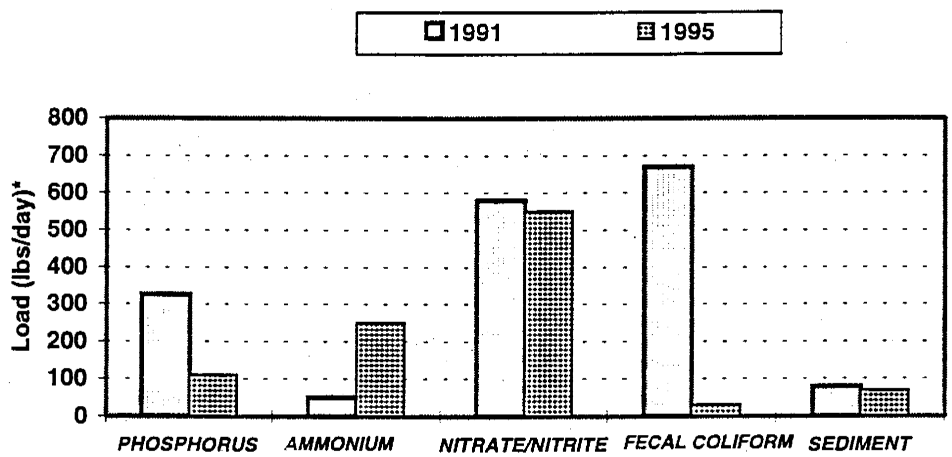
II. Endangered Species and Cultural Preservation Activities

Several salmon stocks and steelhead in the Yakima River basin are currently being considered for listing under The Endangered Species Act. This action will potentially increase the urgency with which water quality problems are corrected within the basin. The potential listing has already caused additional working relationships to be formed within the basin. Because the Yakama Indian Nation resides within the Yakima River Basin additional emphasis is being placed upon returning fish runs.

III. Measured Changes in Water Quality

Ecology implemented a sampling program in 1995 to evaluate water quality parameters in the Yakima River and irrigation return flows. The sampling data was used to set goals for individual tributaries as part of the Total Maximum Daily Load (TMDL) process as required by the Environmental Protection Agency for imparted water bodies. Ecology sampled several sites on the lower Yakima River, including several sites that were a part of South of Ecology's 1995 data with SYCD's 1991 data for fecal coliform, nitrate-nitrite N, ammonium

Figure 1. Granger Drain Pollutant Loads to Yakima River



N, phosphorus and sediment loads to the Yakima River. The pollutant loads are represented as an average per day during the irrigation season (approximately 4/15 to 10/15). Figure 1 indicates a significant reduction in fecal coliform bacteria and phosphorus loading to the Yakima River from the Granger Drain. The data indicates only a marginal improvement in nitrate-N and sediment loads. The data also indicates a large increase in ammonia-N in 1995, which has yet to be explained.

IV. Impacts on Water Use and Impairments

Suspended sediment and persistent pesticide loads from irrigated agricultural areas of the lower Yakima River basin have long been recognized as serious impairments to water quality. This stretch of the river remains on the Section 303(d) list because of continued impairment of water quality due to sediment and sediment-borne pollutants like DDT from irrigation returns. The Granger Drain remains on the 1998 Section 303(d) list for the parameters: 4,4'-DDD, 4,4'-DDE, Ammonia-N, DDT, Dieldrin, Dissolved Oxygen, Endosulfan, Fecal Coliform, pH, and Temperature (see Appendix D).

V. Economics

During FY97, a variety of management practices and structural improvements were implemented in crop production and dairy systems.

Several irrigation systems were upgraded within the project area. Costs were dependent upon the type of system installed; but as the cost increased so did the water quality benefit. Irrigation system installation is estimated at $507 per acre (See Table 1 located in Section VII. Cost Share). A gate pipe system will cost about $200 per acre while a drip system is generally estimated at $1000 per acre. The drip system cost is considerably higher but the water quality benefit approaches 100% because the sediment leaving the field is decreased to zero and the potential to leach nutrients to groundwater is minimal. The type of system installed depends on the cropping system, the topography, and financial resources of the individual producer.

Dairy operations spend approximately $54 per animal unit for installation of waste storage structure. While this cost is relatively low, it only stores approximately 20-35% of the manure (liquid portion from milking parlors). In the Granger Drain HUA, most of the manure is in the form of solids. It is trucked and spread on fields for crop production. The manure does provide a source of nutrients and can add additional benefits including increasing soil organic matter and increasing water-holding capacity of the soil. The down side is the inconsistent application of product and therefore nutrient variability across the field.

Seven dairy operations have started composting operations. When composted, dairy manure becomes a more homegenous product in terms of nutrient content and structure. The bulk is reduced by approximately 35%, making it easier to transport and to spread, as well as reducing transport costs. Composting also makes the manure more environmentally friendly by reducing odor and potential for movement with water. Unfortunately, dairy producers are not recovering the costs associated with the composting process and cost share dollars have not been applied to this type of practice. But the potential to reduce the dairy waste by 35%

has meant a reduction from 194,220 tons of dairy manure to 126,243 tons of compost on seven dairies with a total animal unit count of 16,185. However, composting does not reduce the P and K output from the dairies. Approximately half of the dairies custom compost with local businesses providing the equipment and expertise, the other half are purchasing their own equipment and learning as they go.

VI. Pollution Risk Assessment

Project personnel continued efforts to help crop producers and crop consultants to understand the correlation between the effect of irrigation water management and soil fertility practices on yield and protection of environmental quality. Educational activities included one on one consultation, speaking at grower meetings, and speaking at crop consultant meetings.

VII. Cost Share

A total of $735,244 was utilized in cost share programs within the Granger Drain HUA project boundaries. The monies came from three sources including the EQIP Program and state conservation programs. Approximately 51% ($378,280) of cost share dollars were spent to make improvements to dairy manure storage facilities, 46% ($337,088) was used to improve irrigation systems, the remaining 3% was utilized to fund changes in management practices. The following table shows the distribution of cost share dollars by practice, units affected, unit costs, and project costs.

Table 1. Cost Share Projects funded in FY97

Practice	NRCS Code	Units	Number of Units	Cost per Unit	Project Cost	Cost Share
Dairy Waste Lagoon	425	AU	9340	$54	$504,360	$378,270
Dairy Waste Management	312	AU	14955	$1	$14,955	$11,216
Solid Set	442	AC	42	$725	$30,450	$22,838
Center Pivot	442	AC	330	$540	$178,200	$133,650
Wheel Line	442	AC		$945	$0	$0
Drip System	441	AC	60	$1,000	$60,000	$45,000
Gated Pipe	430-HH	AC	50	$200	$10,000	$7,500
Irrigation Delivery	430-DD	AC	402	$400	$160,800	$120,600
Sediment Basin	350	EA	2	$5,000	$10,000	$7,500
Irrigation Water Management	449	AC	432	$10	$4,320	$3,240
Cover Crop	340	AC	4	$60	$240	$180
PAM	201	AC	140	$50	$7,000	$5,250
Structural Improvements			886	$507.28	$449,450	$337,088
Management Improvements			576	$20.07	$11,560	$8,670
Dairy Waste Management		**AU**	**24295**	**$21**	**$519,315**	**$389,486**
Irrigation Water Management		**AC**	**1462**	**$630.66**	**$461,010**	**$345,758**
Total Cost Share Expenditures					**$980,325**	**$735,244**

VIII. Research Needs

Additional research is needed to understand the relationship between soil test phosphorus levels and the potential for phosphorus to be moved from a field through runoff and erosion. High levels of soil test phosphorus in excess of 10 times the agronomic requirement have been noted in some fields. Phosphorus movement into the second foot has also been found on the highly manured fields.

Composting is being used by some of the dairies as one solution to the manure management problem. Additional research is needed to increase our understanding of the nitrogen release rates from these composted materials. If nitrogen management is to protect the environment and provide adequate nitrogen to the crop during the growing season, we must be able to predict nitrogen availability and timing from various forms of manure additions.

IX. Comments/Remarks

A. Additional Programs within the Project:

Washington State Department of Ecology

In July 1997 the Department of Ecology (Ecology) published *A Suspended Sediment and DDT Total Maximum Daily Load Evaluation Report for the Yakima River* (#97-321). This TMDL had the objective of recommending suspended sediment reduction targets to protect aquatic life in the main stem and in tributaries. Targets were based on relationships between suspended solids and Washington State criteria for turbidity and DDT. The TMDL established 5, 10, and 15 year targets (see Appendix D). The requirement by 2002 is that all drains within the project area will comply with the 90th percentile turbidity target of 25 NTU (56mg/L TSS) at their mouths. The 2007 goal is for all points in the drain to meet the 25 NTU standard. The Granger Drain is currently contributing 10% of the TSS load in the Yakima River. The 2002 goal will require the Granger Drain to decrease TSS loads from 10% to 1% in the Yakima River (Appendix D, page 69). This will require more than a 90% reduction in sediment load. The establishment of the TMDL has given producers and agencies in the Granger Drain a goal and a time frame in which to address the problem.

Ecology has also developed a new program within DOE to be implemented in FY98. The program is a technical assistance/education program focusing on irrigation management and dairy waste management on-farm and will not result in enforcement action. The program will focus on the Yakima River Basin including the Granger Drain.

Yakima River Watershed Council

The Yakima River Watershed Council is a non profit organization formed in March 1994 to improve water supply and quality for both in stream and diversionary users. The Council published its first draft watershed plan *"A 20/20 Vision for a Viable Future of the Water Resource of the Yakima River Basin"* in October 1997. The plan focuses on six substantive areas as potential solutions: water conservation, transfer and marketing, storage, water quality, habitat restoration, and water management. HUA personnel have been very active in the development of the water quality portion of the plan and the HUA has been used as an example of how the education and implementation should be directed.

When adopted, this plan will be used to direct activities in the watershed. An interagency committee has been established to help coordinate activities especially in the water quality and habitat restoration efforts to obtain maximum effect from the dollars invested.

Board of Joint Control

In 1996 the Board of Joint Control (BOJC) was established linking the Sunnyside and Roza irrigation districts. Their mission is to enhance efforts on water conservation and water quality issues. Sunnyside and Roza Irrigation Districts supply irrigation water to producers in the Granger Drain HUA and maintain most of the drainage systems. The pending Endangered Species Act listing of the Yakima River steelhead and renewed interest in the Clean Water Act caused the new BOJC to take a new look at the relationship between irrigation practices and water quality problems in the return flows. Historically irrigation districts had tried to separate water delivery from return flow water quality problems. Efforts of the HUA personnel played a very important role in establishing this new attitude.

In the spring of 1997 the BOJC hired a water quality person to sample return flows and determine water quality. The effort will allow us to compare current data with water quality data collected in 1991 and 1995. Establishment of a water quality monitoring program has been one of the long-term goals of the HUA. Because of the effort of the HUA in the Granger Drain the BOJC selected the Granger Drain as their first emphasis area.

In an effort to clean up return flows the BOJC built two settling basins in the upper portion of the drain to demonstrate their effectiveness. The basins were very effective trapping 3,100 tones of sediment in five days. However, the basins were too small and demonstrated the importance of keeping the soil in the field and not trying to catch it in the drains. The BOJC is also working on a policy that will require producers to reduce the amount of sediment moving off their farms in runoff water. The proposed policy will be based on the 25 NTU requirements established in the TMDL for the lower Yakima River. The policy will be initiated during the 1998 growing season with producers developing a plan to meet TMDL timelines.

Washington State University
Washington State University in cooperation with Bonneville Power Administration implemented the Scientific Irrigation Scheduling program during 1997. This program covered a seven county area in southeast Washington and included several growers in the Granger Drain. The program educated crop producers in the use of a variety of soil water measurement devices, weather information from WSU's Public Agriculture Weather System, and an irrigation scheduling model, Washington Irrigation Forecaster. The program's focus was to help producers become more aware of utilizing management strategies in their irrigation regime. The crop producers can save dollars in terms of energy expenditures and the environment can realize benefits in terms of less runoff and deep percolation. This program has been funded for additional work in 1998 and will include Granger Drain Cooperators.

B. Special Findings, Concerns, Needs:

Additional research is needed to understand the relationship between soil test phosphorus levels and the potential for phosphorus to be removed from a field through runoff and erosion. High levels of soil test phosphorus in excess of 10 times the agronomic requirement have been noted in some fields. Phosphorus movement into the second foot has also been found on the highly manured fields.

Composting is being used by some of the dairies as one solution to the manure management problem. Additional research is needed to increase our understanding of the nitrogen release rates from these composted materials. If nitrogen management is to protect the environment and provide adequate nitrogen to the crop during the growing season, we must be able to predict nitrogen availability and timing from various forms of manure additions.

Appendix A - ASDWQ Tables

Project Name: Granger Drain

V-C.1.a: **Application of Nitrogen Managment Practices/Activities Primarily for Ground Water Protection**

FY	Practice/Activity Code and Name (1)	Unit	Number Installed
1997	449 - Irrigation Water Management	Plans	7
Summary	449 - Irrigation Water Management	Plans	47

(1) Includes all annual and permanent practices/activities (P/A). Annual P/A's initially installed with USDA assistance are assumed to be continued by the producer in subsequent years without assistance. The individual years report BOTH annual numbers installed with assistance and continued by the producer without further USDA assistance.

Project Name: Granger Drain

V-C.1.b: **Application of Nitrogen Managment Practices/Activities Primarily for Surface Water Protection**

FY	Practice/Activity Code and Name (1)	Unit	Number Installed
1997	449 - Irrigation Water Management	Plans	6
	425 - Waste Storage Ponds	Pond	4
	312 - Waste Management Plan	each	9
Summary	449 - Irrigation Water Management	Plans	46
	425 - Waste Storage Pond	Pond	13
	313 - Waste Storage Structure	No.	6
	312 - Waste Management Plan	each	9

(1) Includes all annual and permanent practices/activities (P/A). Annual P/A's initially installed with USDA assistance are assumed to be continued by the producer in subsequent years without assistance. The individual years report BOTH annual numbers installed with assistance and continued by the producer without further USDA assistance.

Project Name: Granger Drain

V-C.1.c: **Application of All Nitrogen Managment Practices/Activities for Water Quality Protection (1) - Summary**

FY	Practice/Activity Code and Name (1)	Unit	Number Installed
1997			
	449 - Irrigation Water Management	Plan	6
	425 - Waste Storage Pond	No.	4
	312 - Waste Management Plan	No.	9
Summary			
	449 - Irrigation Water Management	Plan	46
	425 - Waste Storage Pond	Pond	13
	313 - Waste Storage Structure	No.	2
	312 - Waste Management Plans	No.	18

(1) Includes all annual and permanent practices/activities (P/A). Annual P/A's initially installed with USDA assistance are assumed to be continued by the producer in subsequent years without assistance. The individual years report BOTH annual numbers installed with assistance and continued by the producer without further USDA assistance.

Project Name: Granger Drain

V-C.4.a2: **Animal Waste Management Practices/Activities by Farm Type. (1), Adoption of Improved Application Operation**

FY	Type	Number	Size (2)	Animal Units (3)
1997				
	Dairy	5	230	11,830
Summary				
	Dairy	15	133	19,068

(1) Includes carcass disposal
(2) Express in average number of acres for all farms of one type
(3) Consult Agricultural Waste Management Field Handbook for definition

Project Name: Granger Drain

V-C.4.b: **Animal Waste Practices/Activities**

FY	Practice/Activity Code and Name (1)	Unit	Number Installed
1997			
	425 - Waste Storage Pond	Ponds	5
	590 - Nutrient Management	Acres	675
	449 - Irrigation Water Management	Acres	675
	442 - Sprinkler System	Systems	4
	312 - Waste Management Plan	Each	9
Summary			
	425 - Waste Storage Pond	Pond	14
	313 - Waste Storage Structure	No.	2
	Waste Storage Pond Testing		1
	590 - Nutrient Management	Acres	675
	449 - Irrigation Water Management	Acres	675
	442 - Sprinkler System	Systems	4
	312 - Waste Management Plan	Each	9

(1) Includes all annual and permanent practices/activities (P/A). Annual P/A's initially installed with USDA assistance are assumed to be continued by the producer in subsequent years without assistance. The individual years report BOTH annual numbers installed with assistance and continued by the producer without further USDA assistance.

Project Name: Granger Drain

V-C.5.a: Application of Practices/Activities Primarily for Erosion Control (1)

FY	Practice/Activity Code and Name	Unit	Number Installed
1997			
	201 - 'PAM' Polyacrylamide	Demos	15
	441 - Trickle Irrigation System	System	2
	442 - Sprinkler Irrigation System	System	7
	441 - Trickle/drip Irrigation System	System	3
	430 - Irrigation Pipeline	Feet	7249
Summary			
	201 - 'PAM' Polyacrylamide	Demos	29
	441 - Trickle Irrigation System	System	13
	442 - Sprinkler Irrigation System	System	22
	340 - Cover Crop	No.	2
	620 - Underground Outlet	No.	7
	Surge Flow Demontration	No.	1

(1) Includes all annual and permanent practices/activities (P/A). Annual P/A's initially installed with USDA assistance are assumed to be continued by the producer in subsequent years without assistance. The individual years report BOTH annual numbers installed with assistance and continued by the producer without further USDA assistance.

Project Name: Granger Drain

V-C.5.b: Application of Practices/Activities Primarily for Sediment Control (1)

FY	Practice/Activity Code and Name	Unit	Number Installed
1997	201 - 'PAM' Polyacrylamide	Acres	15
	441 - Trickle Irrigation System	System	3
	442 - Sprinkler Irrigation System	System	7
	350 - Sediment Pond	No.	2
Summary	201 - 'PAM' PolyacrylamidE	Applied Practices	29
	441 - Trickle Irrigation system	System	13
	442 - Sprinkler Irrigation System	System	22
	340 - Cover Crop	No.	2
	620 - Underground Outlet	No.	7
	Sediment Pond	No.	3
	Tail Water Recovery System	No.	1

(1) Includes all annual and permanent practices/activities (P/A). Annual P/A's initially installed with USDA assistance are assumed to be continued by the producer in subsequent years without assistance. The individual years report BOTH annual numbers installed with assistance and continued by the producer without further USDA assistance.

Project Name: Granger Drain

V-C.5.c: **Application of all Erosion and/or Sediment control Practice/Activities (1), Summary**

FY	Practice/Activity Code and Name	Unit	Number Installed
1997			
	201 - 'PAM' Polyacrylamide	Applied Practices	15
	441 - Trickle Irrigation System	System	3
	442 - Sprinkler Irrigation system	System	7
Summary			
	201 - 'PAM' Polyacrylamid	Applied Practices	29
	441 - Trickle Irrigation system	System	13
	442 - Sprinkler Irrigation System	System	22
	340 - Cover Crop	No.	2
	620 - Underground Outlet	No.	7
	Surge Flow Demontration	No.	1
	350 - Sediment Pond	No.	3
	447 - Tailwater Recovery System	No.	1

(1) Includes all annual and permanent practices/activities (P/A). Annual P/A's initially installed with USDA assistance are assumed to be continued by the producer in subsequent years without assistance. The individual years report BOTH annual numbers installed with assistance and continued by the producer without further USDA assistance.

Project Name: Granger Drain

V-C.8: Application of Irrigation Water Management Practice/Activities (1)

FY	Practice/Activity Code and Name	Unit	Number Installed
1997			
	449 - Irrigation Water Management	Plan	7
	430 - Irrigation Pipeline	No.	3
	441 - Trickle Irrigation System	System	3
	442 - Sprinkler Irrigation system	System	7
Summary			
	449 - Irrigation Water Management	Plan	47
	430 - Irigation Pipeline	No	8
	441 - Trickle Irrigation System	System	13
	442 - Sprinkler Irrigation system	System	22

(1) Includes all annual and permanent practices/activities (P/A). Annual P/A's initially installed with USDA assistance are assumed to be continued by the producer in subsequent years without assistance. The individual years report BOTH annual numbers installed with assistance and continued by the producer without further USDA assistance.

Project Name: Granger Drain

V-C.9: Demonstration Practices Adopted (1)

FY	Practice/Activity Code and Name	Unit	Units Adopted
1997			
	PAM/Irrigation	Site	15
	Composted Dairy Manure Demo	Site	7
	Scientific Irrigation Scheduling and Moisture Monitoring	Site	1
Summary			
	CottonWood Demonstration	Site	1
	Manure Management	Site	8
	Return Flow Demonstration	Site	1
	Surge Flow Demonstration	Site	1
	PAM/Irrigation	Site	32
	Composted Dairy Manure Demo	Site	10
	Scientific Irrigation Scheduling and Moisture Monitoring	Site	25

(1) This table only applies to Demonstration Projects (DP's). List Practices/Activities that are adopted by producers in the Demonstration Project but are not; (a) on any of the projects' demonstration sites, (b) installed with technical assistance from DP staff.

Appendix B – Producer Surveys/Questionnaires

Questions

Grower ID#

1. Field Information

	1996	1995	1994	1993	1992
Crop					
Estimated Yield					
Manure Applied					
Fertilizer Applied					
N					
P					
K					

2. Ask to leave strips of manure and no manure to monitor uptake of nutrients.

3. What would it take to apply manure to other field source?

Individual
Soil Sample Report

Grower ID
Sampling Date
Soil pH

Nutrient Levels

	Depth	ppm	lbs/ac mmhos
Nitrates (NO_3)	1 ft		
	2 ft		
	3 ft		
	4 ft		
Ammonium (NH_4)	1 ft		
Phosphorus (P)	1 ft		
Potassium (K)	1 ft		
S. Salt	1 ft		

***Analysis by Agricheck

Appendix C - Granger Drain News, Bulletins, Etc.

Adoption of Best Management Practices (BMPs) to Meet Water Quality Goals in the Granger Drain Hydrologic Unit Area

R.G. Stevens, T.W. Ley and V.I. Prest
Washington State University, Prosser, Washington

This report provides an overview of the Granger Drain Hydrologic Unit Area which has been active since 1991. Implementation and evaluation approaches utilized, environmental benefits measured and lessons learned are reported.

Setting

The Granger Drain Hydrologic Unit Area (Granger HUA) is located in the southern portion of the Yakima River Valley in central Washington State. The Granger Drain is composed of a natural and man-made drainage network that drains approximately 17,000 acres of highly productive irrigated agricultural land. The area within the Granger HUA is part of a desert climatic zone receiving 7-9 inches of precipitation annually. Crop production is dependent upon irrigation water from mountain storage reservoirs. Irrigated soils are predominately silt loams found on rolling topography (2-8%). Irrigation return flows from surface irrigation systems are collected in a series of sub-drains and are returned to the Yakima River via the Granger Drain. This highly productive agricultural system supports a wide variety of crops including: corn, pasture, asparagus, alfalfa, grapes, mint, orchards, hops, wheat and many specialty crops. The Granger HUA has eighteen dairies within its boundaries with cow populations ranging from 100 to over 3,000 and averaging over 600 producing cows.

There are approximately 450 agricultural producers in the project area. This number comprises both commercial operators (275) and noncommercial operators, with outside employment. Most of the small acreages are utilized as pasture. The area surrounds and includes two small communities, Granger and Outlook, with a combined population of 2,000.

Suspended sediment, nutrient and pesticide loads from irrigated agricultural areas of the lower Yakima River basin have long been recognized as serious impairments to water quality. The effects of soil erosion on farmland and the effects of sediment and dichlorodiphenyltrichloroethane (DDT) on the aquatic resource have been the focus of numerous activities by several agencies. Several reaches of the lower Yakima River and several of its tributaries violate numerous state water quality criteria and federal

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Presented at the National Watershed Water Quality Project Symposium, September 22-26, 1997, Washington, D.C.

guidelines (Rinella, et al. 1992, Ecology, 1994, 1995). The Granger Drain (WA-37-1024) has been cited by the Washington Department of Ecology (Washington DOE) as exceeding standards in the following parameters: DDT, 4-4'-DDE, 4-4'-DDD, Dieldrin, Endosulfan, fecal coliform, dissolved oxygen, temperature, pH and ammonia. The Washington DOE estimated that the Granger Drain contributed 60 tons/day of suspended solids during the 1995 irrigation season (unpublished data Joe Joy, Washington DOE).

Objectives

The overall project goal is to reduce nutrient, biological and sediment loading from the Granger Drain to the Yakima River mainstream to a level which allows the river to meet its classification as a "Class A" water according to Washington DOE standards. The specific water quality objectives are to accomplish the following: 1. Reduce sediment loading by: a. increasing irrigation use efficiency by improved scheduling; b. decreasing sediment load in tail water by using Best Management Practices (BMPs); c. reducing tail water movement off the field by reuse. 2. Reduce nutrient loading to surface and ground water by: a. proper assessment of yield goals and nutrient needs; b. reducing nitrogen movement by proper timing and placement; c. reducing excess nutrient applications through soil testing and crediting all available nutrient sources. 3. Reduce input of *E. coli* by: a. optimizing waste management and confined feeding operations; b. optimizing waste application methods and timing; c. renovation and management of pastures.

The key to all of the above objectives is the implementation of BMPs at the individual field level as part of a coordinated farm water quality effort.

Implementation and Evaluation Approaches

Project objectives are being met by providing educational materials, demonstrations, technical assistance and developing working partnerships. Implementations of BMPs has been directed at individual producers by using a newsletter and CE publications to provide educational materials, commodity and area meetings and demonstration sites to share technology and follow-up with individual producers to implement BMPs.

A major focus of the project has been directed at dairy operations and associated nutrient management concerns. Many of the eighteen operating dairies in the HUA have increased significantly in cow numbers, with some dairies more than doubling. These increases have placed an additional strain on waste facilities and nutrient loading. The Lower Yakima Conservation District (CD) working with NRCS has worked with fifteen of the eighteen dairies to develop or update dairy waste management plans. This effort has been mainly directed at improvement in handling facilities to prevent movement of waste into surface waters. Approximately 44% of the $300,000 of FSA cost share money spent in the HUA has been spent on dairy waste facilities. Cooperative Extension's role has been to work with dairymen and other producers receiving manure to implement BMPs for nutrient management. Nutrient content of dairy waste, estimation of crop yield and nutrient requirement and the use of soil testing have been stressed as part of nutrient planning. A 1993 survey of dairy storage lagoons in the HUA found that with current management practices lagoons had significantly lower nutrient levels than other Northwest production areas (Table 1.). This information allowed dairymen to modify their application practices and better utilize this resource.

Table 1. A comparison of dairy lagoon nutrient concentration in Pacific Northwest production areas.

	TKN lbs/1000 gal	Inorganic N lbs/1000 gal	Total P lbs/1000 gal	Total K lbs/1000 gal
Granger Drain, WA	2.80	1.56	0.55	2.43
Whatcom County[1], WA	13.60	7.20	3.0	14.10
Willamette Valley[1], OR	4.88	4.46	0.37	5.10

[1] Data collected by Henry Bierlink in Whatcom County CE and by Mike Gangner in the Willamette Valley

Soil sampling to a depth of 4-6 ft in producer fields that have long histories of manure application have shown significant buildup of residual soil nitrate after harvest. These levels which often exceed 300 lbs N/ac have been used to demonstrate that excess nitrogen is being applied thus increasing the potential risk of significant nitrate being leached to ground water. Demonstration plots have been utilized to show that manure applications on these fields can be reduced or eliminated without yield reduction the next year. Phosphorus (P) soil test values in excess of 200 lbs P_2O_5/ac (bicarbonate extractant) have been found indicating long-term build up of P with its potential for movement to surface waters. Current efforts are addressing the potential for manure composting creating a product that can be economically transported greater distances from the dairies.

Since the major mechanism for the movement of nonpoint pollutants to the Granger Drain is through runoff from surface "furrow" irrigation, a major effort of the project was limiting the movement of sediment off the field. Converting surface furrow irrigation to either sprinkler or drip irrigation is the best long-term solution to this problem, because this essentially eliminates surface movement of NPS pollutants. However, this conversion is expensive and, therefore, implementation of this BMP is slow. Approximately 55% of the FSA cost share monies were used to help producers make this conversion and improve delivery systems. With proper management this conversion eliminates surface movement of nonpoint pollutants.

One of the most rapidly adopted BMPs was first introduced by the HUA project in 1994. Researchers had determined that small amounts of polyacrylamide (PAM) added to surface irrigation water could effectively reduce soil erosion under furrow irrigation. Some of Washington's first demonstrations were conducted in the HUA and sediment losses from the end of furrows were reduced by 90-95%. Producers have continued adopting the use of PAM and CE and NRCS personnel continue providing technical assistance to producers desiring to start using this practice. The use of PAM is a cost effective way of improving irrigation infiltration and significantly limiting movement of sediment and attached chemicals.

In 1992 the HUA was selected for a test site of a new field-level P index used to assess the potential for P movement. High P index levels were found associated with irrigated cropping practices where manure applications had been made (Stevens, et.al. 1993). This information is being used to increase producer's awareness of the long-term effects of continuous high rates of manure application.

In 1993 the HUA program utilized the Home*A*Syst program educating rural landowners of potential management practices that may lead to degradation of drinking water supplies and to introduce management practices that can reduce those risks. This was the first application of this tool in the state. Participants were solicited by offering free nitrate testing for domestic wells. Participants reported changes in current practices that would reduce the potential for drinking water contamination and environmental degradation.

To date the success of the project has been based on changes in public and producer's attitudes about water quality and their responsibility as an active part of the problem and the solution. Success has also been based on the successful implementation and continued use of BMPs by producers.

Although the Granger Drain HUA is a joint project with Natural Resource Conservation Service (NRCS), Washington State University Cooperative Extension (CE) and the Farm Service Agency (FSA), the activities of these groups in the HUA has been a catalyst for many working partnerships within the HUA and across the greater Yakima River Watershed. These partnerships are leading to increased efforts towards improving water quality across the Yakima River Watershed.

Environmental Benefits Measured

Although water quality monitoring has not been a part of this project, the Washington DOE has monitored portions of the Yakima River. In 1994 and 1995 the Washington DOE undertook a total maximum daily load (TMDL) evaluation in the lower Yakima River basin including the Granger Drain to control suspended sediments, turbidity and DDT contamination. Preliminary results of this study indicate reduced levels of *E. coli*. However, sediment levels continue to exceed acceptable levels. Washington DOE has established TMDL targets for sediment from the Granger Drain and the HUA is working with producers developing strategies to meet these goals. The TMDL requires return drains to be at 25 ntu or 56 mg/l for total suspended solids, requiring a 85-95% reduction in the Granger Drain discharge.

Based on the effort of the HUA project and the established TMDL, the local irrigation districts have initiated a monitoring program that will be used to evaluate the effectiveness of implemented BMPs and in evaluating future efforts.

Lessons Learned

In 1991 when this project was initiated the general public and producers had not accepted that a water quality problem existed or that they were part of the solution. The HUA over the years has served as an example of how water quality problems should be addressed in other areas in the watershed. During this time a Yakima River Watershed Council (YRWC) has been formed with an active water quality committee using the HUA as a focal point. As a part of the YRWC an interagency group has been formed coordinating efforts and facilitating transfer of technology between agencies and areas of the watershed.

Rate of adoption of BMPs was found to be directly related to cost of BMP implementation. Conversion of irrigation systems often costing $800-1,000/ac are much slower to be implemented than practices such as the use of PAM costing $4-6/ac per application. However, the implementation of expensive BMPs is often the only long-term solution to problems. Therefore, improving water quality in these cases should be considered a long-term effort.

Although the levels of sediment reduction that was initially anticipated have not been reached, producers and other involved parties are actively working on strategies to make things happen. One of the major lessons learned here is that it takes time to lay the groundwork that is often necessary in accomplishing complex goals such as improved water quality.

References

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Stevens, R.G., T.M. Sobecki, and Thomas L. Spofford. 1993. Using the Phosphorus Assessment Tool in the Field. J. Prod. Agric. 6:487-492.

IT'S TIME!

IT'S THAT TIME OF YEAR AGAIN. FALLING LEAVES, FOOTBALL GAMES, RAINY DAYS, FOGGY MORNINGS, AND...WASTE STORAGE POND PUMPING.

IT IS VERY IMPORTANT TO HAVE YOUR WASTE PONDS AS EMPTY AS POSSIBLE BEFORE WINTER ARRIVES TO AVOID APPLYING MANURE ON FROZEN OR SATURATED SOILS.

AS COLD WEATHER APPROACHES, THE NUMBER OF DAYS AVAILABLE FOR MANURE APPLICATION BECOME FEWER AND FEWER. IT IS NOT AN APPROVED PRACTICE TO APPLY MANURE (LIQUID OR SOLID) ON SOILS THAT ARE SATURATED OR FROZEN.

SOUTH YAKIMA CONSERVATION DISTRICT ASSISTANCE IS AVAILABLE TO THOSE WHO WOULD LIKE TO UPDATE OR DEVELOP A WASTE MANAGEMENT PLAN. CALL US AT 829-3003 OR 837-7911.

IF YOU SHOULD HAVE A WASTE DISCHARGE, CALL MAX LINDEN OR RAY LATHAM AT WDOE 575-2807. THEY ARE WILLING TO WORK WITH YOU ON ANY PROBLEM YOU MIGHT HAVE.
CALL THEM BEFORE THEY CALL YOU

MANAGING ANIMAL WASTE DURING THE YEAR CAN BE DIFFICULT. DURING THE WINTER MONTHS IT IS NOT ONLY DIFFICULT, BUT IMPERITIVE.

TO REDUCE YOUR RISK FOR COMPLAINTS, CHECK THE AREAS THAT MAY BE "POTENTIAL TROUBLE SPOTS":

** RUN-OFF FROM PEN AREAS
** SEEPAGE FROM MANURE STACKS
** WASTE STORAGE STRUCTIONS
** RUN-OFF FROM SNOW MELT

ARE YOU READY FOR WINTER?

The Washington Irrigator NewsLetter

Vol. 2, Issue No. 1 | A WSU Cooperative Extension - Prosser Publication | January 1997

BPA and WSU establish partnership for 1997 SIS (Scientific Irrigation Scheduling) Education Project

The Bonneville Power Administration and Washington State University - Prosser established a partnership on a new project to help irrigation farmers increase their irrigation efficiencies and water management capabilities in central Washington. Tom Ley, Extension Irrigation Engineer, and Ginny Prest, Ag Research Technician at WSU-Prosser, are working on a new project that will focus on letting growers know the benefits of using Scientific Irrigation Scheduling (SIS) in a seven county area including Kittitas, Yakima, Benton, Franklin, Walla Walla, Grant and Adams.

The goals of this project are to 1) determine how many crop producers/landowners are currently using some form of irrigation scheduling to determine crop water use/needs and 2) to conduct demonstration projects to show crop producers the potential benefits of using SIS and to introduce technologies that are available to producers.

What does this mean to a producer? Well, SIS may be coming soon to a farm near you. The demonstration projects will be done ***on-farm***, at least four fields per county. Each demonstration project will consist of an irrigation system evaluation with the producer in the spring, as well as an early spring soil water content determination. Weekly soil water monitoring and irrigation forecasting utilizing the Washington Irrigation Forecaster (WIF) will be provided during the 1997 irrigation season. The software, training, and technical support will be provided to cooperators so that they can use their new skills to schedule the additional fields on their farm.

...SIS may be coming soon to a farm near you ......

There will be educational workshops on the components of SIS, the WIF software, and other irrigation BMP's in each county at the beginning, during and at the end of the 1997 irrigation season. For more information see workshop listings on page 4, ***A workshop will be in your area soon!***

Ley and Prest will also be looking for new ways to measure soil water on-farm other than the currently accepted measuring devices. WSU - Prosser will be field testing the new soil water probes to assess their reliability, ease of operation, and costs for equipment and labor.

Historically soil water monitoring has been performed by scientists, commercial consultants and irrigation specialists on the larger farms. Equipment such as the neutron probe, requires a special license. Additionally, much of the equipment is expensive to purchase. But as technology develops, new equipment and probes are becoming available that do not require a special license, are portable and are less expensive.

... it is hoped that the smaller sized farms may be able to utilize this technology so that they can monitor soil water...

Many of the larger farms will probably continue to utilize irrigation consultants, but it is hoped that the smaller sized farms will be able to utilize this technology so that they can monitor soil water too.

Funding for this project has been provided for by the Bonneville Power Administration.

And on the inside?

Scientific Irrigation Scheduling (SIS) is:

A Best Management Practice (BMP) for:
- **Water Quality Protection**
- **Water Conservation**
- **Energy Conservation**

A systematic process for determining:
- **When to irrigate**
- **How much to irrigate**
- **How to apply the desired amount**

Easily tailored to site specific conditions:
- **Soils**
- **Crops**
- **Irrigation methods/systems**
- **Climate/weather**

Field soil water balance

Previous soil water level
+ Net irrigation
+ Effective rainfall
- Crop water use

= Current soil water level

SIS uses the following parameters to determine a potential irrigation schedule:

Soils Information
- **Water holding capacity**
- **Soil depth**
- **Soil structure**
- **Soil variability**

Crop Information
- **Crop type**
- **Growth stage/development**
- **Rooting characteristics**
- **Water stress characteristics**

Irrigation system information
- **System type**
- **System capacity**
- **Application efficiency**
- **Application uniformity**
- **Desired operating parameters (set times, lengths, etc.)**

Climate/Weather
- **Evapotranspiration (ET) or Crop Water Use**
- **Daily weather data for computing ET**
- **Rainfall**
- **Exposure/Elevation**

What is Scientific Irrigation Scheduling (SIS)?

Scientific Irrigation Scheduling (SIS) is a best management practice (BMP) available to all farmers. SIS is simply a process for balancing readily available water in the soil profile with crop water demand and the capacity of an individual irrigation system to replenish that demand. It uses soil water measurement information irrigation system capacity, current and expected weather conditions, and crop water needs to determine an irrigation schedule that will allow producers to apply irrigation water at the right time and in the right amount.

...SIS is simply a process for balancing available water in the soil profile with crop water demand and the capacity of individual irrigation systems.

SIS has the potential to increase irrigation application efficiency by 10-30 percent. Irrigation scheduling can reduce energy costs. There are other benefits as well. There is less leaching to ground water resulting in optimized nutrient utilization and there is reduced irrigation return flows.

Many growers have considerable knowledge and experience with their own crops, soils and irrigation systems. We recognize this and can help them use it to their advantage. In the long run the great thing about practicing scientific irrigation scheduling is the help provided in fine tuning of irrigation management. Cooperators we have worked with in the past generally agree that the process has helped them to get a better feel for the soil water status in the field at any given point in time and for a specific combination of crop, soil and irrigation system characteristics.

The down side of the process is there is a learning curve which takes time, probably the most precious commodity a producer has. Managing irrigation applications is often low on the priority list because of the relative low cost for water and energy. There are always so many "things" to do and so little "time" to do them.

WIF: Washington Irrigation Forecaster

In the simplest form, the problem of managing plant available soil water in the root zone is similar to tracking cash flow in a bank account. Irrigation and rainfall represent deposits, crop water use and deep percolation represent withdrawals, and the challenge is to manage the balance (root zone soil water content) between acceptable limits. The Washington Irrigation Forecaster (WIF) is a software package for IBM PCs and compatible computers, which provides the user with computer-assisted checkbook irrigation management information. WIF was originally developed by Ken Best as part of his Master of Science degree thesis in Agricultural Engineering at WSU. It was then enhanced with a menu-style user interface for data entry. Several revisions and updates of the WIF are planned as part of the irrigation scheduling education and demonstration project described on the front page. The WIF software package includes models of crop growth, crop water use, irrigation systems, and supporting data files specific to Washington State, which can be used to provide irrigation management information for 39 different crops. *continued page 3 WIF...*

WIF continued ....

The WIF software package really consists of two programs: one to help build a data file for each field to be scheduled, and one to provide irrigation scheduling information. The program to build a field data file must be used before the irrigation scheduling program can be ran on the field that is to be scheduled. Input data required includes the crop (and emergence data if an annual crop), the location, soil type and depth (if depth is limiting full root zone development), field soil water status and the date of measurement, and irrigation system type and application rate. This field data is saved to a file specific to each field. It can be updated or revised as needed.

The WIF irrigation scheduling program is used to update the current soil water content in the root zone of the crop and to forecast crop water use. Soil water can be updated with a current measurement of the soil water content, or by calculating a soil water balance in the root zone. This means that crop water use (withdrawals) and irrigation and rainfall (deposits) must be entered. Crop water use can also be estimated using weather-based crop ET estimates such as those available from the PAWS weather network. Irrigation and rainfall data are measured or estimated for each field by the user.

Once the root zone soil water content is updated, the model provides a forecast of crop water needs and irrigation management recommendations up to 28 days into the future. This forecast is unique in that the first week of the forecast is based upon standard weather forecast information given in local newspapers, or on radio and TV. The irrigation management recommendations allow flexibility in making your irrigation decisions, and generally will provide information to help minimize over irrigation as well as avoid crop water stress.

It is recommended that you run the WIF program routinely (weekly) through the season and not rely completely on the long range forecast of irrigation needs. This usually only takes a few minutes once you learn to operate the program. Soil water content should be periodically measured through the season to keep the estimating procedures used in the program on track. Flow or water application measurements should also be made to check that the desired depths of application are actually being applied.

While the above description of WIF may sound somewhat complex and difficult to use, it is actually very easy to use after some initial "getting used to," and the irrigation management recommendations are easy to interpret.

PAWS- Public Agriculture Weather System

by Tom Ley, P. E.
Extension Irrigation Engineer

Is it alive or not??? Both Ginny and I have heard rumors and comments recently that PAWS, the Washington Public Agriculture Weather System, is dead. Let me say it right here and now (and by the way I manage the PAWS project), the opposite is true. PAWS is alive and well and planning and implementing exciting changes for the future.

I suppose many of the rumors are connected with the demise of the National Weather Service Agricultural Programs operated out of Yakima and Wenatchee. It is true that WSU PAWS and the National Weather Service had a very close and mutually beneficial working relationship. We have supplied NWS with all of our PAWS data from day one. In return they did an excellent job of disseminating useful PAWS weather, frost warning, and crop protection information over the NOAA weather radio. It was a sad omen when the valuable NWS AG Weather Program was terminated in April of 1996. This did not mean the end of PAWS however.

I suppose another recent development may also be giving rise to the rumors of PAWS' demise. During the 1996 growing season we actively transferred weather data to the Tree Fruit BBS operated at WSU Tree Fruit Research and Extension Center in Wenatchee. It was recently announced that this BBS was going to be discontinued. I am sure this has caused some alarm, particularly within the orchard industry. Please reduce your stress level now.

A plan has been developed and is being implemented at PAWS headquarters, WSU Prosser. A new BBS will be available (hopefully with all the major bugs worked out) by mid-March 1997 and will replace the current PAWS computer/modem user interface as well as the Tree Fruit BBS. This new BBS will allow easier and faster access to PAWS weather data and on-line computer models (insect pest and disease models, heat units and growing degree days, crop water use, etc.). There will also be capability to access this BBS over the Internet using TELNET. We also have plans to implement a PAWS Web site which will allow access to data and models.

It is true that PAWS has experienced decreasing budget allocations from WSU. Our goal is to fund our current operation and maintenance support from private industry, grants, and weather station sponsorship. For this reason part of our future support will come in the form of user fees for BBS and Internet access to PAWS similar to those implemented for the Tree Fruit BBS.

I believe WSU has made and will continue to stand by a long term commitment to house the PAWS network and provide personnel support. In fact I wish to take this opportunity to introduce the new PAWS Electronics Technician, Todd Elliott. Todd started on January 2, 1997 and is making significant contributions with the development of the new BBS and Internet access to PAWS.

Information about PAWS is currently available at our anonymous FTP site. Using a Web browser type ftp://frost.prosser.wsu.edu on the URL address line. This should connect you with our site where information about PAWS is posted. PAWS subscription fees will be posted there as well as informational updates on progress towards enhancing access to PAWS data and models. For those of you without Internet access, contact us at (509) 786-9367 for this information.

Want to find out more? A workshop will be in your area soon!

Date	*Time*	*Meeting /Contact Information*	*Location*
Feb 11	8a-4p	**Potato IPM/SIS Workshop** Eric Sorensen, (509) 545-3511	**TRAC, Pasco**
Feb 12	8a-4p	**Potato IPM/SIS Workshop** Gary Pelter, (509) 754-2011	**Hallmark Inn, Moses Lake**
Feb 27	9a-3p	**SIS Workshop** Contact Pat Daly, (509) 786-9230	**WSU - IAREC, Prosser**
Feb 27	6p-9p	**SIS Workshop** Walt Gary, (509) 527-3260	**WSU Extension Office, Walla Walla**
Mar 6	9a-2:30p	**SIS Workshop** Tom Hoffmann, (509) 962-7507	**Best Western, Ellensburg**
Mar 7	9a-1p	**SIS Workshop** Dana Faubion, (509) 574-1600	**WSU Extension Conference Room** **Yakima County Courthouse, Yakima**

For more information about the SIS Project, future workshops, or other irrigation BMPs, please feel free to contact either one listed below:

Tom Ley, P.E.
Extension Irrigation Engineer
(509) 786-9203 leyt@wsu.edu

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Ag Research Supervisor
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Cooperative Extension

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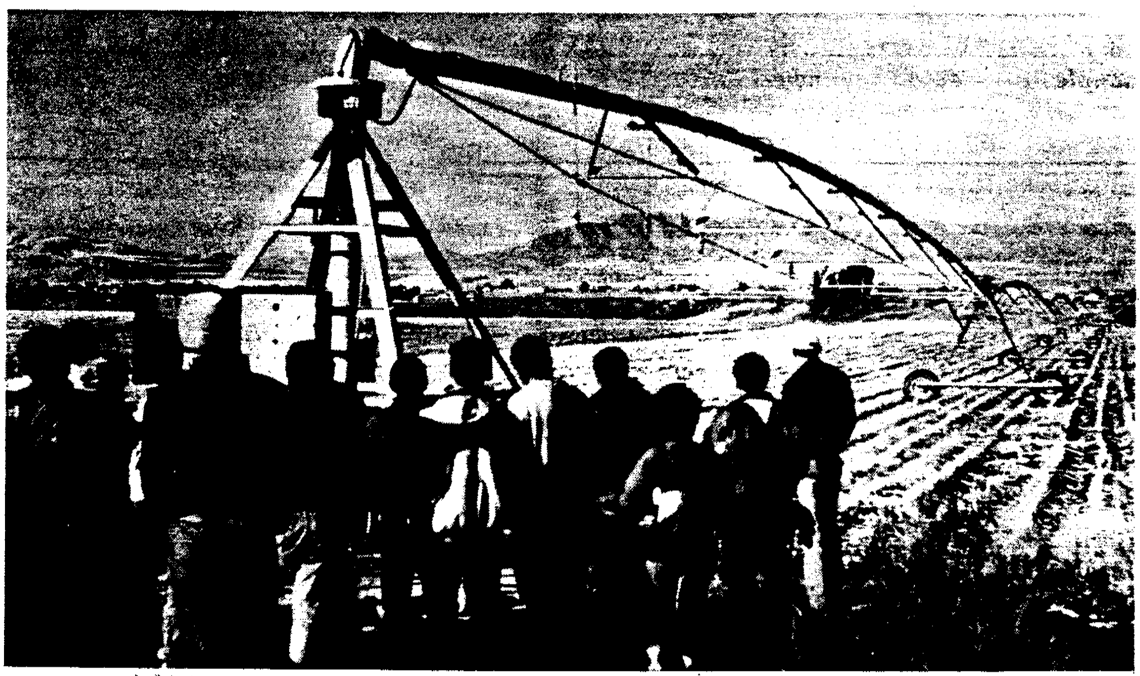
Irrigation Scheduling on Your Farm
A Survey of Central Washington

Please take a few minutes to fill out this survey. The following information is requested for two reasons. First, so we can determine if and how irrigation scheduling is practiced on-farm in Central Washington. Secondly, this survey will also be used to identify what is needed (equipment, tools, technical assistance and training, etc.) to enhance the adoption of Scientific Irrigation Scheduling (SIS) in your area, for your farm size and in other areas of irrigated agricultural areas in Washington State.

This is a Washington State University - Prosser program supported by funding from the Bonneville Power Administration. As always, this information will be kept confidential.

Thank you in advance for your time and even if you do not want to fill out the survey please return it with your correct mailing address so we can keep you on our mailing list. We might have something in the future that would be of value on your farm or in your consulting service.

Ginny Prest (509) 786-9215 and Tom Ley (509) 786-9203.



If you do not wish to participate in the survey but would like to continue to receive the Washington Irrigator NewsLetter, please provide the following information:

Please print

Name ______________________________

Business Name ______________________________

Mailing Address ______________________________

City ____________________ **Zip Code** ____________

Section 1 --- Please tell us about you.

A. Are you a farmer, grower, rancher, or producer? **Yes** **No** **(circle one)**

If Yes, continue on to the Section 2.
If No, please go to next question.

B. Are you a Crop Consultant, Irrigation Consultant, or someone who assists growers in determining an irrigation schedule? **Yes** **No** **(circle one)**

If Yes, continue on to Section 3.
If No, provide us with your mailing information so that you will continue to receive the Washington Irrigator NewsLetter.

Section 2 --- Please tell us about your farm.

This section is intended for use by irrigated crop producers and ranchers. If you are a consultant please continue on to Section 3 - Irrigation Scheduling.

A. Irrigated fields you own, lease, or manage.

Field Id	# of Acres	Irrigation System	95 Crop	96 Crop	97 Crop	Own/Lease
Example #1	*40 A*	*wheel line*	*Hay*	*Hay*	*Corn*	*Own*

B. Tell us about the pumps you use to supply irrigation water to your irrigation systems.

Pump Type	hp	Rated gpm	pressure	Pump Supplies # Acres	Water Source Surface/Well
centrifugal	*15*			*40 A*	*Surface*

C. What electrical utility provides you with power for your pumping stations? ____________

Section 3 --- This section is intended to be used by growers who schedule their own irrigations and by commercial/agency individuals who schedule irrigation for others?

A. Do you use/practice irrigation scheduling? **Yes** **Sometimes** **No** **(circle one)**

B. How many acres do you schedule? _______ **Acres**

C. How many farms does this acreage represent? _______ **Farm(s)**

D. What methods do you use to schedule irrigation water applications?

________ Calendar

________ Seat of the pants

________ Newspaper ET and rainfall data

________ Visual status of crop (color, wilt, etc.)

________ Crop temperature

________ Soil moisture monitoring

________ Personal weather observations/data collection

________ Infrared photography

________ Commercial irrigation scheduling service

________ Computer scheduling - irrigation scheduling software

________ Other (please indicate what) ____

E. What method do you use to measure soil water content?

________ Neutron probe

________ TDR

________ Moisture blocks (gypsum, Watermark)

________ Tensiometer/Irrometer

________ Feel/Appearance (color, etc)

________ Gravimetric sampling

________ Other (please indicate what) ____

F. How do you determine soil properties?

________ Soil surveys

______ Send soil to lab for analysis

________ Other (please indicate) ____

G. Do you use crop evapotranspiration (ET) data to help determine irrigation recommendations? **Yes** **Sometimes** **No** **(circle one)**

________ From daily newspaper

________ From on site weather station

________ On-site pan evaporation

________ From a weather service with a weather station close to the farm

________ From computer software with historical averages

________ Other (please indicate) ____

H. Do you know/analyze irrigation systems to determine the application rate? **Yes** **Sometimes** **No** **(circle one)**

I. Do you know/analyze irrigation systems to determine the efficiency and/or uniformity of application? **Yes** **Sometimes** **No** **(circle one)**

J. Do you adjust your irrigation schedule based on the environmental variables that affect application rates/efficiencies/uniformities at the time of irrigation? **Yes** **Sometimes** **No** **(circle one)**

K. If you do not use scientific irrigation scheduling (SIS), please tell us why?

_______ No need _______ Too expensive

_______ Not enough time available _______ Do not know how

L. What information do you need about irrigation scheduling so that you might consider using it to manage soil water content and irrigation water applications?

____

____

____

M. Do you own/operate a computer? **Yes** **No**

N. What type of computer do you use?

______ IBM or IBM compatible ______ Apple

______ Macintosh

______ Other (please indicate) ____

O. What operating system does your computer use?

______ OS/2 version ______ ______ DOS version ______

______ Window 3.* ______ Windows 95

______ Other (please indicate) ____

P. Is your computer hooked up to a modem? **Yes** **No**

Thank you again for your time spent filling out this survey. It will provide us with valuable information and help us determine how Washington State University can better provide services to assist you in scheduling your irrigations. If you have any questions, please do not hesitate to contact either Ginny Prest at (509) 786-9215 or Tom Ley at (509) 786-9203.

Please place in the self addressed envelope enclosed and mail.

The Washington Irrigator NewsLetter

Volume 2, Issue No.2 | A WSU Cooperative Extension - Prosser Publication | July 1997

Scientific Irrigation Scheduling Project Going Strong

Robert G. Evans and Cindy Mead
Biological Systems Engineering, WSU-Prosser

The scientific irrigation scheduling (SIS) project funded by the Bonneville Power Administration is off and running strong. Twenty-four cooperators in seven south central Washington counties are participating in the 1997 SIS demonstration project. There are 6 fields in Adams County, 6 in Benton County, 2 in Franklin County, 2 in Grant County, 6 in Kittitas County, 6 in Walla Walla County, and 6 in Yakima County.

There are about 1800 total acres covered by this project and include rill, wheel line, hand line, solid set, center pivot, and drip irrigation systems. Crops being scheduled include alfalfa, sweet corn, hops, sugar beets, potatoes, asparagus, onions, cucumbers, dry beans, timothy hay, apples, sweet cherries, and wine grapes.

There are about 1800 total acres covered by this project....

Irrigations are being scheduled weekly using the Washington Irrigation Forecaster software (WIF), PAWS data and readings of weekly soil water status. The field demonstrations involve weekly soil water monitoring using a neutron probe. Some sites were also equipped with additional soil water monitoring tools (e.g., buried Watermark® sensors) to educate cooperators on the available devices and how they work. Project personnel are refining the process and improving the timeliness of the irrigation scheduling reports to assist irrigators in planning future cultural activities including water applications.

The primary purpose of this project is to conserve electrical energy and water resources as well as reduce irrigation costs for growers. Consequently, project personnel are also cooperating with the Kittitas County and Adams County Conservation Districts on some of their water management programs by providing irrigation scheduling services on selected fields.

The primary purpose of this project is to conserve electrical energy and water resources as well as reduce irrigation costs for growers.

There have been some changes in personnel for the Scientific Irrigation Scheduling Demonstration Project. Dr. Robert Evans, Agricultural Engineer, replaced Dr. Tom Ley who has left WSU, as project leader and the main technical support person for this project. Next, Ms. Cindy Mead was hired in May as the principal field technician responsible for the day-to-day operation of the SIS project. Dr. Mary Hattendorf at WSU Prosser has also assumed the management of the Washington Public Agriculture Weather System (PAWS) from Tom Ley.

And on the inside?

Irrigating with High Sodium Well Water

Robert Evans - Biological Systems Engineering
WSU - Prosser

Many of the deep wells in central Washington produce water that is high in bicarbonate and sodium with a pH 8 or greater. Application of high sodium water quickly creates problems with soil sealing and limited infiltration of water into the soil. Overcrop applications of these waters can result in significant deposits of lime (calcium carbonate -$CaCO_3$) on fruit when used for cooling. If allowed to accumulate, sodium may also cause serious leaf burn if applied over crop on sensitive crops such as apples or grapes for either irrigation or cooling. These two separate problems must be considered together but treated individually.

Sodium ions held on soil exchange sites become available for leaching from the soil profile when exchanged for calcium ions. However, the high bicarbonate levels cause the calcium to be unavailable and the sodium builds up on or near the soil surface. The concentration of sodium causes soil structure to break down (deflocculate) and the soil surface develops an infiltration seal resulting in large amounts of runoff and dry root zones. This problem is best addressed by: 1) treating the soil with several tons of gypsum (calcium sulfate - $CaSO_4$) incorporated prior to planting; and 2) continuously keeping the pH of the applied water between 6 and 6.5 with an acidifying agent such as sulfuric acid. Irrigation systems can be used after planting to apply very finely powdered gypsum which is injected as a calcium source but water pH should be 6.5 or less for best results.

Deposits on fruit and leaf burn must be reduced by: 1) reduction of water pH every time the water is applied; and 2) periodic washing of the canopy using low pH water at night. Calcium carbonate (lime) precipitates can be readily controlled by maintaining the pH of the applied water at about 6.5-6.6 (a swimming pool pH tester can be used to monitor) by the careful injection of an acidifying agent or a sulfur burner. The use of "spent acids" from smelting or other industrial applications is not recommended. Technical grade sulfuric acid is commonly used and is the least expensive, but this is a dangerous compound to handle. Another compound that some use is a combined mixture of urea and sulfuric acid (N-pHuric) that is easy to handle but this use may apply nitrogen in excess of plant needs over the season. High quality phosphoric acid may also be used to lower pH but the amount of acidity required to lower pH of water to acceptable levels from phosphoric acid alone usually exceeds the crop's requirement for P. Certain chelating agents are often used to reduce calcium deposits on fruit because of safety concerns, but they are considerably more expensive and less effective than acids. Chelates do not affect water pH and are not needed when acidifying agents are used to lower water pH to acceptable levels. Chelates do not improve soil conditions created by high pH or sodium.

Injection equipment (pumps, tubing, etc.) must be able to withstand the specific chemicals being injected (e.g., PVC pipe cannot be used with concentrated sulfuric acid). The injection pump supplier should have the necessary information for you to purchase and install the correct materials. Positive displacement chemical injection pumps are recommended.

Use a simple, inexpensive portable pH meter to monitor the applied water throughout the season since the chemical characteristics of the water can vary over the year, and adjust injection rates accordingly. Remember that acidification only addresses the carbonate/bicarbonate problem, it may do nothing for problems due to other salts and precipitates.

Mineral deposition tends to be more significant at lower application rates (<30 gpm/ac) because less is washed from the fruit during overtree evaporative cooling. Even with acid treatment, growers may still need to operate low application rate systems for 4-6 hours using with low pH water 1-2

Continued on page 5...High Sodium

continued from High Sodium ...

nights each week to try to wash off deposits. Water for overtree applications must be treated anytime and every time bicarbonate concentrations greater than about 50 ppm are present.

The treatment and use of chemicals requires an in-depth understanding of water and soil chemistry and an idea of what is desired. The first step in determining treatment needs is to have a chemical analyses made of the water supply (pH, electrical conductivity, Ca^{++}, Mg^{++}, Na^{+}, CO_3^{-2}, HCO_3^{-}). These analyses can be used to determine, among other needed information, the "lime deposition potential" (LDP). The LDP is estimated as the least concentration of either (CO_3^- milli-equivalents per liter [meq/L] + HCO_3^- meq/L) or Ca^{++} meq/L. Halverson and Dow (1975) suggested that a LDP below 2.0 should not be a problem for over crop irrigation. However, LDPs above 2 (100 ppm $CaCO_3$) should be cause for concern and probable treatment. An LDP above 4 (200 ppm $CaCO_3$) should be used for over crop irrigation with caution and only with pH reduction treatment. However, experience has shown that LDPs as low as 1.0 have caused serious mineral deposition problems with evaporative cooling applications.

All chemicals and/or chemical mixtures added to irrigation water should also be checked to avoid phytotoxic effects as well as for compatibility to prevent precipitations and maximize efficacy. Except for acids, chemicals should usually be injected upstream of any filters or screens. Injection locations should always provide for adequate mixing. With the exception of chlorine treatments for microirrigation and acidifying agents, the hydraulic systems must be flushed of the chemicals before turning off the water.

Special chemigation safety devices are required for all chemical injection systems under federal/state laws and regulations. There can be no reverse flows, system drainage or back siphoning.

Some Thoughts About "PAM"

Bob Stevens - Extension Soil Scientist
WSU - Prosser

More and more growers are using polyacrylamide (PAM) to reduce erosion and increase infiltration with furrow irrigation. Whether applied through the irrigation water or as a patch treatment in the furrow PAM has been very effective.

I recently received some interesting information from R.E. Sojka and R.D. Lents leading PAM researchers with USDA-ARS at Kimberly, Idaho. They noted two very important points about PAM use.

PAM use in the US for soil erosion control last year (based on an estimate of 400-500,000 acres treated at 3 lbs per acre) was about 1.5 million lbs of PAM applied. This is up from zero acres just a few years ago. Note this application is via irrigation water in one fashion or another, but the application is to the land. Data suggests that the worst case scenario for PAM-loss in tail water is under 5%. Using the NRCS standard the losses are much less than that. Furthermore, in less than 2000 ft of travel in return flow ditches the lost PAM has been shown to adsorb to entrained soil contained in the flow and/or ditch walls, reaching undetectable concentrations.

The industrial/government use of PAM is nearly 200X the use in agriculture, and most of that use is via direct additions to waters in close loop proximity to riparian resources. The annual growth in use of PAM for water treatment alone is over five times the entire use for erosion control in agriculture last year.

Sojka and Lentz also remind us that PAM reduces on-field erosion by ½ ton of soil per ounce of PAM used and that substantial reduction in N, P, BOD, COD and pesticides in return flows have been documented as a result.

To be effective the use of BMPs (Best Management Practices) such as PAM requires management. Irrigation application rates need to be modified (i.e., increased by as much as 2 times the normal rate) to obtain the full benefits of PAM, erosion reduction and infilitration increases, and to reduce the potential for increased leaching due to increased infiltration.

For additional information on the use of PAM contact Bob Stevens, WSU-Prosser, (509) 786-9231 or via email at stevensr@wsu.edu.

There have been some changes at Washington State University's

Public Agricultural Weather Systems, (PAWS) .

Mary Hattendorf - PAWS WSU - Prosser

The Public Agriculture Weather System (PAWS) is Washington State University's agricultural weather service. Weather data are collected electronically at the 58 stations throughout the state and transmitted by radio signal to the base station in Prosser. PAWS is one of the few near real time agricultural weather networks in the country, enabling it to provide up-to-the-hour information to growers.

PAWS has traditionally supplied weather data and models for growing degree days, evapotranspiration and irrigation scheduling, air stability, and pest and disease development. Major system changes have been instituted in the past few months, including high speed modem access on the 4 toll-free bulletin board phone lines, and a site on the World Wide Web(http://frost.prosser.wsu.edu).

PAWS data and models have been free of charge to users in the past; however, with tightening university budgets, PAWS has been required to support itself through paid subscriptions. PAWS new subscription structure is two tiered, with corporate rates at $1,065 per year, and individual rates of $130 per year. A corporate user is one who uses PAWS information to make recommendations to growers or clients. The individual rate is intended for in-house use by a grower, for instance.

PAWS future depends on your support. The PAWS system is actively seeking input from users on the new interface, services currently provided, and services not provided that may be valuable to users. We appreciate the interest in PAWS and plan to improve the system to meet client needs.

For more information, please contact Dr. M. J. Hattendorf at (509) 786-9219, or Todd Elliott, (509) 786-9367.

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Keeping Microirrigation Systems Clean is Critical!!!

Robert Evans - Biological Systems Engineering
WSU - Prosser

Plugging of microirrigation systems is a major problem and it may occur from single or multiple factors. Physical factors such as suspended materials passing through filters or broken pipes, root intrusion and aspiration of soil particles into the emitter orifices are common causes of plugging. Chemical factors such as precipitation of carbonates and iron oxides, and precipitates from chemical injections are significant causes of emitter plugging. Likewise, biological factors such as insects and spiders, algae, fungi and bacteria can be serious plugging sources.

Plugging is minimized with proper design and management. Adequate air relief, vacuum breakers and pressure relief valves must be appropriately sited to ensure proper operation. Management must include regular flushing of lateral lines and faithful injection of chlorine or its equivalent to prevent clogging by algae and other biological growths (colonial protozoa, sulfur bacteria, and other mucous organisms) and even to minimize root intrusion. Iron and manganese precipitating bacteria can be controlled by chlorine treatments of a well, aeration, or polyphosphates.

Most programs chemically treat the water during every irrigation event,

Most programs chemically treat the water during every irrigation event, generally at the end of the irrigation cycle, although periodic (e.g., weekly) shock treatments using very high dose rates can also be effective. Generally, biocides are injected only when fertilizers or other chemicals are not being introduced into the system. Flushing velocities must be high enough (at least 2 ft/sec) to transport and discharge heavy particulate matter from the pipelines. Lateral lines should never be flushed uphill.

Chlorine activity increases exponentially with decreasing pH. Thus, chlorine should be injected when the water pH is less than 6.5 which often requires injection of acids. Inject chlorine downstream from acids after the water pH has been lowered. A pH between 5.5 and 6.0 is preferred for optimal chlorine activity. Chemical compatibility is a concern if chlorine is injected simultaneously with other chemicals, even at low rates. Chlorine should always be injected separate from fertilizers and other chemicals as deadly chlorine gas may be produced by direct mixing in some cases.

All chemical injections should be filtered. Injection usually occurs after the pump and before the media and/or screen filters to trap any undissolved material. Chemicals should be injected into the center of the water flow to ensure quick dilution to safe levels, thus avoiding possible deterioration of the filter tanks, piping, valving or other components. Test kits for swimming pools are available to measure "total" chlorine or "free" chlorine. The use of free residual chlorine (D.P.D.) test kits is required.

Microirrigation also offers many other benefits when using chemical injection and application. For example, water soluble nutrients can be injected to more closely match crop requirements, increase nutrient use efficiencies, and reduce costs. Systemic pesticides and some soil fumigants may be injected with high efficacy. Consistent soil water contents and wetted soil volumes may also increase the efficacy of many chemical applications, but high application uniformities (e.g., DU 90%) are required since the chemical application uniformity will not exceed the water application uniformity.

For more information contact Bob Evans at WSU-Prosser (509) 786-9281 or through the internet at revans@tricity.wsu.edu.

Irrigation Scheduling for Microirrigation Systems

Robert Evans - Biological Systems Engineering
WSU - Prosser

Microirrigation systems normally irrigate only a fraction of the cropped land area. Consequently, the volume of water stored in the soil and available for crop use can be considerably less than the amount of total available soil water volume under surface or sprinkler irrigation systems that wet the entire surface area. Thus, microirrigation is typically characterized by frequent, small water (and often nutrient) applications that are placed directly into or near the crop root zone with minimal losses. This practice can maintain higher, less variable soil water contents than other irrigation methods, reducing the occurrence of plant water stresses which often results in increased yields.

The basic philosophy of microirrigation is to be able to replace water in the root zone in small increments as it is used by a plant at intervals ranging from several times a day to every two to three days rather than refilling a much larger soil water reservoir after several days or weeks. Consequently, the old ideas about field capacity, wilting point and total water holding capacity do not really apply to microirrigation since there is essentially no soil water reservoir. Thus, to avoid plant water stress, microirrigations are scheduled based on replacing the immediate past water use or current plant water status and not on soil parameters such as the maximum allowable depletion (MAD). Sometimes microirrigated crops in Washington are deliberately stressed, such as wine grapes, at certain times during the season to control canopy, improve fruitfulness or improve quality, however, they still receive frequent irrigations during the stress periods but at greatly reduced levels.

There are two major concerns when scheduling microirrigation systems. The first is determining when to irrigate. The second consideration is how much to apply during an irrigation. When to irrigate depends on crop, climate, soil, irrigation system and management factors. It will vary through the season. The maximum interval between irrigations is primarily controlled by soil hydraulic characteristics, soil profile layering, and tubing placement. Irrigations can be scheduled whenever an allowable water use depletion level has occurred, or to replace estimated or measured crop water use, commonly called evapotranspiration (ET), each day. Alternatively, a preset amount of water can be automatically applied whenever the soil water potential (tension) in the wetted volume drops to a predetermined critical level as measured by sensors.

The estimated crop water use or plant water status, combined with the percent of the area irrigated, will determine the total amount of irrigation to be distributed by the microirrigation system. The irrigated area, in general, is taken as the total area, even row crops and high density tree plantings, considering that eventually most of the area is shaded when the crop matures. However, for low density or very young plantings, applications and schedules should be based on the actual canopy size or only the affected irrigated area.

The available soil water may be very limited by drip irrigated row crops such as vegetables with high ET rates with small root zones or on sandy soils, thus requiring irrigation two to ten times daily. Conversely, the irrigated root zone available water capacity might be much larger for tree crops on heavier soils allowing for less frequent irrigations. Daily microsprinkler applications may be required to increase the wetted volume and avoid leaching on light, highly permeable soils. Conversely, on heavier soils with high water holding capacities or poor drainage, optimal microsprinkler irrigations might be only every second or third day.

For more information contact Bob Evans at WSU-Prosser (509) 786-9281 or through the internet at revans@tricity.wsu.edu

Appendix D

Proposed 1998 Section 303(d) List

A Suspended Sediment and DDT Total Maximum Daily Load Evaluation for the Yakima River

WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

A Suspended Sediment and DDT Total Maximum Daily Load Evaluation Report for the Yakima River

Executive Summary

July 1997
Publication No. 97-321
Printed on Recycled Paper

Executive Summary

Purpose and Approach

The lower Yakima River basin is located in south-central Washington State. It is one of the most intensively irrigated and agriculturally diverse areas in the United States. Suspended sediment and persistent pesticide loads from irrigated agricultural areas of the lower Yakima River basin have long been recognized as serious impairments to water quality. Recent water quality evaluations by the US Geological Survey (USGS) have indicated that some improvements have been made, but beneficial uses are still impaired by sediment and sediment-borne pollutants like DDT from irrigation returns (Rinella *et al.*, 1992b, 1993).. Consequently, several reaches of the lower Yakima River and several of its tributaries do not meet numerous state water quality criteria and federal guidelines (Ecology, 1994a, 1995). As a result, these water bodies have been placed on the Washington State's 303(d) list.

The Clean Water Act directs Ecology to perform a total maximum daily load (TMDL) analysis for contaminated waters on the 303(d) list. Ecology had determined that turbidity and DDT represent key water quality impairments on the 303(d) list in the lower Yakima River basin. In response, Ecology conducted a TMDL study to evaluate controls of suspended sediment, the primary cause of the turbidity criteria violations, and a major source DDT transport in the lower basin during the irrigation season. Ecology believes the control of suspended sediment generation and transport during the irrigation season will result in far-reaching water quality and fish habitat improvements in the Yakima Basin.

In addition, the TMDL needed to be coordinated with the Yakama Indian Nation (YIN) since the Yakama Indian Reservation covers over forty percent of basin, but is outside of the state's jurisdiction. The Yakama Indian Nation and Ecology joined in a data-sharing and cooperative monitoring agreement for the project. Like Ecology, the YIN and the US Environmental Protection Agency (USEPA) share similar Clean Water Act and TMDL responsibilities on the Yakama Indian Reservation. They are developing plans, and are undertaking actions to address suspended sediment loads in drains and tributaries from the Reservation. Ecology, the YIN, and the USEPA will continue to coordinate their efforts to improve water quality in the Yakima River

The TMDL evaluation project was undertaken in two phases by the Environmental Investigations and Laboratory Services (EILS) program at Ecology. Phase I tasks included:

- water quality monitoring,
- a historical data review,
- suspended sediment criteria development based on beneficial use impairments, and

0 years (2017)
The DDT human health criteria in fish and water will be met.

'SS reductions necessary to meet the turbidity TMDL targets were estimated from the 994 and 1995 data. Main stem TSS concentrations in both years would have required eductions of approximately 50% to stay within the 5 NTU limit at Kiona. The main tem loading would be adequately reduced to meet the 5 NTU limit if project area and (akama Reservation tributaries complied with the recommended 25 NTU target. The 'SS load from project area tributaries and drains to the Yakima River would have been educed by approximately 207 tons/day in 1995. The 25 NTU target will require the argest return drains to reduce TSS loads 13% to 93% in an irrigation season with normal vater availability, like 1995. Under conditions of limited water availability like in 1994, some of these same return drains would have easily meet the target while others would still have needed reductions of 25% to 90%.

Based on the regression equation, the turbidity-related TMDL target of 56 mg/L TSS at mouths of drains could reduce t-DDT concentrations to 7 ng/L. That would reduce t-DDT loading to the Yakima River by more than 66%. The 7 mg/L TSS target for compliance with the 1 ng/L aquatic toxicity criterion for DDT will require substantial reductions of TSS loads in most tributaries --from 30% to 99%. However, model simulation results suggest the 1 ng/L DDT criterion might not be attained in the river, even if the TSS concentrations in the drains were reduced to the 7 mg/L TSS target. Background t-DDT residuals carried in the river from upstream or in resuspended sediment would become the dominant sources of t-DDT in the lower Yakima River. These inputs could continue to cause DDT concentrations to exceed the criterion. Instream and out-of-basin sources are more difficult to predict and control, and could likely prevent complete water quality compliance in the main stem.

The TSS to t-DDT regression developed from data collected to date shows a greater variability in the lower region of the regression where TSS concentrations are less than 70 mg/L. DDT data are lacking for the lower TSS concentration range. Therefore, as more DDT samples are collected from return drains and tributaries that approach compliance with the interim turbidity TMDL target of 25 NTU (56 mg/L TSS), the regression can be re-calculated.

The suspended sediment and turbidity reductions recommended in the TMDL evaluation provide direction to Ecology for planning, funding, and executing specific actions in priority subbasins. Ecology will hold public workshops in cooperation with conservation and agricultural outreach agencies to discuss all aspects of the TMDL with local growers, water purveyors, and other interested parties in the lower Yakima River basin. At that time, implementation plans and schedules for these recommendations (or alternatives that meet water quality standards, protect fish health and habitat, and protect designated uses) will be formulated.

Two very different irrigation season flow regimes were monitored during 1994 and 1995. Irrigation diversions were severely limited in 1994 because water availability for irrigation was the lowest on record. The 1995 season saw normal water availability. Water availability and use had a direct impact on suspended sediment loading from tributaries and irrigation return drains. Tributaries and drains associated with lands with senior water rights (*i.e.*, only minor reductions in water use) maintained elevated TSS concentrations and turbidities both years. For example, the median turbidities at Moxee Drain and Granger Drain exceeded 50 NTU, the level at which displacement of salmonids can occur, in 1994 and 1995. However, tributaries and return drains from lands affected by lower water use in 1994 resulted in lower mean TSS concentrations and turbidities. In 1994, Sulphur, Spring, and Snipes creeks had median turbidities below 25 NTUs. Salmonid feeding and growth are affected at turbidities above 25 NTUs. In 1995, the median turbidities of Sulphur Creek and Spring Creek were above 25 NTU, while the 90th percentile turbidities for Sulphur, Spring, and Snipes creeks exceeded 50 NTU. In turn, main stem concentrations of TSS and turbidity increased between 1994 and 1995 as TSS loading from tributaries increased. Median and 90th percentile turbidities at main stem sites monitored in 1994 remained below 25 NTU. In 1995, 90th percentile turbidities of the four sites below the Yakima River at Parker exceeded 25 NTU. In both years, turbidity increased by more than 5 NTUs between the confluence of the Yakima and Naches River and Benton City.

A TSS loading balance was calculated from the data collected during the 1995 irrigation season. The cumulative impact of tributary and drain loadings on reaches of the lower Yakima River was clearly seen. For example, in the later part of the irrigation season, the Moxee Drain TSS load (35 tons/day) exceeded the Naches River's load (27 tons/day), even though the average water volume of the Naches River was 14 times that of Moxee Drain. Granger Drain contributed an average 60 tons of TSS /day. The TSS load from Sulphur Creek was 110 tons/day, and Spring and Snipes Creeks' combined TSS load was 46 tons/day. The combined TSS load from the Yakama Reservation drains and tributaries was 75 tons/day. Approximately 1.5 tons/day came from municipal or industrial sources. Ungaged tributaries and instream sources also accounted for substantial loads during the irrigation season.

Using 1994 and 1995 monitoring data generated in this TMDL evaluation, a regression was developed of turbidity as a function of TSS. The following linear regression equation was based on 646 data pairs from river, canal, drain, and tributary sites with TSS concentrations less than 1000 mg/L:

$$\log_{10} \text{Turbidity} = 0.871 * \log_{10} \text{TSS} - 0.145$$

The equation had a coefficient of determination (r^2) of 0.956, which means 96% of the data variability is explained by the TSS data. Such a high correlation is somewhat unusual, but it may be because a ratio turbidimeter was used for all analyses, and because the geographic and seasonal scope of the data was more focused than other studies of this kind.

Pesticides

Nonionic pesticides have been used extensively on the agricultural crops of the Yakima Valley since at least the 1950s. In general, the organochlorine compounds, such as DDT, dieldrin, and endosulfan, have been the most frequently detected pesticides in basin waters, sediments, and biota due to their persistence in the environment and heavy use in the past. Concentrations of total DDT in the water were highest in the early 1970s. In the mid-1970s and early 1980s, DDT was not detected in samples routinely collected by the USGS, most likely because of the higher detection limit. Samples collected by USGS during the NAWQA survey indicate that DDT is still present in the main stem at concentrations above criteria. There is some indication that t-DDT burdens in fish tissues are declining, although there are not enough data to confirm this trend. Fish in the lower Yakima River still have one of the highest concentrations of DDT in the country (Rinella *et al.,* 1993). These findings resulted in a Washington State Department of Health advisory in 1993 recommending that people eat fewer bottom fish from the lower basin (Department of Health, 1993).

In 1995, whole water samples were analyzed for 46 pesticides at Granger Drain, Spring Creek, Sulphur Creek, and the Yakima River at Euclid Bridge as part of the TMDL evaluation. Organochlorine, organophosphate, and nitrogen-containing pesticides were frequently detected at all sites. Total DDT was detected above the human health and aquatic life chronic toxicity criteria at all sites on three or more sampling dates. The t-DDT samples analyzed had concentrations from 0.004 µg/L to 0.357 µg/L, and a median of 0.0083 µg/L. The median concentration, and most sample results, were similar to what has been reported in recent years for these sites. However, one sample collected at Granger Drain contained 0.357 µg/L t-DDT. It was twice the previously highest concentration of t-DDT detected since 1968.

Additional pesticides detected in water at concentrations above criteria or guidelines were: azinphos-methyl, chlorpyrifos, malathion, diazinon, and propargite. Both azinphos-methyl and chlorpyrifos are highly toxic insecticides used on many fruit and vegetable crops. Preventing seasonal entry of these newer pesticides into basin waters deserves further investigation.

The t-DDT concentrations in the small mouth bass and carp tissue samples collected in 1995 from the Yakima River at Euclid exceeded the Ecology screening guideline by an order of magnitude. The bass sample had a higher concentration than bass previously analyzed in the lower basin, and the carp sample was at the higher end of the range of values observed. Dieldrin was also detected in the bass and carp samples at concentrations exceeding the 0.7 µg/kg screening guideline by an order of magnitude.

The carp sample's 15 μg/kg total chlordane concentration exceeded the human health screening level of 8.3 μg/kg. Total PCBs (polychlorinated biphenyls) in both the carp and bass also exceeded the screening guideline for human health risk. Other pesticides detected, but below guideline concentrations, were: heptachlor expoxide, hexachlorobenzene, and trifluralin.

The three largescale sucker composite samples collected from the Yakima River at Euclid in 1995 contained from 2,276 μg/kg to 3,728 μg/kg t-DDT. Dieldrin and total PCB concentrations in the 1995 samples also exceeded wildlife guidelines. These data indicate that pisciverous wildlife are still likely at risk from exposure to t-DDT, dieldrin, and other pesticides in Yakima River fish.

Using 1995 monitoring data generated in this TMDL evaluation and previous USGS and Ecology data, a regression was developed of t-DDT as a function of TSS. The best linear regression equation based on 71 data pairs from river and tributary sites with detectable t-DDT concentrations (expressed as nanograms per liter, or ng/L) was:

$$\log_{10} \text{t-DDT} = 0.953 * \log_{10} \text{TSS} - 0.820$$

The equation had a coefficient of determination (r^2) of 0.747. Data collected in 1995 were not significantly different from previously collected data, and tributary data were not significantly different from main stem data, so all data were grouped. Other pesticides either had too few data, or no significant association with TSS was found.

Total Maximum Daily Load Recommendations

Since suspended sediment and DDT are two of the most significant pollutants in the Yakima River Basin, it is necessary to set nonpoint source reduction targets through load allocations in the study area. Three approaches were used to recommend TSS and DDT targets and nonpoint source load allocations for the Yakima River and its tributaries in the study area:

1. ***Turbidity criterion*** -Using the correlation of TSS concentrations to turbidity values, TSS targets on the main stem Yakima River will be based on the turbidity standard of 5 NTU above background.
2. ***Fisheries (aquatic biota) support*** - Using the narrative criteria to protect aquatic life, a 25 NTU turbidity or 56 mg/L TSS target will apply to irrigation return drains and tributaries as a fish health threshold consistent with the scientific literature.
3. ***Pesticides criteria*** - Based on the correlation of TSS to t-DDT, long-term TSS reduction goals will be set for return drains and tributaries to achieve the t-DDT water quality criterion for protection of aquatic life from chronic toxicity. Targets to meet human health criteria will be assessed as progress to the aquatic life criterion is made.

The TMDL-related activities include re-evaluation work and further target development. The targets based on aquatic community effects should be met in 15 years so that an evaluation of ways to meet DDT human health criteria can be done within 20 years. Limiting DDT uptake by aquatic organisms may require an entirely different approach, but that will be difficult to know until substantial reductions in TSS and associated DDT loadings are accomplished. These are necessary components of the phased-TMDL approach. The effectiveness of individual control measures to reduce soil erosion in irrigated agricultural areas is fairly well understood, but the overall effectiveness of all measures implemented in the basin, and the rate at which they will be adopted under current economic and political conditions is uncertain. The scheduling of targets and TMDL-related activities are proposed as follows:

5 years (2002)

- Yakima River main stem will comply with the turbidity target of not more than a 5 NTU increase between the confluence of the Yakima and Naches Rivers (RM 116.3) and the Kiona gage at Benton City (RM 30).
- All drains and tributaries within the project area will comply with the 90th percentile turbidity target of 25 NTU at their mouths, especially Moxee Drain, Granger Drain, Sulphur Creek, and Spring Creek.
- The efficacy of using TSS load targets for tributaries and drains where the 25 NTU target is not representative of total load reductions will be evaluated.
- Agreements between the State of Washington, Yakama Indian Nation, and the U.S. Environmental Protection Agency that sets load allocations for the Yakama Reservation, and management of basin water quality will be completed.

10 years (2007)

- The mouths of all tributaries and drains, and all points within all basin tributaries and drains will comply with the 90th percentile turbidity target of 25 NTU.
- The 7 mg/L TSS target developed to meet the DDT chronic aquatic toxicity criterion will be re-evaluated using additional data and historical pesticide use analysis.
- Target controls and a strategy to meet the DDT human health criteria in fish and water will be developed.
- Yakima River main stem will comply with the turbidity target of not more than a 5 NTU increase between the confluence of the Yakima and Naches Rivers and the Van Geisan Road bridge at West Richland (RM 8.4).

15 years (2012)

- All tributaries and drains, and the Yakima River main stem will comply with the 1 ng/L DDT chronic aquatic toxicity criterion by the 7 mg/L TSS target or its modified form (see 10 year);
- A control strategy to meet DDT human health criteria using TSS or other targets will be established.

20 years (2017)

- The DDT human health criteria in fish and water will be met.

TSS reductions necessary to meet the turbidity TMDL targets were estimated from the 1994 and 1995 data. Main stem TSS concentrations in both years would have required reductions of approximately 50% to stay within the 5 NTU limit at Kiona. The main stem loading would be adequately reduced to meet the 5 NTU limit if project area and Yakama Reservation tributaries complied with the recommended 25 NTU target. The TSS load from project area tributaries and drains to the Yakima River would have been reduced by approximately 207 tons/day in 1995. The 25 NTU target will require the largest return drains to reduce TSS loads 13% to 93% in an irrigation season with normal water availability, like 1995. Under conditions of limited water availability like in 1994, some of these same return drains would have easily meet the target while others would still have needed reductions of 25% to 90%.

Based on the regression equation, the turbidity-related TMDL target of 56 mg/L TSS at mouths of drains could reduce t-DDT concentrations to 7 ng/L. That would reduce t-DDT loading to the Yakima River by more than 66%. The 7 mg/L TSS target for compliance with the 1 ng/L aquatic toxicity criterion for DDT will require substantial reductions of TSS loads in most tributaries --from 30% to 99%. However, model simulation results suggest the 1 ng/L DDT criterion might not be attained in the river, even if the TSS concentrations in the drains were reduced to the 7 mg/L TSS target. Background t-DDT residuals carried in the river from upstream or in resuspended sediment would become the dominant sources of t-DDT in the lower Yakima River. These inputs could continue to cause DDT concentrations to exceed the criterion. Instream and out-of-basin sources are more difficult to predict and control, and could likely prevent complete water quality compliance in the main stem.

The TSS to t-DDT regression developed from data collected to date shows a greater variability in the lower region of the regression where TSS concentrations are less than 70 mg/L. DDT data are lacking for the lower TSS concentration range. Therefore, as more DDT samples are collected from return drains and tributaries that approach compliance with the interim turbidity TMDL target of 25 NTU (56 mg/L TSS), the regression can be re-calculated.

The suspended sediment and turbidity reductions recommended in the TMDL evaluation provide direction to Ecology for planning, funding, and executing specific actions in priority subbasins. Ecology will hold public workshops in cooperation with conservation and agricultural outreach agencies to discuss all aspects of the TMDL with local growers, water purveyors, and other interested parties in the lower Yakima River basin. At that time, implementation plans and schedules for these recommendations (or alternatives that meet water quality standards, protect fish health and habitat, and protect designated uses) will be formulated.

Implementation of the TMDL will remove turbidity, DDT, DDE, and DDD from the list of contaminants impairing water quality in the lower Yakima River and several of its tributaries. Other pesticide and nutrient-caused impairments on the 303(d) list may be eliminated by implementing this TMDL. For example, future monitoring may show that concentrations of endosulphan, heptachlor, endrin and other chlorinated pesticides similar to DDT are reduced by measures set-up for suspended sediment and DDT removal.

The YIN and USEPA have similar Clean Water Act responsibilities on the Yakama Indian Reservation. They are developing plans, and are undertaking actions to address suspended sediment loads in drains and tributaries from the Yakama Reservation. Ecology, the Yakama Indian Nation, and the USEPA will continue to coordinate their efforts to improve water quality in the Yakima River. Some TSS load allocations in the lower Yakima River will need to be negotiated between these governments and agencies as part of the public process.

WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

A Suspended Sediment and DDT Total Maximum Daily Load Evaluation Report for the Yakima River

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Boating and swimming opportunities in the lower Yakima River and its tributaries also are limited by poor water quality. High turbidities reduce visibility for safe boating and swimming, and reduce the water's aesthetic appeal.

Cultural resources

Salmon and other fish are important cultural resources and food sources for members of the Yakama Indian Nation. Therefore, protection of aquatic community health and habitat on the reservation and on ceded lands, which include the study area, is a key water quality concern for the Yakama People.

Irrigation

Although the lower Yakima River is highly managed for irrigation use, elevated suspended sediment concentrations can interfere with obtaining full use of the water for these purposes. High concentrations of TSS carried in source water and supply canals can create impermeable crusts that reduce water infiltration, plant emergence, and soil aeration. Elevated TSS concentration can damage spray nozzles and clog micro-irrigation system emitters (e.g., drip, trickle, sprayer, or fogger), or increase the cost for spray and micro-irrigation systems by requiring extensive pre-filtration or treatment. Sedimentation in canals, return drains, and reservoirs increases maintenance costs to irrigation or drainage improvement districts for dredging and vegetation control.

Factors/Causes

During the irrigation season, 50% to 75% of the incoming water into the lower valley is diverted for irrigation and power generation. The water in many irrigation return drains and tributaries is highly turbid, and quickly degrades the portion of the Yakima River running at reduced flows. Eroded soils from surface irrigated agricultural areas adsorb elevated concentrations of DDT and other organochlorine pesticides, nutrients, and bacteria. Erosion also occurs along banks or in riparian areas with heavy livestock use. Some soil particles settle in the return drains, but others are transported by return drains and field drains, raising the turbidity of the river. The portion of sediments carried downstream in the water column, characterized by elevated TSS and turbidity measurements, interferes with aquatic organism's feeding, oxygen exchange, homing, mating, and other behaviors. The portion of sediments that settle allows adsorbed pesticides like DDT to be available for uptake into the food chain, eventually posing a health risk to aquatic and terrestrial organisms including humans. Sedimentation where salmon spawn directly interferes with emergence and survival of fry by blocking water circulation in redds and reducing the oxygen available to developing eggs.

Erosive soils under intense cultivation, past pesticide application practices, and inadequate soil and water management practices have contributed to the TSS and DDT problems in the lower Yakima Valley. Tooley (1995) used a geographical information system (GIS) land use analysis to demonstrate that large portions of the agricultural regions of the lower Yakima study area were susceptible to soil erosion. Rinella *et al.* (1993) have documented the history and lingering problem of DDT in the Yakima River Valley. Several reports by NRCS, CD, and Cooperative Extension have demonstrated the advantages of improved water and soil conservation techniques for Yakima Valley conditions (SCS, 1978; South Yakima Conservation District, 1982; King *et al.*, 1984; North Yakima Conservation District, 1993).

Economic factors and water policy also have played a role in reducing incentives to practice better soil and water conservation techniques (Pfeiffer and Whittlesey, 1976; Dawson and Domka, 1987; Meuer, 1992). Lack of regulatory standards and a low agricultural community recognition of the TSS problems have delayed implementation of solutions.

Point sources and non-agricultural nonpoint sources appear to have insignificant roles in the TSS and DDT water quality problems during the irrigation season. Data evaluations in this TMDL study suggest that municipal wastewater treatment plants and industrial discharges are not significant sources of turbidity, TSS, and DDT. Timber and range activities, urban run-off and other nonpoint sources may be more significant sources of TSS and turbidity during other seasons when precipitation is a driver.

Suspended Sediment and Pesticide Targets and Goals

Since suspended sediment and DDT are two of the most significant pollutants in the Yakima River Basin, it is necessary to set nonpoint source reduction targets through load allocations in the study area. Data from this TMDL evaluation have demonstrated that reduction targets for TSS can be established based on Washington State water quality criteria despite the lack of a specific TSS criterion. Three approaches are used to determine TSS and DDT targets and nonpoint source load allocations for the Yakima River and its tributaries in the study area:

1. ***Turbidity criterion*** -Using the correlation of TSS concentrations to turbidity values, TSS targets on the main stem Yakima River will be based on the turbidity standard of 5 NTU above background.
2. ***Fisheries (aquatic biota) support*** - Using the narrative criteria to protect aquatic life, a 25 NTU turbidity or 56 mg/L TSS target will apply to irrigation return drains and tributaries as a fish health threshold consistent with the scientific literature.
3. ***Pesticides criteria*** - Based on the correlation of TSS to t-DDT, long-term TSS reduction goals will be set for return drains and tributaries to achieve the t-DDT water quality criterion for protection of aquatic life from chronic toxicity. Targets to meet human health criteria will be assessed as progress to the aquatic life criterion is made.

Each of these approaches and their application are discussed in detail below.

Turibidity Criterion

Suspended sediment can be addressed through the state turbidity criterion because of a strong correlation found between turbidity and TSS in the lower Yakima River Basin. Using 1994 and 1995 monitoring data generated in this TMDL evaluation, a regression was developed of turbidity as a function of TSS (Figure 22). The details of the relationship are discussed in Appendix 2. Briefly, the best linear regression equation based on 646 data pairs from river, canal, drain, and tributary sites with TSS concentrations less than 1,000 mg/L was obtained on logarithmic (base 10) transformed data:

$$\log_{10} \text{Turbidity} = 0.871 * \log_{10} \text{TSS} - 0.145$$

The equation had a coefficient of determination (r^2) of 0.956, which means 96% of the data variability is explained by the TSS data. Data from various source water (e.g., main stem, canals, return drains, and tributaries) were not significantly different enough to exclude from grouping. A better TSS to turbidity relationship may have been obtained than previous research because a ratio turbidimeter was used, and because the geographic and seasonal scope of the data was more focused.

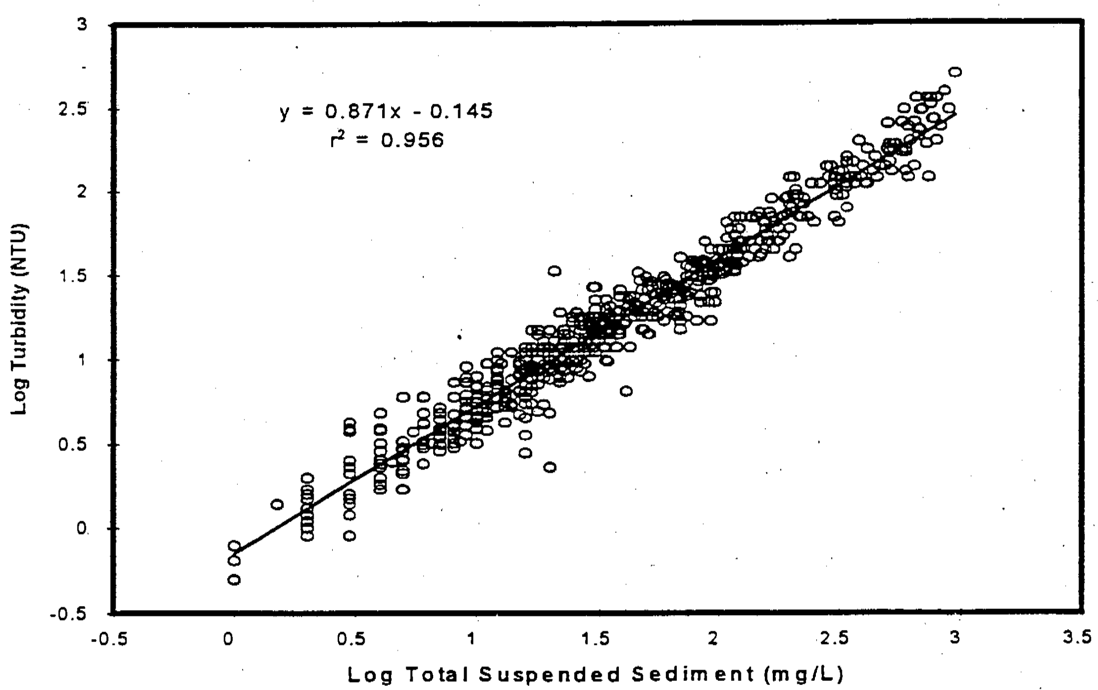


Figure 22. TSS and turbidity regression developed using TMDL data collected 1994 and 1995.

As stated earlier, Washington's turbidity water quality criteria for Class A waters [WAC 173-201A-030(2)(vi)] are:

> "turbidity shall not exceed 5 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10 percent increase in turbidity when the background is more than 50 NTU."

Under the TMDL recommendation, the 5 NTU criterion will be applied to the main stem Yakima River between the confluence of the Naches and Yakima Rivers (RM 116.3) and the Kiona gage at Benton City (RM 29.9) during the irrigation season. In a sense, most of the lower Yakima River basin irrigation project will then be treated as a single source of turbidity and TSS. The application of the state turbidity criterion in this way addresses the cumulative effect from multiple irrigation return discharges. Water quality under the Clean Water Act should be met if the cumulative effect of suspended sediment loads are limited to less than a 5 NTU turbidity increase. The state narrative criteria for protection of sensitive biota is also relevant. It is fairly obvious that water quality would be degraded and beneficial uses would be lost if background were defined as upgradient from each discharge, and if a 5 NTU increase were allowed for each irrigation return in the study area.

The confluence is the most logical control site for measuring the effect of irrigation return drains in the study area because few return drains or sources of consequence enter the lower basin above that point. Although the TSS and turbidity effects in the lower valley occur with greatest intensity between the SVID diversion at Parker (RM 103.7) and Kiona (RM 29.9), diversions, tributaries, return drains, and point sources between the confluence and Parker have a measurable effect during the irrigation season and require control. The Kiona gage is a logical compliance point at this time because it is positioned below a majority of the irrigation returns, and because it continues to be a significant monitoring site for several agencies and programs. Detailed recommendations for other monitoring points between these two sites, and general monitoring guidelines are provided later (see Monitoring Results/Adjusting Controls).

Table 13 outlines the results of this approach for 1994 and 1995 data. As the table indicates, the TSS concentrations in both years would have required reductions of approximately 50% at Kiona.

Table 13. TSS targets for the mainstem Yakima River at Kiona based on the Washington State turbidity criterion, and a regression equation relating turbidity to TSS. Background established at confluence of Naches and Yakima Rivers.

Year	Background Turbidity	Background + 5 NTU	TSS Goal Yakima at Kiona*	90th% TSS Yakima at Kiona	Percent TSS Reduction Needed
1994	5 NTU	10 NTU	20 mg/L	39 mg/L	49%
1995	9 NTU	14 NTU	29 mg/L	62 mg/L	53%

* Calculated as $\log_{10}$ turbidity= 0.871($\log_{10}$ TSS) - 0.145

There was a slight variation between years. In years of low water availability and use, like 1994, storm-generated background values, and agriculture-generated turbidity and suspended sediment concentrations tend to be lower. Under these conditions, the TSS reductions needed to meet the turbidity target in the river in some subbasins may be also lower. However, as 1994 data suggested, main stem turbidity levels may peak upstream of the Kiona gage during lower flow years (Figure 10). The 5 NTU criterion would apply to all points in the main stem between the control and compliance sites.

The irrigation season 90th percentile turbidity value calculated for the confluence of the Naches and Yakima River was used as the background control value. The 90th percentile turbidity was used because it allows for background seasonal variability while still fully supporting uses under USEPA policy (USEPA, 1995), and it is adequate for background definition under Ecology policy (Ecology, 1994c; Ecology, 1996). Background turbidity was based on data from Yakima at Terrace Heights for 1994 (5 NTU) and the flow-weighted average data from Yakima at Harrison Bridge and the Naches River for 1995 (9 NTU). The TSS concentrations at these 90th percentile turbidity values are 9 mg/L and 18 mg/L, respectively. The background values for 1994 and 1995 are below the 25 NTU criterion suggested earlier, and at the lower end of the range that could potentially harm aquatic life (see *Turbidity and TSS Criteria*).

As previously shown in Figure 12, the 1994 and 1995 TSS concentrations were not unusually low compared to past years. However, years that had high water events in March through May (or catastrophic events like the May 1980 eruption of Mt. St. Helens), and six or less sampling points yielded 90th percentile TSS concentrations unacceptably high as background controls. The TSS concentrations at the higher end of this range are usually still reasonably protective for most aquatic life uses since they are from short duration events during the early part of the season. To avoid this type of problem, future monitoring at control and target sites should be performed at the frequency and interval described later (see Monitoring Results/Adjusting Controls).

Fisheries (Aquatic Biota) Support

Tributaries in the study area provide habitat for fish, especially salmon species: Spring Creek and Snipes Creek. Other tributaries, such as Ahtanum Creek, Moxee Drain, Granger Drain and Sulphur Creek, have historically supported fisheries, and require varying levels of restoration. They also discharge to reaches of the main stem with important fish habitat (Figure 20 & 21). Since TSS and turbidities at many return drains and tributaries are constantly discharged at elevated concentrations over the entire 200 days of the irrigation season, TSS reduction targets shall be established in the TMDL to protect aquatic organisms from the chronic effects (*i.e.*, injury or death from long periods of exposure) of suspended sediment.

As discussed earlier, the scientific literature has documented that turbidities and TSS concentrations become detrimental, or lethal, to aquatic life at varying concentrations, depending upon the species of organism, and the duration of exposure (see *Turbidity and TSS Criteria*). A TMDL target of 25 NTU (or 56 mg/L TSS based on the turbidity/TSS regression) for the mouths of tributaries and return drains was chosen as the most appropriate initial action for the following reasons:

- avoids most chronic effects of suspended sediment to aquatic organisms, (e.g., reduced fish growth from poor sight feeding, habitat avoidance, and effects on territorial behavior),
- located at the mid-point of the turbidity range for achieving a moderate fishery that sustains most habitat requirements,
- consistent with technical data used to develop a Idaho's cold water fishery criterion,
- will substantially reduce sediment loading from key tributaries to salmon spawning and aquatic habitat areas on the main stem Yakima River
- will assist in compliance with the main stem turbidity target of not more than a 5 NTU increase over background,
- evidence that it will be an achievable target using conventional soil and water conservation practices for irrigated agriculture, and
- practical for compliance monitoring.

Total suspended solids load targets were not set for project area tributaries and drains because water availability is so variable. A critical discharge condition on which a load could be calculated could not be confidently established. Tributary loading targets may be an optional TMDL compliance measure as soil and water conservation practices are implemented, and the effectiveness of the practices is observed. It may be that a tributary where implementation has reduced overall TSS loads substantially will be allowed an allowance for more frequent excursions of the concentration target.

The 25 NTU target will be applied to the 90th percentile turbidity value of the irrigation season to measure compliance with the TMDL. In this way, only ten percent of the turbidities should exceed the target over the irrigation season, and the average turbidity should be below 25 NTU, which would provide better protection to aquatic life.

In Table 14, estimated TSS reductions for each tributary in the TMDL project area are shown using the 1994 and 1995 data sets. The percent TSS reduction required to meet the TMDL was calculated by comparing the 25 NTU target to the 90th percentile TSS concentrations for each year. Those tributaries which would have required TSS reduction, and are likely candidates for future TMDL compliance monitoring, are highlighted. Tributaries and drains with 1994 or 1995 turbidities lower than 25 NTUs will be monitored as part of the TMDL, and will be expected to remain lower than 25 NTUs.

Most tributaries generally would have required less TSS reduction in 1994 than in 1995 to meet the TMDL target. It may be because of the lower water availability and better water conservation practices in 1994. However, Moxee Drain appeared to have responded to different influences. At Moxee, the lower TSS reduction required for 1995 may have been related to efforts by NYCD and hop growers to convert from furrow to drip irrigation. The next few years of monitoring by NYCD should indicate whether the conversions make significant water quality improvements, or if the difference between the two years was just a reflection of data variability.

Table 14. TSS targets for the tributaries and drains of the Yakima River project area based on support of fisheries compared to data collected in 1994 and 1995. Highlighted sources failed to meet target, and estimated reductions have been calculated.

Tributary	Turbidity Goal	TSS Goal	90th % TSS 1994	90th % TSS 1995	Percent Reduction Needed 1994	Percent Reduction Needed 1995
WideHollow Cr.	25 NTU	56	10		0%	
Ahtanum Cr.	25 NTU	56	6		0%	
Moxee Drain	25 NTU	56	343	285	84%	80%
Granger Drain	25 NTU	56	408	748	86%	93%
DID #7	25 NTU	56	23		0%	
Sulphur Creek	25 NTU	56	57	215	2%	74%
Grandview Drain	25 NTU	56	75		25%	
Spring Creek	25 NTU	56	45	299	0%	81%
Snipes Creek	25 NTU	56	10	64	0%	13%

The TSS reductions required for Spring Creek and Sulphur Creek to meet the TMDL target changed dramatically from 1994 to 1995. In 1994, Spring Creek was in compliance with the target, and Sulphur Creek would have been only about 2% over the target. Both subbasins are heavily influenced by returns from the Roza Irrigation District that received less than half of its normal water allocation in 1994. In response, all districts urged their growers to exercise extra water conservation efforts. In contrast, both subbasins would have needed over 70% in TSS reductions to meet the turbidity target in 1995, an average year for water availability when conservation measures were relaxed. Moxee and Granger were the only two subbasins monitored in both years that would have required at least an 80% TSS reduction in each year. Consequently, both should be given a high priority for implementing erosion controls.

TSS load reductions stated in Table 14 may be underestimated. The average turbidity of individual drains may need to be in the range of 6 to 14 NTU to meet the 25 NTU target value. The daily variability, calculated on the lognormal distribution of TSS and turbidities collected at individual sites in 1995, can be expressed as a coefficient of variation (CV). For example, a site with a high CV will require a lower seasonal average turbidity to ensure the 90th percentile turbidity meets the 25 NTU target value. As measures are introduced by growers in subbasins to reduced TSS concentrations, the variability in seasonal turbidities may drop (*i.e.*, the data may yield a lower CV). Subbasin drain TSS concentrations with a lower CV may then be able to maintain a higher average turbidity value with less risk of the 90th percentile exceeding the TMDL target.

The 1995 TSS mass balance for the study area was recalculated after reducing the TSS loads from the five "overloaded" tributaries identified in Table 14 to meet the target concentration. The cumulative effect of the load reductions on the river would have been substantial. Had the five tributaries met the 25 NTU turbidity target, the TSS load to the Yakima River would have been

been reduced by approximately 207 tons/day. For example, the daily average load from Moxee Drain would have been reduced from 31 tons/day to 5 tons/day. In the reach from Parker to Kiona, the cumulative contribution to the river from Granger Drain, Sulphur Creek, Spring Creek and Snipes Creek would have been reduced from 213 tons/day to 32 tons/day (Figure 23). These four tributaries would have accounted for 9% of the TSS load to the reach instead of 37%.

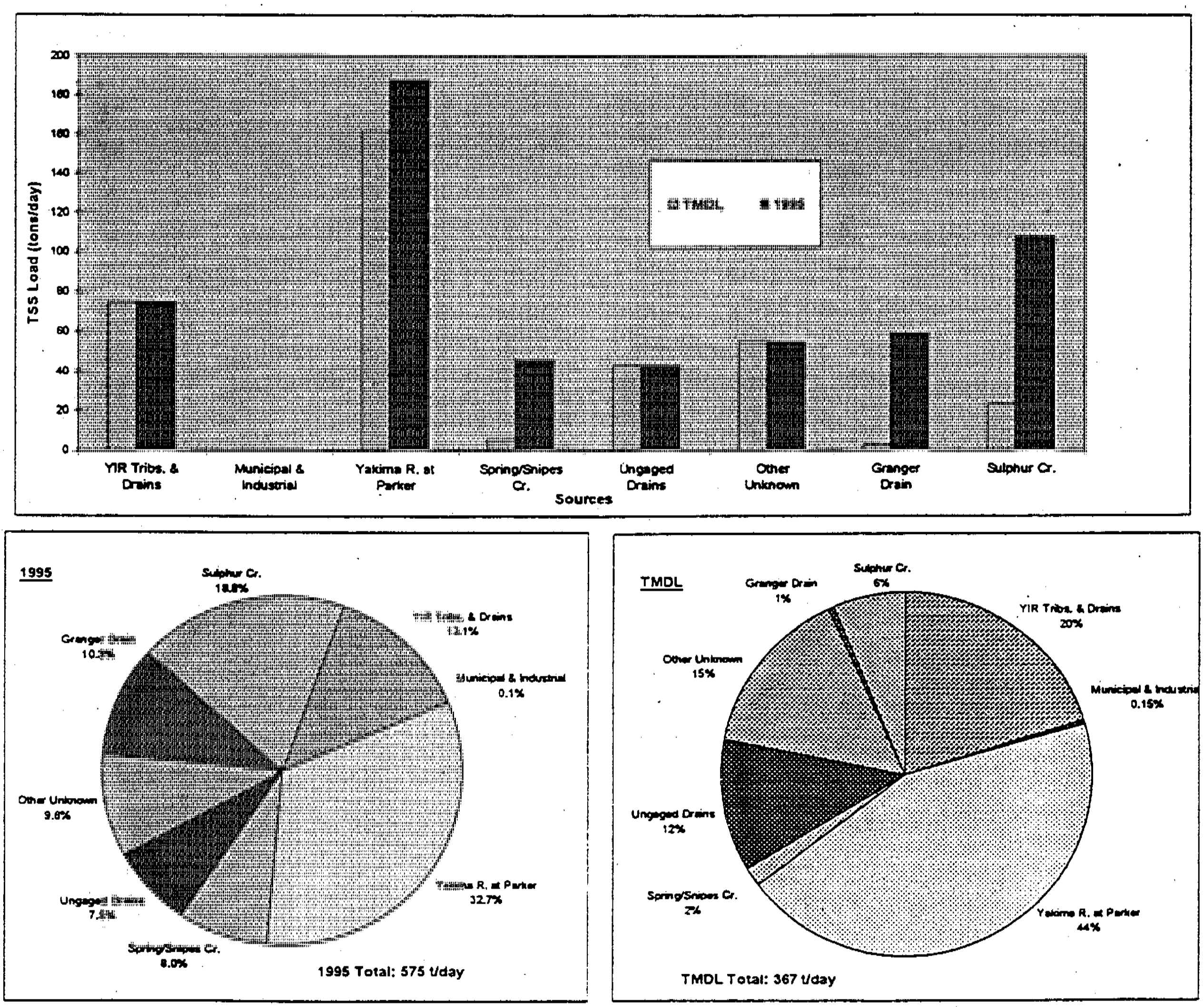


Figure 23. 1995 TSS loads from tributaries in the Parker to Kiona reach of the lower Yakima River compared to loads with TMDL project area tributaries at recommended targets of 25 NTU turbidity or 56 mg/L TSS.

A series of simple computer modeling simulations was performed as another measure of the potential effect of the tributary and drain TMDL targets on main stem turbidities and TSS concentrations. Twelve tributary TSS loads to the Yakima River between East Toppenish Drain (RM 86) and Prosser (RM 47) were used in the model. Simulations were run using the USEPA model, SMPTOX3, with qualitative sedimentation rates estimated from 1988 and 1995 data. A variety of instream flow and sedimentation conditions were used to assess main stem response while tributary loads were set at 90th percentile critical loading situations (Appendix 4, Table 4A; Appendix 4, Figures 4A-4B).

Base simulations were run for the following conditions:

1. May - June high flow (3320 cfs) in the river at Parker, low river sedimentation rates, and 90th percentile TSS loading from gaged and Reservation tributaries.
2. July - October low flow (420 cfs) in the river at Parker, high sedimentation rates, and 90th percentile TSS loading from gaged and Reservation tributaries.
3. July - October low flow (420 cfs) in the river at Parker, low sedimentation rates, and 90th percentile TSS loading from gaged and Reservation tributaries.

For each of these base simulations, another simulation was run with the 25 NTU target imposed on Granger Drain and Sulphur Creek (Appendix 4, Figures 4C-4E). These two drains represented 64% of the combined tributary TSS load in the May-June period and, 77% of the July-October loading period. TSS loads from eight tributaries from the Yakama Reservation were not changed. Two tributaries from the TMDL project area with 90th percentile TSS concentrations below the 56 mg/L (25 NTU) target in 1995 were not changed either. Also, the background TSS concentration in the river (22- 23 mg/L) was kept consistent with 1995 data.

The simulations suggest the 25 NTU target at the mouths of Granger Drain and Sulphur Creek is adequate to maintain the main stem TMDL turbidity target below 5 NTU over background under most, but not all, irrigation season conditions represented in 1995 (e.g., a main stem turbidity in 1995 less than 14 NTU or 29 mg/L TSS). The combined TSS tributary load was reduced by 50% in the May-June scenario, and 64% in the July-October scenario. Under lower river flow conditions with normal sedimentation rates, the turbidity target will be met. This appears to be the most common hydrologic condition in the river in July through October.

However, if sedimentation rates are too low, then instream turbidities may rise to unacceptable levels. Other sources will need limits to meet the main stem turbidity target during this type of critical condition. For example, the river under high flow conditions in April to June may have enough dilution to assimilate the reduced tributary loads from Granger Drain. But, the cumulative loading from all drains and tributaries upstream of Sulphur Creek, combined with high retention of sediments in the water column, will cause main stem turbidities to exceed the target (Appendix 4, Figure 4C). This situation could also happen at lower flow conditions. If fine silts and clays dominated the suspended sediment discharged by the drains and tributaries, they could resist settling (Appendix 4, Figure 4E).

The model simulations reveal that TSS load reductions will be necessary in most return drains below Union Gap to meet the main stem TMDL target during some critical conditions, especially in the reach upstream of Sulphur Creek. An agreement will need to be negotiated with the Yakama Indian Nation and USEPA to provide for adequate protection of the main stem through Reservation tributary load reductions. If project area and reservation loads can be reduced, simulations suggest that main stem target turbidities will be met more often during the higher flow periods of the irrigation season (Figure 24a). In addition, fewer areas may exceed the target during lower flow periods with low sedimentation rates (Figure 24b)

Other controls will be needed. The ungaged and unknown sources in the critical reach between Parker and Prosser during higher flow conditions, which were not modeled in the simulation, could also periodically bring turbidities over the target. Moxee Drain and other upstream sources will need to be controlled so background TSS concentrations for the Parker to Prosser reach are kept at a minimum. Return drains and tributaries that had low turbidities in 1994 and 1995 will be expected to remain below the target. Lower instream turbidities, and a better margin of safety against exceeding the turbidity criterion may be possible when TSS loads from ungaged drains on both sides of the river are placed under control. Unknown sources of TSS will need identification and reduction. However, complete reduction during higher flows may not be feasible if the TSS source is instream resuspension.

Once suspended sediment transport to the main stem Yakima River is controlled, it will be necessary to protect water quality within the subbasins. tributaries will be expected to meet the 25 NTU target at all points within their system to protect aquatic resources. An implementation strategy for each subbasin will be established through coordination with local resource agencies and the Yakima River Enhancement Project.

Pesticides Criteria

State water quality standards and USEPA guidelines provide chronic and acute criteria for DDT and other toxic substances to protect aquatic life (Chapter 173-201A-040 WAC; USEPA, 1986). The USGS demonstrated that DDT and suspended sediment concentrations in the Yakima River basin were highly related (Rinella *et al.* 1992a; Rinella *et al.*, 1993). Using 1995 monitoring data generated in this TMDL evaluation and previous USGS and Ecology data, a regression was developed of t-DDT (t-DDT = DDD+DDE+DDT) as a function of TSS (Figure 25).

The details of the relationship are discussed in Appendix 2. Briefly, the best linear regression equation based on 71 data pairs from river and tributary sites with detectable t-DDT concentrations (expressed as nanograms per liter, or ng/L) was obtained after logarithmic transformation (base 10) of the data:

$$\log_{10} \text{t-DDT} = 0.953 * \log_{10} \text{TSS} - 0.820$$

Impaired and Threatened Surface Waters Requiring Additional Pollution Controls

Proposed 1998 Section 303(d) List

The Washington State Department of Ecology (Ecology) is required under Section 303(d) of the federal Clean Water Act to prepare a list every two years containing surface waters not expected to meet state water quality standards after implementation of technology-based controls.

Ecology uses guidance provided by the U.S. Environmental Protection Agency (EPA) and policies established by our Water Quality Program in preparing new lists. Ecology staff have reviewed new information to revise the last list approved by EPA in 1996, and the proposed list in this report incorporates this new information. The list is organized by Water Resource Inventor Areas (WRIA). Waters in the Puget Sound that share WRIA boundaries and the Columbia appear near the end of the list. A map with WRIA and county boundaries is included in the report.

Information on many waters and water quality parameters were considered and some were excluded from the proposed list for various reasons. The basis for all decisions made to prepare this list is included in this report.

Ecology is currently accepting comments on the proposed list. The comment period ends on October 31, 1997. Information received in the comment period will be assessed against the criteria described in this report. Based on the comments received, Ecology will modify the list, prepare a responsiveness summary, and submit the list to EPA for approval. Comments received after the close of the comment period will be addressed in the year 2000 list.

If you have questions about the listing process, please contact Steve Butkus at (360) 407-6482 or Steve Saunders at (360) 407-6481.

Comments must be postmarked or received by October 31, 1997.
Submit comments to:

Steve Butkus
Washington Department of Ecology
P.O. Box 47600
Olympia, WA 98504-7600

FAX: (360) 407-6426
EMAIL: stbu461@ecy.wa.gov

WA-37-1024	GRANGER DRAIN	pH	5 excursions beyond the criterion between 4/92 and 3/94 at USBR statioN YAV137.		Yes	TMDL
WA-37-1024	GRANGER DRAIN	Temperature	9 excursions beyond the criterion between 8/91 and 9/93 at USBR statioN YAV137.;4 excursions beyond the criterion at USGS station 12505450 in1991.		Yes	TMDL
WA-37-1025	MARION DRAIN	4,4'-DDE	1 excursion beyond National Toxics Rule (40 CFR Part 131) criterion at USGS station 12505510 on 7/28/88.	This waterbody is entirely on the Yakima Indian Nation Reservation and does not fall under the jurisdiction of the state.	Exclude	None
WA-37-1025	MARION DRAIN	Dieldrin	1 excursion beyond National Toxics Rule (40 CFR Part 131) criterion at USGS station 12505510 on 7/28/88.	This waterbody is entirely on the Yakima Indian Nation Reservation and does not fall under the jurisdiction of the state.	Exclude	None
WA-37-1025	MARION DRAIN	Parathion	1 excursion beyond the chronic criterion at USGS station 12505510 on 7/28/88.	This waterbody is entirely on the Yakima Indian Nation Reservation and does not fall under the jurisdiction of the state.	Exclude	None
WA-37-1030	SULPHUR CREEK WASTEWAY	4,4'-DDD	5 excursions beyond National Toxics Rule (40 CFR Part 131) criterion at USGS station 12508850 in 1988.	These old data likely represent current conditions and the segment continue to be listed based on these data per the 8/97 judgement of Bob Barwin and Joe Joy (Dept. of Ecology). This judgment is based on the fact that DDT metabolites continue to be found throughout the basin in the Yakima TMDL study (unpublished).	Yes	TMDL

Segment ID Number	Waterbody Name	Parameter	Basis for Consideration of Listing	Rationale for Not Listing	Place on List?	Action Planned
WA-37-1010	YAKIMA RIVER	4,4'-DDE	Davis and Johnson, 1994. , excursions beyond the criterion inedible fish tissue.; 22 excursions beyond National Toxics Rule (40 CFR Part 131) criterion at USGS station 12510500 between 1968 and 1989.; 1 excursion beyond National Toxics Rule (40 CFR Part 131) criterion at USGS station 12509050 on 7/28/88.; 15 excursions beyond National Toxics Rule (40 CFR Part 131) criterion at USEPA station 543005 between 1969 and 1971.; Johnson, et al. 1986. , excursions beyond the criterion of edible tissue in Largescale Suckers, Northern Squawfish, Smallmouth Bass, and Channel Catfish in 1985.;	The EPA data downloaded from STORET were challenged as not meeting the quality assurance criteria of the Water Quality Program policy on listing. The listed STORET contact (Ray Peterson) was asked to verify that these criteria were met for the data used as a basis for listing. EPA did not verify that these data meet the quality assurance criteria. Therefore, these data from STORET should not be used as a basis for listing.	Yes	TMDL
WA-37-1010	YAKIMA RIVER	Aldrin	3 excursions beyond National Toxics Rule (40 CFR Part 131) criterion at USEPA station 543005 in 1970 and 1971.	The EPA data downloaded from STORET were challenged as not meeting the quality assurance criteria of the Water Quality Program policy on listing. The listed STORET contact (Ray Peterson) was asked to verify that these criteria were met for the data used as a basis for listing. EPA did not verify that these data meet the quality assurance criteria. Therefore, these data from STORET should not be used as a basis for listing.	Exclude	None

Segment ID Number	Waterbody Name	Parameter	Basis for Consideration of Listing	Rationale for Not Listing	Place on List?	Action Planned
WA-37-1010	YAKIMA RIVER	Ammonia-N	Mellor, 1981b. , excursions beyond the criterion shown between 1970 and 1974.	Based on the data cited and other studies, the Richland wastewater discharge was diverted to the Columbia River in 1985. A TMDL was submitted to EPA based on the diversion on 8/25/92. EPA determined that the TMDL was incomplete on 4/8/93. A memo from EPA dated 3/11/97 stated the segment should never have been listed or considered as a TMDL. Ecology withdrew the TMDL from consideration on 4/29/97.; Data Collected from Ecology ambient monitoring station 37A090 (just upstream of original discharge location) show that Ammonia criteria are being.met. Since there are no major sources of ammonia downstream of this station, it is likely that ammonia criteria are me for the entire reach downstream. The activity meets EPA guidance for excluding water under federal regulations 40 CFR 130.7(b)(1).	Exclude	None
WA-37-1010	YAKIMA RIVER	Arsenic	Fuhrer, et al. 1996. , 15 samples collected at station 50 (Kiona) exceeded the National Toxic Rule criterion between 1987 and 1990.; Fuhrer, et al. 1996. , 6 samples collected at station 56 (RM 55) exceeded the National Toxic Rule criterion between 1987 and 1990.;		Yes	TMDL
WA-37-1010	YAKIMA RIVER	Cadmium	Fuhrer, et al. 1996. , 4 samples collected at station 19 (Umtanum) exceeded the criterion between 1987 and 1990.;		Yes	TMDL
WA-37-1010	YAKIMA RIVER	Copper	Fuhrer, et al. 1996. , 2 samples collected at station 19 (Umtanum) exceeded the criterion between 1987 and 1990.;		Yes	TMDL

Segment ID Number	Waterbody Name	Parameter	Basis for Consideration of Listing	Rationale for Not Listing	Place on List?	Action Planned
WA-37-1010	YAKIMA RIVER	DDT	Rinella, et al. 1992. , excursions beyond the criterion at Klona(RM 29.8) on 5/7/88 and 3/8/89.; Johnson, et al. (1986) which showed 1 excursion beyond the criterion at Klona (RM 29.8) on 6/24/85.; 19 excursions beyond National Toxics Rule (40 CFR Part 131) criterion at USGS station 12510500 between 1968 and 1989.; 11 excursions beyond National Toxics Rule (40 CFR Part 131) criterion at USEPA station 543005 between 1989 and 1972.; 1 excursion beyond National Toxics Rule (40 CFR Part 131) criterion at USEPA station 04A015 on 6/24/85.; Johnson, et al. 1986. , excursions beyond the criterion of edible tissue in Largescale Suckers, Northern Squawfish, Smallmouth Bass, and Channel Catfish in 1985.;	The EPA data downloaded from STORET were challenged as not meeting the quality assurance criteria of the Water Quality Program policy on listing. The listed STORET contact (Ray Peterson) was asked to verify that these criteria were met for the data used as a basis for listing. EPA did not verify that these data meet the quality assurance criteria. Therefore, these data from STORET should not be used as a basis for listing.	Yes	TMDL
WA-37-1010	YAKIMA RIVER	Dieldrin	19 excursions beyond National Toxics Rule (40 CFR Part 131) criterion at USGS station 12510500 between 1968 and 1988.; 9 excursions beyond National Toxics Rule (40 CFR Part 131) criterion at USEPA station 543005 between 1969 and 1972.; 1 excursion beyond National Toxics Rule (40 CFR Part 131) criterion at USEPA station 04A015 on 8/5/85.; Johnson, et al. 1986. , 1 excursion beyond the criterion on6/24/85.; Rinella, et al. 1992 ; 3 excursions beyond the criterion at Klona(RM 29.8) on 6/1/88, 7/29/88, and 8/31/88.; Davis and Johnson, 1994. , excursions beyond the criterion inedible fish tissue.; Johnson, et al. 1986. , excursions beyond the criterion of edible tissue in Largescale Suckers, Northern Squawfish, and Channel Catfish in 1985.;	The EPA data downloaded from STORET were challenged as not meeting the quality assurance criteria of the Water Quality Program policy on listing. The listed STORET contact (Ray Peterson) was asked to verify that these criteria were met for the data used as a basis for listing. EPA did not verify that these data meet the quality assurance criteria. Therefore, these data from STORET should not be used as a basis for listing.	Yes	TMDL

Segment ID Number	Waterbody Name	Parameter	Basis for Consideration of Listing	Rationale for Not Listing	Place on List?	Action Planned
WA-37-1010	YAKIMA RIVER	Dissolved Oxygen	1 excursions beyond the criterion out of 10 samples (10%) at Ecology ambient monitoring station 37A095 between 9/91 and 9/96;; Data collected by City of Prosser (as a condition of their NPDES permit and submitted by Phelps Freeborn at CRO) show 9 excursions beyond the criterion out of 23 samples (39%) in 1995 and 1996.	A single excursion beyond the criterion does not meet the Water Quality Program Policy for listing.	Yes	TMDL
WA-37-1010	YAKIMA RIVER	Endosulfan	USGS Report: Rinella et al., 1992.		Yes	TMDL
WA-37-1010	YAKIMA RIVER	Endrin	2 excursions beyond the chronic criterion at USEPA station 543005on 12/2/70 and 1/20/71.	The EPA data downloaded from STORET were challenged as not meeting the quality assurance criteria of the Water Quality Program policy on listing. The listed STORET contact (Ray Peterson) was asked to verify that these criteria were met for the data used as a basis for listing. EPA did not verify that these data meet the quality assurance criteria. Therefore, these data from STORET should not be used as a basis for listing.	Exclude	None
WA-37-1010	YAKIMA RIVER	Fecal Coliform	0 excursions beyond the criterion out of 33 samples (0%) at Ecology ambient monitoring station 37A090 between 9/91 and 9/96;; 0 excursions beyond the criterion out of 9 samples (0%) at Ecology ambient monitoring station 37A095 between 9/91 and 9/96;; 0 excursions beyond the criterion out of 11 samples (10%) at Ecology ambient monitoring station 37A100 between 9/91 and 9/96; 4 excursions beyond the criterion out of 11 samples (36%) at Ecology ambient monitoring station 37A130 between 9/91 and 9/96;; Embrey, 1992. , excursions beyond the criterion at Grandview.		Yes	TMDL

Segment ID Number	Waterbody Name	Parameter	Basis for Consideration of Listing	Rationale for Not Listing	Place on List?	Action Planned
WA-37-1010	YAKIMA RIVER	Heptachlor	3 excursions beyond National Toxics Rule (40 CFR Part 131) criterion at USEPA station 543005 in 1970 and 1971.	The EPA data downloaded from STORET were challenged as not meeting the quality assurance criteria of the Water Quality Program policy on listing. The listed STORET contact (Ray Peterson) was asked to verify that these criteria were met for the data used as a basis for listing. EPA did not verify that these data meet the quality assurance criteria. Therefore, these data from STORET should not be used as a basis for listing.	Exclude	None
WA-37-1010	YAKIMA RIVER	Heptachlor Expoxide	3 excursions beyond National Toxics Rule (40 CFR Part 131) criterion at USEPA station 543005 in 1970 and 1971.	The EPA data downloaded from STORET were challenged as not meeting the quality assurance criteria of the Water Quality Program policy on listing. The listed STORET contact (Ray Peterson) was asked to verify that these criteria were met for the data used as a basis for listing. EPA did not verify that these data meet the quality assurance criteria. Therefore, these data from STORET should not be used as a basis for listing.	Exclude	None

Segment ID Number	Waterbody Name	Parameter	Basis for Consideration of Listing	Rationale for Not Listing	Place on List?	Action Planned
WA-37-1010	YAKIMA RIVER	Instream Flow	U.S. Bureau of Reclamation (1994) , measured flows below Prosser(RM 47); U.S. Fish and Wildlife (1990);Parametrix and Hardin Davis (1984); Yakima River Subbasin Plan (1990);U.S. Bureau of Reclamation (1990);SASSI, 1993;Nehlson, et al. 1991;The lower two segments of the river meet all the Water Quality Program Policy criteria for inadequate instream flow and have been added to the 303d list. The USFWS did an IFIM study and gave minimum flow levels needed by fish. (Simmons 1983 Court Testimony). Parametrix and Hardin Davis (1984) did a review for the Bureau of Reclamation and suggested minimum flows based on the IFIM and water the Bureau could possibly release for instream flows. The hydrograph for below Prosser in 1994 shows that even the minimum flows needed by fish are not being met. The 1990Yakima/Klickitat Production Report states that, low summer flows below Sunnyside Diversion Dam are a problem in most years because all but about 200 cfs of the Yakima River flow above Sunnyside is diverted out of thousands of cfs at RM 103.8. And the flows below the Prosser Diversion Dam at RM 47 are usually 50 to 200cfs when 800-1000 cfs is needed for spawning and rearing (1990Yakima/Klickitat Production Report). These flows also severely hinder up migration of adult salmon and out migration of smolts causing high mortalities The spring chinook and summer steelhead stocks are listed as depressed (SASSI, 1993).		Yes	Other Control
WA-37-1010	YAKIMA RIVER	Mercury	Fuhrer, et al. 1996. , 6 muscle tissue samples out of 7 for largescale sucker samples collected 10/91 exceeded the National Toxic Rule criterion.; Fuhrer, et al. 1996. , 3 samples collected at station 19 (Umtanum) exceeded the criterion between 1987 and 1990.; Fuhrer, et al. 1996. , 3 samples collected at station 50 (Kiona) exceeded the criterion between 1987 and 1990.;		Yes	TMDL

Segment ID Number	Waterbody Name	Parameter	Basis for Consideration of Listing	Rationale for Not Listing	Place on List?	Action Planned
WA-37-1010	YAKIMA RIVER	Parathion	1 excursion beyond the chronic criterion at USGS station 12510500on 3/30/73.; 1 excursion beyond the chronic criterion at USGS station 12509050on 7/28/88.	These old data do not represent current conditions and the segment not be listed based on these data per the 8/97 judgement of Bob Barwin and Joe Joy (Dept. of Ecology). Parathion use was discontinued in 1991. Ecology did not find any detectable parathion in the river basin in the sampling for the Yakima TMDL study (unpublished).	Exclude	TMDL
WA-37-1010	YAKIMA RIVER	PCB-1254	Davis and Johnson, 1994. , excursions beyond the criterion inedible fish tissue		Yes	TMDL
WA-37-1010	YAKIMA RIVER	PCB-1260	Davis and Johnson. 1994. , excursions beyond the criterion inedible fish tissue,; Johnson, et al. 1986. , excursion beyond the criterion of edible tissue in Channel Catfish on 5/20/85.;		Yes	TMDL
WA-37-1010	YAKIMA RIVER	pH	1 excursion beyond the criterion out of 36 samples (3%) at Ecology ambient monitoring station 37A090 between 9/91 and 9/96;;; 1 excursion beyond the criterion out of 12 samples (8%) at Ecology ambient monitoring station 37A100 between 9/91 and 9/96;; 10 excursions beyond the criterion at USGS station 12510500 between 7/1/87 and 7/1/91		Yes	TMDL

Segment ID Number	Waterbody Name	Parameter	Basis for Consideration of Listing	Rationale for Not Listing	Place on List?	Action Planned
WA-37-1010	YAKIMA RIVER	Temperature	4 excursions beyond the criterion out of 35 samples (11%) at Ecology ambient monitoring station 37A090 between 9/91 and 9/96;;; 1 excursions beyond the criterion out of 9 samples (11%) at Ecology ambient monitoring station 37A095 between 9/91 and 9/96;; 1 excursions beyond the criterion out of 11 samples (9%) at Ecology ambient monitoring station 37A100 between 9/91 and 9/96;; 1 excursions beyond the criterion out of 12 samples (8%) at Ecology ambient monitoring station 37A130 between 9/91 and 9/96;; 21 excursions beyond the criterion at USGS station 12510500between 7/1/87 and 7/1/91; Data collected by City of Prosser (as a condition of their NPDES permit and submitted by Phelps Freeborn at CRO) show 4 excursions beyond the criterion out of 23 samples (17%) in 1995 and 1996..		Yes	TMDL
WA-37-1010	YAKIMA RIVER	Turbidity	Joy and Patterson, 1995. Yakima River TMDL Study. Unpublished data collected form 7/94 to 10/94.		Yes	TMDL
WA-37-1012	SNIPES CREEK	4,4'-DDD	1 excursion beyond National Toxics Rule (40 CFR Part 131) criterion at USGS station 12509820 on 7/29/88.; 1 excursion beyond National Toxics Rule (40 CFR Part 131) criterion at USGS station 12509829 on 7/29/88.	Excursions beyond the criterion at multiple stations on a single day does not meet the Water Quality Program Policy for listing.	Exclude	None
WA-37-1012	SNIPES CREEK	4,4'-DDE	1 excursion beyond National Toxics Rule (40 CFR Part 131) criterion at USGS station 12509820 on 7/29/88.; 1 excursion beyond National Toxics Rule (40 CFR Part 131) criterion at USGS station 12509829 on 7/29/88.	Excursions beyond the criterion at multiple stations on a single day does not meet the Water Quality Program Policy for listing.	Exclude	None
WA-37-1012	SNIPES CREEK	DDT	Rinella, et al. 1992 , 1 excursion beyond the criterion on7/29/88.;Johnson, et al. 1986 , 1 excursion beyond the criterion on 8/5/85.		Yes	TMDL

Segment ID Number	Waterbody Name	Parameter	Basis for Consideration of Listing	Rationale for Not Listing	Place on List?	Action Planned
WA-37-1012	SNIPES CREEK	Dieldrin	1 excursion beyond National Toxics Rule (40 CFR Part 131) criterion at USGS station 12509820 on 7/29/88.; 1 excursion beyond National Toxics Rule (40 CFR Part 131) criterion at USGS station 12509829 on 7/29/88.	Excursions beyond the criterion at multiple stations on a single day does not meet the Water Quality Program Policy for listing.	Exclude	None
WA-37-1012	SNIPES CREEK	Dissolved Oxygen	2 excursions beyond the criterion at USBR station YAV139 on5/20/92 and 7/25/94.		Yes	TMDL
WA-37-1012	SNIPES CREEK	Temperature	6 excursions beyond the criterion between 8/90 and 8/93 at USBR station YAV139.		Yes	TMDL
WA-37-1014	SPRING CREEK	4,4'-DDD	1 excursion beyond the criterion at USGS station 12509700 on7/29/88.; 1 excursion beyond National Toxics Rule (40 CFR Part 131) criterion at USGS station 12509710 on 7/29/88.	Excursions beyond the criterion at multiple stations on a single day does not meet the Water Quality Program Policy for listing.	Exclude	None
WA-37-1014	SPRING CREEK	4,4'-DDE	1 excursion beyond the criterion at USGS station 12509700 on7/29/88.; 1 excursion beyond National Toxics Rule (40 CFR Part 131) criterion at USGS station 12509710 on 7/29/88.	Excursions beyond the criterion at multiple stations on a single day does not meet the Water Quality Program Policy for listing.	Exclude	None
WA-37-1014	SPRING CREEK	DDT	Rinella, et al. 1992 , 1 excursion beyond the criterion on7/29/88.;Johnson, et al. 1986 , 1 excursion beyond the criterion on 8/5/85.		Yes	TMDL
WA-37-1014	SPRING CREEK	Dieldrin	1 excursion beyond National Toxics Rule (40 CFR Part 131) criterion at USGS station 12509700 on 7/29/88.; 1 excursion beyond National Toxics Rule (40 CFR Part 131) criterion at USGS station 12509710 on 7/29/88.	Excursions beyond the criterion at multiple stations on a single day does not meet the Water Quality Program Policy for listing.	Exclude	None

Segment ID Number	Waterbody Name	Parameter	Basis for Consideration of Listing	Rationale for Not Listing	Place on List?	Action Planned
WA-37-1020	YAKIMA RIVER	4,4'-DDE	Johnson, et al. 1986. , excursions beyond the criterion of edible tissue in Mountain Whitefish, Suckers, and Northern Squawfish in1985.	These old data likely represent current conditions and the segment continue to be listed based on these data per the 8/97 judgement of Bob Barwin and Joe Joy (Dept. of Ecology). This judgment is based on the fact that DDT metabolites continue to be found throughout the basin in the Yakima TMDL study (unpublished).	Yes	TMDL
WA-37-1020	YAKIMA RIVER	Ammonia-N	Glenn, 1993. , potential for ammonia toxicity in the receiving water from the Mabton and Sunnyside discharges.		Yes	TMDL
WA-37-1020	YAKIMA RIVER	Chlorine	Glenn, 1993. , potential for chlorine toxicity in the receiving water from the Mabton discharge.		Yes	TMDL
WA-37-1020	YAKIMA RIVER	DDT	Johnson, et al. 1986. , excursions beyond the criterion of edible tissue in Mountain Whitefish, Suckers, and Northern Squawfish in1985.; 2 excursions beyond National Toxics Rule (40 CFR Part 131) criterion at USEPA station 04A013 on 6/24/85 and 8/5/85.	The EPA data downloaded from STORET were challenged as not meeting the quality assurance criteria of the Water Quality Program policy on listing. The listed STORET contact (Ray Peterson) was asked to verify that these criteria were met for the data used as a basis for listing. EPA did not verify that these data meet the quality assurance criteria. Therefore, these data from STORET should not be used as a basis for listing.	Yes	TMDL

Segment ID Number	Waterbody Name	Parameter	Basis for Consideration of Listing	Rationale for Not Listing	Place on List?	.ction Planned
WA-37-1020	YAKIMA RIVER	Dieldrin	Johnson, et al. 1988. , excursion beyond the criterion of edible tissue in Mountain Whitefish on 8/20/85.;1 excursion beyond National Toxics Rule (40 CFR Part 131) criterion at USGS station 12509050 on 7/28/88.		Yes	TMDL
WA-37-1020	YAKIMA RIVER	Instream Flow	U.S.G.S. flow data from gage near Parker; U.S.. Fish and Wildlife, 1990;Parametrix and Hardin Davis, 1984;Yakima River Subbasin Plan, 1990;U.S. Bureau of Reclamation, 1990;SASSI, 1993 , Spring Chinook and Summer Steelhead stocks are depressed; Nehlson, et al. 1991 , Summer Chinook, Coho, and Sockeye Salmon are extinct.; The lower two segments of the river meet all the Water Quality ProGram Policy criteria for inadequate instream flow and have been added to the 303d list. The USFWS did an IFIM study and gave minimum flow levels needed by fish. (Simmons 1983 Court TestiMony). Parametrix and Hardin Davis (1984) did a review for the Bureau of Reclamation and suggested minimum flows based on the IFIM and water the Bureau could possibly release for instream flows. The hydrograph for below Prosser in 1994 shows that even the minimum flows needed by fish are not being met. The 1990Yakima/Klickitat Production Report states that, low summer flows below Sunnyside Diversion Dam are a problem in most years because all but about 200 cfs of the Yakima River flow above Sunnyside is diverted out of thousands of cfs at RM 103.8. And the flows below the Prosser Diversion Dam at RM 47 are usually 50 to 200cfs when 800-1000 cfs is needed for spawning and rearing (1990Yakima/Klickitat Production Report). These flows also severely hinder up migration of adult salmon and out migration of smolts causing high mortalities The spring chinook and summer steelhead stocks are listed as depressed (SASSI, 1993).		Yes	Other Control

Segment ID Number	Waterbody Name	Parameter	Basis for Consideration of Listing	Rationale for Not Listing	Place on List?	Action Planned
WA-37-1020	YAKIMA RIVER	PCB-1260	Johnson, et al. 1986.., excursion beyond the criterion of edible tissue in Mountain Whitefish on 8/20/85.	These old data do not represent current conditions and the segment not be listed based on these data per the 8/97 judgement of Bob Barwin (Dept. of Ecology).	Exclude	TMDL
WA-37-1020	YAKIMA RIVER	Temperature	Embrey, 1992., 1 excursion beyond the criterion at two separate locations on different dates (at Zillah on 7/27/88 and at Granger on 7/29/88).		Yes	TMDL
WA-37-1024	GRANGER DRAIN	4,4'-DDD	4 excursions beyond National Toxics Rule (40 CFR Part 131) criterion at USGS station 12505460 in 1988.		Yes	TMDL
WA-37-1024	GRANGER DRAIN	4,4'-DDE	7 excursions beyond National Toxics Rule (40 CFR Part 131) criterion at USGS station 12505460 in 1988 and 1989.		Yes	TMDL
WA-37-1024	GRANGER DRAIN	Ammonia-N	5 excursions beyond the criterion between 11/91 and 2/94 at USBR statioN YAV137.		Yes	TMDL
WA-37-1024	GRANGER DRAIN	DDT	Rinella, et al. 1992., 8 excursions beyond the criterion collected between 5/88 and 6/89 at the mouth near Granger.; Johnson, et al. 1986., 2 excursions beyond the criterion on6/24/85 and 8/5/85.		Yes	TMDL
WA-37-1024	GRANGER DRAIN	Dieldrin	Rinella, et al. 1992., 6 excursions beyond the criterion collected between 5/88 and 11/88 at the mouth near Granger.; Johnson, et al. 1986., 2 excursions beyond the criterion on6/24/85 and 8/5/85.		Yes	TMDL
WA-37-1024	GRANGER DRAIN	Dissolved Oxygen	13 excursions beyond the criterion between 3/91 and 10/93 at USBR statioN YAV137.		Yes	TMDL
WA-37-1024	GRANGER DRAIN	Endosulfan	Rinella, et al. 1992.; 4 excursions beyond the criterion collected between 6/88 and 8/88 at the mouth near Granger.		Yes	TMDL

Segment ID Number	Waterbody Name	Parameter	Basis for Consideration of Listing	Rationale for Not Listing	Place on List?	Action Planned
WA-37-1024	GRANGER DRAIN	Fecal Coliform	Embrey, 1992.		Yes	TMDL
WA-37-1024	GRANGER DRAIN	pH	5 excursions beyond the criterion between 4/92 and 3/94 at USBR statioN YAV137.		Yes	TMDL
WA-37-1024	GRANGER DRAIN	Temperature	9 excursions beyond the criterion between 8/91 and 9/93 at USBR statioN YAV137.;4 excursions beyond the criterion at USGS station 12505450 in1991.		Yes	TMDL
WA-37-1025	MARION DRAIN	4,4'-DDE	1 excursion beyond National Toxics Rule (40 CFR Part 131) criterion at USGS station 12505510 on 7/28/88.	This waterbody is entirely on the Yakima Indian Nation Reservation and does not fall under the jurisdiction of the state.	Exclude	None
WA-37-1025	MARION DRAIN	Dieldrin	1 excursion beyond National Toxics Rule (40 CFR Part 131) criterion at USGS station 12505510 on 7/28/88.	This waterbody is entirely on the Yakima Indian Nation Reservation and does not fall under the jurisdiction of the state.	Exclude	None
WA-37-1025	MARION DRAIN	Parathion	1 excursion beyond the chronic criterion at USGS station 12505510 on 7/28/88.	This waterbody is entirely on the Yakima Indian Nation Reservation and does not fall under the jurisdiction of the state.	Exclude	None
WA-37-1030	SULPHUR CREEK WASTEWAY	4,4'-DDD	5 excursions beyond National Toxics Rule (40 CFR Part 131) criterion at USGS station 12508850 in 1988.	These old data likely represent current conditions and the segment continue to be listed based on these data per the 8/97 judgement of Bob Barwin and Joe Joy (Dept. of Ecology). This judgment is based on the fact that DDT metabolites continue to be found throughout the basin in the Yakima TMDL study (unpublished).	Yes	TMDL

Segment ID Number	Waterbody Name	Parameter	Basis for Consideration of Listing	Rationale for Not Listing	Place on List?	Action Planned
WA-37-1030	SULPHUR CREEK WASTEWAY	4,4'-DDE	8 excursions beyond National Toxics Rule (40 CFR Part 131) criterion at USGS station 12508850 between 1978 and 1989.	These old data likely represent current conditions and the segment continue to be listed based on these data per the 8/97 judgement of Bob Barwin and Joe Joy (Dept. of Ecology). This judgment is based on the fact that DDT metabolites continue to be found throughout the basin in the Yakima TMDL study (unpublished).	Yes	TMDL
WA-37-1030	SULPHUR CREEK WASTEWAY	Arsenic	Fuhrer, et al. 1996. , 15 samples collected at station 52 (near Sunnyside) exceeded the National Toxic Rule criterion between 1987 and 1990.;		Yes	TMDL
WA-37-1030	SULPHUR CREEK WASTEWAY	DDT	Rinella, et al. 1992 , 7 excursions beyond the criterion collected between 5/88 and 6/89 near Sunnyside.; Johnson, et al. 1986 , 2 excursions beyond the criterion on6/24/85 and 8/5/85.; 2 excursions beyond National Toxics Rule (40 CFR Part 131) criterion at USEPA station 04N002 in 1985.	The EPA data downloaded from STORET were challenged as not meeting the quality assurance criteria of the Water Quality Program policy on listing. The listed STORET contact (Ray Peterson) was asked to verify that these criteria were met for the data used as a basis for listing. EPA did not verify that these data meet the quality assurance criteria. Therefore, these data from STORET should not be used as a basis for listing.	Yes	TMDL

APPENDIX 4

PROJECT: 1867

TITLE: Investigation of the Use of Polyacrylamide (PAM) in Hop Production

PERSONNEL:

Project Lead: R.G. Stevens, Extension Soil Scientist, WSU-Prosser
T.W. Ley, Extension Irrigation Engineer, WSU-Prosser

V.I. Prest, Agricultural Tech. III, WSU-Prosser

OBJECTIVE:

The objective of this project was to compare the use of PAM in irrigation water with standard furrow irrigation practices in hop production.

ACCOMPLISHMENTS:

Although complete data analysis has not been completed, the results of the August 14, 1996 irrigation demonstrates the effect of PAM on the measured irrigation parameters.

At comparable inflow rates PAM significantly increased the advance time (time for water to reach the end of the field) in individual furrows. Longer advance times can be related to increased infiltration during the advance phase.

Because of the increased infiltration with PAM, higher inflow rates are needed to obtain uniform distribution of water down the length of the furrow. The use of PAM at normal inflow rates leads to increased water application at the head of the field.

Water retention in PAM treated furrows measured 16 hours after the initiation of outflow expressed as percent of total applied water was equal to or better than control furrows.

Furrow inflow rates greater than twice the conventional rate achieved desirable advance times but showed evidence of excessive furrow scouring even with PAM.

The use of PAM reduced the sediment load leaving the field by as much as 90%.

The concentration of total phosphorus in the outflow stream was decreased by 92% through the use of PAM. Soluble phosphorus was decreased by 63%.

PROCEDURES:

Research was conducted in a commercial hop yard at Prosser WA. The soil was a Warden silt loam with 37.8% sand, 48.2% silt, and 14.0% clay. The soil had a pH of 7.5, 1.1% organic matter, and 44 ppm sodium bicarbonate STP. Treatments were replicated four times in an area with a 3.9% average slope and 565 ft average furrow length. Data reported here were collected on an August irrigation following cultivation and establishment of new furrows.

Irrigation treatments were established to deliver 2.5 gpm (av. rate 2+) without PAM, 3.0 (av. rate 2.5 - 2.8) and 4.0 gpm (av. rate 4) with PAM. A stock solution of 5000 ppm PAM (Superfloc A-836, Cytec) was injected into the irrigation stream to provide a 10 ppm PAM application rate. The PAM application was stopped when the wetting front reached the end of the row. The 2.5 and 3.0 gpm flow rates were maintained throughout the 16 hours following the initiation of outflow. The 4.0 gpm rate was reduced to 2.0 gpm (av. 1.6) rate when the wetting front reached the end of the row and PAM application stopped.

Outflow from individual furrows was measured using small v-notch weirs. Individual furrow stream flow samples were taken on a time interval for determination of sediment and P concentration in outflow. Sediment loss was estimated using an Imhoff cone. Soluble P was determined on filtered samples. Total P and bioavailable P was determined on unfiltered samples. Bioavailable P is an estimate of P that would be readily available for plant or microbial use in a receiving water.

RESULTS:

As expected both inflow rate and the addition of PAM had a significant effect on wetting front advance (Table 1). A comparison of PAM vs no PAM at 2.0 gpm inflow rate in the July 25th irrigation showed a doubling of the time required for water to reach the end of the average furrow from 801 to 1675 minutes. In the August 14th irrigation 2.5 gpm without PAM was compared to 3.0 gpm with PAM and the increased inflow rate with PAM produced a more comparable advance time to the no PAM treatment. These results demonstrate the increased infiltration with PAM treated water and the need for increased inflow rates if advance times are to be maintained to improve application uniformity down the furrow.

Individual furrow dynamics had more of an effect on furrow outflow (gpm) than did inflow rate or PAM application (Fig. 1). Greater inflow rates with PAM application are needed because of the increased infiltration rate maintained in the PAM treated furrows. Outflow rates were slightly higher with the 3.0 gpm with PAM rate than with the 2.5 gpm control flow rate. This indicates that increased infiltration rate was less than 0.5 gpm. The 4.0 gpm inflow rate plus PAM was reduced to 2.0 gpm when the advance reached the end of the furrow. For a short time the 2.0 gpm inflow rate was not able to supply infiltration and outflow stopped (Fig 1).

During the 16 hrs following the initiation of outflow in each furrow more water was retained in the yard with the 3.0 gpm plus PAM treatment than the other two treatments (Table 2.). However, both the 3.0 gpm plus PAM and the 2.5 gpm control treatment retained 78% of the water applied. The highest water retention as a percentage of total water applied was obtained with the 4.0 to 2.0 gpm cutback treatment (86%). However, less total water was retained with this treatment than with the 3.0 gpm plus PAM constant inflow, due to less total water being applied. The cutback treatment will be the most effective treatment once the cutback rate that will keep the furrows wet is determined.

Sediment load estimated as milliliter (ml) of sediment per liter (L) of outflow (Imhoff cone measurement) was affected by furrow dynamics as well as by treatment (Fig. 2). Both irrigation rates with PAM reduced sediment load significantly when compared to the control treatment (Table 2). Higher sediment loads with the 4.0 gpm PAM treatment prior to the cutback of inflow rate supports results indicating that too high inflow rates can overcome the effectiveness of PAM. The average sediment loss from a furrow during the 16 hr period was reduced by over 90% by both PAM treatments (Table 2). Less total outflow with the 4.0 to 2.0 gpm cutback treatment led to less total sediment loss.

The concentration of all three P components was significantly decreased in the outflow with the use of PAM (Fig. 3). The average total P concentration over time was decreased by 92%, from 19.4 to 1.56 ppm, with the application of PAM during the advance phase with 3.0 gpm irrigation. The average soluble P concentration over time decreased from 0.73 in the no PAM treatment to 0.27 and 0.41 ppm with the 3.0 and 4.0 gpm inflow rates with PAM respectively. Bioavailable P was also decreased from a control level of 1.70 to 0.32 and 0.39 ppm in the same PAM treatments.

The decrease in soluble and bioavailable P concentration in outflow may be related to PAM's ability to maintain aggregate stability. By maintaining aggregate stability and flocculating clay and silt particles out of the irrigation stream, PAM may reduce the total contact of particulate P with the irrigation solution, thus reducing movement of P into the solution phase. Soluble and bioavailable P deceased with time over the first 2 hrs of outflow (Table 3).

Data analysis on the results of several irrigations is continuing and a final report and PAM use recommendations will be produced.

Table 1. The effect of inflow rate and PAM application on advance time.

Treatment	Nominal Flow Rate (gpm)	Actual Flow Rate (gpm)	Ave. Advance Time (min)
July 25, 1996			
No-PAM	2.0	~ 1.6-1.7	801
PAM	2.0	~ 1.6-1.7	1675
PAM	4.0 / 2.0	~ 3.9 / 1.6-1.7	252
August 14, 1996			
No-PAM	2.5	~ 2.0	297
PAM	3.0	~ 2.5-2.8	353
PAM	4.0 / 2.0	~ 4 / 1.6-1.7	201

Table 2. Total inflow, outflow and sediment loss comparison by inflow rate / PAM treatments during the first 16 hrs of tailwater runoff.

Irrigation Rate Gal/Min	Inflow	Outflow	Retention	Retention %	Sediment Ft^3/Furrow
	Gal/Furrow				
2.5	4,293 b	928 a	3,365 b	78	4.91 a
3.0 + PAM	4,948 a	1,091 a	3,857 a	78	0.49 ab
4.0 / 2.0 + PAM	3,963 b	559 b	3,404 b	86	0.32 b

Means with same letter within a column are not significantly different ($P \leq 0.05$) according to the LSD test.

Table 3. Outflow concentrations of soluble P, bioavailable P and total P in the first 16 hrs of tailwater runoff.

Time min	Soluble	Bioavailable	Total
	ppm		
0	0.78 a	1.35 a	9.09
30	0.62 b	0.94 a b	6.91
60	0.47 b c	0.84 a b	5.83
120	0.46 c	0.68 b	10.22
240	0.40 c d	0.78 b	9.23
480	0.24 d	0.63 b	5.49
960	0.33 c d	0.64 b	9.85

Means with same letter within a column are not significantly different ($P \leq 0.05$) according to the LSD test.

Fig 1. The effect of inflow rate and PAM treatment on tailwater volume during the first 16 hrs of outflow from treated furrows.

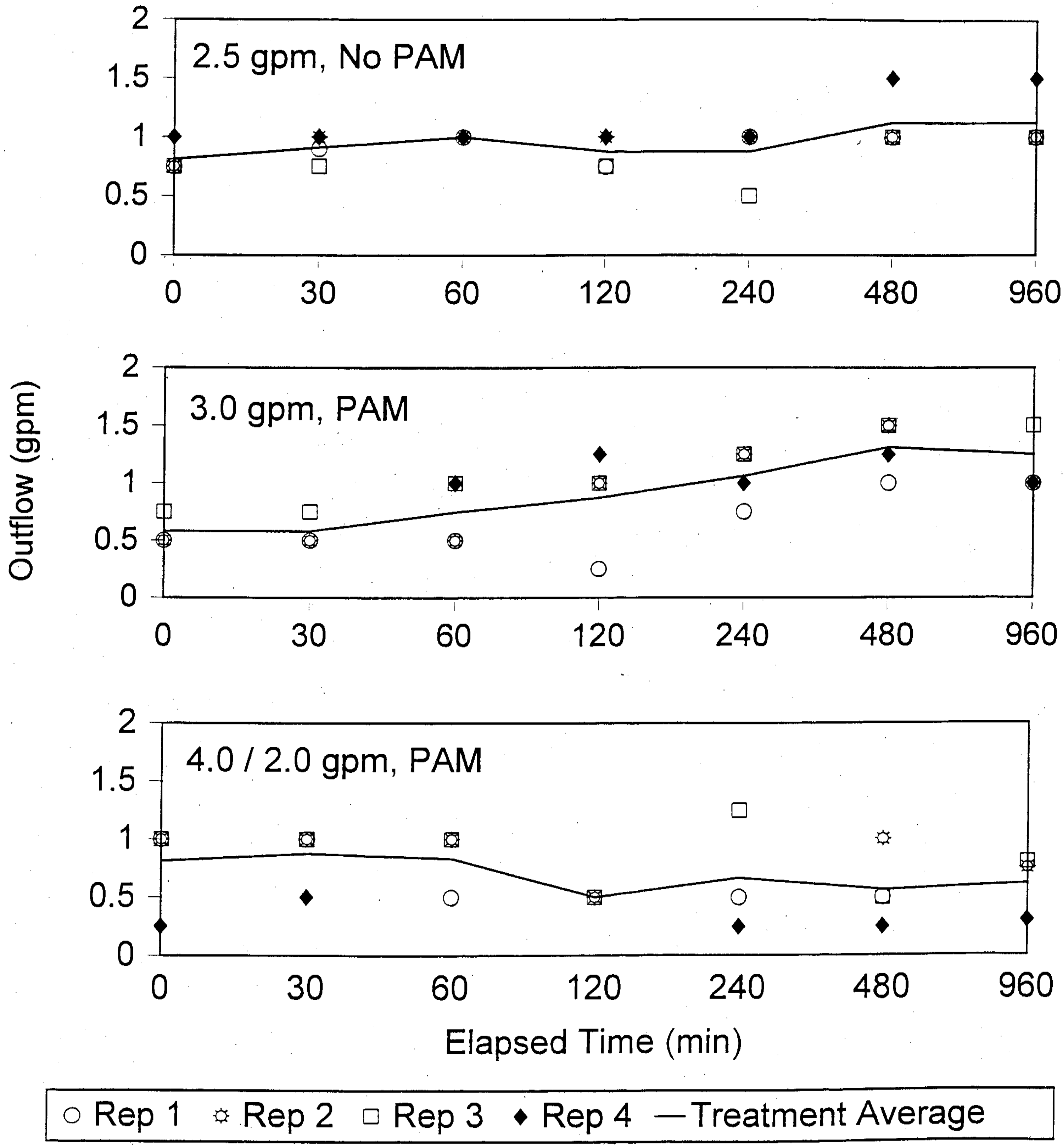


Fig 2. The effect of inflow rate and PAM treatment on sediment concentration in tailwater during first 16 hrs of outflow from treated furrows.

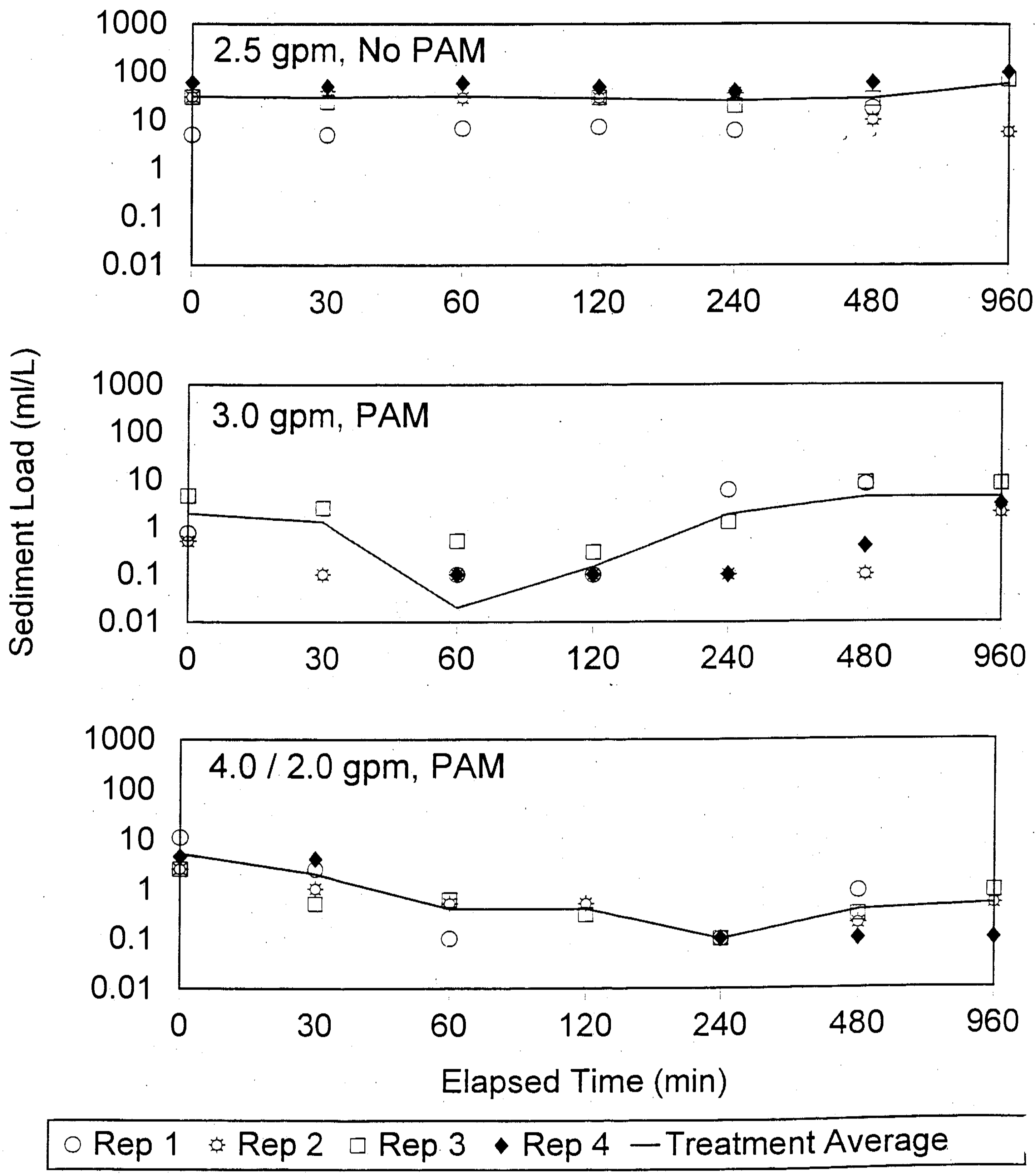
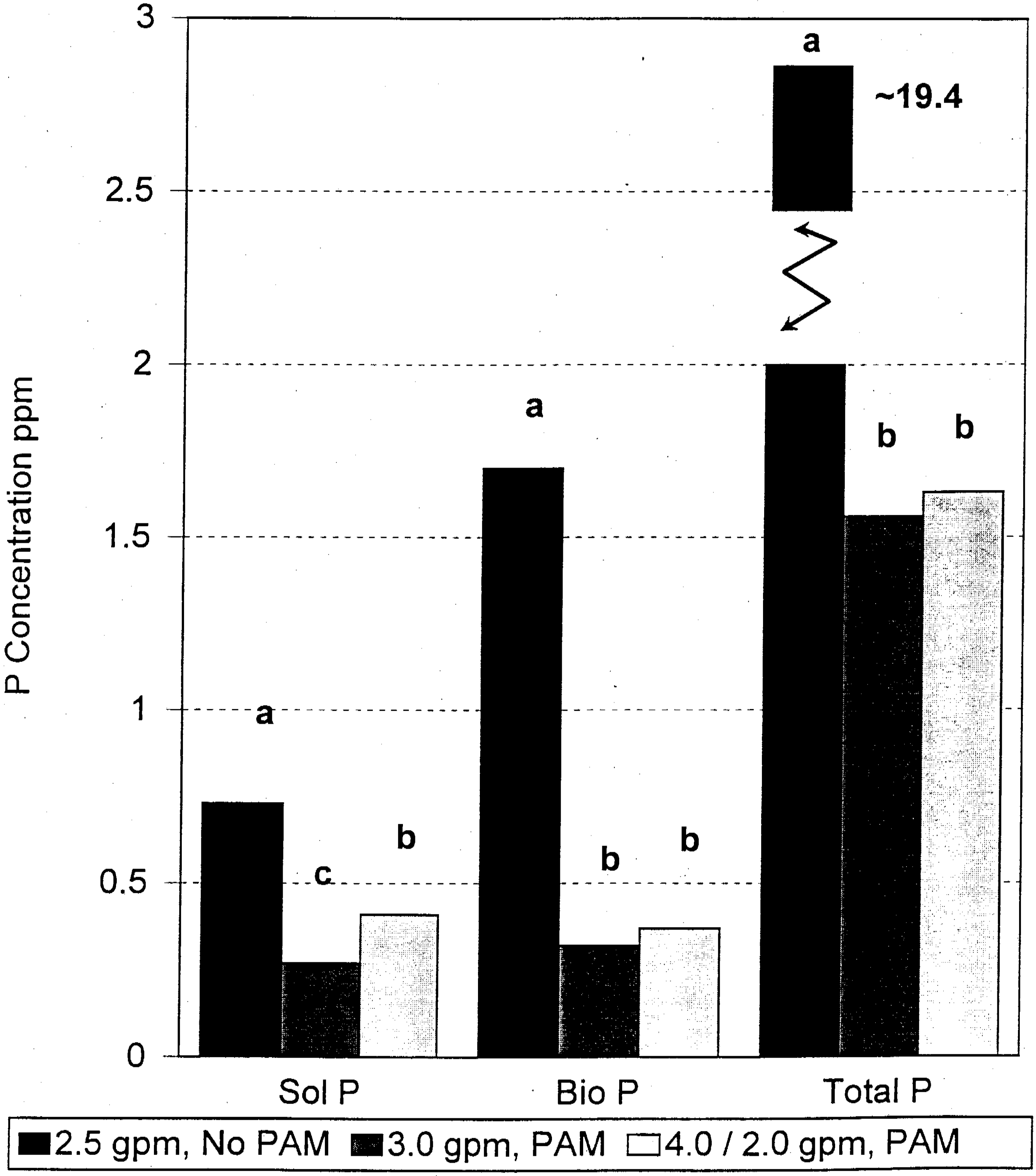


Fig 3. The effect of inflow rate and PAM treatment on the concentrations of soluble P, bioavailable P and total P in tailwater during first 16 hrs of outflow.



APPENDIX 5

SPRING CREEK WATER QUALITY and GIS MAPPING PROJECT

By

Pat Daly

BENTON CONSERVATION DISTRICT

For

WASHINGTON STATE DEPARTMENT OF ECOLOGY
CENTENNIAL CLEAN WATER FUNDS
Grant No. G9600119

JUNE 1998

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1. SETTING, GOALS, PREVIOUS STUDIES AND SUMMARY

1.1 Setting

The Yakima River basin, located in south central Washington, drains 6,155 square miles of highly diverse agriculture, forested, and range land. The first major diversions of river water to support irrigated farming in the valleys began in 1891, and continued development of canals has transformed the lower Yakima basin (below its confluence with the Naches), from grassland to one of the most valuable farmlands in Washington.

Agriculture impacts to water quality conditions in the Yakima River, documented through numerous federal, state and local studies[1], include stream sedimentation due to soil loss on irrigated farmland, and pollution inputs from farm runoff. The Washington Department of Ecology's (WDOE), Total Maximum Daily Load Evaluation[2], completed in 1997, identified several parameters, including temperature, fecal coliform, ammonia-N, and DDT that have excessive levels in tributaries, drains and the main stem of the river.

The Yakima watershed drains approximately 40 percent of Benton County, the jurisdiction of the Benton Conservation District (Figure 1.1). Spring Creek, which joins Snipes Creek one-quarter mile from their drain into the Yakima River, is a major tributary, carrying runoff from approximately 32 square miles. The top of the drainage is at approximately 2900 feet in elevation, while the lower end of the drainage, at Spring Creek's confluence with Snipes Creek, is at 565 feet. This is over a distance of approximately 16 miles, for an average slope of three percent.

Depending on irrigation demands and/or winter rain and snow events, Spring Creek is intermittent above the small stream, which flows into it from the north, ½ mile west of Crosby Road (6 miles above its confluence with Snipes Creek, Figure 1.2). Spring Creek is perennial below this. Because the stream serves as a source of irrigation water, and receives runoff from irrigated fields and irrigation drains, the flows are greater in the spring and summer than they are when irrigation is not running. The Roza Irrigation District uses Spring Creek to receive excess flow from an irrigation drain where the creek passes under the south side of Snipes Road. This usually runs at the beginning of irrigation season in April, and then is turned off as that water is directed to fields for irrigation later in May or June.

1.2 Project Goals

In 1995, the District began the Spring Creek project with the following primary goals:
1) Determine the condition of Spring Creek in terms of water quality parameters;
2) Identify and map the location and number of irrigated acres, the major crops and irrigation methods used within the watershed;
3) Compile both water quality and farm data into a data base; and
4) Evaluate the impacts of agriculture to the water quality of Spring Creek.

Benton County & Lower Yakima River Watershed

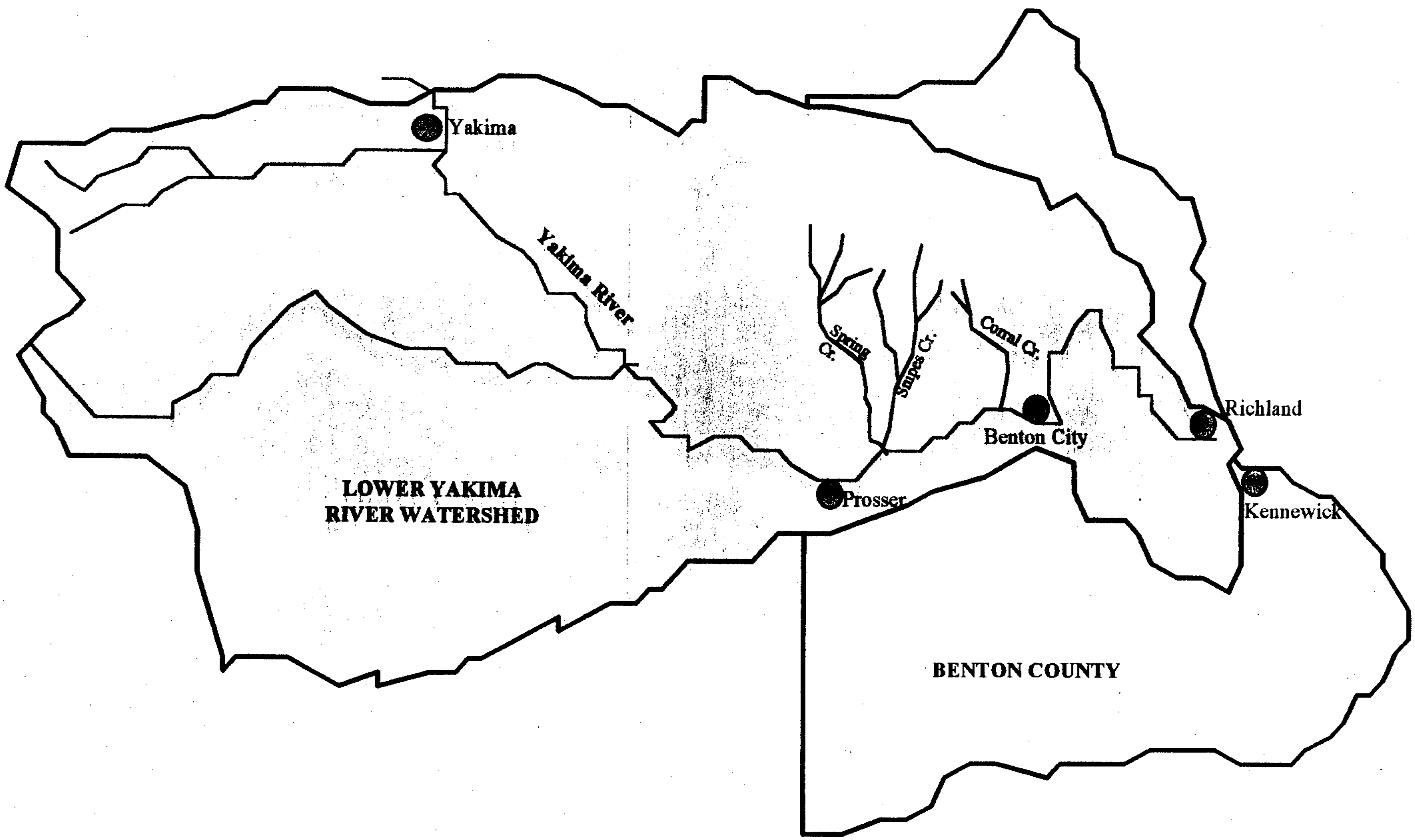
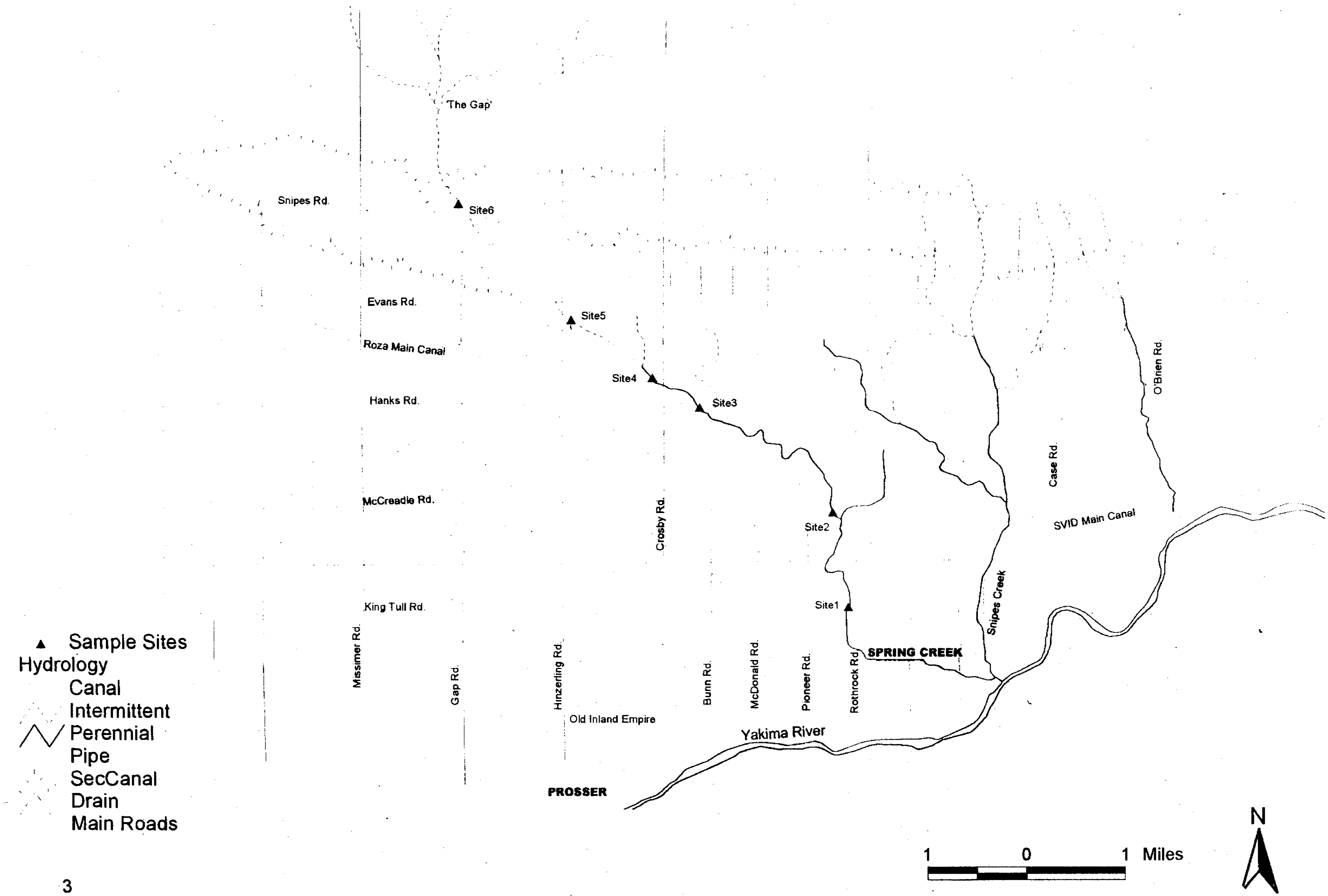


Figure 1.2 Spring Creek Watershed - Hydrology, Roads and Sample Sites



Secondary goals of the project included:
1) Educate the grower community and general public of agriculture's impacts to Spring Creek's water quality and conservation measures to reduce these impacts;
2) Demonstrate a stream restoration project along a section of Spring Creek; and
3) Provide opportunities for local students to work with the District on water quality issues.

1.3 Previous Studies

Previous studies had identified problems in the Yakima's main stem and at tributary confluences, however, no specific data on water quality or irrigated agriculture existed for Spring Creek watershed above its confluence with Snipes Creek. Water quality monitoring by the US Geological Survey (USGS), and the US Bureau of Reclamation, documented by the USGS[3], was done on Spring and Snipes Creeks, but only within one-half mile of their confluence with the Yakima. No data was available upstream on either creek to indicate the conditions closer to agricultural influences.

Analysis by the USGS of this data provided indications of potential water quality concerns within the two creeks:
- Sixteen percent of dissolved-solid and sulfate measurements at Spring Creek, and 23% of these measurements at Snipes Creek, exceeded the US Environmental Protection Agency's guidelines for irrigation or the criterion for drinking water.
- A positive trend of seven percent of median per year for flow-adjusted specific conductance was determined at Snipes Creek during the water years of record, 1975-1980.
- The median value of nitrite-plus-nitrate as N at Spring Creek was 1.4 mg/l during water years 1974-1981 (concentrations greater than 1 mg/l are sufficiently large enough to support eutrophication).
- The sampling sites at Snipes and Spring Creeks showed significant positive time-trend results for total ammonia as nitrogen from 1974-1981 water years.

Observations in the USGS report not specific to Snipes and Spring Creeks, but of concern to agriculture's impact to water quality included:
- Peak concentrations of suspended sediment were observed during the start of irrigation season when soils are freshly tilled and canals and ditches are layered with sediment from recent cleaning, contrasting with the smallest concentrations occurring after the irrigation season.
- Below Union Gap, median concentrations of nutrients increase by a factor of two or more and continue to increase downstream to Kiona.
- Five percent of the instantaneous stream temperature measurements at the class A streams (the Yakima main stem and tributaries except Sulphur Creek Wasteway downstream from the national forest), exceeded the 21°C standard. Most of the exceedences were during the warm July-August period.

The Yakima Valley Council of Governments' Yakima River Basin Water Quality Plan[4], summarizes basin water quality problems and provides recommendations for improvements. The Plan divides the region in to several subbasins, and most of the recommendations for the lower portion of the Yakima River, including Benton County, emphasize the need for improvements to agriculture practices. Best Management Practices (BMPs), are recommended for fertilizer application, agriculture sediment control, and reduction of chemical inputs. The Plan also recommends providing technical assistance for implementation of BMPs.

Of note in this plan was the lack of specifics on the number of acres and types of cropping patterns that needed improvements. The District found this was also the case when looking for information about conditions in the Spring and Snipes Creeks watersheds from Benton County Extension, the Washington State Agriculture Statistics Service, and farm agencies.

The Washington Department of Ecology did additional monitoring of Spring and Snipes Creeks during the period of this project, again at the tributaries' confluence with the Yakima main stem. Data taken included temperature, pH, TSS, turbidity, flow, and conductivity and is available for the period April 1995 through October 1995.

1.4 Project Summary

The Spring Creek project began in November 1995 by initial selection of water quality monitoring sites (described further in Section 2.1). Sampling began in November 1995, with a total of six sites established. Two of those sites have intermittent flows so sampling was done only when water was available.

Agriculture mapping began in winter 1996, when the USDA provided the District with a Global Positioning System (GPS) receiver. This allowed an electronic survey of individual fields and electronic entry of data on crop type, irrigation method, the use of a cover crop and an estimate of field slope. Approximately 3100 acres were mapped the first winter, with an additional 15,950 acres added through the course of the project. Not all of these acres drain directly to Spring Creek; the hydrology is quite complex due to the numerous field, road and irrigation drains. The additional mapping of acres in the Spring Creek vicinity provides information on the concentration and type of crops and irrigation.

In October 1997, the Benton County Planning Department provided the District with orthophotos of most of the sections of interest within the Spring and Snipes Creek Watersheds. Towards the end of the project, these were used to speed the process of mapping the agriculture acres.

During the course of the project, the data being collected was entered into spreadsheets and Geographic Information System (GIS) programs. Analysis of the data was ongoing throughout the project, and occasional presentations were made of selected data portions at both grower and public meetings. This report contains all collected data, analysis and summaries.

The District produced 10 newsletters, offered 5 workshops on irrigation methods for growers, and discussed this project at 4 grower meetings during the 28 months of the project. Many of these discussions focussed on the obvious problems of field soil loss resulting in stream sedimentation, the location of sediment inputs, and the continuing changes of field irrigation practices.

The District began an Annual Irrigated Tour with this project, as a means of communicating to the non-farming public the issues of irrigated agriculture in the Yakima Valley. The first tour was in September 1996, and the following year the second tour was nearly at capacity. This tour has become an annual event for the District, and is discussed further in section 5.1.

A major portion of time was spent during the first year of this project with the fence construction and vegetation planting along a one-quarter mile section of Spring Creek. The purpose of this task was to demonstrate the effectiveness of stream vegetation on reducing the impacts of soil runoff from nearby fields, and potential water quality improvements. Local students assisted with the vegetation planting and growth of this vegetation has been significant. This task is also described later in greater detail.

This project has led to additional projects, which are currently in progress by the District. The mapping has allowed the District to identify both locations and landowners where additional efforts have been successful with encouraging irrigation management changes. Cost-share dollars available to provide financial assistance, and salary dollars for on-farm technical assistance have also increased both the awareness and actions of growers toward improved methods.

2. WATER QUALITY MONITORING

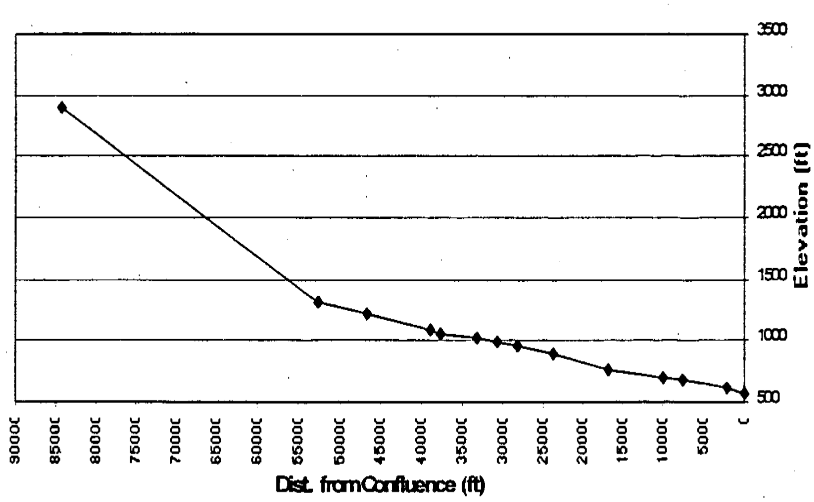
2.1 Sampling Sites

Financial and practical constraints limited selection to six sampling sites along the 10 miles of creek chosen for the project study area. The first point selected for sampling is approximately 1.9 miles above the point Spring Creek enters Snipes Creek. Below this point, most of the land is either pasture or residential, and not subject to a significant amount of soil runoff.

Considerations used to select a sampling site included accessibility, the potential of the stream characterizations at the site to shift and change, the minimum and maximum water depth at the site, and potential receipt of runoff based on surrounding fields. The sampling sites are shown in Figure 1.2, and Figure 2.1 shows the stream profile with the sampling sites.

Figure 2.1 Spring Creek Profile

Stream Location	Feet from Confluen ce	Elevation (feet)
Snipes	0	565
Rothrock Road	7458	678
Sample Site 1	10032	701
Sample Site 2	16767	760
McDonald Rd.	23763	885
Sample Site 3	28185	955
Crosby Rd.	30825	985
Sample Site 5	37689	1050
Sample Site 6	46731	1210
The Gap	52671	1320
Top of Drainage	84351	2900



2.2 Sampling Methods

A water quality-monitoring plan (Attachment A), was written and approved by the WDOE during the initial phases of the project. This plan outlines the methods to be used and data to be collected throughout the project. Stream sampling was done according to WDOE's Surface Water Monitoring guidelines. The equipment used included a Teledyne Gurley #625 Pygmy current meter, a standard 30' tape with one-tenth markings, a Hanna 8314 pH and temperature meter, and plastic water sample bottles provided by US Ag, the lab doing the suspended sediment analysis.

A stake was placed on either side of the stream bank to mark each sampling site. A water sample was collected at the beginning of each sampling event and then a tape was stretched across from each stake. Velocity readings were made at regular intervals across the stream and at several depths at each interval. The number of intervals and depth measurements varied depending on stream width, bottom variability and water depth. Finally, temperature and pH measurements were taken and recorded.

Flow calculations were made using the velocity measurements taken over the width of the stream, i.e., depth times width times velocity equals volume (area in square feet times velocity in feet per second equals flow in cubic feet per second).

Stream gages were initially placed at each sampling location with the anticipation that a correlation could eventually be made between water depth and total flow. However, regular sediment deposits and scouring at sampling locations prevented accurate measurements of water depth from the gages. They were subsequently used to support more accurate measurements, and as reference during runoff periods when velocity was beyond the equipment's ability.

A small portion of the collected a water sample was used to measure turbidity at the District's lab, and the remaining was delivered to commercial lab for suspended sediment analysis. The District used a Hach 2100N turbidometer, as directed by WDOE to measure turbidity. WDOE had shown this equipment to provide a better correlation between total suspended sediment and turbidity. This correlation is useful to reduce the cost of determining suspended sediment levels, in that turbidity measurements are easier and less expensive to make.

The sampling schedule was initially set as twice weekly during irrigation season, and every other week during non-irrigation season. That schedule was maintained from November 1995 through June 1996, when the irrigation season sampling was reduced to once per week. Sampling terminated at Sites 5 and 6 during non-irrigation season when water no longer ran through the sites. This usually occurred in early November, with sampling beginning in early April as flow increased.

There were occasions when mid-winter rain and snow events caused significant runoff, and additional samples were taken as possible. This usually did not include flow measurements because the velocities were well beyond available equipment. Water samples were collected as possible, and analyzed for total suspended sediment.

Figure 2.2 are photographs of some of the sampling sites, and the District's technician doing sampling.

2.3 Water Quality Data

Water quality data is listed in Appendix 1. The following discussion presents a summary of the method of analysis, and significant findings and trends. Water years for purposes of this project are considered November 1 through October 31, to coincide with irrigation patterns. Irrigation season runs from late March to late October; non-irrigation season is from November through March.

Stream Flow

Stream flow distributions for all sampling sites were reviewed by calculating the minimum, maximum and 10th, 25th, 50th, 75th and 90th percentiles, for each site. These were also broken down for each water year and by irrigation and non-irrigation seasons.

Two years of data is not sufficient to state how the calculated stream flows for these years compare to a 'normal' year. Figure 2.3 shows the stream flow distributions by site and year. Stream flow between the two years was not significantly different at any one site, with the exception of Site 5, where the median flow was 3.73 cfs in 1996 and 5.22 cfs in 1997.

Seasonal differences in stream flow are significant, because of the hydrologic pattern of the creek receiving irrigation flows during the summer months. Table 2.1 shows the median stream flow measurements for both 1996 and 1997 water years, and breakdowns for the irrigation and non-irrigation seasonal periods. Site 1, for example, had a median 1996 irrigation flow of 32.68, while its median non-irrigation flow for 1996 was 2.69 cfs.

Again, the differences between years for the same season, are not significant except at Site 5 (where the irrigation season values are the same as the yearly values since there is no flow during non-irrigation – this is true at Site 6 also.) There is no ready explanation for the increase flow at Site 5.

A few storm events were sampled at some locations. In early February 1996, a major rain-on-snow event caused significant mid-winter flows. Limited equipment and access prevented flow readings at all but Site 1, where the flow measured 22.80 cfs and 31.92 cfs on February 7th and 8th, respectively. This compares to readings of 1.72 cfs on Feb. 6 and 2.68 cfs on Feb. 12. The resulting sediment discharge for these storms is discussed below.

Instanteous Mean Stream Flow in cfs, per time period						
Sample	Total Flow		Irrigation		Non-Irrigation	
Site	1996	1997	1996	1997	1996	1997
S1	28.11	29.18	32.68	34.75	2.69	3.98
S2	9.99	10.54	11.99	11.22	2.97	4.56
S3	6.14	5.90	7.58	6.49	1.07	1.33
S4	5.13	5.90	5.59	6.91	0.41	1.01
S5	3.73	5.22	3.73	5.22	0.00	0.00
S6	1.74	1.83	1.74	1.83	0.00	0.00

Table 2.1 Mean Stream Flow Distributions
Figure 2.3 Stream Flow Distributions for 1996 and 1997

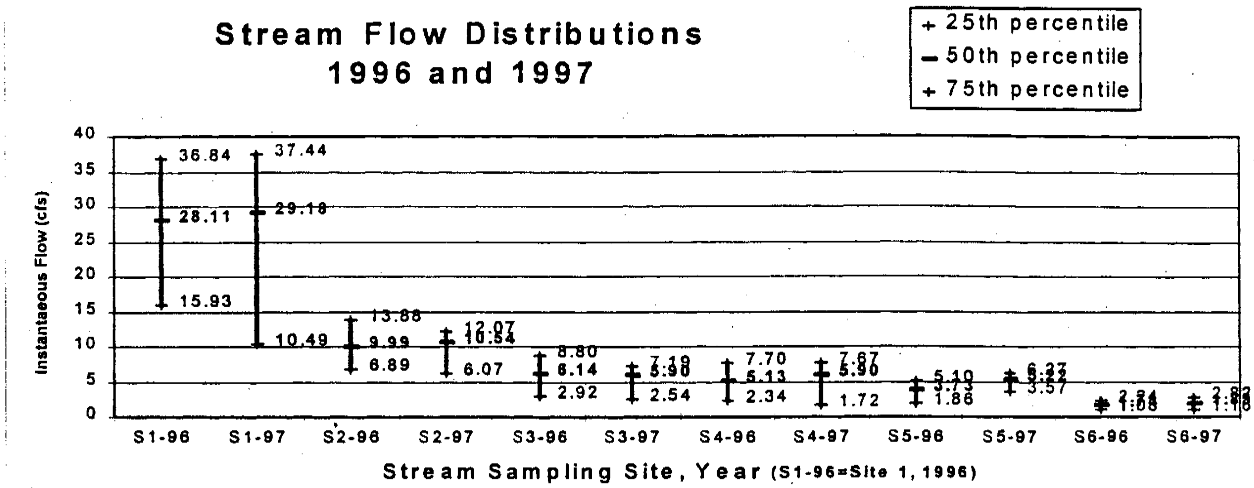
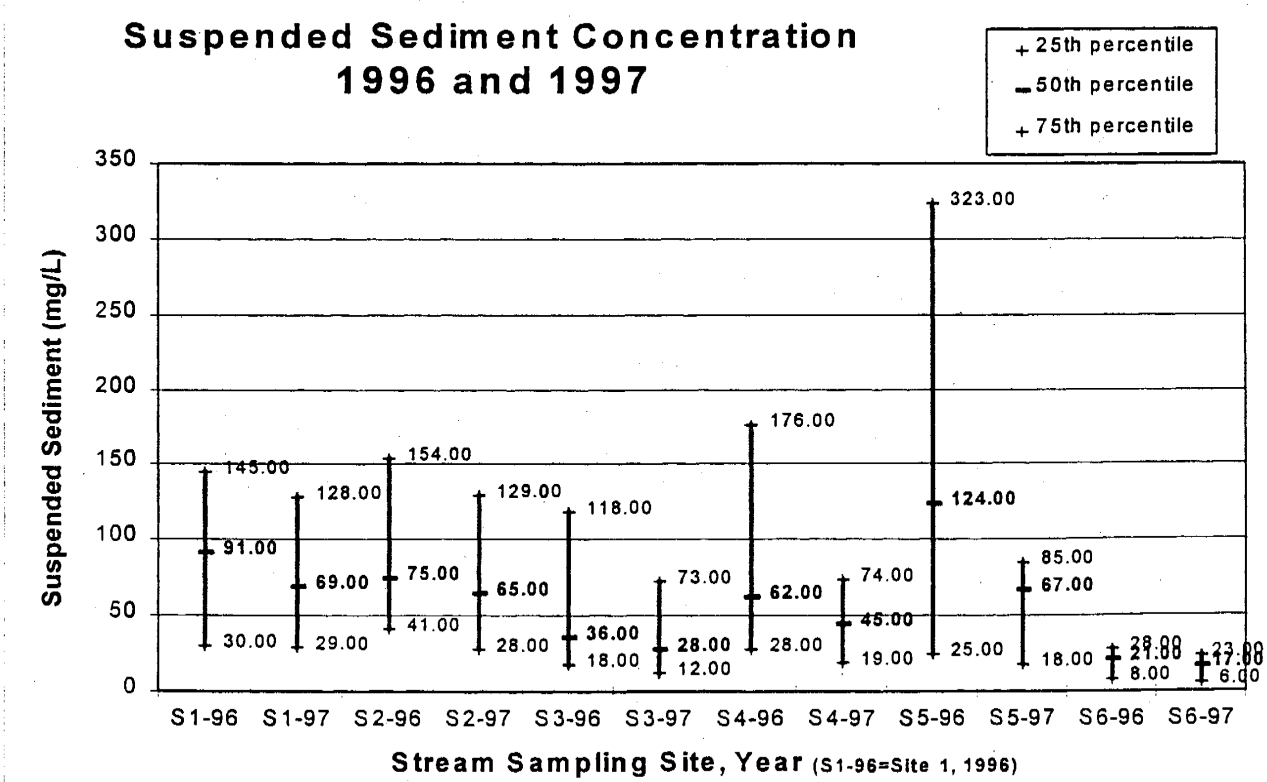


Figure 2.4 Suspended Sediment Concentrations, 1996 and 1997



Suspended Sediment

Measurements of suspended sediment are instantaneous readings of the current amount of non-settable solids traveling with the stream flow. In the relatively small flows of Spring Creek, which is receiving drainage from nearby cultivated fields, these amounts can change dramatically in short time periods, and it becomes important to look at both data trends and individual data points.

The same calculations of minimum, maximum and percentiles were made for suspended sediment measurements, including the yearly and seasonal breakdowns.

Figure 2.4 shows the Total Suspended Sediment Concentrations for 1996 and 1997. At all sampling sites, suspended sediment levels decreased between water years 1996 and 1997, at all percentiles. Site 5 showed a significant decrease in suspended sediment, with its median value decreasing from 124 mg/l to 67 mg/l. District personnel frequently observed the creek's surroundings when taking samples, to assist interpretation of these changes. There are several hop fields above Site 5 that were furrow irrigated in 1996 and converted to drip irrigation prior to the 1997 irrigation season. Since there are no flows during non-irrigation season at Sites 5 and 6, these in-field changes are very likely contributing to the decrease in sediment.

In addition to changes made above Site 5, there were many other fields within the drainage that had on-farm improvements to irrigation systems (discussed in Section 3.2). Although two years' data is not enough to speak to long-term trends, it is anticipated the continual on-farm changes will result in steady decreases in sediment concentration levels.

Figure 2.5 shows the median suspended sediment values during irrigation and non-irrigation seasons for 1996 and 1997. This shows the significant difference in sediment concentrations between irrigation and non-irrigation periods. The chart also reflects the overall changes between 1996 and 1997, showing a decrease in concentrations during both seasons from one year to the next. The decrease is more pronounced during the irrigation season, but the decrease during non-irrigation season might reflect a decrease in the amount of sediment in the water column available for suspension.

Sediment Discharge

Sediment discharge was calculated by multiplying the mean flow by the mean instantaneous suspended sediment concentration, for a given time period (hours), by the time period. Since samples were taken every two weeks during non-irrigation season, the time periods are somewhat long, but changes during this period was, in most cases, minimal. Weekly sampling during irrigation season may also not be short enough to catch all changes, but the data should be viewed as indications of stream conditions during various periods only. Sediment discharge values are in tons per time period.

Table 2.2 and Figure 2.6 show sediment discharge for each sampling site, computed for several time periods: total discharge for each of 1996 and 1997 water years; total during irrigation seasons of 1996 and 1997; and total during non-irrigation seasons for the two years.

Figure 2.5 Median Suspended Sediment Concentrations, Irrigation and Non-Irrigation Seasons

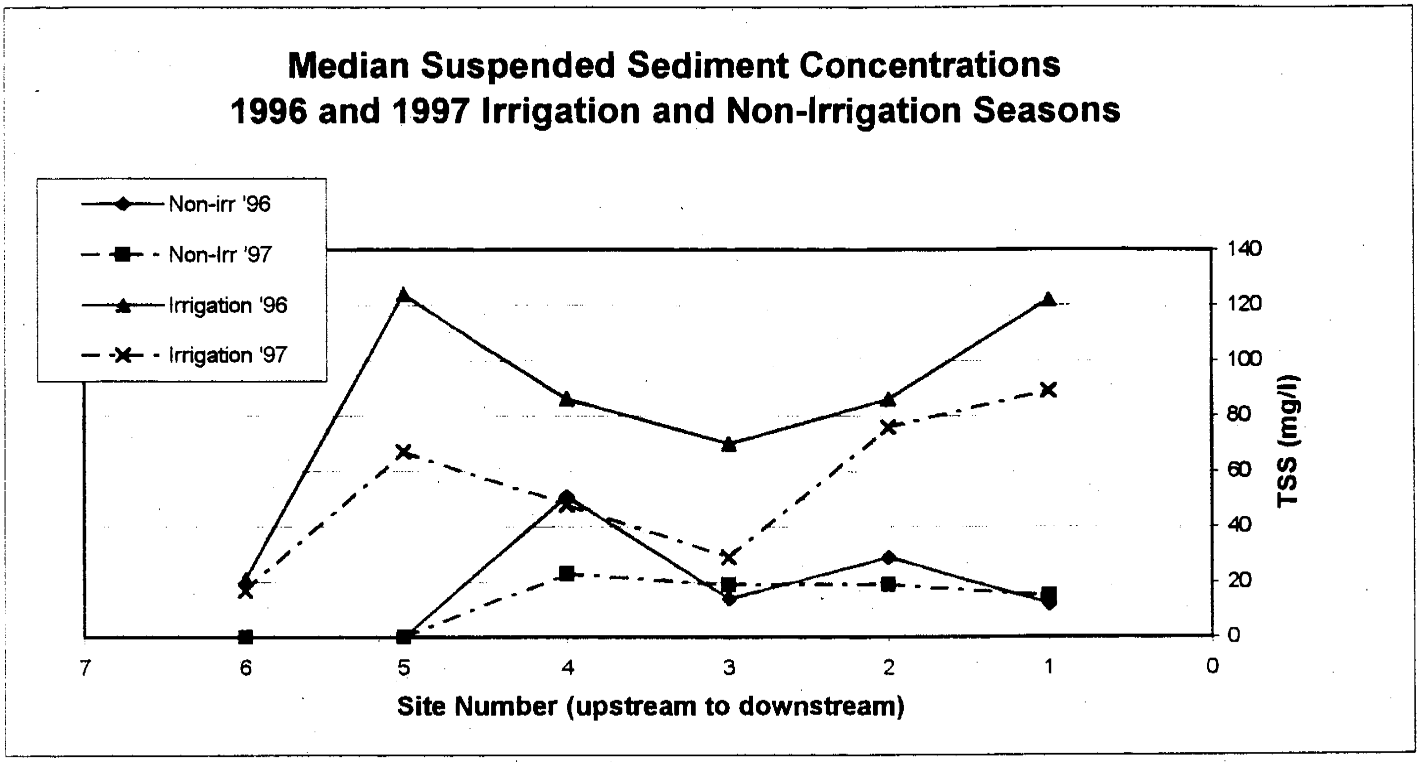


Table 2.2 Sediment Discharge by Sample Site and Time Period

Sample Site	Total 1996	Total 1997	Irrigation 1996	Irrigation 1997	Non-Irrigation 1996	Non-Irrigation 1997
S1	2589.22	2159.16	2377.33	1931.76	211.89	227.40
S2	1007.52	914.48	936.35	757.99	71.17	156.48
S3	301.48	210.30	295.61	186.49	5.86	23.81
S4	343.81	230.34	316.58	213.88	27.23	16.46
S5	438.68	218.29	438.68	218.29	0.00	0.00
S6	26.60	38.73	26.60	38.73	0.00	0.00

(Discharge values in tons per time period)

A decrease in discharge was measured at each site between 1996 and 1997, except at Site 6, where there was an increase in total discharge from 26.60 tons/year to 38.73 tons/year. The difference is primarily due to a significantly larger suspended sediment concentration measured at the start of the 1997 irrigation season. Measurements of 375 mg/l and 107 mg/l were measured on April 3 and 10, respectively (the first two measurements at this site after the irrigation water was turned on). Measurements at the same time the previous year were 6 and 3 mg/l.

The suspended sediment levels at Site 5 were also higher on these two sampling events in 1997 than in 1996, although not to the extent as at Site 6, and the yearly total for Site 5 was considerably less at other times of the year.

These measurements are likely due to Roza Irrigation District discharging directly to the creek just above Site 6. The canals at the beginning of the season carry a significant amount of sediment that has been stored through the winter. Until the desired capacity and sealing of canal walls have been achieved, these early flows are inordinately swift and, therefore, turbid. The stored sediment accumulation, in addition to any soil loosened during the annual routine canal maintenance, causes elevated levels of suspended solids and turbidity. Additionally, it is not unusual for growers to discharge water from on-farm water storage facilities in the spring, thereby contributing even more sediment to these early canal flows.

Table 2.2 shows an increase in the sediment discharge between 1996 and 1997 during the non-irrigation season at Sites 1-3. Site 4 shows a decrease for this period. Most of the non-irrigation season discharge is due to storm events and the difference between the years is likely more a function of data taken during storm events (see next section), than major changes in the water resource. Stream flow measurements were not taken at Sites 2-4 during the storm event of 1996, nor during the storm event in late January 1997. However, measurements were taken during a smaller event on January 2 1997, and were used in calculating stream discharge.

Storm Events

There were several storm events that occurred during the thirty months of this project. Storm events occur in this watershed when heavy winter rains fall with warm conditions, when there has been some snow at the higher elevations. Although Spring Creek runs dry most of the year above Site 4, a rain-on-snow event can cause significant flows for short periods, several miles above Snipes Road (Site 6).

A major event occurred February 6, 7 and 8, 1996. District personnel drove four miles north of Site 6 and measured the flow in Spring Creek using sixteen measurement stations across 17.5 feet. Water depths at this point reached a maximum of 1.3 feet. Total flow was 30.82 cfs.

Water samples were collected at the regular sampling sites on February 7 and 8, and at an additional site approximately 300 feet downstream of Site 6, due to access problems at Site 6 on February 7. Flow levels made it difficult to take accurate flow measurements at most sites during the event, but flow was measured at Site 1, which was 22.8 and 31.9 cfs on February 7 and 8 respectively. For comparison, flow measurements were 1.72 cfs on February 6 and 2.68 cfs on February 12 at Site 1.

Suspended sediment levels at these sites ranged from 334 mg/l at Site 3 on February 7, to 2584 mg/l at Site 4 on February 8. Suspended sediment levels were significantly greater at most sites the second day of the event, due to the amount of soil stirred and carried with the flows. Table 2.3 shows the data collected during this event.

Two events occurred in late January and early February 1997. Flow readings were not possible, and event collecting water samples was difficult during the February event. Water samples collected at Sites 2 and 6 on January 31, 1997, produced suspended sediment levels of 9,144 and 12,656 mg/l, respectively, while a sample collected at Site 5 on February 12, 1997, had a suspended sediment reading of 24,908.

The creek was well over its banks throughout the length of the stream during the February 1997 event. Again, the events are quite short, and by February 13 (the next day), there was no water at Site 5 to take a sample of, and the suspended sediment reading for Site 4 was down to 51 mg/l.

The sediment flowing with the creek during a storm event is generated from several sources, including surface runoff from dryland areas well upstream of irrigated fields, and re-suspension of soils that have settled in the stream. Velocities are much greater during a storm event, which stirs up much of the particles that have previously settled in the stream.

Table 2.3 Data Collected During Storm Events

	Flow (cfs)		TSS (mg/l)		Turbidity (ntu)	
Site	2/7/96	2/8/96	2/7/96	2/8/96	2/7/98	2/8/98
10a	30.82	NA	1656	NA	632	NA
S7	NA	NA	1556	2772	772	2952
S6	NA	NA	NA	2284	NA	2381
S5	NA	NA	420	2552	406	2237
S4	NA	NA	736	562	428	2584
S3	NA	NA	592	1132	334	1924
S2	NA	NA	978	1112	431	1839
S1	22.8	31.92	770	1372	348	1910

3. AGRICULTURE MAPPING

3.1 Methods

The District began mapping efforts in spring, 1996. A Trimble Global Positioning System (GPS) unit ProXRS was used to map individual farm fields by driving or walking around each field with the unit on. This surveying via satellite worked well in terms of accurately getting locational information on all fields, although it was fairly time-consuming. A database in the unit was also used to create a record of crop type, irrigation method, the use of a cover crop, and the slope for each field.

Data from the GPS unit was downloaded into the District's Geographic Information System (GIS), ArcInfo and ArcView. These programs allow the information to be edited, viewed by selection of information, and printed. This system was then used to print maps of cropping, irrigation, and other patterns.

Hydrologic, transportation and point data was also entered into this program. The hydrologic data came from the US Geological Survey's digital Land Use and Land Cover at the 1:100,000 scale. Major roads were mapped with the GPS unit for the same area as the fields. Point data included the sampling sites, major intersections, and major irrigation discharge points to Spring Creek.

Mapping was done primarily during the winter months, due to availability of the equipment and personnel. Approximately 4500 acres were mapped prior to irrigation season 1996, and an additional 6550 acres were mapped prior to irrigation season 1997. In 1998 the District received orthophotos of the North Prosser area, from which fields were directly drawn. Field checks identified crop type, irrigation and other information for the newly mapped acres. An additional 9,400 acres were mapped this way prior to the 1998 irrigation season.

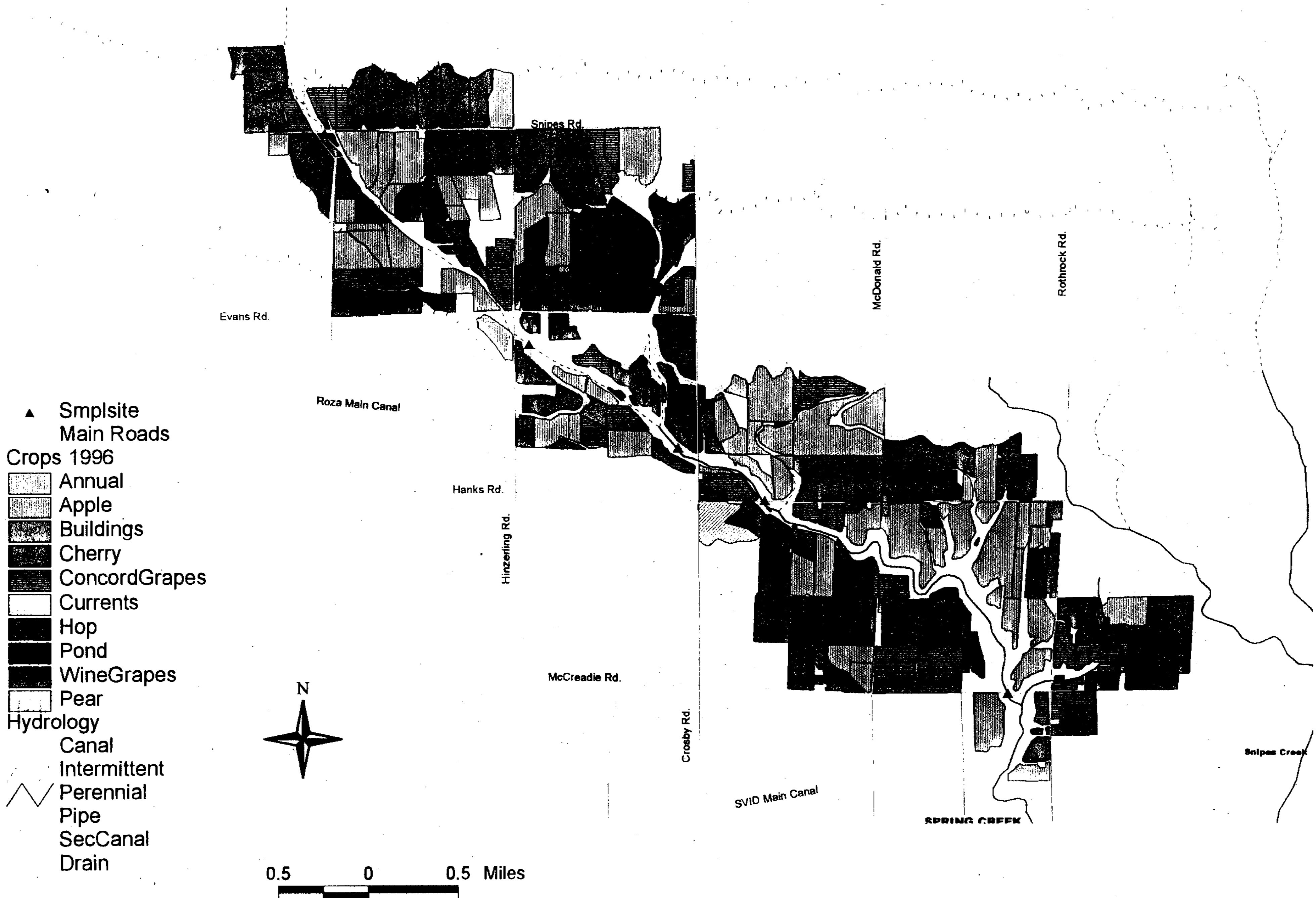
3.2 Yearly Results / Changes

<u>Crops and Irrigation Methods</u>

The maps on Figures 3.1through 3.6 show the crop and irrigation maps produced over the course of the project. Table 3.1 gives a breakdown of the acres for these maps by specific crop and irrigation method. The maps visually show the changes on a particular field from on year to another, but it is difficult to pull changes out of the acreage numbers since new fields were added each year. To provide additional information, percentages of total acres mapped to date were calculated for specific crop and irrigation method.

As expected in an area of dense permanent crops, there was not a significant change in cropping patterns from one year to the next. However, irrigation methods did change between 1996 and 1997, and between 1997 and 1998. Of the 4500 acres mapped in 1996, approximately 120 acres were converted from sprinkler to drip irrigation, 47 acres were converted from rill to sprinklers, and 90 acres were converted from rill to drip systems, prior to the 1997 irrigation season. An additional 123 acres that were mapped during the winter of 1996-97, were converted from rill to either drip or sprinkler systems between the time they were mapped and prior to the 1997 irrigation season.

Figure 3.1 Spring Creek Crop Types, 1996 Survey



F ıre 3.2 Spring Creek Crop Types, 1997 Surve

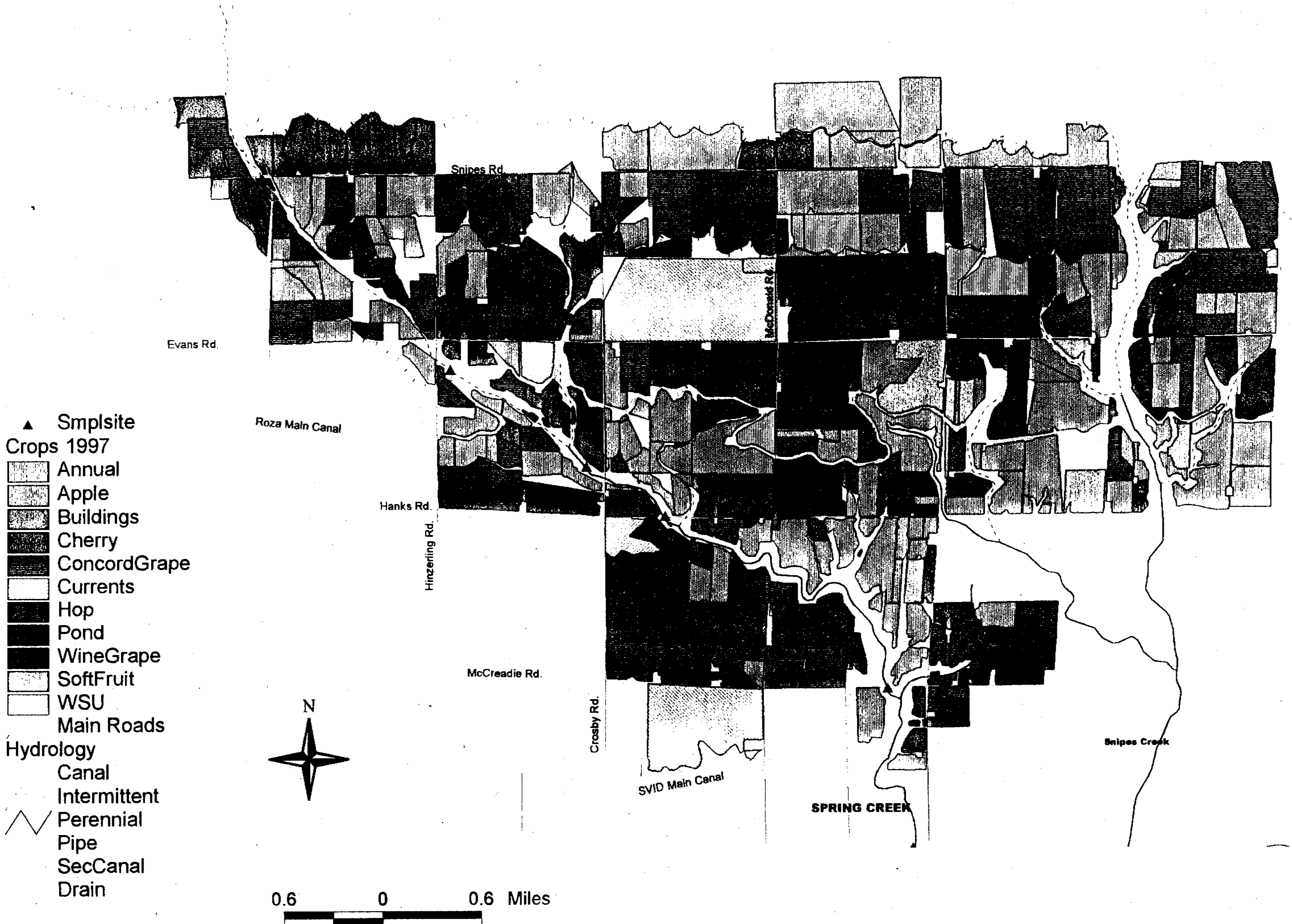
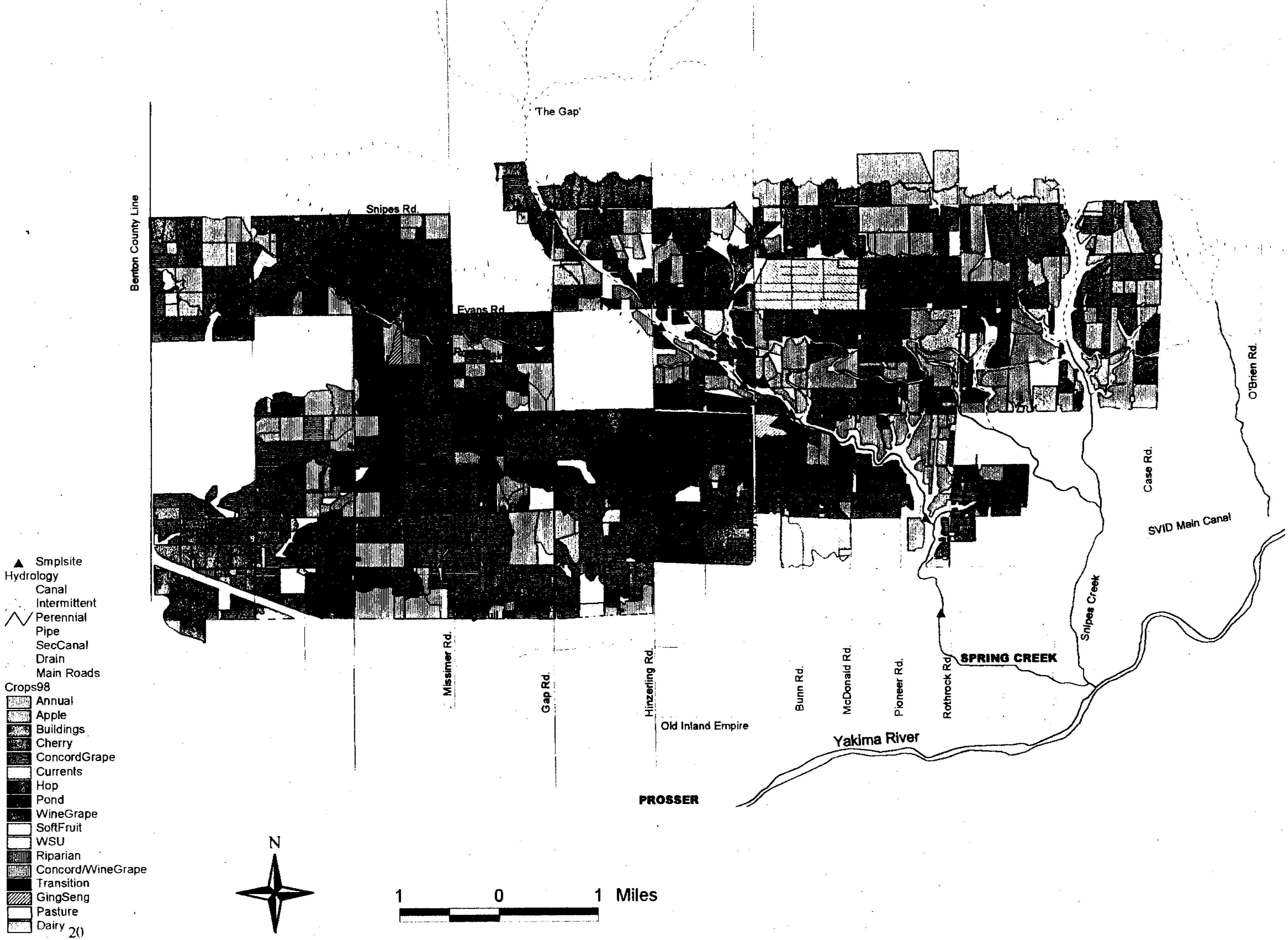


Figure 3.3 Spring Creek Crop Types, 1998 Survey



Fi re 3.4 Spring Creek Irrigation Methods, 1996 ırvey

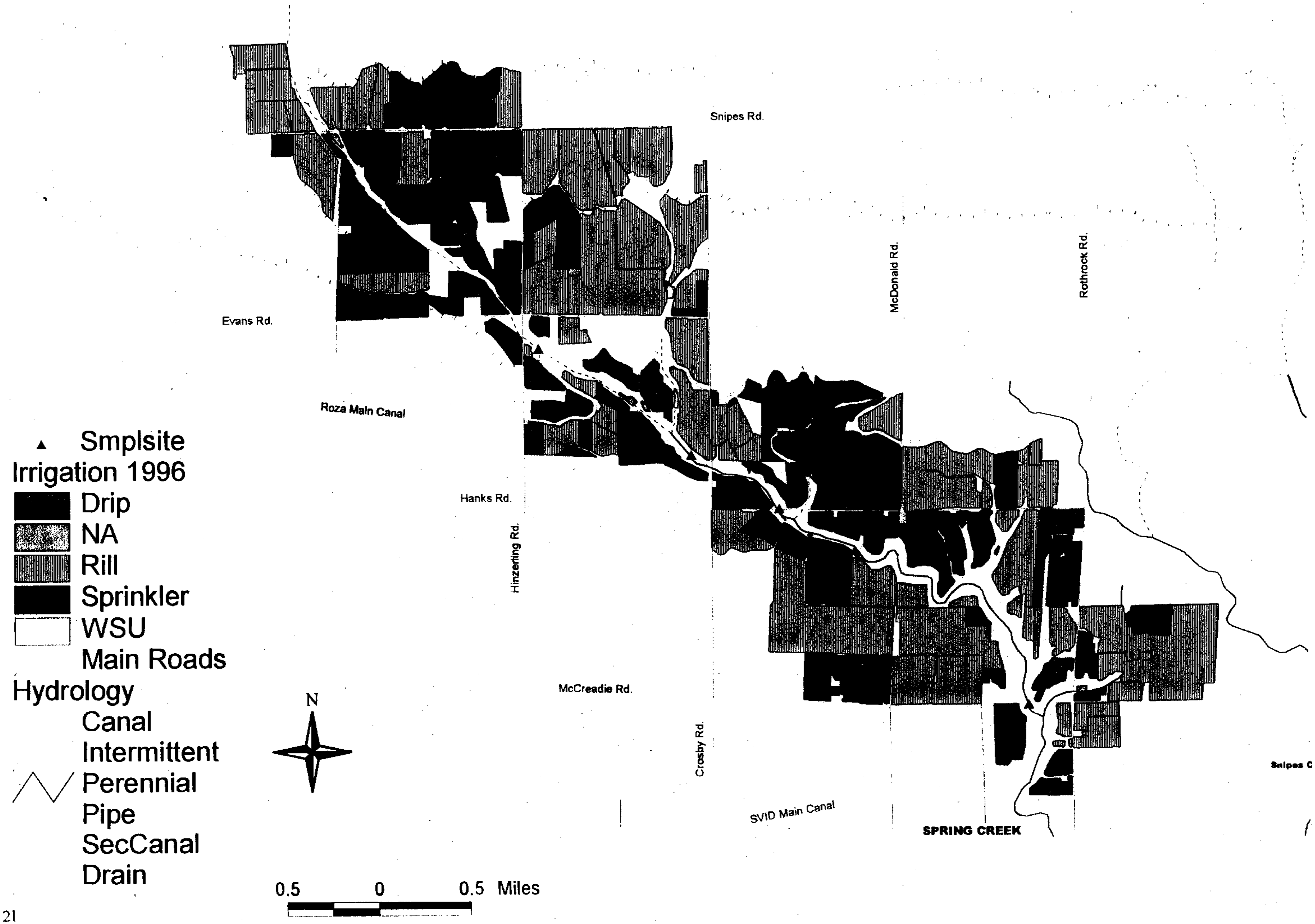


Figure 3.5 Spring Creek Irrigation Methods, 1997 Survey

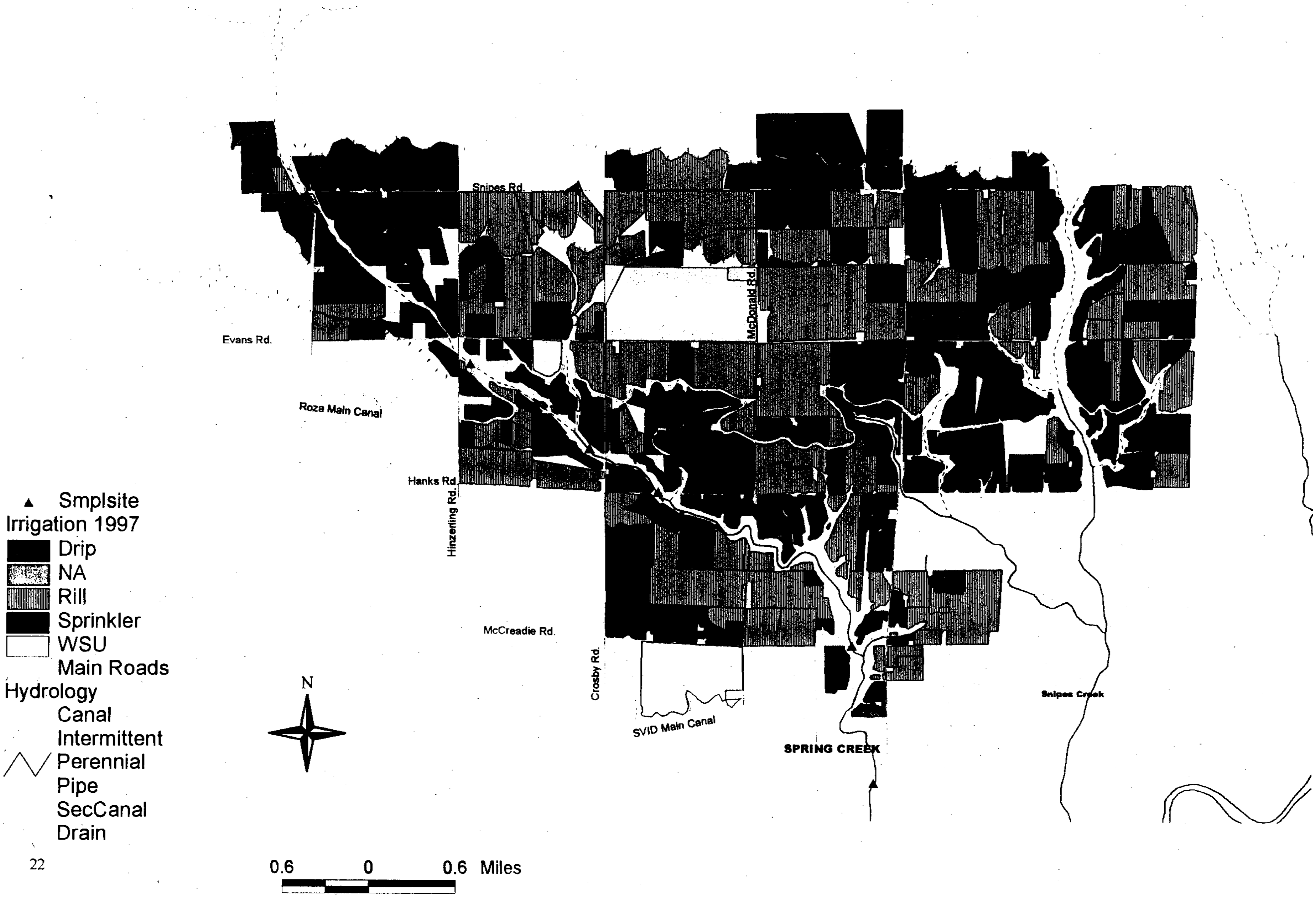


Figure 3.6 Spring Creek Irrigation Methods, 1998 Survey

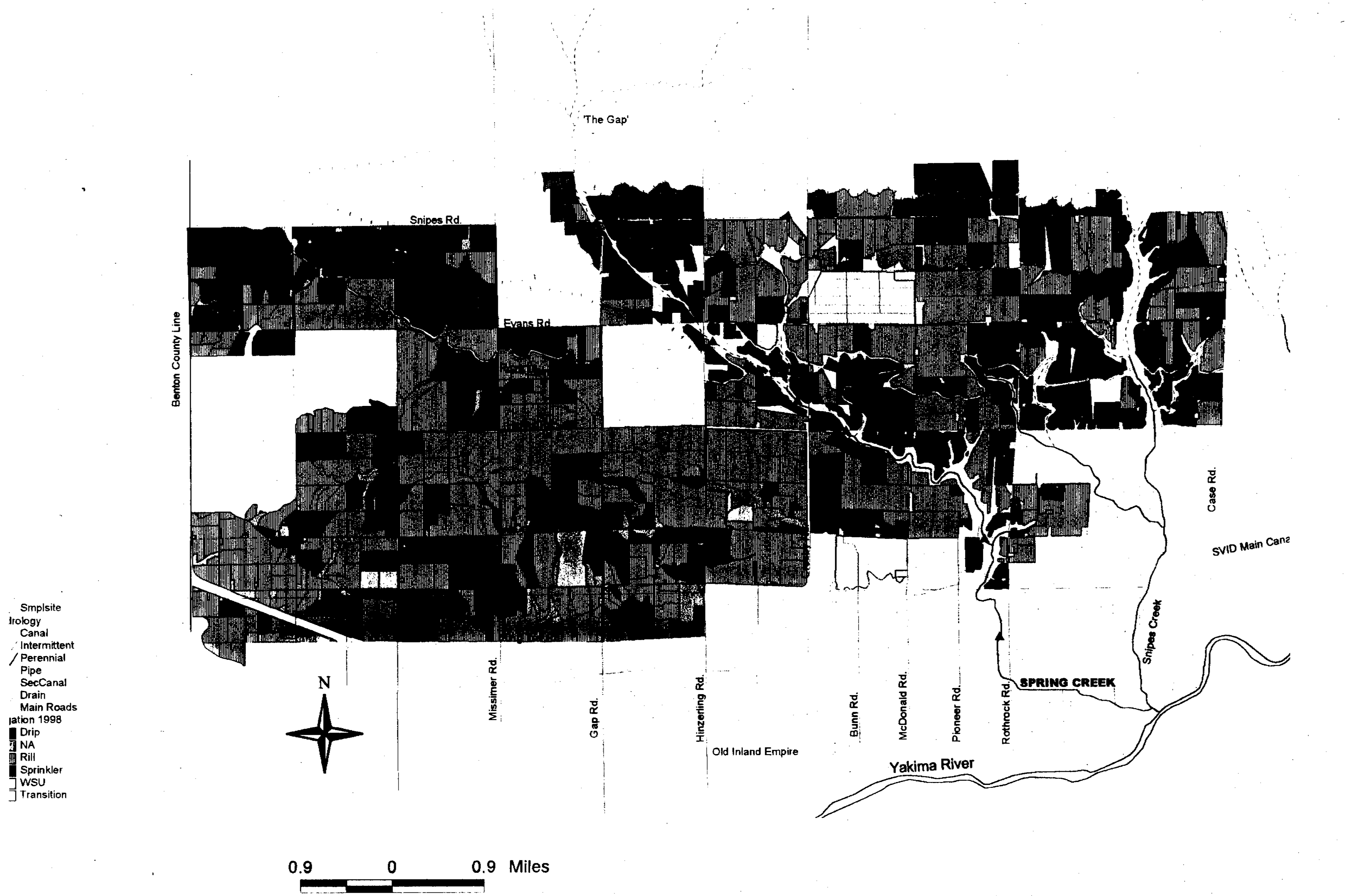


Table 3.1 Summary of GIS Map Survey Information Collected for Crop and Irrigation System

YEAR	April, 1996		April, 1997		April, 1998	
Acres Mapped To Date	**4491.65**	% of Total	**11044.54**	% of Total	**20462.39**	% of Total
By Crop:						
Annual	172.10	3.83	665.04	6.02	1060.76	5.18
Apple	1224.62	27.26	3232.05	29.26	4488.97	21.94
Cherry	149.53	3.33	259.62	2.35	523.50	2.56
ConcordGrape	598.48	13.32	1700.71	15.40	3908.25	19.10
Currents	43.64	0.97	43.64	0.40	43.64	0.21
Hop	1115.18	24.83	2288.97	20.72	4446.08	21.73
WineGrape	1162.39	25.88	1879.46	17.02	3950.15	19.30
OtherFruit	0.00	0.00	250.65	2.27	673.80	3.29
Misc. (Pond, WSU, Bldg)	25.72	0.57	724.42	6.56	1367.24	6.68
By Irrigation:						
Rill	2427.73	54.05	4486.53	40.62	8788.93	47.25
Sprinkler	1890.77	42.10	4739.37	42.91	7404.52	39.81
Drip	147.42	3.28	1094.24	9.91	2406.18	12.94

The calculated percentages reflect these irrigation changes as the percent of rill-irrigated acres decreasing from 54 to 40 and the percent of drip-irrigated acres increasing from 3% to nearly 10% of mapped acres.

Irrigation changes continued to occur between 1997 and 1998. Of the fields in the 1997 maps, 238 acres were converted from rill to either sprinkler or drip, and 207 acres were converted from sprinkler to drip. Table 3.1 shows rill irrigation increasing as a percent of total between 1997 and 1998, but that is due more to the type of acres added to the map data than to on-the-ground changes. The percent of drip irrigated acres continued to show a steady increase, which is substantiated by field work showing an increase in the number of growers installing drip systems.

The cover crop information was not available for the 1998 survey at the time the report was written. The District is continuing to update the map database.

Cover Crops and Slope

Crop, irrigation method, personal preference and other factors determine the use of a cover crop by a particular grower. Figure 3.7 is a map of the cover crops identified when each field was mapped (cover crops changes were not updated through the course of the project). The final percentage of the use of cover crops is shown in Table 3.2.

Slope was noted for each field during field surveys, although it was difficult to assign a single slope value to many of them. Fields at the edge of canyons can be quite steep over a large portion of the field. Slope was generalized over an entire field as one of the following:

- <1 percent
- 1-2 percent
- 2-3 percent
- 3-4 percent; or
- >4 percent.

Figure 3.8 shows a map of the slopes identified for each field. In general the steeper fields follow the line of the canyons, while fields with shallower slopes are either up on the flats between Spring and Snipes Creeks.

Table 3.2 Summary of GIS Map Survey Information Collected for Cover Crops

YEAR	April, 1996		April, 1997		April, 1998	
Acres Mapped To Date	**4491.65**	**% of Total**	**11044.54**	**% of Total**	**20462.39**	**% of Total**
By Cover Crop:						
None	1162.39	25.88	2888.10	26.15	Not Available	
Permanent	1248.02	27.79	3413.49	30.91		
Seasonal	2055.52	45.76	3469.14	31.41		
NA			549.40	4.97		

Figure 3.7 Spring Creek Cover Crops, 1998 Survey

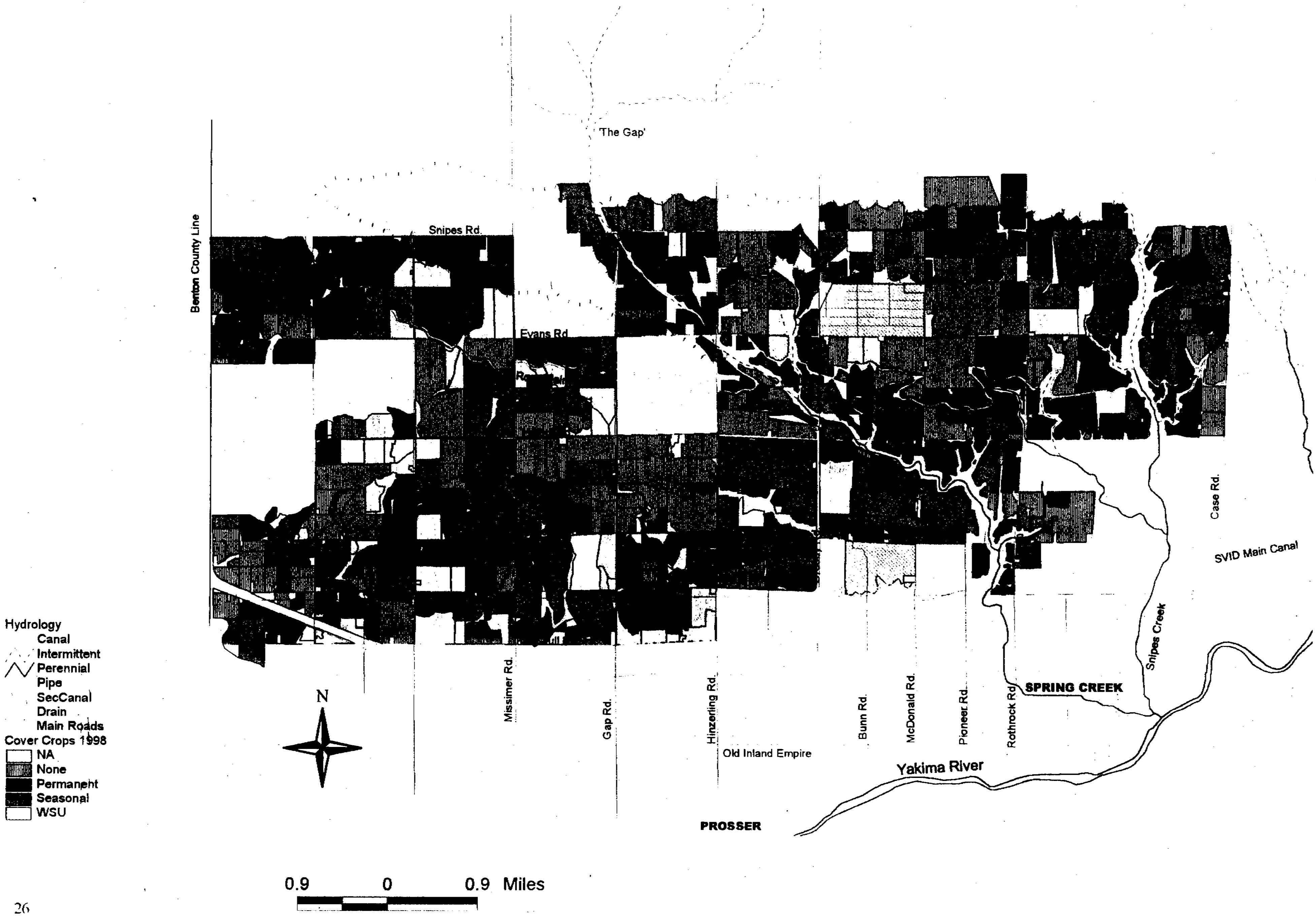
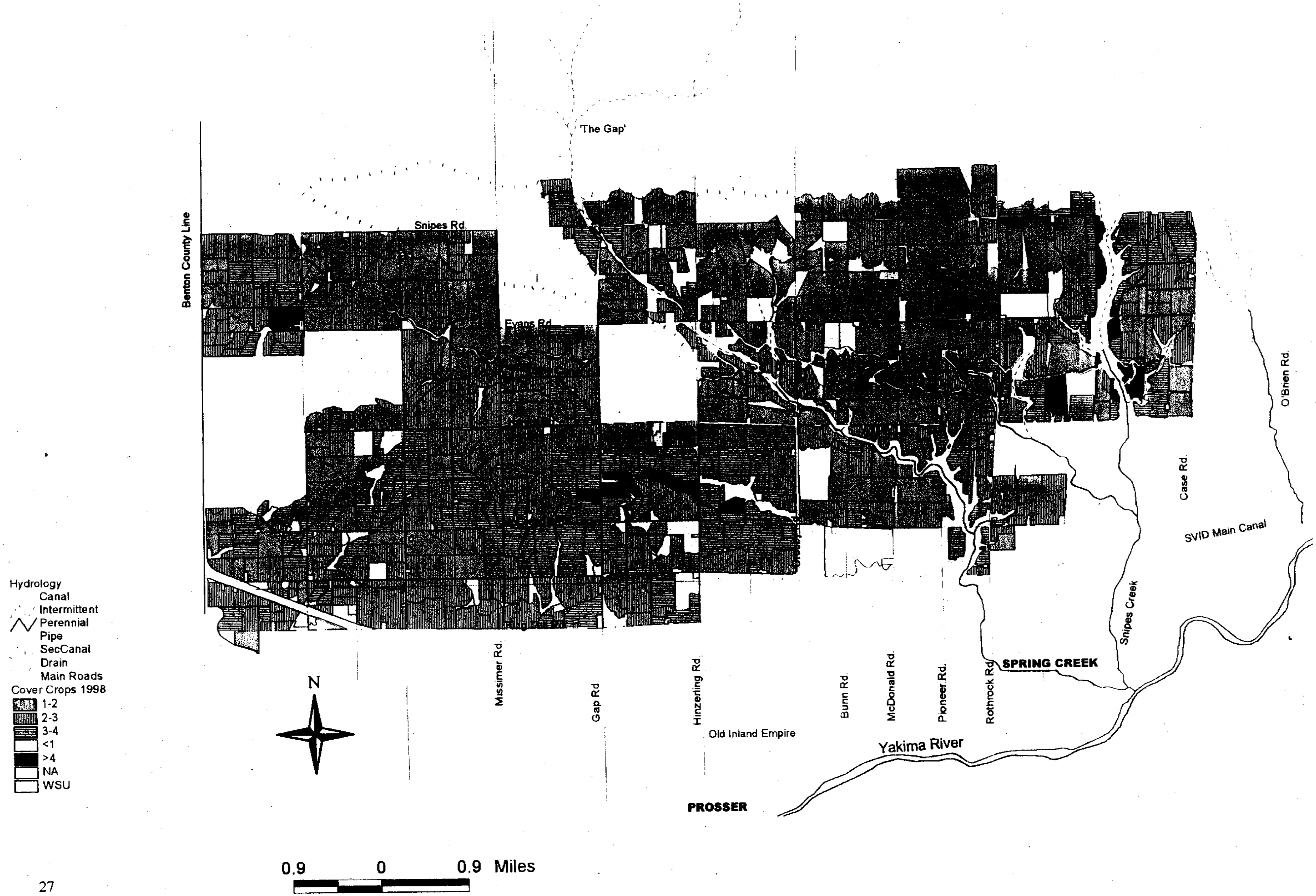


Figure 3.8 Spring Creek Slope, 1998 Survey



4. STREAM RESTORATION

As part of this project, a one-half mile section of the canyon along Spring Creek (approximately 5 acres), was improved from a grazing area to a grass/brush covered area. The section had been heavily grazed for several years, and the landowner was interested in improving the condition of the stream riparian area. The District was interested in this both for the riparian improvements, and to determine water quality benefits from this type of improvement.

In the spring of 1996 a fence was erected at approximately 30 feet on either side of the creek for the entire half-mile section. The fence was designed to allow the landowner to continue grazing a reduced number of cows, so stream crossings were built at two locations, providing access to either north or south portions of the canyon along the stream.

The 'New Zealand' style fence was constructed of three strand wire, fiberglass poles, and wooden posts every 100 feet. The first and third wires of the fence were electrified from a source initially at the southeast corner of the property. The fence was later proven not to be 'hot' enough, and an additional source of electricity was added at the northwest corner the following summer.

Local boy scouts and a high school activity group were recruited to plant trees along the stream bank inside the fenced area in early April, 1996. Two hundred willows and red osier dogwood were planted in approximately three hours, followed by a picnic provided by the landowner. The trees were purchased seedlings approximately two-to-three feet long, and planted along the creek edge.

During the months following the fence construction, the vegetation along the stream bank increased dramatically. The loss rate for the planted trees was fairly low, approximately 10 percent did not take root. This may have been due to being planted too far from the stream bank. At the time of planting, the irrigation water had not yet been turned on so the creek was running quite low and it was difficult to judge how high the water was going to flow.

There were several problems with the fence in the months following its construction, including the low electricity mentioned above. The landowner had greater difficulty than expected reducing the number of cattle grazing on the 30 acres, and new calves remained in the section as well. The calves quickly learned they could get under the lowest wire of the fence and there were enough adults to cause additional damage after the fence had been weakened. Because the grass was growing so well, the field along the edges of the fence had to be cleaned with a mechanical weed cutter and sprayed with herbicide on a regular basis.

These problems were addressed as possible between District personnel and the landowner. By late fall 1996, an additional electricity source, regular maintenance and periodic checks were keeping problems to a minimum. The number of cattle was finally reduced in late fall, from over 35 head to about 10. This number has been maintained and has greatly improved the fence maintenance.

In the winter of 1996-97 flooding occurred during the storm events discussed in section 2.3. This caused some damage to the planted dogwood and willow, but had little effect on the grass and stream banks. The floods were high and fast for very short periods, and most plants recovered within a short period. The fence was under water to the second wire at some places during the flooding, and a few repairs were necessary, but it was generally undamaged.

The vegetation grew very well during the summer of 1997. In many places it became difficult to know where the stream bank was, even when running full. The planted willows and dogwood have firmly established themselves, and native grasses and native willows have also become prominent.

The District maintained a sampling location on the restoration piece at Site 4 (approximately 800 feet upstream of Crosby Road), from the start of the project through the end of October 1997. The next sampling site downstream (Site 3), was at the intersection with Hanks Road, approximately 2700 feet downstream of the fence project. Monitoring at Site 3 began in November 1995, and is continuing as part of additional District projects.

The stream flow and suspended sediment data for Sites 3 and 4 do not differ significantly from the changes identified at the other sites between sampling years or seasons. The flows increased or slightly decreased at both sites during irrigation and non-irrigation seasons, which is true for the other four sampling sites. The mean suspended sediment concentration at both sites also decreased, as it did at the other sites.

The major difference in water quality findings in the vicinity of the stream restoration site was a decrease in the sediment discharge during the non-irrigation season at Site 4 between 1996 and 1997 sampling years. The other three sites that have year round flow showed increases in sediment discharge between those periods (Table 2.2).

This difference may be due to recordings of suspended sediment measured on February 6 and February 12, 1996. These samplings occurred just before and shortly after a storm event, but Site 4 had considerably higher suspended sediment values on these days than any of the other flowing sites (Sites 1-3). This was prior to the fence construction, and may have been due to an unused irrigation pond, which was filling and draining at the time.

5. EDUCATIONAL EFFORTS

5.1 Annual Irrigated Agriculture Tour

The District held the first of what has become an annual event in September 1996. The Irrigated Ag Tour takes non-farm community members on a bus tour to various farms in the North Prosser area. The first year there were five stops: an apple orchard, a hop field, a Roza Irrigation District Re-regulating reservoir, the stream restoration site described above, and a PAM demonstration field near WSU-Prosser.

At each stop speakers discussed methods of growing the crops, how irrigation water is used, the problems associated with irrigated agriculture and how growers are working to reduce their impacts on water and soil resources. For example, Mike O'Brien of C&M Orchards discussed their application of pest management techniques in an orchard certified as 'organic'. The installation and use of drip irrigation in a hop field was another discussion stop. A highlight of the trip in September 1997 was a tour of a hop processing plant.

The tour has been received very well the two years it has been running, with excellent feedback and comments from those participating. There were over 20 participants the first year, and about 30 the second year. The District is planning to continue this tour, expanding the scope to include stops at locations beyond the north Prosser area.

5.2 Student Information and Education

One of the objectives of this project was to get students involved in water quality issues in the Spring Creek and/or Yakima River watersheds. The District was successful in getting over 30 students to participate in the tree planting held at the stream restoration site, but has been unsuccessful in other attempts to generate student involvement.

One of the problems encountered is the logistics of taking students out of school for over an hour at a time and transporting them to a stream site. Once the students are gone for over a single class period, additional teachers, substitute teachers and other students become affected. Attempting to arrange a single event may be possible, but arranging for a series of visits to a stream to examine water quality became much more of a challenge with local schools.

The District made several contacts with local teachers and had some participation on the ag tour, but did not organize any specific events (other than the tree planting), specifically for student groups. The District has hired a person under a new grant who has the responsibility of working local schools to establish some educational events for students that discuss water quality issues.

5.3 Grower Contacts and Presentations

One of the more valuable educational results of this project was the regular contact the District had with local growers as a consequence of being out in the field regularly doing water quality sampling and field mapping. This one-on-one contact provided numerous opportunities to discuss both the method and findings of the project, and to talk about methods the grower could apply to reduce their impacts. In some cases, it provided the best opportunity to educate a grower specifically on how his practices were impacting the creek.

There were also several presentations made to grower groups during the course of the project, primarily at the annual meeting the District holds each year. Much of the information was still being gathered, but growers were interested in seeing the mapping and noting that even as we attempted to identify changes in crops or irrigation methods, there is a constant transition and the information will continually need to be updated.

Additional presentations and discussions were made about the project at the annual ag tour, to smaller grower groups as part of other meetings, and to various resource agency groups during the course of the project.

6. FURTHER STUDY

The District has received two additional grants from the Washington Department of Ecology to continue and advance the work done on this Spring Creek Project. The first was designed to examine more closely the practice of irrigation scheduling and to educate growers on the use of this project. As part of that grant, several workshops were held for both growers and resource agency personnel on irrigation efficiency, scheduling and uniformity.

The second grant provides support to put technical assistance personnel in the field to educate and assist growers with irrigation management, installation of new systems, and the use of soil moisture monitoring equipment. The technical assistance also supports a grant from the Washington Conservation Commission that provided cost-share funding for growers installing improved irrigation systems.

Each of these two grants has water quality monitoring and educational activities as part of their objectives. This has enabled the District to continue doing water quality sampling at the sites established with the first Spring Creek project. This will provide a valuable source of continual information on the water quality conditions of Spring and Snipes Creek (where sampling has been expanded to), and the impacts of agriculture activities on these creeks.

The additional grants have also allowed the District to continue updating its agriculture mapping information and to identify changes. These maps will again assist in determining how educational and study efforts are being put into place to improve the use of the resources.

The District has a proposal out to WDOE to demonstrate the use of a management method, which incorporates differences in soil types and depths into the design of an irrigation system. The objective is to design an irrigation system that provides management zones based on the expected water requirements of the soil. For a high-value crop such as wine grapes, this method can allow the grower to reduce his inputs of water and fertilizer, while improving the quality of the crop. The District will be able to use its GPS/GIS equipment and software to work with a grower to help them identify these management zones.

Potential future grant requests will be for continued technical assistance for on-farm improvements, continued water quality monitoring, and an increase in educational efforts, both for high school and grade school students and for farm and non-farm community members.

APPENDIX 6

Conservation Review

A quarterly publication of the Benton Conservation District and Conservation Association

April, 1997

1997 EQIP Program - Deadline Announced for Cost-Share Dollars

The United States Department of Agriculture has announced that they are now accepting applications for the new Environmental Quality Incentives Program (EQIP). Sign up is taking place at the local Natural Resource Conservation Service office (NRCS). The deadline for applications is May 20th.

EQIP was established in the 1996 Farm Bill to provide a single, voluntary conservation program for farmers and ranchers to address significant natural resources needs and objectives. It combines the former Water Quality Incentives Program and the Agricultural Incentives Program.

Under the rules of EQIP, the maximum amount of cost-share dollars an individual producer can receive will not exceed \$10,000 per year, and/or \$50,000 for the duration of the five-to-ten year contract. All EQIP activities must be carried out according to a conservation plan in a five to ten year contract. Each farm plan will be put through a ranking process with other applications. Projects with the highest environmental benefits will have the best chance for funding.

Cost-sharing pays a percentage of certain conservation practices, such as sprinkler systems, manure management facilities, drip systems and other practices important to improving and maintaining the health of natural resources in this area.

Incentive payments may also be paid to encourage a producer to perform land management practices such as irrigation water management, nutrient management, manure management, integrated pest management and wildlife habitat management.

The NRCS has leadership for EQIP, with support from the Farm Service Agency (FSA) and the Conservation District.

For more information contact your local NRCS office. In Prosser the number is 786-1923. Other numbers: Zillah (829-3003), Yakima (454-5736), or Sunnyside (837-7911).

Scott Manley can be seen sampling Spring Creek regularly this summer.

District Begins Another Sampling Season

The District's water quality monitoring program is back into irrigation-season schedule. Scott will be sampling six sites along Spring Creek on a weekly basis for suspended sediment, turbidity, temperature and pH.

The District is in the second year of sampling at these locations so the data collected this summer will be compared with last year's numbers. We hope to see a change in sediment levels at some of the sites due to improvements being made on irrigation systems throughout the watershed. Several hop fields have been converted from rill to drip irrigation, so soil loss and resulting sediment inputs should be less than previous levels.

Scott will also be sampling soil loss on several fields as irrigation begins this spring, and occasionally throughout the summer. This information is useful to help growers understand how much soil is lost under various irrigation conditions and methods.

For more information about the District's sampling program, stop and ask Scott is you see him out in the field, or call Pat at 786-9230.

District Programs and Activities

Irrigation Management Workshops a Success

Two workshops in irrigation management, scheduling and evaluation were attended by over 45 participants in late February. Peter Canessa, an irrigation specialist from California led the workshops.

The first day was directed to irrigation consultants and discussion focused on system evaluations and design. Participants on the second day were growers and irrigators, and questions and discussion centered on drip irrigation use, applicability and design.

In addition to hopefully passing on lots of useful information, the workshops identified the need for additional information exchanges on irrigation system management. Pat Daly, District Manager is currently seeking funds to start a program of assisting growers with irrigation evaluations, perhaps through cost-share with consulting services.

Additional workshops on this and other topics are planned for next winter, perhaps beginning in fall of 1997, after field work has slowed. Watch the newsletter for more information as these workshops are organized.

Scholarships Available for Inland Empire Youth Camp - Deadline May 2

The District will once again be offering scholarships to youths ages 13 to 16 to attend the Inland Empire Natural Resources Youth Camp. This year's camp will be held June 15-21 on the east shore of Lake Coeur d'Alane. The camp is a fun-packed week for youths to participate in natural resource programs such as wildlife, soil and water quality.

The cost for the week is $190.00, with a limited number of scholarships available from the District for $150.00 of this expense. Applications for the camp and financial assistance can be picked up at the Natural Resources Conservation District office at 618 8th Street in Prosser, at the District office WSU-Prosser, or by calling 786-9230.

Frank Berg Joins District Board

The District welcomed Frank Berg to its Board of Supervisors at the Annual Meeting in February. Frank has been farming in the Horse Heaven Hills for 30 years, primarily in dryland wheat. Recently he has been converting a portion of his acreage to circle irrigation and will be growing potatoes and other crops in addition to continued what production.

Frank has already been helpful in working on a proposal for a project in the Glade Creek drainage, and we hope having Frank's input will increase the District's ability to assist growers in a wider portion of the county.

Farm Equipment For Sale/Rent

For Rent: Hesston Round Bale processor, for straw mulching areas prone to soil erosion. Processor is equipped with speed kit and PTO drive. Rental fee is $50./day. The District can help find straw. Contact Pat at 786-9230 or Scott at 786-9216 for information.

For Sale: Deutz four-cylinder, turbocharged, air-cooled diesel engine. Rated at 106HP at 2500 RPM. Includes instrument panel with safety shutdowns and 20 gallon fuel tank. Contact Scott at 786-9216.

Farm Classifieds....

The District is now accepting farm-related classified and display advertising for the Review. For rates and information, contact the District.

For Sale: Hobson two-row furrow mulcher for vineyard. $2500. Call 973-2009.

TMDL Update

by Chris Coffin, WA Department of Ecology

The Department of Ecology is continuing work on the suspended sediment TMDL for the lower Yakima River. "TMDL" stands for "Total Maximum Daily Load", which is an estimate of the amount of a specific pollutant that a waterbody can 'safely' take up without threatening the beneficial uses of the waterbody. This TMDL targets turbidity and DDT. Both turbidity and DDT can be associated with fine soil particles washed from agricultural fields in tailwater runoff and carried to the river in irrigation return drains. Although DDT was banned for use in 1972, its degradation in soil is slow and residual deposits can remain attached to soil particles for many years. Nutrients, fecal bacteria and other pesticides can also be transported by tailwater runoff. These pollutants are also found in the lower Yakima River at levels above state standards.

Ecology will soon be releasing its Draft-Suspended Sediment and DDT Total maximum Daily Load Evaluation Report for the Yakima River. This report is the result of two years of extensive monitoring, flow modeling and historical data review by Ecology. The findings in this document will be used to set enforceable limits on the amount of suspended sediment that can be discharged from irrigation return drains to the Yakima River. The draft report will be available for public review and comment prior to its final submission to USEPA.

The limits that this TMDL will set on suspended sediment may effect irrigation practices and water and crop management for some growers. Ecology is working with federal, state and local agencies, including the Conservation Districts, to encourage the adoption of 'best management practices' (BMPs) by growers. BMPs will help reduce soil erosion and thus reduce suspended sediment in the Yakima River. Many growers have already begun to adopt BMPs which eliminate tailwater runoff, conserve water and increase productivity. Technical assistance as well as limited financial assistance is available to help with the implementation of some BMPs.

Ecology is taking an approach to this TMDL process that relies on public participation in designing and implementing the activities necessary to meet the limits outlined in the Evaluation Report. Look for workshops and programs in your area discussing the TMDL and BMPs. We need your participation.

For technical assistance contact Pat Daly or Scott Manley at the Benton Conservation District, WSU Cooperative Extension or NRCS. For more information on the Suspended Sediment TMDL for the lower Yakima River contact Chris Coffin at the Dept. of Ecology, (509) 454-7860.

Weather Info Available on Web Site from WSU

PAWS (Public Agriculture Weather System) is Washington State University's agricultural weather service. Weather data are collected electronically at the 58 stations throughout the state and transmitted by radio signal to the base station in Prosser. PAWS is one of the few near real-time agricultural weather networks in the country, enabling it to provide up-to-the-hour information to growers. PAWS has traditionally supplied weather data and models for growing degree days, evapotranspiration, air stability, and pest and disease development. Major system changes have been instituted in the past few months, including high-speed model access on the 4 bulletin board phonelines, and a site on the World Wide Web (http://frost.prosser.wsu.edu).

PAWS has been essentially free to users in the past; however, with tightening university budgets, PAWS has been required to support itself through paid subscriptions. PAWS' new subscription structure is two-tiered, with corporate rates at $1065 per year, and individual rates of $130 per year. PAWS' policy is to charge an annual maintenance fee to weather station sponsors, but no additional charges for system access. Unfortunately, because of personnel time constraints, PAWS cannot add new stations at this time.

PAWS' future depends on your support. The PAWS system is actively seeking input from users on the new interface, services currently provided and services not provided that may be valuable to users. We appreciate the interest in PAWS and plan to improve the system to meet customer needs. For more information, please contact Dr. M.J. Hattendorf at (509) 786-9219, or Todd Elliott, (509) 786-9367.

Benton Conservation District
24106 N. Bunn Rd.
Prosser, WA 99350

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Address Correction Requested

MEMBERSHIP FORM - BENTON CONSERVATION ASSOCIATION

Yes, I would like to become a member of the Association and receive regular updates on local conservation issues and on-farm resources. (Individuals or businesses must reside in Benton County to be eligible for membership.)

Name____ **Phone No.**________________

Address____

Dues:
- ☐ Regular Membership: $25/year (voting membership)
- ☐ Affiliate Membership: $26.00-$50.00/year (non-voting)
- ☐ Supporting Membership: $51.00-$500.00/year (non-voting)
- ☐ Sustaining Membership: $501.00 or more/year (non-voting)

Please enclose check and mail to: ***Benton Conservation Association, 24106 N. Bunn Rd., Prosser, WA 99350***

Thank you to everyone who have become members -- we appreciate your support!

Benton Conservation District

Supervisors: Dave Roseberry, Chairman; Frank Anderson,Vice-Chairman; Mike Duncan, Secretary-Treasurer; Mike O'Brien and Frank Berg, Members.
Employees: Pat Daly, District Manager; Scott Manley, Resource Technician.
District Phone Numbers: P.Daly: 786-9230
S.Manley: 786-9216

Benton Conservation Association

Board of Directors: Mike O'Brien, Chairman; Virginia Prest, Vice-Chairman; Dave Roseberry, Secretary-Treasurer; Frank Anderson and Keith Oliver (representing Olsen Brothers Inc.), Members.

Conservation Review

January, 1997

A quarterly publication of the Benton Conservation District and Conservation Association

Spring Creek Watershed - Project Summary

Project Overview

This project was designed to evaluate water quality conditions in Spring Creek and determine the potential sediment sources from agricultural practices in the watershed. Mapping ag activities was combined with stream monitoring to determine current conditions and develop future projects to reduce stream inputs from ag sources.

Geographic Positioning System/Geographic Information System (GPS/GIS) technology was used to map irrigated fields in the watershed. GPS was used by driving the perimeter of any field greater than ten acres, while recording information on crop type, irrigation method, cover crops and field slope. This information was transferred to the District's GIS program, edited, and used to produce maps showing fields differentiated by crop type, irrigation method, the use of cover crops or slope percentage.

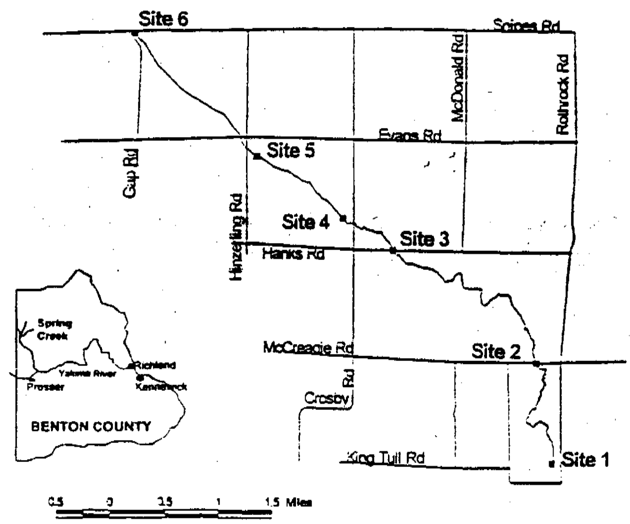
Stream monitoring was done at six locations along a 6-mile stretch of the creek (see map), on a bi-weekly basis during non-irrigation season, and twice-weekly when irrigation was on. Monitoring began in October, 1995 and will continue through summer 1997. Flow, temperature and pH were recorded at each site, and a sample taken for suspended sediment analysis. The results of this are not only trends in instantaneous sediment levels at the six locations, but also computation of monthly and yearly sediment discharge at these locations.

The relationship between ag activities and stream sediment levels is being reviewed by comparing the monitoring results with map information, to determine possible sediment sources from fields draining to the creek. Potential runoff is based on crop type, irrigation, slope and other factors recorded.

GPS/GIS Results

The maps shown on page 3 reflect data taken January-March, 1996. Additional GPS/GIS work will be done in winter 1996-97 to include areas beyond the mainstem of Spring Creek. The maps depict the crops, irrigation methods, use of cover crops and slope for those fields which drain directly into Spring Creek.

Spring Creek Watershed Study Area



A summary of the total crop and irrigation acres indicates most crops are irrigated either by sprinkler or rill (47.5% under sprinkler and 45% under rill irrigation). Only 232 acres were under drip irrigation during the 1996 season, although that number is slowly increasing as more fields are converted. Apples were the largest crop in 1996, in terms of acres, with 1024 acres. Hops and wine grapes were the next two large crops; hops were grown on 723 acres, and wine grapes on 710 acres. Other crops included concord grapes, cherries, and annuals.

Stream Monitoring Results

Stream sampling results showed the majority of sediment is transported through the stream between May and September, with July contributing the most at Sites 1 and 2, and May at Site 4. Sediment discharge for the period November 1995 through October 1996 was 2350 tons at Site 1, 1056 tons at Site 2 and 319 tons at Site 4.

More interesting to the project is the distribution of sediment levels along the stream, particularly during irrigation season. The charts on page 4 show the sampling sites (from upstream to downstream), versus instantaneous suspended sediment levels, taken on various dates. Chart 1 shows the difference in recorded sediment levels in March (prior to irrigation) and in June when irrigation is on. Chart 2 shows sediment levels on six dates with irrigation on;

...continued on Page 2

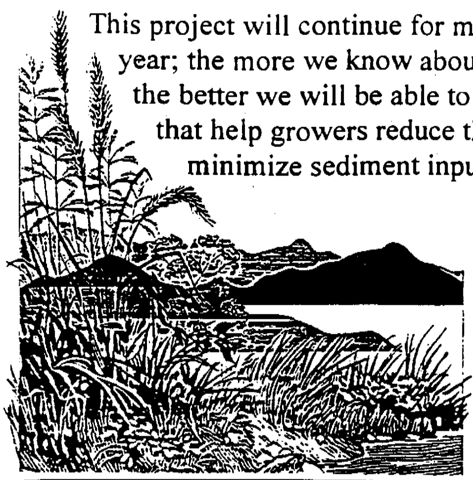
Spring Creek, continued:
spikes in sediment levels at Sites 5 and 2 can be related to irrigation activities in rill-irrigated fields above these sampling points.

Field sampling of sediment loss was also done by the District this summer. In these tests, soil loss (with irrigation runoff) was measured from rill-irrigated hop fields during individual irrigation runs. The results showed a range of from 0.0053 tons/acre to 0.08 tons/acre lost during irrigation runs of 24 hours. If a field is irrigated a total of 15 days during an irrigation season, soil loss could range from 0.08 tons/acre to 1.3 tons/acre during the year. Studies from other areas show annual rates of from 9 to 45 tons/acre on rill-irrigated fields. (A ton is roughly equal to one cubic yard, so a determination of soil loss can be made in number of cubic yards, feet or inches for a given field.)

Conclusions / Continuing Work

There is no doubt rill-irrigation results in significant soil loss from fields, and sediment increases to nearby streams. This study provides a view of these loses in one watershed in terms of where, when and how much soil is moving through the system. Sampling Site 5, just below the corner of Evans and Hinzerling Roads, collects soil lost from hop and other rill irrigated fields with slopes of 2-4%, located above Evans. Some of this soil filters out or is caught in ponds as it moves downstream. More is picked up from other fields between Sites 4 and 2; again the maps show rill irrigated fields likely contributing soil runoff.

This project will continue for most of another year; the more we know about these drainages, the better we will be able to design programs that help growers reduce their soil loss and minimize sediment inputs to the streams.



Annual Meeting to Focus on CRP Takeout and Delaney Clause

Featured Speakers at the District's Annual Meeting will be Allen Schreiber from WSU-Tri-Cities, and Roger Veseth from the WSU and the University of Idaho. Their topics will be "Affect of New Regulations with the Delaney Clause Being Discontinued", and "Management Considerations for Returning CRP to Production in Low Rainfall Areas". Using PAM and pesticides in drip irrigation will also be discussed.

Three Pesticide Credits can be earned by meeting participants. The meeting will be February 5th from 8 am to 12:30 pm at the Barn in Prosser. The meeting is free and open to the public.

District Elections

The District will hold its annual elections at the Annual Meeting on February 5th. Two Supervisor positions are open; one elected and one appointed. The requirements for these positions are to provide direction to District staff by attending a 2-hour monthly meeting, and providing support as needed at other times. Supervisors must also be registered voters within Benton County and be owners of, or occupy land within Benton County. Although these are unpaid positions, the work is vital to keep the District operating and provides an opportunity for a landowner to play a role in improving agriculture in Benton County. For more information on applying for a position, contact Pat at 786-9230, or at the address on page 6.

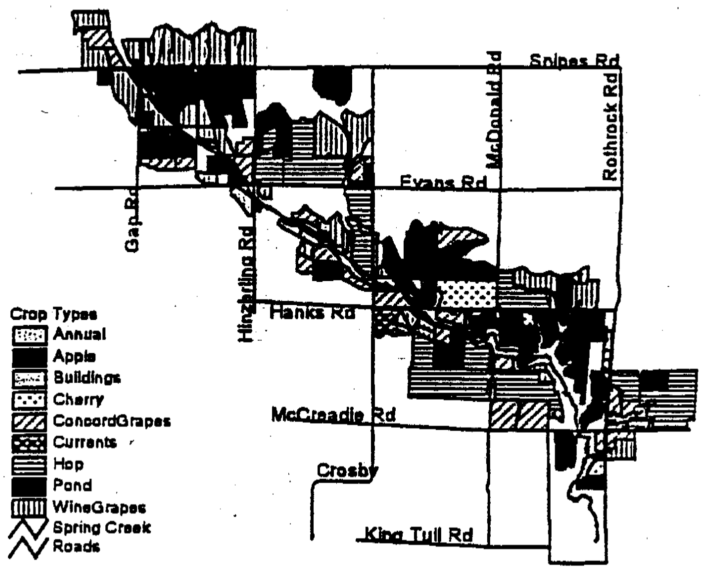
Irrigation Water Management Seminar Coming Up

The District and WSU Cooperative Extension will sponsor an Irrigation Water Management Seminar in February. Peter Canessa will be the featured presenter for the two-day workshop, which will be held both at WSU-Prosser and in fields north of the station. The workshop is designed for growers, irrigators and researchers working with IWM.

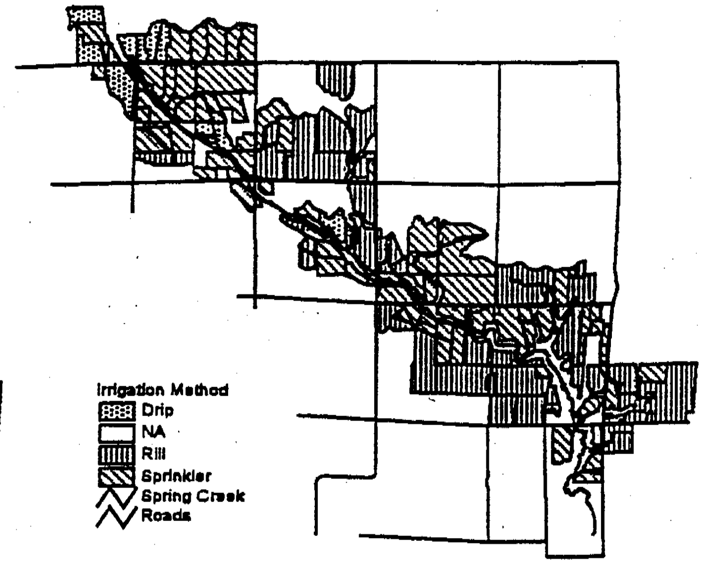
Tentative dates for the seminar are February 25th and 26th. To request further information as the workshop is finalized, please contact Pat at 786-9230.

Reminder -- Tree Orders need to be into the District by January 10th!

Fields Draining to Spring Creek

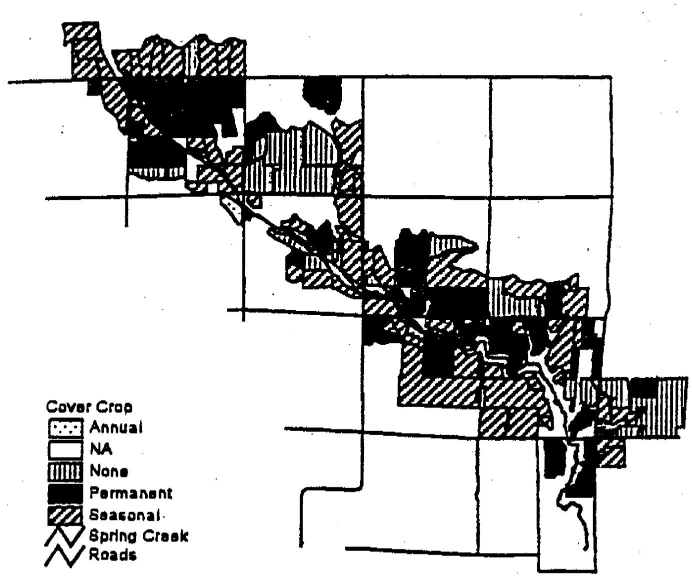


By Crop Type

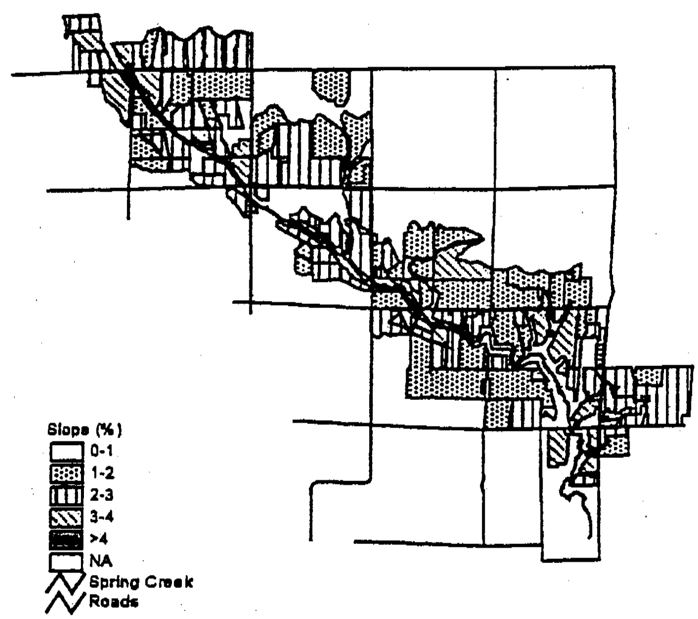


By Irrigation Method

By Cover Crop



By Slope



0.5 0 0.5 1 1.5 2 2.5 Miles

Chart 1:

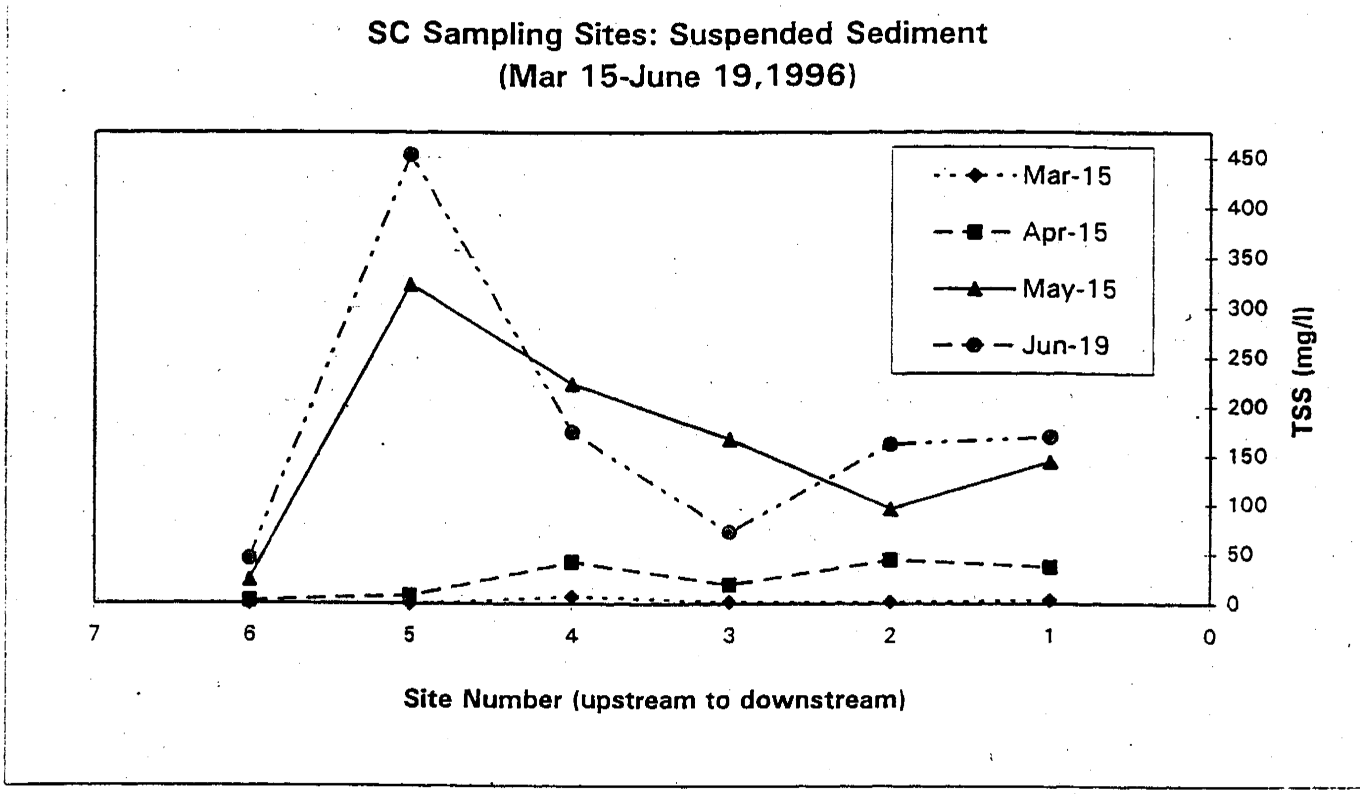
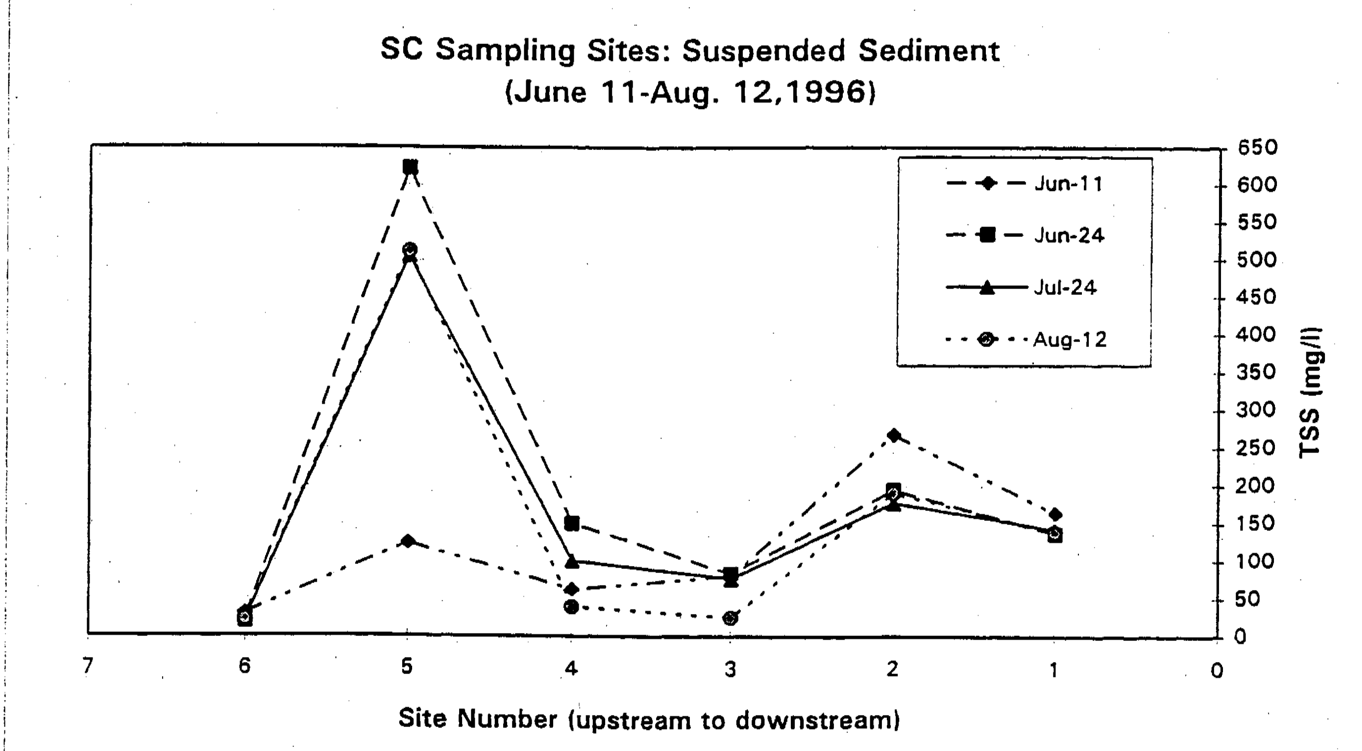


Chart 2:



EPA Changing the PM (Particulate Matter) Standard

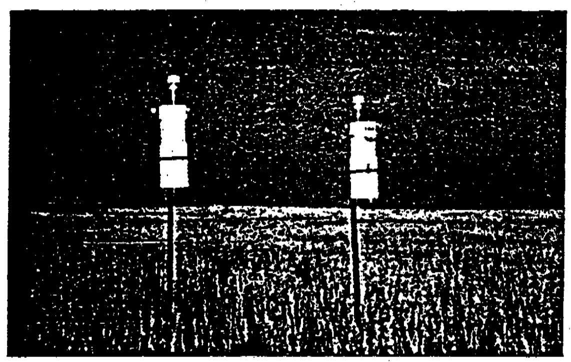
by David Roseberry, Chairman

The federal EPA is proposing a revision to the national ambient air quality standards for particulate matter and is accepting public comment on the proposal until Feb. 14, 1997. I urge everyone who has an opinion to send in written comments (in duplicate) to: Office of Air and Radiation, Dockets & Information Center (6102), attn. Doc. #A-95-54, USEPA, 401 M. St. SW, Washington DC 20460, or call 1-888-tell-EPA to give verbal comments. In addition to general comments, EPA has three specific options under consideration for which they are soliciting comment. Your opinion on these options, which are explained below, will have the most impact. The agency is under a court order to complete revision of the standard by July 1997. The complete text of the proposal along with a fact sheet and other information is available on the web at http://www.epa.gov/airlinks/

Current standards require that concentrations of particulate matter with diameters < 10 micrometers (PM10) be less than 50 micrograms per cubic meter averaged annually (the annual standard) and less than 150 micrograms when averaged over 24 hours (the daily standard). Measurements of PM10 taken in Kennewick, Spokane, and Walla Walla have all exceeded the daily standard at least once. The Kennewick sampler recorded extreme exceedences on several occasions during dust storms in the late 80's and early 90's.

The proposal includes keeping the current PM10 annual and daily standards unchanged and adding a PM2.5 annual and daily standard. The proposed PM2.5 standard is 15 (annual) and 50 (daily) maximum. The three specific options under consideration are: 1) a "limited" policy response option consisting of a PM2.5 standard set at 20 annual and 65 daily, 2) a "highly precautionary" policy response option consisting of a PM2.5 standard set at 12 annual and 20 - 50 daily, and 3) revoking the PM10 daily standard .

My written comments focus on encouraging EPA to revoke the PM10 daily standard. There is, in fact, plenty of reason to eliminate the PM10 standard entirely. The Harvard Six Cities Study, a large, prospective epidemiological study initiated in 1974, has studied the effects of PM2.5, PM10, and the fraction larger than PM2.5 but smaller than PM10, called CM (course mass). The study authors conclude, through several different and convincing lines of evidence, that the association between CM and mortality is "essentially zero." In other words the **health effects from particulate matter are entirely due to the size fraction smaller than 2.5 microns.**



PM_{10} samplers in CRP grass fields.

It is believed that agricultural dust in PM10 consists largely of CM rather than PM2.5. PM2.5 particles are believed to result mostly from combustion processes. It is likely therefore, that if the standards were designed to be equally restrictive, agricultural dust would be less likely to run afoul of a PM2.5 standard than a PM10 standard. However, soils differ greatly and the lack of PM2.5 data make it unclear at this time whether or not there is significant PM2.5 in local windblown dust; and the proposed PM2.5 standard is much more restrictive than the old PM10 standard, at least in the urban smog setting for which the standards are primarily designed. There are several proposed mechanisms for the toxicity of PM2.5 which would rule out dust entirely. Unfortunately, none of these ideas has been confirmed and small size alone cannot be excluded as the culprit at this time. It is also possible that only an even smaller fraction is toxic, PM1 for example (which would be less likely than PM2.5 to contain much dust). At any rate the EPA does not have a reliable and inexpensive way to separate dust from smoke, and evidence is still sketchy for sizes below 2.5 so PM2.5 will be the regulated entity for the foreseeable future.

...continued on next page

EPA Standard, continued:

Several studies, including the afore-mentioned Harvard Six Cities Study, conclude that significant increases in mortality from heart and lung disease are caused specifically by particles 2.5 microns in diameter or smaller. Increased mortality is approximately 1.5% per each 10 micrograms per cubic meter increase in PM2.5 level. No threshold exists at least down to 25 micrograms per cubic meter. The mortality increase is only slightly higher for ages 65+ than for the population as a whole. The data for PM toxicity is unusually consistent for epidemiological studies, so the public health community has great confidence in these results.

The proposal includes a change in the way non-attainment of a PM daily standard is calculated, replacing the current 1-expected-exceedance form with a 98th percentile form averaged over 3 years. The new method is an improvement but would probably not prevent non-attainment of the daily PM10 standard caused by windblown dust in circumstances similar to the those in the early '90s.

This is a proposed federal rule under the Clean Air Act and has nothing to do with the proposed phase out of grass seed field burning. However, the proposed PM2.5 daily standard could possibly effect field burning, grass seed or any other, if it is determined to result in the Kennewick sampler exceeding the standard.

District Tree Sales

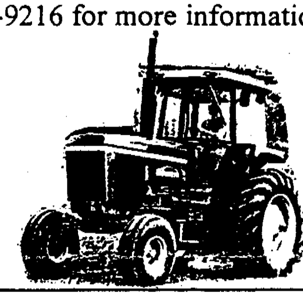
You still have time to order trees for wind breaks, shade and to add greenery to your homesite. The District is offering seedlings of three evergreens and four deciduous trees and shrubs at very reasonable rates, as we do every year. This year's species are: Austrian Pine, Blue Spruce, Ponderosa Pine, Golden Willow, Lombardy Poplar, Hybrid Cottonwood and Tatarian Honeysuckle. Seedlings range from 6 to 24 inches and most are priced $1.00 or less each.

The seedlings are purchased in bulk from major nurseries and arrive at the District in late March, just in time for spring planting. If you would like more information or an order form, contact Pat at 786-9230 or Scott at 786-9216.

Farm Equipment For Sale or Rent

For Sale: Deutz four-cylinder, turbocharged, air-cooled diesel engine. Rated at 106HP at 2500 RPM. Includes instrument panel with safety shutdowns and 20 gallon fuel tank. Contact Scott at 786-9216 for more information.

For Rent: Hesston Round Bale Processor, for straw mulching areas prone to soil erosion. Bale Processor has undergone major modifications and is now equipped with speed kit and PTO drive to accommodate all tractors and Challengers. Rental fee is $50.00 per day. The District also has a source of straw for mulching. Contact Pat at 786-9230 or Scott at 786-9216 for more information.

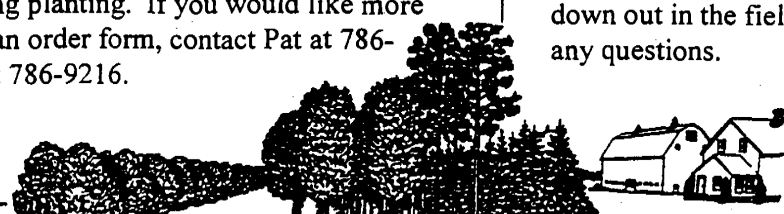


District Continuing GPS Work in North Prosser Area

Scott Manley, District Resource Technician will be traveling about the fields north of Prosser again this winter (you may have already seen him), using the GPS equipment to continue mapping agriculture in our area. (See Spring Creek article on pages 1 and 2.)

The District hopes eventually to map all of the irrigated acres in the county, at least west of Benton City, although that may take some time. For now, we are concentrating on areas near the major Yakima tributaries, particularly Spring and Snipes Creeks.

The information is and will continue to be used to help understand what effects local conditions have on these water bodies, and where limited resources can best be applied to reduce water quality impacts from agriculture activities. For more information, contact Pat or Scott at the District. Or wave Scott down out in the field -- he is always eager to answer any questions.



FARM BILL PROGRAM

by Barbara Bolick, NRCS

Conservation Reserve Program - TAKE OUT OR SIGN UP? That is the question that I have been hearing most recently. For those who are wondering HOW they will convert CRP acres back to cropland, there will be a Conservation Farming Conference held January 7-8 at Cavanaugh's in Kennewick. If you did not get a brochure on this conference from me recently, please stop in and pick one up. The PNW STEEP III Extension publication "Returning CRP Land to Crop Production--A Summary of the 1994-96 Research Trials in Washington State," was printed in November 1996 as PNW Conservation Tillage Handbook Series No. 16 for Chapter 2. It reports on 10 field research trials in low rainfall areas. Fifteen different growers cooperated with these large scale, replicated on-farm tests with farm-scale equipment owned by the growers. Please contact the Extension Office in Prosser or Kennewick, for a copy.

If you are interesting in re-enrolling the CRP, you should know by now, that you will be competing with farmers nationwide for CRP contracts. The rules have changed since most of the Benton County acreage entered the program. First, bids will be by TRACTS not farms. Second, you may have heard of EI or Erodibility Index, that must exceed "8" in order to be eligible for consideration. Unfortunately, most of the CRP acres in Benton County do not exceed 8. The good news is that Washington State NRCS has been working (along with other groups) at the national level to get the rule changed. If you are in a county designated a non-attainment area or potential non-attainment for air quality, you will not need to meet the EI of 8. We are still waiting for this change to be made official. Please stop in after the holidays, and I'll explain EI to you. I am starting a list of those wanting to re-up their CRP, so we can begin to determine "EI's." We hear the next CRP sign-up is "sometime in January."

Environmental Quality Incentive Program (EQIP) - The National Office of NRCS has not selected the Geographic Priority Areas (GPA) from those sent to them by the different states. The Yakima River Basin GPA Local Working Group is still moving forward, a meeting has been set for December 17th. The intention of that meeting is to develop a ranking system, a process too determine which EQIP applicants will qualify for funds. Please contact Rick, Barbara, or Glenn if you are interested in developing a 5 year Long Term Contract (LTC) to address the conservation needs on your farm. Even though we don't have all the rules and we don't know if we have been funded, we do know that developing an LTC takes more time than doing the old ACP "one field, one project" plan. We don't want your applications to be delayed once we are funded, so we'd like to start the planning process right now. The policy will be first come, first served.

$$$$$$$$$$$$$$$$$$$$$$$$

EQIP Update, *by Pat Daly*

At the meeting on Dec. 17, several points were cleared up: We expect to hear if the Yakima Watershed GPA will be funded by late January or early February. If it is, there may be as much as two million dollars available for farm improvements in the four-county area. We feel there is a good chance of these dollars being available.

The funds will be distributed for a minimum of 5-year contracts (can go as long as 10 years), with a maximum amount of $50,000 per farm entity. A resource management plan will be done for each entity as part of the program, and awards will be based on the expected resource results as well as the cost of improvements. Priority issues are going to be improving water quality, reducing soil erosion and water conservation.

Applications for the program will be taken this spring for the 1997 fiscal year, and (assuming the valley is awarded the funds) farm contracts will be awarded by early summer. Payments to farms cannot be made until the next fiscal year (October, 1997 for this cycle), but contracts must be signed before the end of September. Construction can begin any time after the contract is signed, either this year or next.

This is not going to be a simple program, but it may provide some valuable funding for growers who have a smaller amount of acreage on which improvements, particularly switching from rill to either sprinkler or drip, need to be made.

For more information, contact Pat at the District (786-9230), or Barbara, Rick or Glenn at the NRCS office (786-1923).

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MEMBERSHIP FORM - BENTON CONSERVATION ASSOCIATION

Yes, I would like to become a member of the Association and receive regular updates on local conservation issues and on-farm resources. (Individuals or businesses must reside in Benton County to be eligible for membership.)

Name____________________________________ **Phone No.**________________

Address____

Dues:
- ☐ Regular Membership: $25/year (voting membership)
- ☐ Affiliate Membership: $26.00-$50.00/year (non-voting)
- ☐ Supporting Membership: $51.00-$500.00/year (non-voting)
- ☐ Sustaining Membership: $501.00 or more/year (non-voting)

Please enclose check and mail to: ***Benton Conservation Association, 24106 N. Bunn Rd., Prosser, WA 99350***

Thank you to everyone who have become members -- we appreciate your support!

Benton Conservation District

Supervisors: Dave Roseberry, Chairman; Frank Anderson, Secretary-Treasurer; Mike O'Brien and Mike Duncan, Members; Frank Berg, Affiliate Member.
Employees: Pat Daly, District Manager; Scott Manley, Resource Technician.

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Benton Conservation District
24106 N. Bunn Rd.
Prosser, WA 99350

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Conservation Review

A quarterly publication of the Benton Conservation District and Conservation Association

October, 1996

Ecology to Set Limits on Sediment Pollution in Yakima River

The Washington Department of Ecology will soon be setting enforceable limits on the amount of suspended sediment that can be discharged from irrigation return drains.

When waters of the state fail to meet state standards, the federal Clean Water Act requires states take action to bring those waters back into compliance. The lower Yakima River fails to meet state water quality standards for turbidity, DDT and other pesticides, fecal coliforms and temperature.

Ecology, in cooperation with the US Environmental Protection Agency and Yakama Indian Nation, is designing a strategy so the Yakima River will meet state water quality standards.

Decades of monitoring by numerous state and federal agencies has shown that the greatest source of the pollution in the lower Yakima is from irrigated agriculture return drains. Recent monitoring has shown conclusively that many of the pollutants are directly linked to suspended sediment loads. Thus, Ecology will focus its pollution control strategies on limiting suspended sediment loads in the irrigation return drains.

The suspended sediment limits to be set by Ecology are designed to bring the lower Yakima River back to within state water quality standards. The limits on suspended sediments will reduce not only sediment pollution, but also pollution by DDT and other pesticides, turbidity and nutrients and may help reduce summer water temperatures.

According to Ray Hennekey, Ecology's Yakima River project coordinator, greater than ninety percent reductions in sediment loads will be required in certain irrigation return drains to meet water quality targets. Some growers will have to make drastic changes in their irrigation practices, water management and crop management practices in order for the drains to meet those targets. Hennekey is quick to add however, that local input will be a vital part in designing the cleanup strategies that will ultimately be used to meet the water quality targets.

"My sincere hope is that citizens in the Yakima watershed will help us design and implement cleanup strategies and schedules that are practical, efficient and achievable for them. There is no one answer to the Yakima's complex pollution problems," Hennekey said. "We will consider all ideas."

State, local and federal agencies are ready to help growers make decisions about cleanup strategies and take action to reduce pollutant discharges to meet Ecology's limits. WSU Cooperative Extension, local Conservation Districts, NRCS, and others are targeting funding, technical expertise, and on-the-ground assistance on the Yakima River's pollution problems.

For more information on the lower Yakima River Project, contact Ray Hennekey at the Department of Ecology in Yakima, (509) 454-7832. For assistance with improving irrigation management and reducing sediment erosion, contact Pat at the Benton Conservation District office (786-9230).

1996 Ag Tour

About 20 people participated in the first Annual Irrigated Agriculture Tour put on by the District in early September. Stops were made at C&M Orchards, a drip installation in one of Olsen Brother's hop fields, the Roza Irrigation District's Re-regulating reservoir and for a PAM demonstration at WSU-Prosser.

The purpose of the tour was to give non-farmers an idea of the complexities that go into growing crops using irrigation in the Lower Yakima Valley.

Comments about the tour from the group noted that they learned a great deal and were eager to learn more, particularly about hop processing!

District Programs and Activities

Association Files for Non-Profit Status

The Benton Conservation Association was formed this summer to support the activities of the Conservation District. It has received non-profit status from the state of Washington, and recently filed for non-profit status from the IRS. As a non-profit, the Association will seek grants to continue programs established by the District. The major significant difference between the District and the Association is an expanded number of funding sources available to the non-profit Association.

The Boards of the District and the Association overlap – there are three members on the District Board who are also on the Association Board. They are David Roseberry, Frank Anderson and Mike O'Brien. Keith Oliver, representing Olsen Brothers, and Virginia Prest, a researcher at WSU-Prosser, are also on the Association Board.

The first project the Association is developing is financial support to be used for on-farm conservation measures. The Association hopes to be able to work directly with growers to implement changes to irrigation systems that work to reduce soil loss and improve water conservation and water quality. Other programs being developed are additional water quality monitoring; and workshop, training and education activities.

Individual, business and organization memberships are available for the Association. Membership benefits include the newsletter, notices of Association activities, and your partnership with a local organization working to improve resources for on farm conservation.

A membership form is included – please join to support local conservation activities.

New Groundwater Project Underway in North Prosser

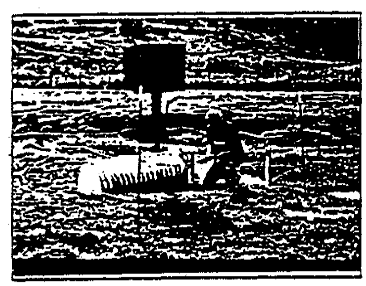
The District has begun a project with the US Geological Survey to sample up to 30 wells in the North Prosser area. The purposes of the project are to get an idea of current ground water quality, to help the District determine agriculture's role in local ground water issues, and to develop further programs to improve water quality.

Tests will be made of depth, temperature, pH, and conductivity, and a sample will be taken to test nitrates. The information will be reviewed on an area-wide basis, not well-by-well. Again, the data will be reviewed to provide an indication of current conditions and trends in local groundwater.

New Stream Gage Installed as Part of USGS Work

If you drive along McCreadie between Rothrock and Pioneer Roads, looking south when you cross Spring Creek, you will notice a strange new pipe standing next to the creek. The site is a stream gage installed by the USGS and the District to monitor stream levels.

Locals are aware of how stream levels can change rapidly depending on irrigation schedules. The gage will help the District determine those changes more closely, and corresponding water samples will allow calculation of sediment discharge. This information is important for helping the District and Association secure additional funding for on-farm improvements, and to demonstrate impacts improvements can make.



District Compiling Ag Data With GPS/GIS

The District is mapping fields in the North Prosser area as part of its program to understand local watersheds and develop information sources for use in seeking funding. Mapping begins by driving around a field with WSU's GPS (Global Positioning System) survey equipment, recording the field perimeter. Data is noted on crop type, irrigation method, cover crops, and field slope. The information is transferred to the District's computer, into ARC/Info (a Geographic Information System mapping software) and compiled. Maps can be produced of a given area, the concentration of various crops and other spatial information, useful for describing this unique area.

Agencies / Organizations - Farm Assistance

BCD, FSA, NRCS... What's the Difference??

With old and new names, two of the three agencies in the same office, similar programs... its not surprising the differences between these agencies is not always clear. Here's a summary that may help:

BCD (Benton Conservation District) is a sub-division of the state. It is run by a local board of directors, made up of people either farming or involved in agriculture who volunteer their time. The purpose of the District is to work directly with farmers to improve their on-farm conservation practices. Funding for the District comes from state, federal and local grants. Pat Daly is District Manager, Scott Manley is a Resource Technician; their offices are located at WSU-Prosser.

FSA (Farm Service Agency) (formerly the ASCS), is an agency of the US Department of Agriculture which administers farm commodity and conservation cost-share programs for farms, and makes farm ownership and operating loans. The local office is administered by John Harris and Bonnie Anderson at 620 8th St., Prosser.

NRCS (Natural Resources Conservation Service), is the former Soil Conservation Service. The local office is at 618 8th St. in Prosser, where Barbara Bolick is the District Conservationist. Their function is to provide free technical assistance with conservation planning, design and construction for implementing best management practices. The NRCS is also an agency of the US Department of Agriculture.

1996 Farm Bill Update

Under the Food, Agriculture, Improvement and Reform Act of 1996, funding for conservation programs will be based on Geographic Priority Areas and Natural Resource Priority Concerns. The Yakima River Basin is one of five Priority Areas selected in Washington State by the NRCS state office. Final selections are yet to be made at a national level. If the Yakima Basin is included in the final selection, funding will be allocated to resource needs identified during the state selection process, which included improving water quality and quantity.

Local NRCS personnel will be attending a workshop on the new Farm Bill October 15-18. For those with questions on EQIP, CRP and WRP, the NRCS hopes to be able to answer your concerns in greater detail.

NRCS Note: Public comment is being requested on proposed conservation rules and regulations dealing with wetland protection, soil erosion and conservation on private lands. A public forum will be held in Spokane on Monday, Oct. 21 at 1:00 pm. For more details, contact Barbara at 786-1923.

Yakima River Basin Water Enhancement Project

Irrigation districts, conservation districts, water purveyors and other area wide entities are eligible for receiving Federal Funds under the Yakima River Basin Water Enhancement Project. Applicants must meet the definition of 'public body' as defined in RCW 43.99E.030 to receive State funds. Reducing irrigation water diversions and installing water measuring devices are requirements for funding in the YRBWEP.

Cost share funds are available for preparing a conservation plan, determining feasibility of proposed conservation measures, implementing approved conservation measures and monitoring the conservation measures installed.

Application packages are available at the Bureau of Reclamation, PO Box 1749, Yakima, WA 98907. Questions about this program can be answered by calling Roberta Ries at 509-575-5848, ext. 265.

Assistance Available for Fencing & Stream Enhancement

The US Fish and Wildlife Service has a program to assist landowners improve riparian areas along streams with fencing and other controls. Landowners can receive up to 50% of the cost of the project by working with the USFW office to design a project that both protects streams and allows grazing.

Projects may include fence design and construction, tree and/or shrub planting and possible other stream bank stabilization.

For more information about this program, contact Pat at the District Office at 786-9230.

MEMBERSHIP FORM - BENTON CONSERVATION ASSOCIATION

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- ☐ Supporting Membership: $51.00-$500.00/year (non-voting)
- ☐ Sustaining Membership: $501.00 or more/year (non-voting)

Note: Membership in Association is not tax-deductible until the Association receives federal non-profit status – see related article.

Please enclose check and mail to: ***Benton Conservation Association, 24106 N. Bunn Rd., Prosser, WA 99350***

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INSIDE:
- Limits on Sediment to Yakima River
- Irrigated Ag Tour
- Update on District & Association Activities
- New Farm Bill Review

Benton Conservation District

Located at WSU-Prosser

Technical Assistance

The Benton Conservation District has equipment and personnel available for irrigation system evaluation, soil moisture monitoring and irrigation scheduling. The Benton Conservation District personnel have several years of experience in on-farm grower assistance.

Cost-Share Money

The Benton Conservation District has recently completed another round of cost sharing for irrigation projects that demonstrate soil erosion reduction and/or water savings and conservation. In the past year the Benton Conservation District has cost-shared on 14 projects and has applied for a Federal grant that would be provide money exclusively for on–farm irrigation project cost-sharing. The District's money can, and has been, used in conjunction with other Federal programs, such as EQIP.

EQIP Sign-up

As a working partner with NRCS and FSA, the Benton Conservation District can receive applications and assist growers with the EQIP sign-up process. Although the 1998 EQIP sign-up ends January 30, applications for 1999 EQIP can be accepted any time throughout the year.

Benton Conservation District

Pat Daly, District Manager **786-9230**

Scott Manley, Resource Technician **786-9216** *cellular* **786-8707**

24106 N. Bunn Rd. Prosser, WA. 99350

APPENDIX 7

ROZA - SUNNYSIDE BOARD OF JONT CONTROL

Mission Statement

"Implement a program to enhance water supplies by supporting storage development, improving water quality, and increasing management efficiency in order to achieve within ten years: a) system improvements such as canal automation, regulating reservoirs, and closed conduit delivery systems and additional storage which will protect existing rights while providing higher quality and more reliable irrigation service to Sunnyside Division landowners; b) water savings sufficient to support the goal of furnishing at a minimum, 75% of entitlement to Roza Irrigation District landowners in all years; and c) compliance with the TMDL process for return flows discharging from lands under Roza-Sunnyside Board of Joint Control jurisdiction."

6. Water Quality Monitoring

The RSBOJC will continue its water quality monitoring program with the following objectives:

- Record the annual and seasonal TSS loads and other water quality characteristics of water diverted from the Yakima River into the RSBOJC.
- Record the variation in water quality characteristics of water throughout the conveyance and delivery system.
- Record TSS loads and other water quality characteristics of water discharged into RSBOJC project waterways.
- Determine the benefits of implementation of on-farm Best Management Practices.
- Provide quality control for individual water user water quality sampling programs as requested.
- Coordinate with other agencies in the collection and analysis of water quality data.

7. Sedimentation Ponds and Wetland Areas

The RSBOJC will pursue the planning, construction, and operation of sedimentation ponds and wetland areas in RSBOJC project facilities to improve the quality of water within and exiting the RSBOJC.

Mission Statement

The RSBOJC's mission is to implement a program to enhance water supplies by supporting storage development, improving water quality, and increasing management efficiency. The RSBOJC's goal is to achieve the following within ten years:

√ system improvements such as canal automation, regulating reservoirs, and closed conduit delivery systems and additional storage which will protect existing rights while providing higher quality and more reliable irrigation service to Sunnyside Division landowners

√ water savings sufficient to support the goal of furnishing at a minimum, 75% of entitlement to Roza Irrigation District landowners in all years

√ compliance with the total maximum daily load process for return flows discharging from lands under Roza-Sunnyside Board of Joint Control jurisdiction

A muddy plume of irrigation return water enters the Yakima River at Granger Drain.

Roza-Sunnyside Board of Joint Control

WATER QUALITY POLICY

Adopted January 28, 1998

"We are not inheriting from our ancestors; we are borrowing from our children."

Background

Since the formation of the Roza-Sunnyside Board of Joint Control in August 1996, the directors have been discussing ways to improve water quality and increase water conservation. The recently adopted *Water Quality Policy* is the culmination of many months of hard work and discussion.

The RSBOJC is taking a proactive approach to improving water quality in the lower Yakima River. As custodians of the family farm, we must help preserve and protect our most important natural resource—WATER. If we fail, future generations will suffer because of our lack of commitment to the environment.

We must work together to improve water quality.

Water Quality Policy

The Roza-Sunnyside Board of Joint Control Water Quality Policy began in 1998. Below is a summary of the policy:

1. Permit Required for Discharges to Project Waterways

All discharges into project waterways (canals, laterals, drains, and wasteways operated and maintained by a RSBOJC member and for which an easement or right of way exists) shall require a discharge permit from the appropriate RSBOJC member. The discharge permit will be issued to a discharger and provide among other things, for:

- Operational piped inlets so no erosion occurs to the project waterway.
- Water quality parameters for the discharged water.
- Termination of permit upon noncompliance of its terms and conditions.

2. Irrigation Runoff

All irrigation runoff discharged to project waterways from lands within RSBOJC boundaries must comply with water quality parameters established by the RSBOJC and referenced in the discharge permits.

- The RSBOJC will monitor discharge into project waterways and record turbidity levels above 25 NTU (current TMDL goal of waters discharging to the Yakima River). Such observation will be considered a water quality violation.
- In the event RSBOJC personnel observe a water quality violation, the discharger will be notified of the noncompliance by mail and requested to submit a Compliance Plan prior to the 1999 irrigation season. The plans will include proposed practices or projects to bring the runoff water into compliance and a time schedule for implementation.
- In 1999, landowners must implement their respective Compliance Plans.
- If the landowner fails to perform according to the Compliance Plan, the RSBOJC, may, upon observation of a subsequent water quality violation, turn off the irrigation water to the land until the Compliance Plan is implemented.

3. Buffer Zones

Buffer zones are required on both sides of RSBOJC project waterways.

- Fencing: Livestock grazing is prohibited on project waterways. The RSBOJC will put the initial emphasis on the Joint Drain system. Priority for fencing will be on the basis of water quality protection and operation and maintenance of project waterways.
- No-till zones: Installation of farm drainage ditches and drain inlets as needed to provide a no-till zone typically 20 feet wide from the top of the bank to the edge of the farm operation. Actual width requirements may vary depending on the size of the waterway.

4. Runoff Into Borrow Ditches

The RSBOJC will, with Yakima and Benton counties, develop strategies to regulate runoff into borrow ditches.

5. Water User Awareness Program

In cooperation with appropriate Federal, State, County, and River Basin entities, the RSBOJC will formulate and implement a water user awareness program related to effective on-farm water management.

ROZA-SUNNYSIDE BOARD OF JOINT CONTROL
POLICIES AND PROGRAMS TO IMPROVE WATER QUALITY AND THE USE OF WATER

Adopted January 28, 1998

1. Permit Required for Discharges to Project Waterways

All discharges into project waterways (canals, laterals, drains, and wasteways operated and maintained by a BOJC member and for which an easement or right of way exists) shall require a discharge permit from the appropriate BOJC member. The discharge permit will be issued to a discharger and provide among other things, for:

A. Discharge into the project waterway through a piped inlet of specified size and type to be installed by the discharger or the appropriate BOJC member.
B. Maintenance of the piped inlet by the discharger so that it remains operational in a manner that no erosion occurs to the project waterway.
C. Timely (Immediate) corrective action to be taken by the discharger upon verbal or written notification from the appropriate BOJC member that the piped inlet is not operational and/or erosion is occurring to the project waterway.
D. Reimbursement by the discharger of any costs that may be incurred by the appropriate BOJC member in the installation of or corrective action to the piped inlet.
E. Periodic inspection of the piped inlet by the permit holder.
F. Water quality parameters for the discharged water.
G. The termination of the discharge permit and the right to discharge into the waterways upon noncompliance of its terms and conditions.

2. Irrigation Runoff

A. All irrigation runoff discharged to project waterways from lands within BOJC boundaries must comply with water quality parameters established by the BOJC and referenced in the discharge permits. If the irrigation runoff is not in compliance with the water quality parameters, the discharger, upon written notification from the appropriate BOJC member, will implement appropriate corrective measures so that timely compliance is achieved. Beginning with the 1998 irrigation season, the BOJC will monitor discharge into project waterways and record turbidity levels above 25 NTU (current TMDL goal of waters discharging to the Yakima River). Such observation will be considered a water quality violation.
B. In the event BOJC personnel observe a water quality violation, the discharger will be notified of the noncompliance by mail and requested to agree to Short and Long Term Compliance Plan. The landowner, after notification, must sign and submit a Compliance Plan prior to the 1999 irrigation season. The plan will include proposed practices or projects to bring the runoff water into compliance and a time schedule for implementation. The plan will be tied to a drain inlet or series of inlets and will address proposed practices on a field by field basis. The Compliance Plan will be signed by the landowner and approved by the BOJC.
C. If the landowner refuses to enter into a Compliance Plan, the BOJC may, upon observation of subsequent water quality violation, turn off the irrigation water to the land until the Compliance Plan is executed.
D. If the landowner fails to perform according to the Compliance Plans the BOJC may, upon observation of a subsequent water quality violation, turn off the irrigation water to the land until the Compliance Plan is implemented.

3. Buffer Zones for BOJC Project Waterways

Buffer zones consisting of project operation and maintenance roads or no till-no grazing areas are required on both sides of BOJC project waterways. Where project operation and maintenance roads do not exist, the establishment and maintenance of appropriate buffer zones will be determined by the appropriate BOJC member.

A. FENCING: A policy is adopted prohibiting livestock grazing on project waterways. The Board of Joint Control will put the initial emphasis on the Joint Drain system. Where livestock grazing currently exists on the drains, the BOJC will construct and/or move existing fences to provide a buffer zone on each side of the waterway. Typical buffer strips will be 20 feet from the fence to the edge of the top of the bank. Actual width requirements may vary depending on the size of the waterway. The completed fence will be the property of the landowner. Priority for fencing will be on the basis of water quality protection and operation and maintenance of project waterways.

B. NO-TILL ZONES: The Board of Joint Control adopts a policy creating a no-till zone on both sides of an open project waterway. Implementation of this requirement will be prioritized based on protection of a project waterway. The landowner will be required to install a farm drainage ditch and drain inlets as needed to provide a no-till zone typically 20 feet wide from the top of the bank to the edge of the farm operation. Actual width requirements may vary depending on the size of the waterway.

C. Enforcement of buffer zones will be promoted by the enforcement of water quality standards, exercising the right to existing rights of way and easements, education, and financial assistance.

4. Runoff into County Borrow Ditches

The BOJC will, with Yakima and Benton Counties, develop strategies to regulate runoff into borrow ditches.

5. Water User Awareness Program

The BOJC, in cooperation with appropriate Federal, State, County, and River Basin entities, will formulate and implement a water user awareness program related to effective on-farm water management.

6. Water Quality Monitoring

The BOJC will continue its water quality monitoring program with the following objectives:

A. Identify the annual and seasonal NTU values and TSS loads and other water quality characteristics of water diverted from the Yakima River into the BOJC.

B. Identify the variation in water quality characteristics of water throughout the conveyance and delivery system.

C. Identify TSS loads and other water quality characteristics of water discharged into BOJC project waterways.

D. Determine the effectiveness of implementation of on-farm Best Management Practices.

E. Provide quality control for individual water user water quality sampling programs as requested.

F. Coordinate with other agencies in the collection and analysis of water quality data.

7. Sedimentation Ponds and Wetland Areas

The BOJC will pursue the planning, construction, and operation of sedimentation ponds and wetland areas into BOJC project facilities to improve the quality of water within and exiting the BOJC.

Roza~Sunnyside Board of Joint Control
P.O. Box 810 ■ Sunnyside, WA 98944

MEETING ANNOUNCEMENT

The Roza-Sunnyside Board of Joint Control (BOJC) invites you to come learn more about the challenges facing today's irrigators and learn ways to help improve water quality. The BOJC is taking a proactive approach to improving water quality in the lower Yakima River, and we must work together to make an impact.

WHO: A representative from the BOJC will provide an overview of the Board's recently adopted Water Quality Policies.

Also, Bob Stevens with Washington State University's Irrigated Agriculture Research and Extension Center will present on-farm best management practices.

WHAT: Topics include Water Quality Issues, BOJC's Water Quality Policies, District Programs and Projects, and Landowner Solutions (including funding sources).

WHEN: **January 29 at 9:30 a.m. or 1:30 p.m.**
February 4 at 9:30 a.m. or 1:30 p.m.
February 11 at 9:30 a.m. or 1:30 p.m.

WHERE: Sunnyside Valley Irrigation District office, 120 South 11th St., Sunnyside

LANDOWNER MEETING AGENDA

I. Overview (Board Member / Staff)

- A. The Problem
  1. The Endangered Species Act
  2. The Clean Water Act
- B. The Solution (Staff)
  1. Projects
     - a. Settling Basins
     - b. Improved Waterway Stabilization
  2. Programs
     - a. Water Quality Monitoring
     - b. Education / Communications
  3. Policies
     - a. Discharges to Project Waterways
     - b. Buffer Zones
  4. Coordination with Landowners
     - a. Education
     - b. Incentives
     - c. Compliance with Policies

II. Implications to Landowner (Board Member / Landowner)

- A. The Risks to Landowners
- B. The Approach by the BOJC

2nd Draft

ROZA - SUNNYSIDE BOARD OF JOINT CONTROL

COMPLIANCE PLAN

Name: ____
First Middle Last

Address: ____
Street / PO Box City State Zip

Phone: ____
Home Business Cellular

Location: ________________ Point(s) of Noncompliance: ________________
Parcel Number Canal/Lateral/Drain

Problem Description

____
____
____
____

Proposed Solution

Management Practice or Project	Estimated Cost	Completion Date

Description of Available Cost Sharing

____
____
____

Submitted

____
Signature of Landowner

____
Date

Approved

____
Chairman
Roza-Sunnyside Board of Joint Control

____
Date

BULK RATE
Permit No. 37
Sunnyside, WA 98944

THE WATERFRONT

December 1997 Volume 3, Number 4

A PUBLICATION OF SUNNYSIDE VALLEY IRRIGATION DISTRICT
120 South 11th Street ♦ P.O. Box 239 ♦ Sunnyside, WA 98944

Board of Joint Control Sets Water Quality Policy

For the past several months, the Roza-Sunnyside Board of Joint Control (BOJC) has been busy discussing how to improve water quality in the lower Yakima River. Working with state and federal agencies, the BOJC looked at water quality problems associated with irrigation and determined corrective measures to help improve water quality. Below is the recently adopted Roza-Sunnyside Board of Joint Control Water Quality Policy which will take effect in 1998.

1. DISCHARGES TO PROJECT WATERWAYS OF THE BOJC

All discharges into project waterways (canals, laterals, drains, and wasteways operated and maintained by a BOJC member and for which an easement or right of way exists) shall require a discharge permit from the appropriate BOJC member. The discharge permit will provide among other things, for:

- Maintenance of the piped inlet by the discharger so that it remains operational in a manner that no erosion occurs to the project waterway.
- Establishment of water quality parameters for the discharged water.
- The termination of the discharge permit and the right to discharge into the waterways upon non-compliance of its terms and conditions.

2. IRRIGATION RUNOFF

All irrigation runoff from lands within BOJC boundaries must comply with acceptable water quality parameters established by the BOJC.

- Beginning with the 1998 irrigation season, the BOJC will monitor discharge into project waterways and record turbidity levels above 25 NTU (current TMDL goal of waters discharging to the Yakima River). Such observation will be considered a water quality violation.
- In the event BOJC personnel observe a water quality violation, the landowner will be notified of the noncompliance by mail and requested to agree to a Short and Long Term Compliance Plan. The landowner, after notification, must sign and submit Compliance Plans prior to the 1999 irrigation season. These plans will include proposed practices or projects to bring the runoff water into compliance and a time schedule for implementation. These plans will be tied to a drain inlet or series of inlets and will address proposed practices on a field by field basis. The Compliance Plans will be signed by the landowner and approved by the BOJC.
- In 1999, landowners will be required to begin implementing their respective Compliance Plans.

3. BUFFER ZONES FOR BOJC WATERWAYS

Buffer zones consisting of project operation and maintenance roads or no till-no grazing areas will be required on both sides of BOJC project waterways.

- Fencing: Livestock grazing will be eliminated on project waterways. The BOJC will put the initial emphasis on the Joint Drain system. Priority for fencing will be on the basis of water quality protection and operation and maintenance of project waterways.
- No-till zones: The landowner will be required to install a farm drainage ditch and drain inlets as needed to provide a no-till zone typically 20 feet wide from the top of the bank to the edge of the farm operation. Actual width requirements may vary depending on the size of the waterway.
- Enforcement of buffer zones will be promoted by the enforcement of water quality standards, exercising the right to existing rights of way and easements, education, and financial assistance.

4. RUNOFF INTO COUNTY BORROW DITCHES

The BOJC will, with Yakima and Benton Counties, develop strategies to regulate runoff into borrow ditches.

5. WATER USER AWARENESS PROGRAM

The BOJC, in cooperation with appropriate Federal, State, County, and River Basin entities, will formulate and implement a water user awareness program related to effective on-farm water management. *Look for announcement of workshops to be held in early 1998.*

(Policy continued on back page...)

Inside this issue:

Director Election Results

Two terms of office of the Sunnyside Valley Irrigation District Board of Directors expire in 1997—Director Division #1 (Granger) and Director Division #5 (Mabton).

Pursuant to RCW 87.03.075, if only one candidate in a division qualifies for election, that person is declared elected to the division for which he or she was nominated and qualified.

Bob Golob and Doug Simpson were declared elected to serve Director Divisions #1 and #5, respectively. Both submitted nominating petitions signed by at least ten qualified electors in the division for which they ran. Both ran unopposed. Each of the directors is elected for a three-year term. The new terms begin January 1, 1998.

Bob Golob

The Board of Directors of SVID, as with any elected governing body, sets operational policy for the district. Board members receive no salary, but are compensated for attending meetings or when otherwise engaged in District business, and are reimbursed for necessary expenses such as travel, food and lodging while on District business.

Bob Golob has served on the SVID Board of Directors since 1986. Doug Simpson has been on the board since 1978 and has served as its chairman since 1980.


Doug Simpson

The time commitment for serving as a director varies with the issues confronting SVID. All of the directors are landowners with busy schedules and lots of work to do for their own farm operations. Over the past year, since the formation of the Board of Joint Control, serving on the SVID board has meant putting in a lot of extra hours.

Assessments Set for 1998 Irrigation Season

The Sunnyside Valley Irrigation District Board of Directors has set 1998 assessments for beneficial use lands at $54.50* per acre. This is an increase of $7.25 per acre. Representing the biggest increase in assessments (15%) in several years, these costs are associated primarily with water quality planning and implementation.

A little background on irrigation assessments:

An assessment is the fee paid to an irrigation district to maintain the irrigation system and provide the opportunity to obtain irrigation water. Irrigation districts are not-for-profit entities which collect funds to cover the cost of operation and maintenance and provide necessary reserves for future projects and emergencies.

The annual assessments are set by projecting the cost of operation, maintenance and administration, together with capital projects and necessary reserves for the following year minus revenues from approved grants. The assessment for each parcel of land is then computed based on acreage.

The Board of Directors has felt compelled to respond in a proactive manner to improving water quality of the return flows discharging into the Yakima River. This proactive position is driven by the threat of the Endangered Species Act listings and the resultant recovery programs which could reduce diversions for irrigation purposes. Secondly, under the Clean Water Act, the Washington State Department of Ecology has set total maximum daily loading (TMDL) for the lower Yakima River with goals to remove 90% of the sediment reaching the river within five years. This would include all drains and irrigation facilities that discharge to the river.

Following is a breakdown of the cost increases:

A total of five additional employees are being hired, increasing costs by $3.25 per acre. Three employees will be working on drainage and water quality projects. One employee will be added for building and pump maintenance responsibilities and another employee will be added to work in the shop for metal fabrication – related primarily to health and safety issues, i.e., walk bridges, screens, catch cables, etc. Funding of water quality programs and projects including increased water quality monitoring, construction of settling basins, and habitat negotiations and restorations are expected to increase assessments by approximately $2 per acre.

Materials and supplies are expected to increase in costs by $1.25 an acre – driven primarily by the cost of chemicals, fuels, metals, rock, and gravel. The Bureau of Reclamation has accelerated the storage operation and maintenance program which will add an additional $.75 per acre. The total of these increases is $7.25 per acre.

For more information, please contact the Sunnyside Valley Irrigation District office at (509) 837-6980.

**Lands with local improvement district indebtedness or assessments may experience different percentage increases or decreases on the total assessment.*

Q & A . . . Assessment questions answered here

With all the bills and invoices you get in the mail, it may get a little confusing deciphering all the information and determining what you are actually paying for. Before Christmas each year, Sunnyside Valley Irrigation District (SVID) mails the annual assessment or billing statement. Landowners have a variety of questions about the billing process. Below are some frequently asked questions along with SVID's answers to those questions.

Q. When must I pay?

A. Assessments may be paid any time after they are received, though they become due on February 15 and must be paid before water is delivered. If an assessment is not paid by October 31, it becomes delinquent.

Q. Why bill in December?

A. SVID sends the statements before Christmas for the people who want their statements before December 31 for tax purposes.

Q. Where does the money go?

A. SVID is a not-for-profit entity and the fifth largest irrigation district in the state of Washington in terms of irrigable acreage.

The money raised through assessments goes toward providing services—the delivery of irrigation water to more than 5,500 landowners. This includes maintenance, repair, and rehabilitation of our water distribution system. SVID's water distribution system is complex and more than 100 years old. It includes 60 miles of main canal, 44 miles of major subsystem canals, and 296 miles of laterals and branch laterals. The district also oversees the maintenance of nearly 90 miles of joint drains and maintains 132 miles of drainage improvement district systems.

Assessments are set based on the budget, an estimate of the amount of money it will take to operate all of the above from January 1 through December 31 each year. SVID's 1997 budget was $4.9 million.

Q. But I don't get water! Why do I have to pay?

A. Some people receive an assessment who do not utilize irrigation water and are confused as to why they must still pay the bill. There is an explanation: When an irrigation district such as SVID is organized, the idea is to provide irrigation water delivery to the entire area within the geographical boundary of the district. In order to pay for that designation, a fee is assessed on all lands within that area which carry a water right.

In other words, everyone in the area with a water right makes the irrigation service possible by paying for the right to receive water—whether they use the water or not.

Just like everyone in a given city might see their taxes used to pay for a certain stretch of sidewalk—they still get to pay, whether they will use the sidewalk or not, and the community benefits by having the sidewalk there—so the members who live there are actually paying for the right to use the sidewalk, whether they choose to use it or not.

According to Washington state law, irrigation districts can establish an annual assessment on all lands which carry a water right, whether or not the water is used.

Q. Why is my access to water limited?

A. Problems develop when acreage which was irrigated under the original system is platted into home sites. When a large piece of land is divided into smaller segments this may result in difficult or no access to the water delivery—but still having to pay a piece of the cost of that water right because the water right is still an obligation on that land. In this case, the water right isn't lost, it is just divided into smaller pieces.

SVID is responsible to deliver water to the point originally designated, and the landowner must take whatever steps are necessary to deliver water to his acreage—piping, pumping, or whatever. This puts the responsibility on the developers and landowners to develop their distribution system. Since 1985, state law permits irrigation districts the authority to require the construction of an irrigation distribution system as part of subdivision requirements.

Q. What's on the billing statement?

A. The assessment includes your parcel number, levy rate assessed, number of acres assessed, and amount due. Statements also tell you the beat, lateral, delivery, and number of acres on each delivery.

Q. The number of acres on my SVID bill is different than what the county shows, why is that?

A. Irrigation district acres may differ with the county acres because they are water right acres, not real estate acres.

Q. Questions?

A. Call 837-6980 or stop by the office during regular business hours to inquire about your assessment.

OFFICE CLOSURES FOR 1998

New Year's Day	Thursday, January 1, 1998
Presidents Day	Monday, February 16, 1998
Memorial Day	Monday, May 25, 1998
Independence Day	Friday, July 3, 1998
Labor Day	Monday, September 7, 1998
Veterans Day	Wednesday, November 11, 1998
Thanksgiving Day	Thursday, November 26, 1998 and Friday, November 27, 1998
Christmas Eve Afternoon	Thursday, December 24, 1998
Christmas Day	Friday, December 25, 1998

DID #3 Merger Approved

The second largest drainage improvement district (DID) in Yakima County, DID #3, with almost 8,000 acres, held an election on September 16, 1997, to merge with Sunnyside Valley Irrigation District. The vote was an emphatic "YES." Election results were:

613 – YES   184 – NO

The total drainage acreage now merged totals over 35,000 acres since 1990.

Drainage Improvement Districts were formed in the early 1900s with the building of drains and establishment of boundaries for both ground and surface water based on topography.

About five years ago, SVID offered the DIDs an opportunity provided by Washington State law allowing DIDs to merge with an irrigation district. There were about 18 DIDs and, to date, 11 of these have merged with SVID. These 11 represent about 75% of the total acres in Yakima County within DID boundaries.

Landowners benefit from the merger, receiving better service for less money. Before the merger the landowner would pay through county taxes and after the merger the costs of drainage are spread over the 75,000 acres within SVID. Landowners within merged DIDs have saved between $2-5 per acre on their county taxes.

There are proposals for two more mergers in the early stages. If these are completed, less than 6,000 acres will remain in DIDs.

The Sunnyside Valley Irrigation District publishes the **WATERFRONT** quarterly for landowners. All articles, letters and other items submitted to Sunnyside Valley Irrigation District (SVID) for use in SVID's landowner newsletter become the property of SVID which is authorized to use any item submitted, without payment or compensation to the person submitting the item, in any newsletter or other publication of SVID. SVID reserves the right to edit all items submitted. Douglas Simpson, Chairman. Robert Golob, Dave Michels, John Newhouse, Douglas Vining, Directors. Officers: James W. Trull, Secretary-Manager-Treasurer; Joseph Buchanan, Assistant Manager; Patricia Bailey, Assistant Secretary-Treasurer. Address comments to: Cyndi King, Editor, P.O. Box 239, Sunnyside, WA 98944.

Joint Project with Sunnyside Airport

Sunnyside Valley Irrigation District (SVID) and Roza Irrigation District are working with the Port of Sunnyside to install 1400 feet of drain pipe at the east end of the Sunnyside Airport runway. For the project, SVID and Roza will be contributing approximately $40,000 in labor and equipment. In addition to SVID and Roza's contribution, the Port of Sunnyside received a $82,000 grant from the state Department of Transportation and the City of Sunnyside is contributing all labor related to runway and lighting changes. This project will aid in the improvement of the safety level at the airport as well as help make the airport more attractive for development.

The partners in this project consist of the Port of Sunnyside, SVID, Roza, the Department of Transportation, and the City of Sunnyside. The irrigation districts are playing a major role in this project by donating the total project engineering as well as labor and equipment on sixty percent of the project.

Airplanes landing and taking off from the airport can experience problems due to a down draft caused by cold air created over the water in the drain. Piping of the waterway will eliminate this problem.

As partners in this project, SVID and Roza are assisting the efforts to increase industrial growth and continued economic stability for Sunnyside.

Policy continued from front page...

6. WATER QUALITY MONITORING

The BOJC will continue its water quality monitoring program with the following objectives:

- Identify the annual and seasonal TSS loads and other water quality characteristics of water diverted from the Yakima River into the BOJC.
- Identify the variation in water quality characteristics of water throughout the conveyance and delivery system.
- Identify TSS loads and other water quality characteristics of water discharged into BOJC project waterways.
- Determine the effectiveness of implementation of on-farm Best Management Practices.
- Provide quality control for individual water user water quality sampling programs as requested.
- Coordinate with other agencies in the collection and analysis of water quality data.

7. SEDIMENTATION PONDS AND WETLAND AREAS

The BOJC will pursue the planning, construction, and operation of sedimentation ponds and wetland areas into BOJC project facilities to improve the quality of water within and exiting the BOJC.

The BOJC is taking a proactive approach to improving water quality in the lower Yakima River. We must work together to improve water quality and to maintain the status quo with the threats of Endangered Species Act listings and stricter water quality standards looming.

THE WATERFRONT

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September 1997 Volume 3, Number 3

A PUBLICATION OF SUNNYSIDE VALLEY IRRIGATION DISTRICT
120 South 11th Street ♦ P.O. Box 239 ♦ Sunnyside, WA 98944

Report Finds Yakima River Water Unacceptable

A report on pollution in the lower Yakima River has been released by the Washington State Department of Ecology, signaling major changes in water management for many farmers in the Yakima River basin. The basic finding of the report is that the lower Yakima River fails to meet state water quality standards. As a result, Section 303(d) of the Federal Clean Water Act requires the state to list this section of the river as an impaired water body and perform a Total Daily Maximum Load (TMDL) analysis with the goal of bringing the river into compliance with water quality standards.

> *"The most obvious sign of pollution in the lower Yakima is the muddy water entering the river at the mouths of irrigation return drains and tributaries."*
> —Chris Coffin, Department of Ecology

The report identifies sediment and the associated pesticide DDT as the river's biggest pollution problems. It details the amount and sources of sediment and DDT released to the river during the irrigation season, and sets limits and a schedule for reducing those pollutants. The goal is to restore the quality of the lower Yakima River water so that it meets state water quality standards.

"The most obvious sign of pollution in the lower Yakima is the muddy water entering the river at the mouths of irrigation return drains and tributaries," said Chris Coffin, Yakima River water quality project coordinator for the Washington State Department of Ecology.

"Our sampling indicates tens of thousands of tons of top soil are eroded from valley farms during the irrigation season. The soil is carried down the drains and ends up in the Yakima River. That's bad for agriculture and it's bad for the fishery that we're trying to restore in the river," Coffin said.

The new report is called *A Suspended Sediment and DDT Total Maximum Daily Load Evaluation Report for the Yakima River*. "Total Maximum Daily Loads" are estimates of the amount of specific pollutants that a body of water can safely take in without threatening the beneficial uses of the water such as stock water, irrigation, fishing, swimming and aesthetic enjoyment.

The report states that most of the sediment is eroded from farmland by poor irrigation management and is carried back to the river through the irrigation return drains. One of the recommendations from the report is for growers to convert to sprinkler and drip irrigation where appropriate to eliminate tail water runoff and the resulting topsoil erosion. The Department of Ecology believes the control of suspended sediment generation and transport during the irrigation season will result in far-reaching water quality and fish habitat improvements in the Yakima River basin.

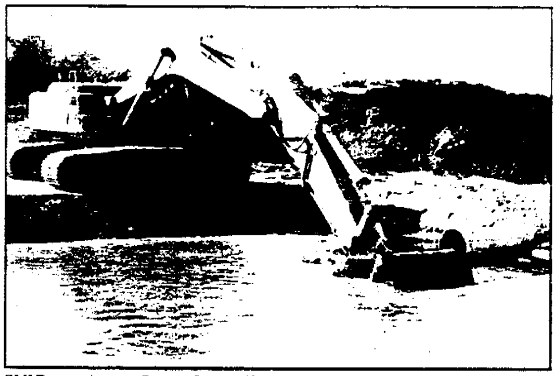
Jim Trull, district manager of the Sunnyside Valley Irrigation District (SVID) said water quality is a priority for the recently created Board of Joint Control involving SVID and the neighboring Roza Irrigation District. "Our board believes it is better to move cooperatively to solve the problem than wait until there is rigorous enforcement. It is in our best interests to be good stewards of the water resources," Trull said.

SVID, working through the Roza-Sunnyside Board of Joint Control, is working on the water quality problem. The board has installed two sedimentation basins near drains to allow the sediment to settle out of the water before the water returns to the Yakima River. In addition to the settling basins, the board is monitoring water samples using an on-site water quality specialist to pinpoint the sources of pollution.

For a copy of the executive summary of the report or a fact sheet on the Total Maximum Daily Load process on the Yakima River, contact Department of Ecology's Chris Coffin at (509) 454-7860.

Inside this issue:

Sedimentation Basins A Success



SVID employee Dave Gosnell removes sediment from Joint Drain 27.2

The sedimentation basins constructed in June as part of a Roza-Sunnyside Board of Joint Control (BOJC) project have been very useful to plan future actions by BOJC. To date, over 4,000 tons of sediment have been removed from the sedimentation basins located at Joint Drains 27.2 and 32.0.

Jim Trull, SVID district manager said, "When the sedimentation basin project was first discussed by the BOJC we knew it would have a positive impact on sediment reduction. At the time though, we had no idea how much material was being transported in the return flow."

But Trull said the sedimentation basins are only a temporary solution to a very large problem. "Irrigation districts and landowners are taking the problem of topsoil erosion and sediment-bearing return flows and trying to find a better solution." Trull said.

The irrigation return flow carries not only valuable topsoil, but also nutrients and agricultural chemicals. Hence, farmers lose valuable topsoil and fertilizer potential, while at the same time the irrigation water returning to the river contains sediment and chemicals.

Sedimentation basins allow particles in the water to "settle out" of the water. This means higher quality water returning to the river or the irrigation canals. According to Bill Rice, BOJC's water quality specialist, "Effectively designed sedimentation basins will capture soil and nutrients carried by irrigation runoff."

Jack Schaneman Joins 25-Year Club

Jack Schaneman is the newest member to join SVID's 25-year club. Jack celebrated 25 years with SVID on September 5. Due to his length of employment at SVID, he is number two on the union seniority list.

Jack has held the same job at SVID over the years and some might wonder why he stayed in the same job, but it is rather simple. When you are good at what you do and have been doing it since you were young, why change? Jack has been running equipment since he was 10-years old.

He doesn't remember what he made when he first started at SVID, but he does remember getting paid only once a month. "When I first started at SVID, one of my jobs was roofing ditchriders' houses and also remodeling the insides of houses," Jack said. His job since as heavy equipment operator has involved laying pipe, cleaning drains and laterals, and driving the dump truck.

Jack has a great work attitude. "I have always done everything the best way and the quickest way. I never tried to goof off," Jack said.

Jim Trull, SVID's district manager had this to say about Jack, "I commend Jack for his 25 years of service to the district. He is a dedicated and valuable employee."

Jack Schaneman

Jack has seen a lot of changes at SVID over the years, probably the most important of which is the equipment improvements. "Equipment has improved considerably over the past 25 years," Jack said. He said he thanks Jim Trull for the equipment improvements. Another improvement Jack has noticed is the wage increase. "Wages have improved a lot since I started here in 1972."

Jack and his wife, Cheryl, have been married for 34 years and have two children, Lisa, who lives in Zillah and Rod, who lives in Sunnyside right next door to his mom and dad. Jack is proud to say he also has a grandson, Chance.

Friendly Assessment Reminder

SVID will be mailing reminders for unpaid 1997 irrigation assessments next week. Remember, assessments become delinquent October 31 — Please check parcel numbers and payment records. Thank you!

SVID Welcomes its New Assistant Manager

Joe Buchanan has recently joined SVID as assistant manager, and we welcome him as the newest member of our team.

Joe received a Bachelor of Science in Mechanical Engineering from the University of Washington in 1983. For ten years, he served as Manager of Engineering for a manufacturing firm active in developing controls for coal, oil, and gas-fired boilers. During his tenure, Joe received four U.S. patents on specialized controls used in combustion processes.

In 1994, Joe and his family relocated to Yakima, where he started working with local farmers on water management in irrigated agriculture. "Moving my family back here to my wife's hometown fulfilled a long time personal goal," he says. "Having taken our vacations here for the last fifteen years, I have grown to love the Valley, its people, and its climate. Over this time, I have developed an abiding respect for the accomplishments of the region's agricultural industry."

SVID Manager Jim Trull is glad to have the position filled. "We are pleased to add Joe to our staff. He brings a lot of drive and enthusiasm to this position. In addition, with his background, he may bring some new perspectives on water management at a time when we are redirecting our focus on water conservation and water quality issues."

Joe is quite excited about his new position with SVID. "I'm proud to be affiliated with an organization that plays such a vital role in sustaining the region's agricultural economy." About his responsibilities, Joe says, "The role of the Assistant Manager is crucial to the daily operation of the District's facilities, and I take these duties quite seriously. However, I also hope to contribute to building a vision for the future that aids the District in meeting the challenges which will be posed over the next twenty years."

Joe Buchanan

Joe and his family currently reside in Yakima, where his wife Cathy is a social worker for Memorial Hospital's Home Health and Hospice. Joe and Cathy have three children and are now searching for a new home closer to the District's office in Sunnyside.

Improvements Planned for Off-Water Season

As the end of the water year approaches, SVID is formulating its plans for construction activity over the upcoming winter. SVID would like to take this opportunity to advise landowners in the district on major projects scheduled for this construction season.

As in previous seasons, a large part of SVID's construction efforts will be the continuation of projects which have seen much activity over recent years, such as the lateral piping program and the Sunnyside Canal Re-Alignment Project.

The lateral piping program, funded in part by Referendum 38 monies provided by the State of Washington, continues with the piping of 4,100 feet of open laterals and the repair or replacement of 17,500 feet now piped with concrete, wood, or clay materials.

The realignment program continues with work on Sunnyside Canal starting at Mile 17.10. This program is an ongoing effort to ensure the Sunnyside Canal holds to the existing right-of-way. Realignment consists of ensuring the canal is in the proper alignment, along with maintenance of canal banks and service roads above and below the canal.

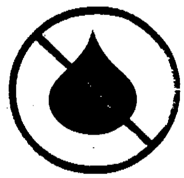
Another project which will get a great deal of attention is the continued maintenance, repair, and replacement of delivery structures throughout the district. As pipelines are replaced or realigned, delivery boxes are evaluated for maintenance.

Mile Post 60 on the Sunnyside Canal will be the site of work on a mechanized trash rack. In addition to fixing operational problems with the existing rack, SVID will be extending the trash conveyer to allow it to dump directly into a bunker. SVID expects this will reduce the labor necessary to handle the large amount of trash which accumulates at this point, and to reduce unpleasant odors encountered by landowners in the area.

Finally, SVID will be working on the Joint Drain 40.2 canal crossing structure near Factory and Edison Roads. This structure, erected in 1908, is nearing the end of its useful life.

Season Over Once Again

Well, the irrigation season is almost over. SVID board members will decide the official date at its October board meeting, which will be held this year on October 7.



Water turn-off is typically done around October 20. The date of the water turn off may not be the same day your water runs out, because it takes SVID about 10 days to completely "dewater" our system. This gradual decrease prevents damage that could occur to the distribution system.

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Time For Flip Flop Again

Have you ever wondered why there are rapids and rafters on the Tieton in September, but you don't see them earlier in the year? The answer is FLIP FLOP!

Sometime during the beginning of every September, the reservoir system releases are switched (or "flipped") in order to protect salmon and still provide irrigation water storage.

It all started back in 1979 when the Yakama Indian Nation went to federal court complaining that reservoir cutbacks at the end of each irrigation season were killing thousands of salmon eggs each year.

Judge Justin Quackenbush ordered the United States Bureau of Reclamation (USBR) to find a way to protect salmon eggs with the least impact on water storage for irrigation.

So Flip Flop began. How it works: The water in Rimrock and Bumping Reservoirs is held in reserve until September, (with the exception of releases for Yakima-Tieton Irrigation District and other Naches River diverters) to meet the irrigation demands during spawning.

Lake Cle Elum and other Yakima River Reservoirs (Kachess, Keechelus) are used to provide most of the irrigation water through the middle of summer.

After Labor Day each year, the use of the reservoirs is "flip-flopped," that is, Cle Elum, Kachess and Keechelus flows are cut back and Rimrock and Bumping Reservoirs assume the responsibility for downstream needs (primarily Wapato Irrigation Project and the Sunnyside Division). By reducing reservoir releases, there is less water in the Yakima River. The fish are then forced to lay their eggs lower in the channel where they have a better chance for survival.

A benefit of the Flip Flop is the recreational opportunities created by increased flows in the Tieton River. After the Flip Flop, the Tieton becomes a popular location for whitewater enthusiasts throughout the Northwest.

How Much Water Do We Use?

Irrigating a 1/4-acre lawn during irrigation season – 6,500 gallons per week
Taking a bath or shower – 9-12 gallons
Washing the dishes by machine/hand – 8-13 gallons
Washing clothes – 35-50 gallons
Washing the car – 50 gallons
Brushing your teeth – 2-5 gallons
Cooking – 5-10 gallons
Drinking – 1/2 gallon
Flushing the toilet (once) – 4-7 gallons
Leaking toilet (per day) – 60 gallons

SVID Goes To The Fair

The Roza-Sunnyside Board of Joint Control will be part of a display at this year's Central Washington State Fair. The theme of the display is "Partnership in the Yakima River Watershed." The Fair, which will take place in Yakima, starts September 19 and runs through September 28. Please stop by and learn more about the Board of Joint Control's Water Quality Program.

BULK RATE
Permit No. 50
Sunnyside, WA 98944

RSBOJC UPDATE

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March 1998

Volume 1, Number 1

A PUBLICATION OF ROZA–SUNNYSIDE BOARD OF JOINT CONTROL
P.O. Box 810 ♦ Sunnyside, WA 98944

Welcome to the RSBOJC Newsletter

The Roza-Sunnyside Board of Joint Control would like to welcome you to the first issue of its newsletter. Through the *RSBOJC Update*, the board can keep landowners up-to-date on water issues, district policy changes, and board activities. The newsletter will be produced twice a year, in March and September. We welcome your comments and suggestions for future newsletter articles.

What is the Roza-Sunnyside Board of Joint Control?

In 1994, a group of landowners approached the state's fifth and sixth largest irrigation districts and suggested forming a joint committee to begin addressing similar concerns of both districts. The Roza-Sunnyside Board of Joint Control is the realization of an idea developed by the landowner group.

How was the Joint Board formed?

After successfully getting enabling legislation passed, the landowner group petitioned the Board of County Commissioners in the county of jurisdiction to form the Roza-Sunnyside Board of Joint Control. The petition was followed by a public hearing process, after which the county commissioners approved the petition. The "Yakima County Board of Joint Control #1" was approved August 13, 1996.

Who is on the Roza-Sunnyside Board of Joint Control?

The first directors were appointed by the county commissioners. The Roza-Sunnyside Board of Joint Control is composed of the five Roza Irrigation District directors, five Sunnyside Valley Irrigation District directors, and two members from other entities in the Sunnyside Division.

What is the Roza-Sunnyside Board of Joint Control's mission?

To implement a program to enhance water supplies by supporting storage development, improving water quality, and increasing management efficiency. The Board's goal is to achieve the following within ten years:

- System improvements such as canal automation, regulating reservoirs, and closed conduit delivery systems and additional storage which will protect existing rights while providing higher quality and more reliable irrigation service to Sunnyside Division landowners:
- Water savings sufficient to support the goal of furnishing at a minimum, 75% of entitlement to Roza Irrigation District landowners in all years:
- Compliance with the total maximum daily load process for return flows discharging from lands under Roza-Sunnyside Board of Joint Control jurisdiction.

Why have a Roza-Sunnyside Board of Joint Control?

A Board of Joint Control provides a structure for the two entities to combine resources where it is appropriate, feasible, and to the advantage of both, while maintaining their separate respective authorities and responsibilities.

A Board of Joint Control allows each district:

- Operational efficiencies
- Financial strength
- Representation
- Shared information

The Board of Joint Control allows Roza Irrigation District and the Sunnyside Division to work together in ways that we have not been able to before—without changing the structure of either entity. Roza Irrigation District serves 72,600 acres and the Sunnyside Division serves 103,570 acres.

Inside this issue:

RSBOJC Sets Water Quality Policy

For the past several months, the Roza-Sunnyside Board of Joint Control (RSBOJC) has been busy discussing how to improve water quality in the lower Yakima River. Working with state and federal agencies, the RSBOJC looked at water quality problems associated with irrigation and determined corrective measures to help improve water quality. Below is the recently adopted Roza-Sunnyside Board of Joint Control Water Quality Policy which will take effect in 1998.

1. DISCHARGES TO PROJECT WATERWAYS OF THE RSBOJC

All discharges into project waterways (canals, laterals, drains, and wasteways operated and maintained by a RSBOJC member and for which an easement or right of way exists) shall require a discharge permit from the appropriate RSBOJC member. The discharge permit will provide among other things, for:

- Maintenance of the piped inlet by the discharger so that it remains operational in a manner that no erosion occurs to the project waterway.
- Establishment of water quality parameters for the discharged water.
- The termination of the discharge permit and the right to discharge into the waterways upon non-compliance of its terms and conditions.

2. IRRIGATION RUNOFF

All irrigation runoff from lands within RSBOJC boundaries must comply with acceptable water quality parameters established by the RSBOJC.

- Beginning with the 1998 irrigation season, the RSBOJC will monitor discharge into project waterways and record turbidity levels above 25 NTU (current TMDL goal of waters discharging to the Yakima River). Such observation will be considered a water quality violation.
- In the event RSBOJC personnel observe a water quality violation, the landowner will be notified of the noncompliance by mail and requested to agree to a Short and Long Term Compliance Plan. The landowner, after notification, must sign and submit Compliance Plans prior to the 1999 irrigation season. These plans will include proposed practices or projects to bring the runoff water into compliance and a time schedule for implementation. These plans will be tied to a drain inlet or series of inlets and will address proposed practices on a field by field basis. The Compliance Plans will be signed by the landowner and approved by the RSBOJC.
- In 1999, landowners will be required to begin implementing their respective Compliance Plans.

3. BUFFER ZONES FOR RSBOJC WATERWAYS

Buffer zones consisting of project operation and maintenance roads or no till-no grazing areas will be required on both sides of RSBOJC project waterways.

- Fencing: Livestock grazing will be eliminated on project waterways. The RSBOJC will put the initial emphasis on the Joint Drain system. Priority for fencing will be on the basis of water quality protection and operation and maintenance of project waterways.
- No-till zones: The landowner will be required to install a farm drainage ditch and drain inlets as needed to provide a no-till zone typically 20 feet wide from the top of the bank to the edge of the farm operation. Actual width requirements may vary depending on the size of the waterway.
- Enforcement of buffer zones will be promoted by the enforcement of water quality standards, exercising the right to existing rights of way and easements, education, and financial assistance.

4. RUNOFF INTO COUNTY BORROW DITCHES

The RSBOJC will, with Yakima and Benton Counties, develop strategies to regulate runoff into borrow ditches.

5. WATER USER AWARENESS PROGRAM

The RSBOJC, in cooperation with appropriate Federal, State, County, and River Basin entities, will formulate and implement a water user awareness program related to effective on-farm water management.

6. WATER QUALITY MONITORING

The RSBOJC will continue its water quality monitoring program with the following objectives:

- Identify the annual and seasonal TSS loads and other water quality characteristics of water diverted from the Yakima River into the RSBOJC.
- Identify the variation in water quality characteristics of water throughout the conveyance and delivery system.
- Identify TSS loads and other water quality characteristics of water discharged into RSBOJC project waterways.
- Determine the effectiveness of implementation of on-farm Best Management Practices.
- Provide quality control for individual water user water quality sampling programs as requested.
- Coordinate with other agencies in the collection and analysis of water quality data.

7. SEDIMENTATION PONDS AND WETLAND AREAS

The RSBOJC will pursue the planning, construction, and operation of sedimentation ponds and wetland areas into RSBOJC project facilities to improve the quality of water within and exiting the RSBOJC.

The RSBOJC is taking a proactive approach to improving water quality in the lower Yakima River. We must work together to improve water quality and to maintain the status quo with the threats of Endangered Species Act listings and stricter water quality standards looming.

Roza Corner (for RID customers)

Message from the Manager to Roza Irrigation District customers:

I want to take this opportunity before we begin the 1998 irrigation season to remind everyone receiving water through a flow meter of the new regulations that take effect this year. No water will be delivered through any flowmeter unless the farm operator has his own worm gear driven control valve in place beyond district facilities.

I would also like to clear up some confusion on the flow restrictions that are being implemented. A maximum draw of 15 g.p.m. (gallons per minute) will be allowed on any flowmeter delivery. This does not mean that you can get 15 g.p.m. all the time. The systems are designed for 7.5 g.p.m. per acre and that is what your system should be designed for. If everyone on a particular system is drawing their entitlement, 7.5 g.p.m. is all you are likely to get. When fewer people are drawing you may be able to receive more, up to a maximum of 15 g.p.m. Designing your system for too high of flow requirements will definitely become a problem for you at certain times during the season, most likely when you need it the most as that is when everyone else will be running also.

One last reminder, as is always necessary. Reclamation forms must be completed and assessments paid before water will be delivered after April 1. Hope you all have a productive and prosperous season.

RSBOJC Meetings Open to All

This is a reminder that Roza-Sunnyside Board of Joint Control meetings are open to the public. Meetings are held on the third Tuesday of every month at 9:30 a.m. at the Sunnyside Valley Irrigation District office located at 120 South Eleventh Street in Sunnyside.

SVID Corner (for SVID customers)

Sunnyside Valley Irrigation District would like to remind its customers that if a water emergency occurs after regular business hours, please call the district's office number at 837-6980. The Voice Response Unit guides the caller through a series of options. Press "3" for emergency service.

CLIP & SAVE

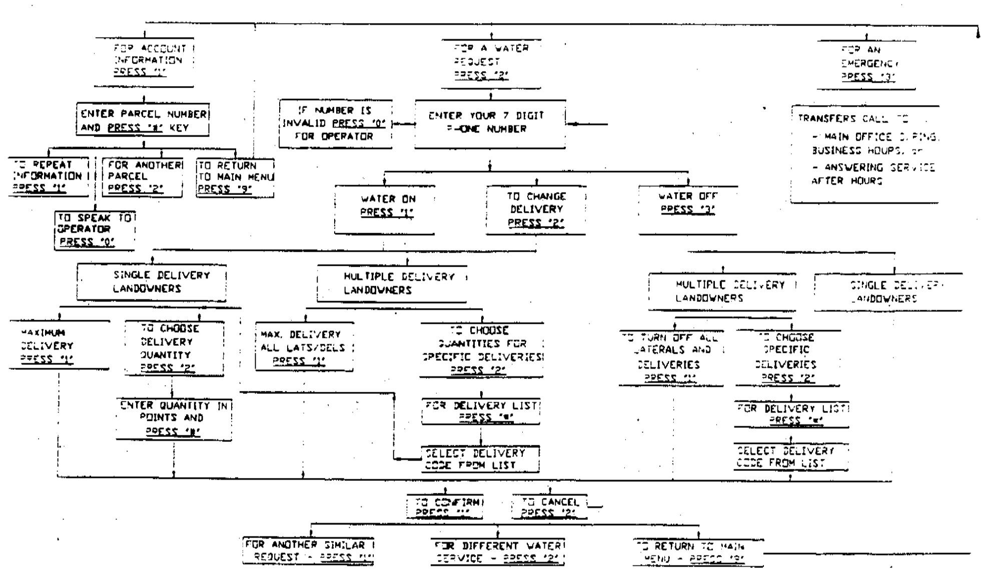
Sunnyside Valley Irrigation District

WATER ORDERING SYSTEM

TO ORDER WATER, PLEASE CALL 854-1540, 837-8611 OR 882-4343

TIP #1: When you are at a menu and you know the number of your selection, you may press it at any time. You do not need to wait until all selections have been given.

TIP #2: Some push-button phones have a Tone-Pulse switch. This must be in the "Tone" position to allow menu selection.



Landowner Meetings Held

In January and February, the RSBOJC held several landowner education meetings. The purpose of the meetings was to present information on the challenges facing today's irrigators and give ways to help improve water quality.

A representative from the RSBOJC provided an overview of the Board's recently adopted Water Quality Policy. Bob Stevens with Washington State University's Irrigated Agriculture Research and Extension Center presented on-farm best management practices.

Meeting topics included Water Quality Issues, RSBOJC's Water Quality Policy, District Programs and Projects, and Landowner Solutions (including funding sources).

For the first set of meetings, landowners in the Granger Drainage Basin were invited. Other areas will be addressed in the coming months. If you would like to learn more about improving water quality, the following agencies may be contacted for technical assistance:

Benton County Conservation District	Pat Daly	786-9230
Natural Resource Conservation Service	Chris Johnson	829-3003
	Cal Aylsworth	829-3003
	Jay Kehne	454-5736
	Rick Beck	786-1923
North Yakima Conservation District	Mike Tobin	454-5736
South Yakima Conservation District	Judith Vesper	837-7911
Washington State Department of Ecology (Ag Water Quality Education)	Jane Tonkin	454-7894
Washington State University at Prosser (Cooperative Extension)	Bob Stevens	786-9231

The Roza-Sunnyside Board of Joint Control (RSBOJC) publishes the **RSBOJC UPDATE** biannually for landowners. All articles, letters and other items submitted to RSBOJC for use in its landowner newsletter become the property of RSBOJC which is authorized to use any item submitted, without payment or compensation to the person submitting the item, in any newsletter or other publication of RSBOJC. RSBOJC reserves the right to edit all items submitted. Ric Valicoff, Chairman; Douglas Simpson, Vice-Chairman. Robert Golob, Ken Lisk, Dave Michels, Mike Miller, David Minick, John Newhouse, Dean Sizer, Douglas Vining, Harry Visser, Jim Willard, Directors. Officers: Ron Van Gundy, Secretary: James W. Trull, Treasurer. Address comments to: Cyndi King, Editor, P.O. Box 239, Sunnyside, WA 98944.

Board Receives Environmental Award

Governor Gary Locke recognized the Roza-Sunnyside Board of Joint Control on February 12 for taking aggressive action to improve water quality in the Yakima River. Gov. Locke presented the Environmental Excellence Award before a large audience at a Rotary meeting in Yakima.

The Board adopted the water quality policy at its January board meeting. The complete text of the new policy is presented on page 2 of this newsletter. The policies are designed to improve the quality of water that leaves farms and flows to the Yakima River via return drains. The goal is to meet the water quality cleanup goals set by Ecology for the lower Yakima River.

"I'm proud of the courage and foresight the Board of Joint Control has shown," said Tom Fitzsimmons, director of the Department of Ecology. "The board's vision and its willingness to take on these problems is exactly the kind of leadership Washington state needs right now to solve the state's serious water quality problems."

Board Director Doug Simpson said the board believes in taking action to deal with problems facing irrigated agriculture.

"The directors have worked hard to develop the water quality policies," Simpson said. "We know it will take some hard work and money to achieve our goals, but we must do this together."

Environmental Excellence Awards recognize special efforts to protect or enhance Washington's environment. Ecology reserves the honor for those who have shown exceptional initiative or innovation.

Pictured from left to right: Jim Willard, Dave Michels, David Minick, Doug Simpson, Mike Miller, Ric Valicoff, John Newhouse, Gov. Gary Locke, Bob Golob, Ken Lisk, and Doug Vining.

SUNNYSIDE VALLEY IRRIGATION DISTRICT

120 S. 11th
P.O. Box 239
509-837-6980 Sunnyside, Washington FAX 509-837-2088
98944

July 30, 1998

Dear

As all waterusers have been previously notified, the Roza-Sunnyside Board of Joint Control has adopted policies relative to the implementation of a water quality program. The policy as set by the Board of Directors, is consistent with the Total Maximum Daily Loading goal set by the Department of Ecology for the lower Yakima River. This requires that runoff from agricultural lands discharging into project waterways does not exceed 25 NTU.

With the board's water quality monitoring program, samples have been collected from field runoff sites where visual observation indicated non-compliance with the standard. Samples have been collected for your farm (parcel numbe[redacted] with turbidity levels on three occasions exceeding 25 NTUs. The dates and sample results are as follows:

May 14, 1998	4000
June 12, 1998	3023
June 24, 1998	4000

Consistent with the board's policy, we are asking that you prepare a compliance plan to be submitted to the Board for approval. This plan will identify what measures you propose to take to come into compliance and the time frame for doing so. Your compliance plan must be submitted and approved by the Board of Directors prior to receiving water for the 1999 irrigation season.

If you would like to help in developing your plan we suggest you call Bob Stevens at WSU Extension (509) 786-2226, or Ryan Anderson at Department of Ecology (509) 575-2800, or others. If you are within the Granger Drainage basin some financial assistance may be available to you for implementation. For questions about financial assistance or procedures in filing you compliance plan, please contact Lori Brady in this office.

Sincerely,

JWT

James W. Trull
District Manager

Enclosures

c: Don Schramm, Assistant Manager (SVID)
Robert Hood
Bob Stevens (WSU Extension)
Ryan Anderson (DOE)
Lori Brady (SVID)

Irrigation Feeds the Nation

APPENDIX 8

PROPOSED 1998 IRRIGATION SEASON WATER QUALITY MONITORING PLAN

Season

- Early-April through mid-October 1998.

Sampling Frequency

- Two-week intervals, unless indicated otherwise.

Parameters Measured

- Discharge (or stage reading with rating curve).
- Field measurements (temperature, dissolved oxygen, pH, and specific conductance).
- RS-BOJC laboratory measurements (turbidity, total suspended solids, fecal coliform)
- U.S.B.R. laboratory measurement of nutrients (total phosphorus, nitrite plus nitrate, total kjeldahl nitrogen, and ammonia if kjeldahl nitrogen is ≥ 5 mg/L as nitrogen).

Site Locations

- Mouth of tributaries to Yakima River (sites 24-27; 1997 monitoring program).
- Diversion of Roza and Sunnyside Canals from the Yakima River. Samples taken at two-week intervals during early spring through snowmelt runoff, then monthly for the remainder of the season. Discharge will be estimated from waters diverted.
- Main canal sites located near Beam Road, Hanford Highway, and Gap Road. Samples taken at two-week intervals during early spring through snowmelt runoff, then monthly for the remainder of the season. Discharge will be estimated by the appropriate watermasters.
- Sampling sites monitored in the Granger Drain HUA during 1997, and those to be monitored in the 1998 season, include the following: 1, 3, 4, 5, 7, 9, 11, 12, 15, 17, 19, 20, 22, 23, plus one additional site located in DID #2.
- Reserving approximately 15% of monitoring effort in contingency to quantify water quality conditions identified during the irrigation season. Examples of such monitoring efforts may include 1) short-term (synoptic) sampling of all drains and tributaries into the Yakima River from RS-BOJC drainage areas, 2) short-term (synoptic) sampling of spur-drains (DIDs) within the current monitoring area, with emphasis on those which contribute significant loads, or 3) quantify the quality of water in outfalls to the Roza and Sunnyside Canals.

Roza-Sunnyside Board of Joint Control

P.O. Box 810 ■ Sunnyside, WA 98944 ■ (509) 837-5141 ■ FAX: (509) 837-8541

Date: May 7, 1997

To: Members of the Water Quality Advisory Group

From: William Rice

Subject: Roza-Sunnyside Board of Joint Control Water Quality Monitoring Program

The Water Quality Advisory Group will meet in the office of the Sunnyside Valley Irrigation District on Tuesday, May 13, 1997 at 9:00 a.m. Enclosed is a copy of 1) the objectives of the RS-BOJC water quality monitoring plan and 2) proposed sampling sites (i.e., name, location, maps, etc.), sampling schedule and frequency, and protocols (i.e., sample collection and handling, quality control, etc.) developed by Stuart McKenzie and myself for your review and input at our meeting.

See you then.

Objectives

The Roza-Sunnyside Board of Joint Control (RS-BOJC) has a long-term objective of determining how management activities by the irrigation districts and land-use and water-use practices by landowners affect water quality conditions in agriculture drains, which, in turn, impact the overall water quality in the Yakima River. The RS-BOJC has a goal of bringing these drains into compliance with the recent total maximum daily load (TMDL) guidelines provided by the Washington Department of Ecology (Ecology).

The RS-BOJC has tasked Bill Rice with developing a water quality monitoring plan to accomplish this objective. Activities that are likely to be important include identifying best management practices (BMPs) which:

- Reduce soil erosion and sediment loading to the Yakima River.

- Reduce biological loading (fecal coliform) through better waste management practices and waste application methods at confined animal operations (dairies and feedlots).

- Reduce nutrient (phosphorus and nitrogen) losses from the root zone and subsequent loading.

- Increase irrigation-use efficiency and reduce the quantity of water needed through diversions.

- Promote ecological habitats and enhance desirable biological diversity along agricultrure drains by reducing conditions which affect temperature, dissolved oxygen, and pH.

The goals of the RS-BOJC and the TMDL process should, in the long-term (decade of time), afford the following:

- Decreases in turbidity levels and total suspended solids and fecal coliform concentrations (meeting TMDL guidelines and State water quality standards).

- Decrease flows in agriculture drains with less water diverted from the Yakima River.

- Decrease in water temperature and pH levels.

- Increases in dissolved oxygen concentrations.

- Increases in ecological conditions.

In addition to the collection and analysis of samples, the monitoring plan will include the following activities:

- Coordinate with other agencies collecting water quality data including: Ecology, United States Bureau of Reclamation (BOR), South Yakima Conservation District (SYCD), Benton Conservation District (BCD), North Yakima Conservation District (NYCD), Washington State University Cooperative Extension (WSU), Yakama Indian Nation (YIN), Kittitas Reclamation District (KRD), and others.

- Share data with all participants interested in RS-BOJC data.

- Ensure that all data collection, analysis, and data management protocols are consistent with other participating agencies.

- Identify a quality assurance/quality control (QA/QC) plan to quantify the quality of data collected which is consistent with other participating agencies.

I. <u>Roza-Sunnyside Board of Joint Control Water Quality Monitoring Plan Protocols</u>

The protocols used will, in general, be taken from existing protocols established by the U.S. Geological Survey (USGS), American Public Health Association (SM), U.S. Environmental Protection Agency (USEPA), and Washington Department of Ecology (Ecology).

1. <u>Sample collection</u>

   - USGS Western Region Field Manual (Sylvester et al., 1990)

2. <u>Sample preservation, handling, and shipping</u>

   - USGS National Field Manual for the Collection of Water-Quality Data (Wilde et al., 1997)

3. <u>Sample analysis</u>

   A. *Field measurements (pH, temperature, dissolved oxygen, specific conductance)*

   - USGS National Field Manual for the Collection of Water-Quality Data (Wilde and Radtke, 1997)

   B. *Total suspended solids (laboratory)*

   - SM 2540D

   C. *Ratio turbidimetery (laboratory)*

   - Ecology

   D. *Fecal coliform (laboratory)*

   - SM 9222D
   - USGS Western Region Field Manual (Sylvester et al., 1990)

   E. *Nutrients (USBR laboratory)*

   Total Kjeldahl nitrogen (TKN)

   - USEPA 351.2

Total phosphorus (TP)

- USEPA 365.3

Nitrate plus nitrite (NO_{3+2})

- USEPA 353.2

F. *Discharge*

- USGS Techniques for Water Resource Investigations (Smoot and Novak, 1968)

4. Data management

All environmental data will be stored in a suitable spreadsheet at the Sunnyside Valley Irrigation District main office. The spreadsheet will be capable of formatting the data for both statistical and graphical analysis, and allow for the dissemination of data and information to interested agencies. Nutrient data obtained by the USBR regional laboratory (Boise, ID) will also be stored and available through Storet (USEPA). All quality control data will be stored in a separate spreadsheet. All environmental data will include the following meta data: station name and number, date and time of sample collection, and location (latitude and longitude).

5. Quality control (QC) data

A. *Field measurements (pH, temperature, dissolved oxygen, specific conductance)*

- 10% of the measurements will be sequentially replicated

B. *Total suspended solids (laboratory)*

- Ten percent of the samples will be replicated by sub-sampling.
- Ten percent of the samples will be replicated in the field.
- Five percent of the samples will include standard reference materials of known concentration (provided by USGS or Ecology).
- Five percent of the samples will include blanks (field).
- Four samples per year (quarterly) will be split with an independent laboratory.

C. *Ratio turbidimetery (laboratory)*

- Same as for total suspended solids.

D. *Fecal coliform (laboratory)*

- Ten percent of the samples will be replicated by sub-sampling.
- Ten percent of the samples will be replicated in the field.
- Five percent of the samples will include blanks (contamination in dilution water).
- Four samples per year (quarterly) will be split with an independent laboratory.
- Four samples per year (quarterly) will be split from an independent source and analyzed in-house.

E. *Nutrients (USBR laboratory)*

- Ten percent of the samples will be replicated in the field.
- Five percent of the samples will include blanks (field), spikes, and standard reference materials.

F. *Discharge*

- Ten percent of all measurements will be replicated at the same cross section or at an alternate cross section.

II. <u>List of sampling sites, schedule (start date), and frequency</u>

See Table I and maps incluced.

Table I Overview of Sampling Sites, Schedule, and Frequency

Site Name	Site No.	Map ID No.	Location and Description	Lat/Long	Sampling Schedule (Start Date)	Sampling Freq Irr/non-Irr
JD 26.6 at Knowles Road and SS main canal	BOJC26.6-1	1	Joint Drain 26.6 above Sunnyside main canal at concrete intake into conduit and siphon . Access through Knowles Road on the East and dirt road in orchard from the South.	To be determined	Start 5/19/97 (Mon.)	biweekly/monthly
JD 26.6at Snyder Road	BOJC26.6-2	2	Joint Drain 26.6 on the South side of Snyder Road where the drain is culverted under the road.	"	Start 5/19/97 (Mon.)	"
JD 26.6 at I-82 access ramp	BOJC26.6-3	3	Joint Drain 26.6 on the South side of the I-82 access ramp (from Granger) where the drain is culverted under the freeway.	"	Start 5/19/97 (Mon.)	"
JD 27.2 at intake to settling pond	BOJC27.2-1	4	Joint Drain 27.2, South of Knowles Road and directly above the Sunnyside main canal at the intake of the proposed settling pond (to be constructed in 1997).	"	To be determined	"
JD 27.2 at outlet of settling pond	BOJC27.2-2	5	Joint Drain 27.2, South of Knowles Road and directly above the Sunnyside main canal at the outlet of the proposed settling pond (to be constructed in 1997).	"	To be determined	"
JD 27.5 at Hudson Road	BOJC27.5-1	6	Joint Drain 27.5 on the South side of Hudson Road where the drain is culverted under the road.	"	Start 5/19/97 (Mon.)	"
JD 27.5 at VanBelle Road	BOJC27.5-2	7	Joint Drain 27.5 on the South side of Van Belle Road where the drain is culverted under the road.	"	Start 5/19/97 (Mon.)	"

JD 27.5 at Cherry Hill Road and I-82	BOJC27.5-3	8	Joint Drain 27.5, 750 feet East of Bagley Road and North of Cherry Hill Road, near the I-82 span over the railroad tracks.	"	Start 5/19/97 (Mon.)	"
JD 28.0 at Outlook Canal	BOJC28.0-1	9	Joint Drain 28.0 directly above the Outlook Canal (West lateral), East of Price Road with access along the canal.	"	Start 5/20/97 (Tue.)	"
JD 28.0 at Independence Road & SS main canal	BOJC28.0-2	10	Joint Drain 28.0 on the South side of Independence Road, near the concrete sill where the drain is culverted under the road, and directly above the Sunnyside main canal.	"	Start 5/20/97 (Tue.)	"
JD 28.0 at Hudson Road	BOJC28.0-3	11	Joint Drain 28.0 on the North side of Hudson Road before the drain is culverted under the road.	"	Start 5/20/97 (Tue.)	"
JD 28.0 at Yakima Valley Highway	BOJC28.0-4	12	Joint Drain 28.0 on the South side of the Yakima Valley Highway where the drain is culverted under the highway.	"	Start 5/20/97 (Tue.)	"
JD 28.0 at Liberty Road & Yakima Valley Highway	BOJC28.0-5	13	Joint Drain 28.0 South of Liberty Road, Yakima Valley Highway, and railroad tracks, upstream of culvert and below inflow on left bank of drain.	"	Start 5/20/97 (Tue.)	"
JD 31.0W at Phipps Road & Outlook Canal	BOJC31.0W-1	14	Joint Drain 31.0W South of Phipps Road and below the Outlook Canal (West lateral) where the drain is culverted under the road.	"	Start 5/20/97 (Tue.)	"
JD 31.0W at Hudson Road & Snipes Mnt. Lat.	BOJC31.0W-2	15	Joint Drain 31.0W 50 feet East of drainage into Snipes Mountain Lateral along Hudson Road.	"	Start 5/20/97 (Tue.)	"
JD 31.0E at Outlook Canal	BOJC31.0E-1	16	Joint Drain 31.0E 50 feet South of Outlook Canal siphon (East lateral) and below inflow on left bank of drain.	"	Start 5/21/97 (Wed.)	"

JD 31.0E at Reeves Road	BOJC31.0E-2	17	Joint Drain 31.0E South of Reeves Road where the drain is culverted under the road.	"	Start 5/21/97 (Wed.)	"
JD 32.0 at Independence Road	BOJC32.0-1	18	Joint Drain 32.0 North of Independence Road before drain is culverted under the road.	"	Start 5/21/97 (Wed.)	"
JD 32.0 at intake to settling pond	BOJC32.0-2	19	Joint Drain 32.0, 1/4 mile East of Fordyce Road along the North side of the Sunnyside main canal at the intake of the proposed settling pond (to be constructed in 1997).	"	To be determined	"
JD 32.0 at outlet of settling pond	BOJC32.0-3	20	Joint Drain 32.0, 1/4 mile East of Fordyce Road along the North side of the Sunnyside main canal at the outlet of the proposed settling pond (to be constructed in 1997).	"	To be determined	"
JD 32.0 at Fordyce Road	BOJC32.0-4	21	Joint Drain 32.0 East side of Fordyce Road where the drain is culverted under the road.	"	Start 5/21/97 (Wed.)	"
JD 32.0 at VanBelle Road & Snipes Mnt. Lateral	BOJC32.0-5	22	Joint Drain 32.0 North side of Van Belle Road and 50 feet West of Snipes Mountain Lateral where the drain is culverted under the lateral.	"	Start 5/21/97 (Wed.)	"
JD 32.0 at Yakima Valley Highway & JD 28.0	BOJC32.0-6	23	Joint Drain 32.0 South side of the Yakima Valley Highway, 50 feet upstream of the confluence of Joint Drain 32.0 into 28.0.	"	Start 5/21/97 (Wed.)	"
Granger Drain at Sheep Barn	GDO-1	24	Town of Granger where the drain is culverted under the dirt road between the former sheep barns and truck weigh scale.	"	Start 5/27/97 (Tue.)	"
Sulphur Creek Wasteway at Holaday Road	SCW-1	25	South of Sunnyside on Holaday Road and East of Midvale Road where the bridge spans over the wasteway.	"	Start 5/27/97 (Tue.)	"

Spring Creek at Hess Road & Chandler Canal	SpC-1	26	100 feet West of Hess Road and below the Chandler Canal at the concrete apron where the creek is culverted under the canal.	"	Start 5/28/97 (Wed.)	"
Snipes Creek at Railroad Bridge	SnC-1	27	1,400 feet East of Hess Road, directly below the old Burlington Northern Railroad bridge.	"	Start 5/28/97 (Wed.)	"

Roza-Sunnyside Board of Joint Control
Water Quality Monitoring Plan

William Rice (SVID/RID)
Stuart McKenzie (USGS)

April 7, 1997

1. Questions of Interest

Question 1:

a. What is the seasonal and spatial variability of constituent concentrations and levels among the major drainage outlets (Granger Drain, Sulfur Creek, Spring Creek, and Snipes Creek) to the Yakima River mainstem with respect to the **water quality parameters of interest** [total suspended solids (TSS), turbidity, fecal coliform (FC), nutrients, dissolved oxygen (DO), pH, temperature, and specific conductance (SC)]?

b. What is the difference between the irrigation and non-irrigation seasons?

c. What are the long-term trends in the data?

d. Does the data exceed state standards?

e. How does the concentration measured relate to discharge?

f. What is the relationship between turbidity and TSS?

Question 2:

a. What are the loads (lb/day) and yields (lb/acre/day) at the major drainage outlets (Granger Drain, Sulfur Creek, Spring Creek, and Snipes Creek) to theYakima River mainstem with respect to TSS, FC, and nutrients?

b. What are the sources or causes within a given hydrologic unit area (HUA) which are responsible for the variability in constituent loads and yields?

c. What is the difference between the irrigation and non-irrigation seasons with respect to loads and yields?

d. What are the long-term trends with respect to loads and yields?

e. What is an estimation of the errors associated with calculating loads and yields?

Question 3:

a. What is the seasonal and spatial variability of constituent concentrations and levels, loads, and yields within the Granger, Sulfur Creek, Spring Creek, and Snipes Creek HUAs for the water quality parameters of interest?

b. What are the sources or causes within a given HUA which are responsible for the variability in constituent loads and yields?

c. What is the difference between irrigation and non-irrigation seasons?

d. What are the long-term trends in the data?

e. Does the data exceed state standards?

f. How does the concentration measured relate to discharge?

g. What is the relationship between turbidity and TSS?

Question 4:

a. How effective are sedimentation ponds at reducing TSS, turbidity, FC, and total phosphorus (TP) levels in irrigation return flows?

b. What percent of the constituents are retained or not retained by the sedimentation ponds?

c. How was the effectiveness of a particular sedimentation pond related to the independent variables within a given drainage sub-basin (e.g., soil type, stream and land gradients, land-use practices, irrigation methods, water use, drainage acreage, the number of confined animal operations, the total number of animals associated with each operation, etc.).

Question 5 (Emergency Response):

What is the magnitude of constituent concentrations, levels, and loads for spills at point and non-point source discharges observed in the field (Granger and Sulfur Creek HUAs) with respect to the water quality parameters of interest?

Question 6:

a. What is the variability in concentration along the length of the Roza and Sunnyside main canals for the water quality parameters of interest? (What is the quality of water being delivered to farmers in each district?)

b. What are the likely sources or causes of change in water quality along the main canals?

c. What are the long-term trends in the data?

d. Does the data exceed state standards?

e. What is the relationship between turbidity and TSS?

Question 7:

a. What is the range in concentrations, levels, and loads over storm events at key sites in the Granger and Sulfur Creek HUAs (identified in Questions 1 & 2) for TSS, turbidity, FC, and nutrients?

b. What is the difference between the irrigation and non-irrigation seasons?

c. What are the long-term trends in the data?

d. Does the data exceed state standards?

e. How does the concentration measured relate to discharge?

f. What is the relationship between turbidity and TSS?

Question 8:

a. What is the effectiveness of reducing the concentrations and levels of the constituents of interest through on-farm management activities or BMPs (e.g., drip, sprinkler, micromist, and surge-flow irrigation practices, implementation of mulches, PAM, grassed wasteways and drainages, riparian buffers, and other practices)?

b. What percent of the upstream drainage basin must be effected by BMPs for there to be a measurable change in the associated agricultural drains with respect to the water quality parameters of interest?

Question 9:

What is the diel variability during the irrigation and non-irrigation seasons at key sites in the Granger and Sulfur Creek HUAs (identified in Questions 1 & 2) for the water quality parameters of interest?

Question 10:

a. What are the biological (ecological) characteristics and indicators at the sites monitored (e.g., habitat of stream banks and streambeds, size of bed materials, embeddedness of streambeds, stream gradients, shading, populations of periphyton, phytoplankton, benthic invertebrates, and fish, the complexity of aquatic habitats, etc.)? Consider concentration of nutrients, as well as the concentrations of TSS and nutrients, and diel measurements of turbidity, DO, pH, and temperature.

b. How have biological (ecological) characteristics and indicators changed in agricultural drains? Consider low-frequency sampling (once every five years) with a high number of replicates. Distributions will be compared over five year periods.

2. Questions, Hypotheses, and Methods of Analysis for the Proposed Water Quality Monitoring Program

Question 1 - Granger Drain, Spring Creek, and Snipes Creek (Concentrations and Levels):

a. What is the seasonal and spatial variability of constituent concentrations and levels among the major drainage outlets (Granger Drain, Spring Creek, and Snipes Creek) to the Yakima River mainstem with respect to the **water quality parameters of interest** [total suspended solids (TSS), turbidity, fecal coliform (FC), nutrients, dissolved oxygen (DO), pH, temperature, and specific conductance (SC)]?

b. What is the difference between the irrigation and non-irrigation seasons?

c. What are the long-term trends in the data?

d. Does the data exceed state standards?

e. How does the concentration measured relate to discharge?

f. What is the relationship between turbidity and TSS?

Question 1 - Hypotheses:

a. Concentration and measurements are variable in time and space. Observed FC and nutrient concentrations are related to the number of confined animal operations (dairies and feedlots) and the type of waste management practices employed within a given HUA. Turbidity and TSS will be higher at the start of the irrigation season. Water temperature, SC, and pH are expected to increase over the course of the irrigation season.

b. Trends likely to be observed going from the irrigation to the non-irrigation seasons include: 1) decreases in turbidity, TSS, FC (increase during storm events), and flow, 2) increases in nutrients, DO, and SC, and 3) a small increase in pH values.

c. Long-term trends include: 1) decreases in TSS, turbidity, FC, and TP and 2) increases in nitrate plus nitrite (NO_{3+2}) and SC during the irrigation season, with a decrease in these parameters observed during the non-irrigation season.

d. Measured values expected to exceed state standards include: 1) turbidity values of 25 NTU (often), 2) FC (often), 3) temperature (often), and 4) DO and pH (seldom).

e. A direct relationship is expected between flow and concentration during the irrigation season for TSS, turbidity, FC, and TP. An indirect relationship is expected during the same period for NO_{3+2} and SC. During the non-irrigation season, similar results will be found if increased flows are the result of surface water runoff caused by storm events.

f. Good relationships are expected between turbidity and TSS; however, relationships established during the irrigation season may not agree well with the non-irrigation season.

Question 1 - Method of Analysis:

a. Plots of concentration versus time will establish temporal variability for the constituents of interest. Box plots for all samples at a given drainage outlet site versus all others will establish spatial variability for the constituents of interest. Plot the number of animals associated with confined animal operations (dairy and/or feedlot) within a given HUA versus FC and nutrient levels. Look for a relationship between waste management practices and FC and nutrient levels within a given HUA. Plot TSS and turbidity levels versus time, and, in doing so, consider two time periods within the irrigation season such that box plots can be used.

b. Box plots between the irrigation and non-irrigation seasons will establish seasonal differences for the constituents of interest.

c. When 50 samples per site have been established over multiple years, compare distributions of data from year-to-year, with and without flow correction, to establish long-term trends.

d. Compare results obtained to state standards.

e. Plot the logarithm of measured flow against the concentration of each constituent.

f. Plot the logarithm of TSS versus the logarithm of turbidity for both the irrigation and non-irrigation seasons and overlay the two plots. Test the feasibility of using one relationship for all three HUAs.

Question 2 - Granger Drain, Spring Creek, and Snipes Creek (Loads and Yields):

a. What are the loads and yields at the major drainage outlets (Granger Drain, Spring Creek, and Snipes Creek) to theYakima River mainstem with respect to TSS, FC, and nutrients?

b. What are the sources or causes within a given HUA which are responsible for the variability in constituent loads and yields?

c. What is the difference between the irrigation and non-irrigation seasons with respect to loads and yields?

d. What are the long-term trends with respect to loads and yields?

e. What is an estimation of the errors associated with calculating loads and yields?

Question 2 - Hypotheses:

a. Discharge has a dominant influence on the seasonal variability of constituent loads and yields, and is directly related to the seasonal variability in surface water flow.

b. Independent variables within a given HUA (e.g., soil type, stream and land gradients, land-use practices, irrigation methods, water use, drainage acreage, the number of confined animal operations, and the total number of animals associated with each operation) determine some of the observed variability in constituent loads and yields.

c. The major source of dissolved nutrients (NO_{3+2}) and dissolved solids (through SC measurements) is related to ground water seepage.

d. Any long-term trends in constituent loads and yields will be related to trends in flow and land-use activities.

e. Observed FC and nutrient yields are related to the number of animals associated with confined animal operations (dairies and feedlots) and the type of waste management practices employed within a given HUA.

f. Errors associated with annual and seasonal (irrigation and non-irrigation) loads and yields will decrease with the availability of daily, mean discharge information and higher sampling frequency.

Question 2 - Method of Analysis:

a. A method of calculating loads, yields, and variability (annual and seasonal) will be selected which is acceptable to all users of the data.

b. Use regression analysis to determine the relationship between dependent variables (constituent loads and yields) and independent variables.

c. Plot the logarithm of discharge against the logarithm of constituent loads. If there is a noticeable break in how the data correlates, consider splitting the data into two data sets.

d. Use regression analysis to establish a relationship between flow and constituent loads. If constituent loads are defined with sufficient precision, consider decreasing sampling frequency and only measuring discharge.

e. When 50 samples per site have been established over multiple years, compare distributions of data from year-to-year, with and without flow correction, to establish long-term trends. Also, look for trends that might correlate with current land-use activities.

Question 3 - Granger Hydrologic Unit Area:

a. What is the seasonal and spatial variability of constituent concentrations and levels, loads, and yields within the Granger HUA for the water quality parameters of interest?

b. What are the sources or causes within a given HUA which are responsible for the variability in constituent loads and yields?

c. What is the difference between irrigation and non-irrigation seasons?

d. What are the long-term trends in the data?

e. Does the data exceed state standards?

f. How does the concentration measured relate to discharge?

g. What is the relationship between turbidity and TSS?

Question 3 - Hypotheses:

a. Concentration and measurements are variable in time and space. Observed FC and nutrient concentrations are related to the location of confined animal operations (dairies and feedlots) within a sub-basin. Turbidity and TSS will be higher at the start of the irrigation season. Water temperature, SC, and pH are expected to increase from the headwaters to the mouth of drains.

b. Independent variables within a given HUA (e.g., soil type, stream and land gradients, land-use practices, irrigation methods, water use, drainage acreage, the number of confined animal operations, and the total number of animals associated with each operation) determine some of the observed variability in constituent loads and yields.

c. Trends likely to be observed going from the irrigation to the non-irrigation seasons include: 1) decreases in turbidity, TSS, FC (increase during storm events), and flow, 2) increases in nutrients, DO, and SC, and 3) a small increase in pH values.

d. Long-term trends include: 1) decreases in loads and yields for TSS, turbidity, FC, and TP, and in concentrations if flows are comparable to previous years, and 2) increases in NO_{3+2} concentrations and SC levels during the irrigation season, with a decrease in these parameters during non-irrigation season, if flows are comparable to previous years.

e. Measured values expected to exceed state standards include: 1) turbidity values of 25 NTU (often), 2) FC (often), 3) temperature (often), 4) DO and pH (seldom).

f. A direct relationship is expected between flow and concentration during the irrigation season for TSS, FC, turbidity, and TP. An indirect relationship is expected during the same period for NO_{3+2}, and SC. During the non-irrigation season, similar results will be found if increased flows are the result of surface water runoff caused by storm events.

g. Good relationships are expected between turbidity and TSS; however, relationships established during the irrigation season may not agree well with the non-irrigation season.

Question 3 - Method of Analysis:

a. Plots of concentration versus time will establish temporal variability for the constituents of interest. Box plots for all samples at a particular site versus all other sites will establish spatial variability for the constituents of interest. Plot the number of animals associated with confined animal operations (dairy and/or feedlot) above sampling sites versus FC and nutrient levels. Plot the distance between confined animal operations and sampling sites to determine if a relationship exists between FC and nutrient levels and the proximity to sample site locations. Look for a relationship between waste management practices and FC and nutrient levels at sampling sites downstream of operations. Plot TSS and turbidity levels versus time, and, in doing so, consider two time periods within the irrigation season such that box plots can be used. Plot temperature, pH, and SC versus distance from the mouth of the drain to the sampling sites.

b. Use regression analysis to determine the relationship between dependent variables (constituent loads and yields) and independent variables.

c. Box plots between the irrigation and non-irrigation seasons will establish seasonal differences for the constituents of interest.

d. When 50 samples per site have been established over multiple years, compare distributions of data from year-to-year, with and without flow correction, to establish long-term trends.

e. Compare results obtained to state standards.

f. Plot the logarithm of measured flow against the concentration of each constituent.

g. Plot the logarithm of TSS versus the logarithm of turbidity for both the irrigation and non-irrigation seasons and overlay the two plots. Test the feasibility of using one relationship for each sub-basin and one for the entire Granger HUA.

Question 4 - Granger Hydrologic Unit Area Sedimentation Ponds:

a. How effective are sedimentation ponds at reducing TSS, turbidity, FC, and TP levels in irrigation return flows?

b. What percent of the constituents are retained or not retained by the sedimentation ponds?

c. How was the effectiveness of a particular sedimentation pond related to the independent variables within a given drainage sub-basin (e.g., soil type, stream and land gradients, land-use practices, irrigation methods, water use, drainage acreage, the number of confined animal operations, the number of animals associated with each operation, etc.).

Question 4 - Hypotheses:

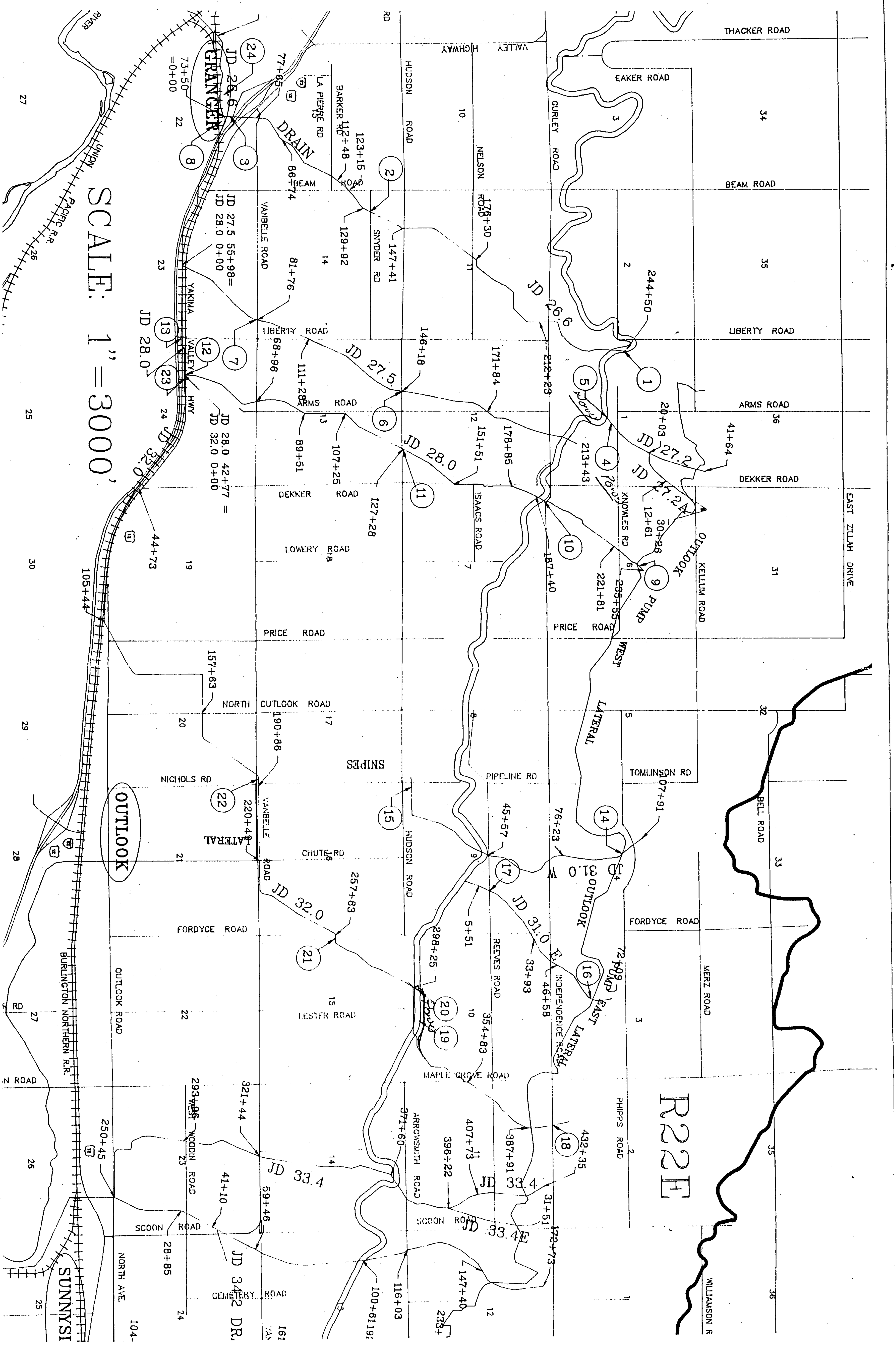
a. TSS and TP levels are anticipated to decrease by 50% and 25% respectively, with a corresponding decrease in turbidity expected as well.

b. The effectiveness of sedimentation ponds will be dependent on the independent variables within a given drainage sub-basin.

Question 4 - Method of Analysis:

a. Evaluate the mass of solid material which enters, exits, and is retained by a particular sedimentation pond. Sum the mass of material which is retained to that which exits and compare this value to the mass of solid material which enters the system.

b. Determine correlations between the dependent variables (TSS, turbidity, FC, and TP) and independent variables to evaluate the causes and sources of materials retained by sedimentation ponds. This correlation can then be used to identify primary locations within drainage sub-basins for the construction of sediment ponds that will serve as BMPs.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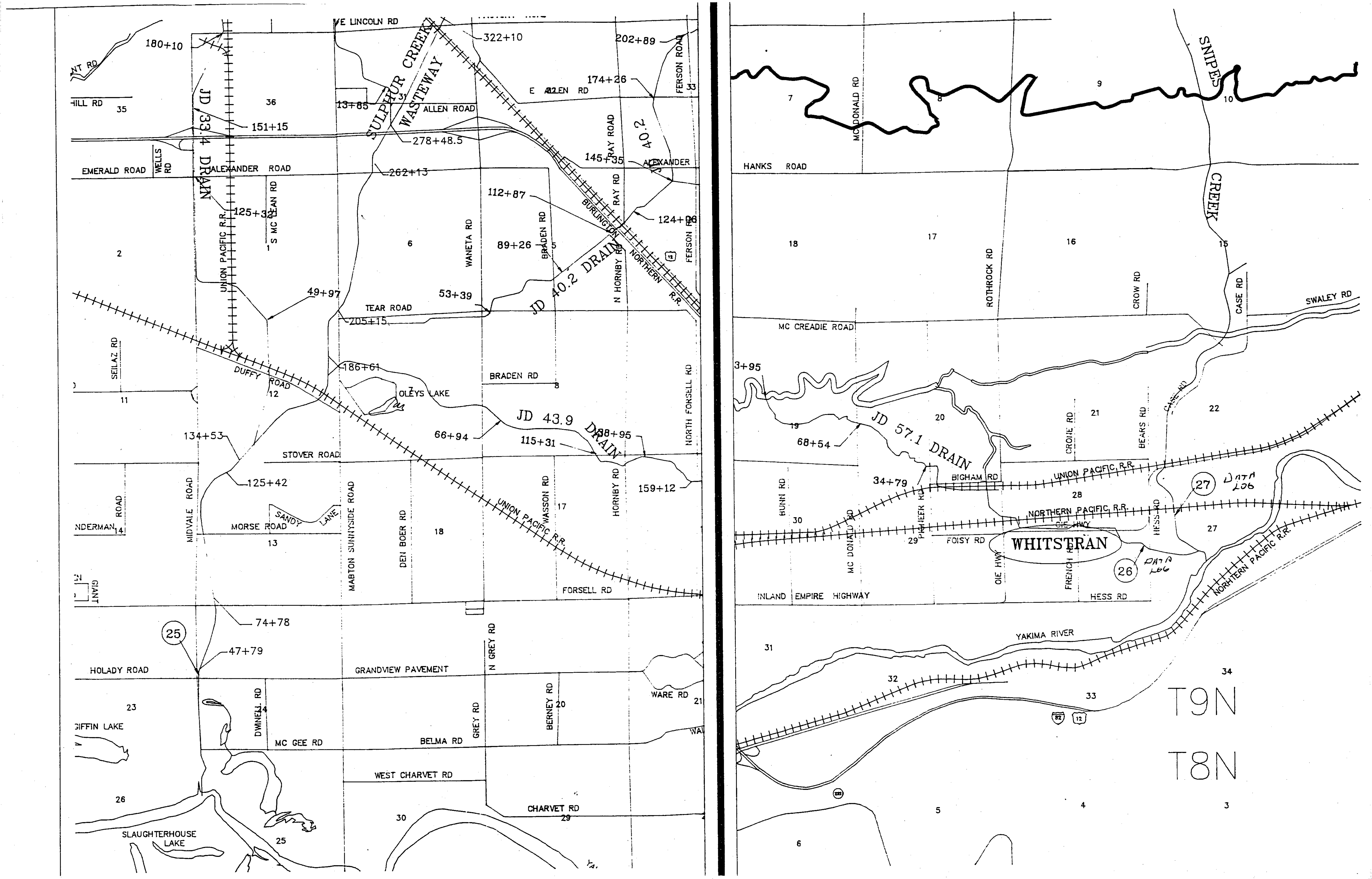
GRANGER
OUTLOOK
SNIPES
R22E
THACKER ROAD
EAKER ROAD
BEAM ROAD
LIBERTY ROAD
ARMS ROAD
DEKKER ROAD
EAST ZILLAH DRIVE
KELLUM ROAD
PRICE ROAD
TOMLINSON RD
BELL ROAD
FORDYCE ROAD
MERZ ROAD
PHIPPS ROAD
WILLIAMSON R
GURLEY ROAD
NELSON ROAD
HUDSON ROAD
VALLEY HIGHWAY
BARKER RD
LA PIERRE RD
SNYDER RD
VANBELLE ROAD
YAKIMA VALLEY HWY
ISAACS ROAD
KNOWLES RD
LOWERY ROAD
NORTH OUTLOOK ROAD
NICHOLS RD
PIPELINE RD
CHUTE RD
REEVES ROAD
INDEPENDENCE ROAD
LESTER ROAD
MAPLE GROVE ROAD
ARROWSMITH ROAD
SCOON ROAD
WOODIN ROAD
CEMETERY ROAD
OUTLOOK ROAD
NORTH AVE.
UNION PACIFIC R.R.
BURLINGTON NORTHERN R.R.
RIVER
DRAIN
OUTLOOK PUMP
WEST LATERAL
EAST LATERAL
JD 26.6
JD 27.2
JD 27.2A
JD 27.5
JD 28.0
JD 31.0 W
JD 31.0 E
JD 32.0
JD 33.4
JD 33.4E
JD 34.2 DR.
SUNNYSI



JD 33.4 DRAIN
JD 40.2 DRAIN
JD 43.9 DRAIN
JD 57.1 DRAIN
SULPHUR CREEK WASTEWAY
SNIPES CREEK
YAKIMA RIVER
WHITSTRAN
UNION PACIFIC R.R.
BURLINGTON NORTHERN R.R.
NORTHERN PACIFIC R.R.
180+10
322+10
202+89
174+26
151+15
278+48.5
145+35
262+13
112+87
125+32
124+06
89+26
49+97
53+39
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88+95
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134+53
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FERSON ROAD
HILL RD
EMERALD ROAD
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ALEXANDER ROAD
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BRADEN RD
TEAR ROAD
N HORNBY RD
FERSON RD
NORTH FORSELL RD
SEILAZ RD
DUFFY ROAD
OLEYS LAKE
STOVER ROAD
HORNBY RD
WASSON RD
MIDVALE ROAD
MORSE ROAD
SANDY LANE
MABTON SUNNYSIDE ROAD
DEN BOER RD
FORSELL RD
GIANT
HOLADY ROAD
GRANDVIEW PAVEMENT
N GREY RD
GREY RD
BERNEY RD
WARE RD
DWINELL RD
MC GEE RD
BELMA RD
WEST CHARVET RD
CHARVET RD
GIFFIN LAKE
SLAUGHTERHOUSE LAKE
HANKS ROAD
MC DONALD RD
ROTHROCK RD
CROW RD
CASE RD
SWALEY RD
MC CREADIE ROAD
BUNN RD
PIONEER RD
BIGHAM RD
CRONE RD
BEARS RD
HESS RD
FOISY RD
OIE HWY
FRENCH RD
INLAND EMPIRE HIGHWAY

APPENDIX 9

Who We Are and What We're Doing

The Department of Ecology has started a new project to provide water quality education and technical assistance to irrigators and farmers in the basin. Field staff will be visiting agricultural areas throughout the Yakima Basin during the growing season to help identify and solve potential pollution problems.

Important facts we'd like you to know:

- **Soil erosion and the migration of nutrients and chemicals from agricultural areas adds to water pollution in the Yakima River.**
- **The average farmer using furrow/rill irrigation in the Yakima Valley loses about 30 tons of topsoil per acre each year.**
- **Several species of Yakima River fish may soon be listed as "threatened" or "endangered" species, increasing demands for cool, clean water in the Yakima River.**
- **Water in irrigation canals, ditches and drains must meet applicable Washington State water quality standards.**
- **New total maximum daily load (TMDL) targets require that water flowing from drains and tributaries into the Lower Yakima River must have sediment loads reduced by as much as 95% of current loads.**

If you have questions ...... feel free to give us a call at (509) 454-7894 or (509) 575-2642, or stop by Ecology's Yakima office. We look forward to talking with you.

What Are "Best Management Practices"?

Best Management Practices (or "BMPs" as they are commonly known) are specific agricultural management principles or hardware changes. BMPs can help reduce water pollution and soil erosion and increase water conservation. Farmers have found that using BMPs can result in lower operating costs and reduced fertilizer and water expenses. Farmers have also found that crop production and crop quality improve noticeably after using BMPs.

Examples of BMPs:

- **Use soil moisture measurements to help plan irrigation.**
- **Apply PAM (polyacryliamide) or install straw mulch in furrows to prevent erosion.**
- **If using rill/furrow irrigation, consider converting to drip or sprinkler.**
- **Install sedimentation ponds.**
- **Install vegetative buffering strips.**
- **Gather and reuse surface runoff.**
- **Use conservation tillage methods to reduce erosion.**
- **Evaluate the irrigation system using NRCS, CD or WSU Extension Service procedures.**

We have a variety of free materials to give you regarding BMPs and other related issues. Give us a call at (509) 454-7894 or (509) 575-2642 to request this information.

AGRICULTURAL WATER QUALITY EDUCATION PROGRAM

North Yakima County

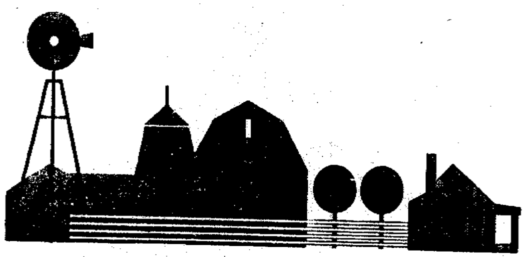
Washington State Department of Ecology

Central Washington Regional Office
Yakima, WA 98902
(509) 575-2490

Publication No. 98-06

Natural Resource Conservation Service (NRCS)

The Natural Resources Conservation Service (NRCS), formerly the Soil Conservation Service, is the federal agency in Washington State that works with people to help sustain natural resources on private lands. Their capable staff is ready to provide free technical and educational assistance. NRCS can help you with plans to promote water and soil conservation on your farm.



The Environmental Quality Incentives Program (EQIP) was created in the 1996 Farm Bill to provide a voluntary conservation program for farmers and ranchers to address significant natural resource needs and objectives. EQIP funding is cost-share. NRCS also provides a variety of other cost share programs that growers can use for conservation and other improvements.

Contact your local NRCS representative for more information about EQIP and other programs:

Jay Kehne
NRCS District Conservationist
1606 Perry Street, Suite F
Yakima, WA 98902
(509) 454-5736

North Yakima Conservation District

A conservation district (CD) is a local unit of government, established to increase voluntary soil and water conservation practices among farmers, ranchers and other land users. A group of local landowners directs all operations of the CD.

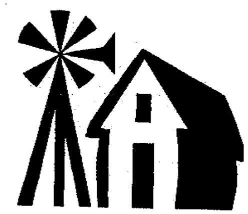
The North Yakima Conservation District works with NRCS to provide cost-share funding for agricultural soil and water conservation programs.

Contact your CD's knowledgeable staff for details on designing a farm conservation plan and applying for financial assistance:

Mike Tobin
District Manager
1606 Perry Street, Suite F
Yakima, WA 98902
(509) 454-5736

WSU Cooperative Extension Service

The Washington State University (WSU) Cooperative Extension Service helps farmers use research-based knowledge to improve farming practices and crop production. All extension agents are faculty of Washington State University and are available for free consultation. The Extension Service also has hundreds of research publications on a variety of topics.



Contact your local Extension Service office at:

WSU Cooperative Extension Service
128 North 2nd Street
Courthouse, Room 209
Yakima, WA 98902
(509) 574-1600

Ecology is an equal opportunity agency. To receive information in alternate format, call (509) 454-7894 (voice) or (509) 454-7673 (TDD).

APPENDIX 10

CHAPTER 90.48 RCW

WATER POLLUTION CONTROL

Sections

responsible for water quality standards--Forest practices regulations--Promulgation--Examination--Enforcement procedures.

90.48.425 Forest practices act and regulations relating to water quality protection to be utilized to satisfy federal water pollution act.

90.48.430 Watershed restoration projects--Approval process--Waiver of public review.

90.48.445 Aquatic noxious weed control--Water quality permits--Definition.

90.48.450 Discharges from agricultural activity--Consideration to be given as to whether enforcement action would contribute to conversion of land to nonagricultural use--Minimize the possibility.

90.48.455 Discharge of chlorinated organics--Engineering reports by pulp and paper mills--Permits limiting discharge.

90.48.465 Water discharge fees.

90.48.480 Reduction of sewer overflows--Plans--Compliance schedule--Report to the legislature.

90.48.490 Sewage treatment facilities--Plans to upgrade or construct.

90.48.495 Water conservation measures to be considered in sewer plans.

90.48.500 Pollution Disclosure Act of 1971.

90.48.520 Review of operations before issuance or renewal of wastewater discharge permits--Incorporation of permit conditions.

90.48.900 Severability--1945 c 216.

90.48.901 Severability--1967 c 13.

90.48.902 Severability--1970 ex.s. c 88.

90.48.903 Severability--1971 ex.s. c 180.

90.48.904 Severability--1989 c 262.

90.48.906 Short title--1971 ex.s. c 180.

NOTES:

County water and sewerage systems, approval of the department of social and health services and the department of ecology: RCW 36.94.100.

Domestic waste treatment plants--Certification and regulation of operators: Chapter 70.95B RCW.

Ecology, department of, powers, duties, and functions: RCW 43.21A.060.

Environmental certification programs--Fees--Rules--Liability: RCW 43.21A.175.

Oil and hazardous substance spill prevention and response: Chapter 90.56 RCW.

Oil tankers on Puget Sound, restrictions, etc.: RCW 88.16.170 through 88.16.190.

Shellfish, sanitary control: RCW 69.30.130.

Washington clean air act: Chapter 70.94 RCW.

Water-sewer district powers as to mutual systems, approval of exercise by pollution control commission: RCW 57.08.065.

Water pollution control facilities, tax exemptions and credits: Chapter 82.34 RCW.

RCW 90.48.010 Policy enunciated. It is declared to be the public policy of the state of Washington to maintain the highest possible standards to insure the purity of all waters of the state consistent with public health and public enjoyment thereof, the propagation and protection of wild life, birds, game, fish and other aquatic life, and the industrial development of the state, and to that end require the use of all known available and reasonable methods by industries and others to prevent and control the pollution of the waters of the state of Washington. Consistent with this policy, the state of Washington will exercise its powers, as fully and as effectively as possible, to retain and secure high quality for all waters of the state. The state of Washington in recognition of the federal government's interest in the quality of the navigable waters of the United States, of which certain portions thereof are within the jurisdictional limits of this state, proclaims a public policy of working cooperatively with the federal government in a joint effort to extinguish the sources of water quality degradation, while at the same time preserving and vigorously exercising state powers to insure that present and future standards of water quality within the state shall be determined by the citizenry, through and by the efforts of state government, of the state of Washington. [1973 c 155 § 1; 1945 c 216 § 1; Rem. Supp. 1945 § 10964a.]

RCW 90.48.020 Definitions. Whenever the word "person" is used in this chapter, it shall be construed to include any political subdivision, government agency, municipality, industry, public or private corporation, copartnership, association, firm, individual or any other entity whatsoever.

Wherever the words "waters of the state" shall be used in this chapter, they shall be construed to include lakes, rivers, ponds, streams, inland waters, underground waters, salt waters and all other surface waters and watercourses within the jurisdiction of the state of Washington.

Whenever the word "pollution" is used in this chapter, it shall be construed to mean such contamination, or other alteration of the physical, chemical or biological properties, of any waters of the state, including change in temperature, taste, color, turbidity, or odor of the waters, or such discharge of any liquid, gaseous, solid, radioactive, or other substance into any waters of the state as will or is likely to create a nuisance or render such waters harmful, detrimental or injurious to the public health, safety or welfare, or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or to livestock, wild animals, birds, fish or other aquatic life.

Wherever the word "department" is used in this chapter it shall mean the department of ecology.

Whenever the word "director" is used in this chapter it shall mean the director of ecology.

Whenever the words "aquatic noxious weed" are used in this chapter, they have the meaning prescribed under RCW 17.26.020. [1995 c 255 § 7; 1987 c 109 § 122; 1967 c 13 § 1; 1945 c 216 § 2; Rem. Supp. 1945 § 10964b.]

NOTES:

Severability--Effective date--1995 c 255: See RCW 17.26.900 and 17.26.901.

Purpose--Short title--Construction--Rules--Severability--Captions--1987 c 109: See notes following RCW 43.21B.001.

RCW 90.48.030 Jurisdiction of department. The department shall have the jurisdiction to control and prevent the pollution of streams, lakes, rivers, ponds, inland waters, salt waters, water courses, and other surface and underground waters of the state of Washington. [1987 c 109 § 123; 1945 c 216 § 10; Rem. Supp. 1945 § 10964j. FORMER PART OF SECTION: 1945 c 216 § 11; Rem. Supp. 1945 § 10964k, now codified as RCW 90.48.035.]

NOTES:

Purpose--Short title--Construction--Rules--Severability--Captions--1987 c 109: See notes following RCW 43.21B.001.

Powers, duties, and functions transferred to department of ecology: RCW 43.21A.060.

RCW 90.48.035 Rule-making authority. The department shall have the authority to, and shall promulgate, amend, or rescind such rules and regulations as it shall deem necessary to carry out the provisions of this chapter, including but not limited to rules and regulations relating to standards of quality for waters of the state and for substances discharged therein in order to maintain the highest possible standards of all waters of the state in accordance with the public policy as declared in RCW 90.48.010. [1987 c 109 § 124; 1970 ex.s. c 88 § 11; 1967 c 13 § 6; 1945 c 216 § 11; Rem. Supp. 1945 § 10964k. Formerly RCW 90.48.030, part.]

NOTES:

Purpose--Short title--Construction--Rules--Severability--Captions--1987 c 109: See notes following RCW 43.21B.001.

RCW 90.48.037 Authority of department to bring enforcement actions. The department, with the assistance of the attorney general, is authorized to bring any appropriate action at law or in equity, including action for injunctive relief, in the name of the people of the state of Washington as may be necessary to carry out the provisions of this chapter or chapter 90.56 RCW. [1991 c 200 § 1102; 1987 c 109 § 125; 1967 c 13 § 7.]

NOTES:

Effective dates--Severability--1991 c 200: See RCW 90.56.901 and 90.56.904.

Purpose--Short title--Construction--Rules--Severability--Captions--1987 c 109: See notes following RCW 43.21B.001.

RCW 90.48.039 Hazardous substance remedial actions--Procedural requirements not applicable. The procedural requirements of this chapter shall not apply to any person conducting a remedial action at a facility pursuant to a consent decree, order, or agreed order issued pursuant to chapter 70.105D RCW, or to the department of ecology when it conducts a remedial action under chapter 70.105D RCW. The department of ecology shall ensure compliance with the substantive requirements of this chapter through the consent decree, order, or agreed order issued pursuant to chapter 70.105D RCW, or during the department-conducted remedial action, through the procedures developed by the department pursuant to RCW 70.105D.090. [1994 c 257 § 19.]

NOTES:

Severability--1994 c 257: See note following RCW 36.70A.270.

RCW 90.48.045 Environmental excellence program agreements--Effect on chapter. Notwithstanding any other provision of law, any legal requirement under this chapter, including any standard, limitation, rule, or order is superseded and replaced in accordance with the terms and provisions of an environmental excellence program agreement, entered into under chapter 43.21K RCW. [1997 c 381 § 26.]

NOTES:

Purpose--1997 c 381: See RCW 43.21K.005.

RCW 90.48.080 Discharge of polluting matter in waters prohibited. It shall be unlawful for any person to throw, drain, run, or otherwise discharge into any of the waters of this state, or to cause, permit or suffer to be thrown, run, drained, allowed to seep or otherwise discharged into such waters any organic or inorganic matter that shall cause or tend to cause pollution of such waters according to the determination of the department, as provided for in this chapter. [1987 c 109 § 126; 1967 c 13 § 8; 1945 c 216 § 14; Rem. Supp. 1945 § 10964n.]

NOTES:

Purpose--Short title--Construction--Rules--Severability--Captions--1987 c 109: See notes following RCW 43.21B.001.

RCW 90.48.090 Right of entry--Special inspection requirements for metals mining and milling operations. The department or its duly appointed agent shall have the right to enter at all reasonable times in or upon any property, public or private, for the purpose of inspecting and investigating conditions relating to the pollution of or the possible pollution of any of the waters of this state.

The department shall have special inspection requirements for metals mining and milling operations regulated under chapter 232, Laws of 1994. The department shall inspect these mining and milling operations at least quarterly in order to ensure compliance with the intent and any permit issued pursuant to this chapter. The department shall conduct additional inspections as needed during the construction phase of these mining operations in order to ensure compliance with this chapter. [1994 c 232 § 21; 1987 c 109 § 127; 1945 c 216 § 15; Rem. Supp. 1945 § 10964o.]

NOTES:

Severability--1994 c 232: See RCW 78.56.900.

Effective date--1994 c 232 §§ 6-8 and 18-22: See RCW 78.56.902.

Purpose--Short title--Construction--Rules--Severability--Captions--1987 c 109: See notes following RCW 43.21B.001.

RCW 90.48.095 Authority of department to compel attendance and testimony of witnesses, production of books and papers--Contempt proceedings to enforce--Fees. In carrying out the purposes of this chapter or chapter 90.56 RCW the department shall, in conjunction with either the adoption of rules, consideration of an application for a waste discharge permit or the termination or modification of such permit, or proceedings in adjudicative hearings, have the authority to issue process and subpoena witnesses effective throughout the state on its own behalf or that of an interested party, compel their attendance, administer oaths, take the testimony of any person under oath and, in connection therewith require the production for examination of any books or papers relating to the matter under consideration by the department. In case of disobedience on the part of any person to comply with any subpoena issued by the department, or on the refusal of any witness to testify to any matters regarding which he may be lawfully interrogated, it shall be the duty of the superior court of any county, or of the judge thereof, on application of the department, to compel obedience by proceedings for contempt, as in the case of disobedience of the requirements of a subpoena issued from such court or a refusal to testify therein. In connection with the authority granted under this section no witness or other person shall be required to divulge trade secrets or secret processes. Persons responding to a subpoena as provided herein shall be entitled to fees as are witnesses in superior court. [1991 c 200 § 1103; 1987 c 109 § 128; 1967 c 13 § 9.]

NOTES:

Effective dates--Severability--1991 c 200: See RCW 90.56.901 and 90.56.904.

Purpose--Short title--Construction--Rules--Severability--Captions--1987 c 109: See notes following RCW 43.21B.001.

RCW 90.48.100 Request for assistance. The department shall have the right to request and receive the assistance of any educational institution or state agency when it is deemed necessary by the department to carry out the provisions of this chapter or chapter 90.56 RCW. [1991 c 200 § 1104; 1987 c 109 § 129; 1945 c 216 § 16; Rem. Supp. 1945 § 10964p.]

NOTES:

Effective dates--Severability--1991 c 200: See RCW 90.56.901 and 90.56.904.

Purpose--Short title--Construction--Rules--Severability--Captions--1987 c 109: See notes following RCW 43.21B.001.

RCW 90.48.110 Plans and proposed methods of operation and maintenance of sewerage or disposal systems to be submitted to department--Exceptions. (1) Except under subsection (2) of this section, all engineering reports, plans, and specifications for the construction of new sewerage systems, sewage treatment or disposal plants or systems, or for improvements or extensions to existing sewerage systems or sewage treatment or disposal plants, and the proposed method of future operation and maintenance of said facility or facilities, shall be submitted to and be approved by the department, before construction thereof may begin. No approval shall be given until the department is satisfied that said plans and specifications and the methods of operation and maintenance submitted are adequate to protect the quality of the state's waters as provided for in this chapter.

(2) To promote efficiency in service delivery and intergovernmental cooperation in protecting the quality of the state's waters, the department may delegate the authority for review and approval of engineering reports, plans, and specifications for the construction of new sewerage systems, sewage treatment or disposal plants or systems, or for improvements or extensions to existing sewerage system or sewage treatment or disposal plants, and the proposed method of future operations and maintenance of said facility or facilities and industrial pretreatment systems, to local units of government requesting such delegation and meeting criteria established by the department. [1994 c 118 § 1; 1987 c 109 § 130; 1967 c 13 § 10; 1945 c 216 § 17; Rem. Supp. 1945 § 10964q.]

NOTES:

Purpose--Short title--Construction--Rules--Severability--Captions--1987 c 109: See notes following RCW 43.21B.001.

RCW 90.48.112 Plan evaluation--Consideration of reclaimed water. The evaluation of any plans submitted under RCW 90.48.110 must include consideration of opportunities for the use of reclaimed water as defined in RCW 90.46.010. [1997 c 444 § 9.]

NOTES:

Severability--1997 c 444: See note following RCW 90.46.010.

RCW 90.48.120 Notice of department's determination that violation has or will occur--Report to department of compliance with determination--Order or directive to be issued--Notice. (1) Whenever, in the opinion of the department, any person shall violate or creates a substantial potential to violate the provisions of this chapter or chapter 90.56 RCW, or fails to control the polluting content of waste discharged or to be discharged into any waters of the state, the department shall notify such person of its determination by registered mail. Such determination shall not constitute an order or directive under RCW 43.21B.310. Within thirty days from the receipt of notice of such determination, such person shall file with the department a full report stating what steps have been and are being taken to control such waste or pollution or to otherwise comply with the determination of the department. Whereupon the department shall issue such order or directive as it deems appropriate under the circumstances, and shall notify such person thereof by registered mail.

(2) Whenever the department deems immediate action is necessary to accomplish the purposes of this chapter or chapter 90.56 RCW, it may issue such order or directive, as appropriate under the circumstances, without first issuing a notice or determination pursuant to subsection (1) of this section. An order or directive issued pursuant to this subsection shall be served by registered mail or personally upon any person to whom it is directed. [1992 c 73 § 25; 1987 c 109 § 131; 1985 c 316 § 3; 1973 c 155 § 2; 1967 c 13 § 11; 1945 c 216 § 18; Rem. Supp. 1945 § 10964r.]

NOTES:

Effective dates--Severability--1992 c 73: See RCW 82.23B.902 and 90.56.905.

Purpose--Short title--Construction--Rules--Severability--Captions--1987 c 109: See notes following RCW 43.21B.001.

Appeal of orders under RCW 90.48.120(2): RCW 43.21B.310.

RCW 90.48.140 Penalty. Any person found guilty of willfully violating any of the provisions of this chapter or chapter 90.56 RCW, or any final written orders or directive of the department or a court in pursuance thereof shall be deemed guilty of a crime, and upon conviction thereof shall be punished by a fine of up to ten thousand dollars and costs of prosecution, or by imprisonment in the county jail for not more than one year, or by both such fine and imprisonment in the discretion of the court. Each day upon which a willful violation of the provisions of this chapter or chapter 90.56 RCW occurs may be deemed a separate and additional violation. [1992 c 73 § 26; 1973 c 155 § 8; 1945 c 216 § 20; Rem. Supp. 1945 § 10964t.]

NOTES:

Effective dates--Severability--1992 c 73: See RCW 82.23B.902 and 90.56.905.

RCW 90.48.142 Violations--Liability in damages for injury or death of fish, animals, vegetation--Action to recover. (1) Any person who:

(a)(i) Violates any of the provisions of this chapter or chapter 90.56 RCW;

(ii) Fails to perform any duty imposed by this chapter or chapter 90.56 RCW;

(iii) Violates an order or other determination of the department or the director made pursuant to the provisions of this chapter or chapter 90.56 RCW;

(iv) Violates the conditions of a waste discharge permit issued pursuant to RCW 90.48.160; or

(v) Otherwise causes a reduction in the quality of the state's waters below the standards set by the department or, if no standards have been set, causes significant degradation of water quality, thereby damaging the same; and

(b) Causes the death of, or injury to, fish, animals, vegetation, or other resources of the state;

shall be liable to pay the state and affected counties and cities damages in an amount determined pursuant to RCW 90.48.367.

(2) No action shall be authorized under this section against any person operating in compliance with the conditions of a waste discharge permit issued pursuant to RCW 90.48.160. [1991 c 200 § 810; 1989 c 262 § 2; 1988 c 36 § 69; 1987 c 109 § 132; 1985 c 316 § 6; 1970 ex.s. c 88 § 12; 1967 ex.s. c 139 § 13.]

NOTES:

Effective dates--Severability--1991 c 200: See RCW 90.56.901 and 90.56.904.

Findings--1989 c 262: "The legislature finds that there is confusion regarding the measure of damages authorized under RCW 90.48.142. The intent of this act is to clarify existing law on the measure of damages authorized under RCW 90.48.142, not to change the law." [1989 c 262 § 1.] "This act" consists of the 1989 c 262 amendments to RCW 90.48.142, 90.48.390, and 90.48.400.

Purpose--Short title--Construction--Rules--Severability--Captions--1987 c 109: See notes following RCW 43.21B.001.

Severability--1967 ex.s. c 139: See RCW 82.34.900.

RCW 90.48.144 Violations--Civil penalty--Procedure. Except as provided in RCW 43.05.060 through 43.05.080 and 43.05.150, every person who:

(1) Violates the terms or conditions of a waste discharge permit issued pursuant to RCW 90.48.180 or 90.48.260 through 90.48.262, or

(2) Conducts a commercial or industrial operation or other point source discharge operation without a waste discharge permit as required by RCW 90.48.160 or 90.48.260 through 90.48.262, or

(3) Violates the provisions of RCW 90.48.080, or other sections of this chapter or chapter 90.56 RCW or rules or orders adopted or issued pursuant to either of those chapters, shall incur, in addition to any other penalty as provided by law, a penalty in an amount of up to ten thousand dollars a day for every such violation. Each and every such violation shall be a separate and distinct offense, and in case of a continuing violation, every day's continuance shall be and be deemed to be a separate and distinct violation. Every act of commission or omission which procures, aids or abets in the violation shall be considered a violation under the provisions of this section and subject to the penalty herein provided for. The penalty amount shall be set in consideration of the previous history of the violator and the severity of the violation's impact on public health and/or the environment in addition to other relevant factors. The penalty herein provided for shall be imposed pursuant to the procedures set forth in RCW 43.21B.300. [1995 c 403 § 636; 1992 c 73 § 27; 1987 c 109 § 17; 1985 c 316 § 2; 1973 c 155 § 9; 1970 ex.s. c 88 § 13; 1967 ex.s. c 139 § 14.]

NOTES:

Findings--Short title--Intent--1995 c 403: See note following RCW 34.05.328.

Part headings not law--Severability--1995 c 403: See RCW 43.05.903 and 43.05.904.

Effective dates--Severability--1992 c 73: See RCW 82.23B.902 and 90.56.905.

Purpose--Short title--Construction--Rules--Severability--Captions--1987 c 109: See notes following RCW 43.21B.001.

Severability--1967 ex.s. c 139: See RCW 82.34.900.

RCW 90.48.150 Construction of chapter. This chapter shall not be construed as repealing any of the laws governing the pollution of the waters of the state, but shall be held and construed as ancillary to and supplementing the same and an addition to the laws now in force, except as the same may be in direct conflict herewith. [1945 c 216 § 21; Rem. Supp. 1945 § 10964u.]

RCW 90.48.153 Cooperation with federal government--Federal funds. The department is authorized to cooperate with the federal government and to accept grants of federal funds for carrying out the purposes of this chapter. The department is empowered to make any application or report required by an agency of the federal government as an incident to receiving such grants. [1987 c 109 §

133; 1949 c 58 § 1; Rem. Supp. 1949 § 10964pp. , Formerly RCW 90.48.040.]

NOTES:

Purpose--Short title--Construction--Rules--Severability--Captions--1987 c 109: See notes following RCW 43.21B.001.

RCW 90.48.156 Cooperation with other states and provinces--Interstate and state-provincial projects. The department is authorized to cooperate with appropriate agencies of neighboring states and neighboring provinces, to enter into contracts, and make contributions toward interstate and state-provincial projects to carry out the purposes of this chapter and chapter 90.56 RCW. [1991 c 200 § 1105; 1987 c 109 § 134; 1949 c 58 § 2; Rem. Supp. 1949 § 10964pp-1. Formerly RCW 90.48.050.]

NOTES:

Effective dates--Severability--1991 c 200: See RCW 90.56.901 and 90.56.904.

Purpose--Short title--Construction--Rules--Severability--Captions--1987 c 109: See notes following RCW 43.21B.001.

RCW 90.48.160 Waste disposal permit--Required--Exemptions. Any person who conducts a commercial or industrial operation of any type which results in the disposal of solid or liquid waste material into the waters of the state, including commercial or industrial operators discharging solid or liquid waste material into sewerage systems operated by municipalities or public entities which discharge into public waters of the state, shall procure a permit from either the department or the *thermal power plant site evaluation council as provided in RCW 90.48.262(2) before disposing of such waste material: PROVIDED, That this section shall not apply to any person discharging domestic sewage only into a sewerage system.

The department may, through the adoption of rules, eliminate the permit requirements for disposing of wastes into publicly operated sewerage systems for:

(1) Categories of or individual municipalities or public corporations operating sewerage systems; or

(2) Any category of waste disposer;

if the department determines such permit requirements are no longer necessary for the effective implementation of this chapter. The department may by rule eliminate the permit requirements for disposing of wastes by upland finfish rearing facilities unless a permit is required under the federal clean water act's national pollutant discharge elimination system. [1989 c 293 § 2; 1973 c 155 § 3; 1967 c 13 § 13; 1955 c 71 § 1.]

NOTES:

***Reviser's note:** The "thermal power plant site evaluation council" was redesignated the "energy facility site evaluation council" by 1975-'76 2nd ex.s. c 108.

RCW 90.48.162 Waste disposal permits required of counties, municipalities and public corporations. Any county or any municipal or public corporation operating or proposing to operate a sewerage system, including any system which collects only domestic sewerage, which results in the disposal of waste material into the waters of the state shall procure a permit from the department of ecology before so disposing of such materials. This section is intended to extend the permit system of RCW 90.48.160 to counties and municipal or public corporations and the provisions of RCW 90.48.170 through *90.48.210 and 90.52.040 shall be applicable to the permit requirement imposed under this section. [1972 ex.s. c 140 § 1.]

NOTES:

***Reviser's note:** RCW 90.48.210 was repealed by 1987 c 109 § 159.

RCW 90.48.165 Waste disposal permits required of counties, municipalities and public corporations--Cities, towns or municipal corporations may be granted authority to issue permits--Revocation--Termination of permits. Any city, town or municipal corporation operating a sewerage system including treatment facilities may be granted authority by the department to issue permits for the discharge of wastes to such system provided the department ascertains to its satisfaction that the sewerage system and the inspection and control program operated and conducted by the city, town or municipal corporation will protect the public interest in the quality of the state's waters as provided for in this chapter. Such authority may be granted by the department upon application by the city, town or municipal corporation and may be revoked by the department if it determines that such city, town, or municipal corporation is not, thereafter, operated and conducted in a manner to protect the public interest. Persons holding municipal permits to discharge into sewerage systems operated by a municipal corporation authorized by this section to issue such permits shall not be required to secure a waste discharge permit provided for in RCW 90.48.160 as to the wastes discharged into such sewerage systems. Authority granted by the department to cities, towns, or municipal corporations to issue permits under this section shall be in addition to any authority or power now or hereafter granted by law to cities, towns and municipal corporations for the regulation of discharges into sewerage systems operated by such cities, towns, or municipal corporations. Permits issued under this section shall automatically terminate if the authority to issue the same is revoked by the department. [1987 c 109 § 135; 1967 c 13 § 14.]

NOTES:

Purpose--Short title--Construction--Rules--Severability--Captions--1987 c 109: See notes following RCW 43.21B.001.

RCW 90.48.170 Waste disposal permits required of counties, municipalities and public corporations--Application--Notice as to new operation or increase in volume--Investigation--Notice to other state departments. Applications for permits shall be made on forms prescribed by the department and shall contain the name and address of the applicant, a description of the applicant's operations, the quantity and type of waste material sought to be disposed of, the proposed method of disposal, and any other relevant information deemed necessary by the department. Application for permits shall be made at least sixty days prior to commencement of any proposed discharge or permit expiration date, whichever is applicable. Upon receipt of a proper application relating to a new operation, or an operation previously under permit for which an increase in volume of wastes or change in character of effluent is requested over that previously authorized, the department shall instruct the applicant to publish notices thereof by such means and within such time as the department shall prescribe. The department shall require that the notice so prescribed shall be published twice in a newspaper of general circulation within the county in which the disposal of waste material is proposed to be made and in such other appropriate information media as the department may direct. Said notice shall include a statement that any person desiring to present his or her views to the department with regard to said application may do so in writing to the department, or any person interested in the department's action on an application for a permit, may submit his or her views or notify the department of his or her interest within thirty days of the last date of publication of notice. Such notification or submission of views to the department shall entitle said persons to a copy of the action taken on the application. Upon receipt by the department of an application, it shall immediately send notice thereof containing pertinent information to the director of fish and wildlife and to the secretary of social and health services. When an application complying with the provisions of this chapter and the rules and regulations of the department has been filed with the department, it shall be its duty to investigate the application, and determine whether the use of public waters for waste disposal as proposed will pollute the same in violation of the public policy of the state. [1994 c 264 § 91; 1988 c 36 § 70; 1987 c 109 § 136; 1967 c 13 § 15; 1955 c 71 § 2.]

NOTES:

Purpose--Short title--Construction--Rules--Severability--Captions--1987 c 109: See notes following RCW 43.21B.001.

RCW 90.48.180 Waste disposal permits required of counties, municipalities and public corporations--Issuance--Conditions--Duration. The department shall issue a permit unless it finds that the disposal of waste material as proposed in the application will pollute the waters of the state in violation of the public policy declared in RCW 90.48.010. The department shall have authority to specify conditions necessary to avoid such pollution in each permit under which waste material may be disposed of by the permittee.

Permits may be temporary or permanent but shall not be valid for more than five years from date of issuance. [1987 c 109 § 137; 1967 c 13 § 16; 1955 c 71 § 3.]

NOTES:

Purpose--Short title--Construction--Rules--Severability--Captions--1987 c 109: See notes following RCW 43.21B.001.

RCW 90.48.190 Waste disposal permits required of counties, municipalities and public corporations--Termination--Grounds. A permit shall be subject to termination upon thirty days' notice in writing if the department finds:

(1) That it was procured by misrepresentation of any material fact or by lack of full disclosure in the application;

(2) That there has been a violation of the conditions thereof;

(3) That a material change in quantity or type of waste disposal exists. [1987 c 109 § 138; 1967 c 13 § 17; 1955 c 71 § 4. (1987 3rd ex.s. c 2 § 43 repealed by 1989 c 2 § 24, effective March 1, 1989.)]

NOTES:

Purpose--Short title--Construction--Rules--Severability--Captions--1987 c 109: See notes following RCW 43.21B.001.

RCW 90.48.195 Waste disposal permits required of counties, municipalities and public corporations--Modification or additional conditions may be ordered. In the event that a material change in the condition of the state waters occurs the department may, by appropriate order, modify permit conditions or specify additional conditions in permits previously issued. [1987 c 109 § 139; 1967 c 13 § 18.]

NOTES:

Purpose--Short title--Construction--Rules--Severability--Captions--1987 c 109: See notes following RCW 43.21B.001.

RCW 90.48.200 Waste disposal permits required of counties, municipalities and public corporations--Nonaction upon application--Temporary permit--Duration. In the event of failure of the department to act upon an application within sixty days after it has been filed the applicant shall be deemed to have received a temporary permit. Said permit shall authorize the applicant to discharge wastes into waters of the state as requested in its application only until such time as the department shall have taken action upon said application. [1987 c 109 § 140; 1967 c 13 § 19; 1955 c 71 § 5.]

NOTES:

Purpose--Short title--Construction--Rules--Severability--Captions--1987 c 109: See notes following RCW 43.21B.001.

RCW 90.48.215 Upland finfish facilities--Waste discharge standards--Waste disposal permit. (1) The following definition shall apply to this section: "Upland finfish hatching and rearing facilities" means those facilities not located within waters of the state where finfish are hatched, fed, nurtured, held, maintained, or reared to reach the size of release or for market sale. This shall include fish hatcheries, rearing ponds, spawning channels, and other similarly constructed or fabricated public or private facilities.

(2) Not later than September 30, 1989, the department shall adopt standards pursuant to chapter 34.05 RCW for waste discharges from upland finfish hatching and rearing facilities. In establishing these standards, the department shall incorporate, to the extent applicable, studies conducted by the United States environmental protection agency on finfish rearing facilities and other relevant information. The department shall also issue a general permit as authorized by the federal clean water act, 33 U.S.C. 1251 et seq., or RCW 90.48.160 by September 30, 1989, for upland finfish hatching and rearing facilities. The department shall approve or deny applications for coverage under the general permit for upland finfish hatching and rearing facilities within one hundred eighty days from the date of application, unless a longer time is required to satisfy public participation requirements in the permit process in accordance with applicable rules, or compliance with the requirements of the state environmental policy act under chapter 43.21C RCW. The department shall notify applicants for coverage by a general permit as soon as it determines that a proposed discharge meets or fails to comply with the standards or general permit conditions set forth pursuant to this section, or that a time period longer than one hundred eighty days is necessary to satisfy public participation requirements or the state environmental policy act. [1989 c 293 § 1.]

RCW 90.48.220 Marine finfish rearing facilities--Waste discharge standards--Discharge permit applications--Exemption. (1) For the purposes of this section "marine finfish rearing facilities" means those private and public facilities located within the salt water of the state where finfish are fed, nurtured, held, maintained, or reared to reach the size of release or for market sale.

(2) Not later than October 31, 1994, the department shall adopt criteria under chapter 34.05 RCW for allowable sediment impacts from organic enrichment due to marine finfish rearing facilities.

(3) Not later than June 30, 1995, the department shall adopt standards under chapter 34.05 RCW for waste discharges from marine finfish rearing facilities. In establishing these standards, the department shall review and incorporate, to the extent possible, studies conducted by state and federal agencies on waste discharges from marine finfish rearing facilities, and any reports and other materials prepared by technical committees on waste discharges from marine finfish rearing facilities. The department shall approve or

deny discharge permit applications for marine finfish rearing facilities within one hundred eighty days from the date of application, unless a longer time is required to satisfy public participation requirements in the permit process in accordance with applicable rules, or compliance with the requirements of the state environmental policy act under chapter 43.21C RCW. The department shall notify applicants as soon as it determines that a proposed discharge meets or fails to comply with the standards adopted pursuant to this section, or if a time period longer than one hundred eighty days is necessary to satisfy public participation requirements of the state environmental policy act.

(4) The department may adopt rules to exempt marine finfish rearing facilities not requiring national pollutant discharge elimination system permits under the federal water pollution control act from the discharge permit requirement. [1993 c 296 § 1.]

RCW 90.48.230 Application of administrative procedure law to rule making and adjudicative proceedings. The provisions of chapter 34.05 RCW, the Administrative Procedure Act, apply to all rule making and adjudicative proceedings authorized by or arising under the provisions of this chapter. [1989 c 175 § 181; 1967 c 13 § 21.]

NOTES:

Effective date--1989 c 175: See note following RCW 34.05.010.

RCW 90.48.240 Water pollution orders for conditions requiring immediate action--Appeal. Notwithstanding any other provisions of this chapter or chapter 90.56 RCW, whenever it appears to the director that water quality conditions exist which require immediate action to protect the public health or welfare, or that a person required by RCW 90.48.160 to obtain a waste discharge permit prior to discharge is discharging without the same, or that a person conducting an operation which is subject to a permit issued pursuant to RCW 90.48.160 conducts the same in violation of the terms of said permit, causing water quality conditions to exist which require immediate action to protect the public health or welfare, the director may issue a written order to the person or persons responsible without prior notice or hearing, directing and affording the person or persons responsible the alternative of either (1) immediately discontinuing or modifying the discharge into the waters of the state, or (2) appearing before the department at the time and place specified in said written order for the purpose of providing to the department information pertaining to the violations and conditions alleged in said written order. The responsible person or persons shall be afforded not less than twenty-four hours notice of such an information meeting. If following such a meeting the department determines that water quality conditions exist which require immediate action as described herein, the department may issue a written order requiring immediate discontinuance or modification of the discharge into the waters of the state. In the event an order is not immediately complied with the attorney general, upon request of the department, shall seek and obtain an order of the superior court of the county in which the violation took place directing compliance with the order of the department. Such an order is appealable pursuant to RCW 43.21B.310. [1991 c 200 § 1106; 1987 c 109 § 15; 1967 c 13 § 22.]

NOTES:

Effective dates--Severability--1991 c 200: See RCW 90.56.901 and 90.56.904.

Purpose--Short title--Construction--Rules--Severability--Captions--1987 c 109: See notes following RCW 43.21B.001.

RCW 90.48.250 Agreements or contracts to monitor waters and effluent discharge. The department is authorized to make agreements and enter into such contracts as are appropriate to carry out a program of monitoring the condition of the waters of the state and the effluent discharged therein, including contracts to monitor effluent discharged into public waters when such monitoring is required by the terms of a waste discharge permit or as part of the approval of a sewerage system, if adequate compensation is provided to the department as a term of the contract. [1987 c 109 § 141; 1967 c 13 § 23.]

NOTES:

Purpose--Short title--Construction--Rules--Severability--Captions--1987 c 109: See notes following RCW 43.21B.001.

RCW 90.48.260 Federal clean water act--Department designated as state agency, authority--Powers, duties and functions. The department of ecology is hereby designated as the State Water Pollution Control Agency for all purposes of the federal clean water act as it exists on February 4, 1987, and is hereby authorized to participate fully in the programs of the act as well as to take all action necessary to secure to the state the benefits and to meet the requirements of that act. With regard to the national estuary program established by section 320 of that act, the department shall exercise its responsibility jointly with the *Puget Sound water quality authority. The powers granted herein include, among others, and notwithstanding any other provisions of chapter 90.48 RCW or otherwise, the following:

(1) Complete authority to establish and administer a comprehensive state point source waste discharge or pollution discharge elimination permit program which will enable the department to qualify for full participation in any national waste discharge or pollution discharge elimination permit system and will allow the department to be the sole agency issuing permits required by such national system operating in the state of Washington subject to the provisions of RCW 90.48.262(2). Program elements authorized herein may include, but are not limited to: (a) Effluent treatment and limitation requirements together with timing requirements related thereto; (b) applicable receiving water quality standards requirements; (c) requirements of standards of performance for new sources; (d) pretreatment requirements; (e) termination and modification of permits for cause; (f) requirements

for public notices and opportunities for public hearings; (g) appropriate relationships with the secretary of the army in the administration of his responsibilities which relate to anchorage and navigation, with the administrator of the environmental protection agency in the performance of his duties, and with other governmental officials under the federal clean water act; (h) requirements for inspection, monitoring, entry, and reporting; (i) enforcement of the program through penalties, emergency powers, and criminal sanctions; (j) a continuing planning process; and (k) user charges.

(2) The power to establish and administer state programs in a manner which will insure the procurement of moneys, whether in the form of grants, loans, or otherwise; to assist in the construction, operation, and maintenance of various water pollution control facilities and works; and the administering of various state water pollution control management, regulatory, and enforcement programs.

(3) The power to develop and implement appropriate programs pertaining to continuing planning processes, area-wide waste treatment management plans, and basin planning.

The governor shall have authority to perform those actions required of him or her by the federal clean water act. [1988 c 220 § 1; 1983 c 270 § 1; 1979 ex.s. c 267 § 1; 1973 c 155 § 4; 1967 c 13 § 24.]

NOTES:

***Reviser's note:** The Puget Sound water quality authority and its powers and duties, pursuant to the Sunset Act, chapter 43.131 RCW, were terminated June 30, 1995, and repealed June 30, 1996. See 1990 c 115 §§ 11 and 12. Powers, duties, and functions of the Puget Sound water quality authority pertaining to cleanup and protection of Puget Sound transferred to the Puget Sound action team by 1996 c 138 § 11. See RCW 90.71.903.

Severability--1983 c 270: "If any provision of this act or its application to any person or circumstance is held invalid, the remainder of the act or the application of the provision to other persons or circumstances is not affected." [1983 c 270 § 5.]

RCW 90.48.261 Exercise of powers under RCW 90.48.260--Aquatic resource mitigation. When exercising its powers under RCW 90.48.260, the department shall, at the request of the project proponent, follow the guidance contained in RCW 90.74.005 through 90.74.030. [1997 c 424 § 7.]

RCW 90.48.262 Implementation of RCW 90.48.260--Permits for energy facilities--Rules and procedures. (1) The powers established under RCW 90.48.260 shall be implemented by the department through the adoption of rules in every appropriate situation. The permit program authorized under RCW 90.48.260(1) shall constitute a continuation of the established permit program of RCW 90.48.160 and other applicable sections within chapter 90.48 RCW. The appropriate modifications as authorized in *this 1973 amendatory act are designed to avoid duplication and other wasteful practices and to insure that the state permit program contains all required elements of and is compatible with the requirements of any national permit system.

(2) Permits for energy facilities subject to chapter 80.50 RCW shall be issued by the energy facility site evaluation council: PROVIDED, That such permits shall become effective only if the governor approves an application for certification and executes a certification agreement pursuant to said chapter. The council shall have all powers necessary to establish and administer a point source discharge permit program pertaining to such plants, consistent with applicable receiving water quality standards established by the department, and to qualify for full participation in any national waste discharge or pollution discharge elimination permit system. The council and the department shall each adopt, by rules, procedures which will provide maximum coordination and avoid duplication between the two agencies with respect to permits in carrying out the requirements of *this act including, but not limited to, monitoring and enforcement of certification agreements, and in qualifying for full participation in any such national system. [1975-'76 2nd ex.s. c 108 § 41; 1973 c 155 § 5.]

NOTES:

***Reviser's note:** "This 1973 amendatory act" and "this act" apparently refer to 1973 c 155, which consists of this section, amendments to RCW 90.48.010, 90.48.120, 90.48.140, 90.48.144, 90.48.160, and 90.48.260, and the repeal of RCW 90.48.070.

Severability--Effective date--1975-'76 2nd ex.s. c 108: See notes following RCW 43.21F.010.

RCW 90.48.264 Federal clean water act--Rules for on-site sewage disposal systems adjacent to marine waters. In implementing this chapter and in participating in programs under the federal clean water act, the department may consult with the department of social and health services concerning standards for repair of existing, failing on-site sewage disposal systems that are adjacent to marine waters. By January 1, 1989, the department of social and health services shall propose rules for adoption by the state board of health identifying the standards for repair of existing, failing on-site sewage disposal systems at single-family residences that were legally occupied prior to June 9, 1988, and that are adjacent to marine waters. The rules may specify the design, operation and maintenance standards for such repaired systems so as to ensure protection of the public health, attainment of state water quality standards and the protection of shellfish and other public resources. The rules shall also provide that any proposed discharge to marine water shall be considered only if on-site sewage disposal systems are not feasible and that such discharges shall meet the requirements of this chapter and department of ecology regulations. The state board of health shall adopt such proposed rules unless the board finds modification or rejection of them necessary to protect the public health. [1988 c 220 § 2.]

RCW 90.48.270 Sewage drainage basins--Authority of department to delineate and establish. The department shall have authority to delineate and establish sewage drainage basins in the state for the purpose of developing and/or adopting comprehensive plans for the control and abatement of water pollution within such basins. Basins may include, but are not limited to, rivers and their tributaries, streams, coastal waters, sounds, bays, lakes, and portions or combinations thereof, as well as the lands drained thereby. [1987 c 109 § 142; 1967 c 13 § 26.]

NOTES:

Purpose--Short title--Construction--Rules--Severability--Captions--1987 c 109: See notes following RCW 43.21B.001.

Aquifer protection areas: Chapter 36.36 RCW.

RCW 90.48.280 Sewage drainage basins--Comprehensive plans for sewage drainage basins. The department is authorized to prepare and/or adopt a comprehensive water pollution control and abatement plan and to make subsequent amendments thereto, for each basin established pursuant to RCW 90.48.270. Comprehensive plans for sewage drainage basins may be prepared by any municipality and submitted to the department for adoption.

Prior to adopting a comprehensive plan for any basin or any subsequent amendment thereof the department shall hold a public hearing thereon. Notice of such hearing shall be given by registered mail, together with copies of the proposed plan, to each municipality, or other political subdivision, within the basin exercising a sewage disposal function, at least twenty days prior to the hearing date. Such hearing may be continued from time to time and, at the termination thereof, the department may reject the plan proposed or adopt it with such modifications as it shall deem proper.

Following adoption of a comprehensive plan for any basin, the department shall require compliance with such plan by any municipality or person operating or constructing a sewage collection, treatment or disposal system or plant, or any improvement to or extension of an existing sewage collection, treatment or disposal system or plant, within the basin. [1987 c 109 § 143; 1967 c 13 § 27.]

NOTES:

Purpose--Short title--Construction--Rules--Severability--Captions--1987 c 109: See notes following RCW 43.21B.001.

RCW 90.48.285 Contracts with municipal or public corporations and political subdivisions to finance water pollution control projects--Requisites--Priorities. The department is authorized to enter into contracts with any municipal or public corporation or political subdivision within the state for the purpose of assisting such agencies to finance the construction of water pollution control projects necessary to prevent the discharge of untreated or inadequately treated sewage or other waste into the waters of the state, including but not limited to, systems for the control of storm or surface waters which will provide for the removal of waste or polluting materials in a manner conforming to the comprehensive plan of water pollution control and abatement proposed by the agencies and approved by the department. Any such contract may provide for:

The payment by the department to a municipal or public corporation or political subdivision on a monthly, quarterly, or annual basis of varying amounts of moneys as advances which shall be repayable by said municipal or public corporation, or political subdivision under conditions determined by the department.

Contracts made by the department shall be subject to the following limitations:

(1) No contract shall be made unless the department shall find that the project cannot be financed at reasonable cost or within statutory limitations by the borrower without the making of such contract.

(2) No contract shall be made with any public or municipal corporation or political subdivision to assist in the financing of any project located within a sewage drainage basin for which the department shall have previously adopted a comprehensive water pollution control and abatement plan unless the project is found by the department to conform with the basin comprehensive plan.

(3) The department shall determine the interest rate, not to exceed ten percent per annum, which such advances shall bear.

(4) The department shall provide such reasonable terms and conditions of repayment of advances as it may determine.

(5) The total outstanding amount which the department may at any time be obligated to pay under all outstanding contracts made pursuant to this section shall not exceed the moneys available for such payment.

(6) Municipal or public corporations or political subdivisions shall meet such qualifications and follow such procedures in applying for contract assistance as shall be established by the department.

In making such contracts the department shall give priority to projects which will provide relief from actual or potential public health hazards or water pollution conditions and which provide substantial capacity beyond present requirements to meet anticipated future demand. [1987 c 109 § 144; 1980 c 32 § 13; 1969 ex.s. c 141 § 1.]

NOTES:

Purpose--Short title--Construction--Rules--Severability--Captions--1987 c 109: See notes following RCW 43.21B.001.

Severability--1969 ex.s. c 141: "If any provision of this act, or its application to any person or circumstance is held invalid, the remainder of the act, or the application of the provisions to other persons or circumstances is not affected." [1969 ex.s. c 141 § 2.]

RCW 90.48.290 Grants to municipal or public corporations or political subdivisions to aid water pollution control projects--Limitations. The department is authorized to make and administer grants within appropriations authorized by the legislature to any municipal or public corporation, or political subdivision within the state for the purpose of aiding in the construction of water pollution control projects necessary to prevent the discharge of untreated or inadequately treated sewage or other waste into the waters of the state including, but not limited to, projects for the control of storm or surface waters which will provide for the removal of waste or polluting materials therefrom.

Grants so made by the department shall be subject to the following limitations:

(1) No grant shall be made in an amount which exceeds the recipient's contribution to the estimated cost of the project: PROVIDED, That the following shall be considered a part of the recipient's contribution:

(a) Any grant received by the recipient from the federal government pursuant to section 8(f) of the Federal Water Pollution Control Act (33 U.S.C. 466) for the project;

(b) Any expenditure which is made by any municipal or public corporation, or political subdivision within the state as a part of a joint effort with the recipient to carry out the project and which has not been used as a matching contribution for another grant made pursuant to this chapter, and

(c) Any expenditure for the project made by the recipient out of moneys advanced by the department from a revolving fund and repayable to said fund.

(2) No grant shall be made for any project which does not qualify for and receive a grant of federal funds under the provisions of the Federal Water Pollution Control Act as now or hereafter amended: PROVIDED, That this restriction shall not apply to state grants made in any biennium over and above the amount of such grants required to match all federal funds allocated to the state for such biennium.

(3) No grant shall be made to any municipal or public corporation, or political subdivision for any project located within a drainage basin unless the department shall have previously adopted a comprehensive water pollution control and abatement plan and unless the project is found by the department to conform with such basin comprehensive plan: PROVIDED, That the requirement for a project to conform to a comprehensive water pollution control and abatement plan may be waived by the department for any grant application filed with the department prior to July 1, 1974, in those situations where the department finds the public interest would be served better by approval of any grant application made prior to adoption of such plan than by its denial.

(4) Recipients of grants shall meet such qualifications and follow such procedures in applying for grants as shall be established by the department.

(5) Grants may be made to reimburse recipients for expenditures made after July 1, 1967 for projects which meet the requirements of this section and were commenced after the recipient had filed a grant application with the department. [1987 c 109 § 145; 1969 ex.s. c 284 § 1; 1967 c 13 § 28.]

NOTES:

Purpose--Short title--Construction--Rules--Severability--Captions--1987 c 109: See notes following RCW 43.21B.001.

Severability--1969 ex.s. c 284: "If any provision of this act, or its application to any person or circumstance is held invalid, the remainder of the act, or the application of the provision to other persons or circumstances is not affected."

[1969 ex.s. c 284 § 24.] This applies to RCW 90.48.290, 90.48.295, 90.22.010 through 90.22.040, 90.14.031 through 90.14.121, 43.27A.190 through 43.27A.220, 43.27A.075, and to the repeal of RCW 43.21.145 and 90.14.030 through 90.14.120.

RCW 90.48.300 Pollution control facilities--Tax exemptions and credits. See chapter 82.34 RCW.

RCW 90.48.364 Discharge of oil into waters of the state--Definitions. For the purposes of this chapter, "technical feasibility" or "technically feasible" means that given available technology, a restoration or enhancement project can be successfully completed at a cost that is not disproportionate to the value of the resource before the injury. [1991 c 200 § 811.]

NOTES:

Effective dates--Severability--1991 c 200: See RCW 90.56.901 and 90.56.904.

RCW 90.48.366 Discharge of oil into waters of the state--Compensation schedule. By July 1, 1991, the department, in consultation with the departments of *fisheries, wildlife, and natural resources, and the parks and recreation commission, shall adopt rules establishing a compensation schedule for the discharge of oil in violation of this chapter and chapter 90.56 RCW. The amount of compensation assessed under this schedule shall be no less than one dollar per gallon of oil spilled and no greater than fifty dollars per gallon of oil spilled. The compensation schedule shall reflect adequate compensation for unquantifiable damages or for damages not quantifiable at reasonable cost for any adverse environmental, recreational, aesthetic, or other effects caused by the spill and shall take into account:

(1) Characteristics of any oil spilled, such as toxicity, dispersibility, solubility, and persistence, that may affect the severity of the effects on the receiving environment, living organisms, and recreational and aesthetic resources;

(2) The sensitivity of the affected area as determined by such factors as: (a) The location of the spill; (b) habitat and living resource sensitivity; (c) seasonal distribution or sensitivity of living resources; (d) areas of recreational use or aesthetic importance; (e) the proximity of the spill to important habitats for birds, aquatic mammals, fish, or to species listed as threatened or endangered under state or federal law; (f) significant archaeological resources as determined by the office of archaeology and historic preservation; and (g) other areas of special ecological or recreational importance, as determined by the department. If the department has adopted rules for a compensation table prior to July 1, 1992, the sensitivity of significant archaeological resources shall only be included among factors to be used in the compensation table when the department revises the rules for the compensation table after July 1, 1992; and

(3) Actions taken by the party who spilled oil or any party liable for the spill that: (a) Demonstrate a recognition and affirmative acceptance of responsibility for the spill, such as the

immediate removal of oil and the amount of oil removed from the environment; or (b) enhance or impede the detection of the spill, the determination of the quantity of oil spilled, or the extent of damage, including the unauthorized removal of evidence such as injured fish or wildlife. [1994 sp.s. c 9 § 855; 1992 c 73 § 28; 1991 c 200 § 812; 1989 c 388 § 2.]

NOTES:

***Reviser's note:** Powers, duties, and functions of the department of fisheries and the department of wildlife were transferred to the department of fish and wildlife by 1993 sp.s. c 2, effective July 1, 1994.

Severability--Headings and captions not law--Effective date--1994 sp.s. c 9: See RCW 18.79.900 through 18.79.902.

Effective dates--Severability--1992 c 73: See RCW 82.23B.902 and 90.56.905.

Effective dates--Severability--1991 c 200: See RCW 90.56.901 and 90.56.904.

Intent--Application--Captions--Severability--1989 c 388: See notes following RCW 90.56.010.

RCW 90.48.367 Discharge of oil into waters of the state--Assessment of compensation. (1) After a spill or other incident causing damages to the natural resources of the state, the department shall conduct a formal preassessment screening as provided in RCW 90.48.368.

(2) The department shall use the compensation schedule established under RCW 90.48.366 to determine the amount of damages if the preassessment screening committee determines that: (a) Restoration or enhancement of the injured resources is not technically feasible; (b) damages are not quantifiable at a reasonable cost; and (c) the restoration and enhancement projects or studies proposed by the liable parties are insufficient to adequately compensate the people of the state for damages.

(3) If the preassessment screening committee determines that the compensation schedule should not be used, compensation shall be assessed for the amount of money necessary to restore any damaged resource to its condition before the injury, to the extent technically feasible, and compensate for the lost value incurred during the period between injury and restoration.

(4) Restoration shall include the cost to restock such waters, replenish or replace such resources, and otherwise restore the stream, lake, or other waters of the state, including any estuary, ocean area, submerged lands, shoreline, bank, or other lands adjoining such waters to its condition before the injury, as such condition is determined by the department. The lost value of a damaged resource shall be equal to the sum of consumptive, nonconsumptive, and indirect use values, as well as lost taxation, leasing, and licensing revenues. Indirect use values may include existence, bequest, option, and aesthetic values. Damages shall be determined by generally accepted and cost-effective procedures, including, but not limited to, contingent valuation method studies.

(5) Compensation assessed under this section shall be recoverable in an action brought by the attorney general on behalf of the people of the state of Washington and affected counties and cities in the superior court of Thurston county or any county in which damages occurred. Moneys recovered by the attorney general under this section shall be deposited in the coastal protection fund established under RCW 90.48.390, and shall only be used for the purposes stated in RCW 90.48.400.

(6) Compensation assessed under this section shall preclude claims under this chapter by local governments for compensation for damages to publicly owned resources resulting from the same incident. [1991 c 200 § 813; 1989 c 388 § 3.]

NOTES:

Effective dates--Severability--1991 c 200: See RCW 90.56.901 and 90.56.904.

Intent--Application--Captions--Severability--1989 c 388: See notes following RCW 90.56.010.

RCW 90.48.368 Discharge of oil into waters of the state--Preassessment screening. (1) The department shall adopt rules establishing a formal process for preassessment screening of damages resulting from spills to the waters of the state causing the death of, or injury to, fish, animals, vegetation, or other resources of the state. The rules shall specify the conditions under which the department shall convene a preassessment screening committee. The preassessment screening process shall occur concurrently with reconnaissance activities. The committee shall use information obtained from reconnaissance activities as well as any other relevant resource and resource use information. For each incident, the committee shall determine whether a damage assessment investigation should be conducted, or, whether the compensation schedule authorized under RCW 90.48.366 and 90.48.367 should be used to assess damages. The committee may accept restoration or enhancement projects or studies proposed by the liable parties in lieu of some or all of: (a) The compensation schedule authorized under RCW 90.48.366 and 90.48.367; or (b) the claims from damage assessment studies authorized under RCW 90.48.142.

(2) A preassessment screening committee may consist of representatives of the departments of ecology, fish and wildlife, natural resources, social and health services, and emergency management, the parks and recreation commission, the office of archaeology and historic preservation, as well as other federal, state, and local agencies, and tribal and local governments whose presence would enhance the reconnaissance or damage assessment aspects of spill response. The department shall chair the committee and determine which representatives will be needed on a spill-by-spill basis.

(3) The committee shall consider the following factors when determining whether a damage assessment study authorized under RCW 90.48.367 should be conducted: (a) Whether evidence from reconnaissance investigations suggests that injury has occurred or is likely to occur to publicly owned resources; (b) the potential loss in services provided by resources injured or likely to be injured and the expected value of the potential loss; (c) whether

a restoration project to return lost services is technically feasible; (d) the accuracy of damage quantification methods that could be used and the anticipated cost-effectiveness of applying each method; (e) the extent to which likely injury to resources can be verified with available quantification methods; and (f) whether the injury, once quantified, can be translated into monetary values with sufficient precision or accuracy.

(4) When a resource damage assessment is required for an oil spill in the navigable waters of the state, as defined in RCW 90.56.010, the state trustee agency responsible for the resource and habitat damaged shall conduct the damage assessment and pursue all appropriate remedies with the responsible party.

(5) Oil spill damage assessment studies authorized under RCW 90.48.367 may only be conducted if the committee, after considering the factors enumerated in subsection (3) of this section, determines that the damages to be investigated are quantifiable at a reasonable cost and that proposed assessment studies are clearly linked to quantification of the damages incurred.

(6) As new information becomes available, the committee may reevaluate the scope of damage assessment using the factors listed in subsection (3) of this section and may reduce or expand the scope of damage assessment as appropriate.

(7) The preassessment screening process shall provide for the ongoing involvement of persons who may be liable for damages resulting from an oil spill. The department may negotiate with a potentially liable party to perform restoration and enhancement projects or studies which may substitute for all or part of the compensation authorized under RCW 90.48.366 and 90.48.367 or the damage assessment studies authorized under RCW 90.48.367.

(8) For the purposes of this section and RCW 90.48.367, the cost of a damage assessment shall be considered "reasonable" when the anticipated cost of the damage assessment is expected to be less than the anticipated damage that may have occurred or may occur. [1994 c 264 § 92; 1992 c 73 § 29; 1991 c 200 § 814; 1989 c 388 § 4.]

NOTES:

Effective dates--Severability--1992 c 73: See RCW 82.23B.902 and 90.56.905.

Effective dates--Severability--1991 c 200: See RCW 90.56.901 and 90.56.904.

Intent--Application--Captions--Severability--1989 c 388: See notes following RCW 90.56.010.

RCW 90.48.369 Discharge of oil into waters of the state--Annual report. The department shall submit an annual report to the appropriate standing committees of the legislature for the next five years beginning January 1, 1990. The annual report shall cover the implementation of RCW 90.48.366, 90.48.367, 90.48.368, and 90.48.369 and shall include information on each spill for which a preassessment screening committee was convened, the outcome of each process, any compensation claims imposed or damage assessment studies conducted, and the revenues to and expenditures from the coastal protection fund. [1991 c 200 § 817; 1989 c 388 § 5.]

NOTES:

Effective dates--Severability--1991 c 200: See RCW 90.56.901 and 90.56.904.

Intent--Application--Captions--Severability--1989 c 388: See notes following RCW 90.56.010.

RCW 90.48.386 Department of natural resources leases. After May 15, 1991, the department of natural resources shall include in its leases for onshore and offshore facilities the following provisions:

(1) Require those wishing to lease, sublease, or re-lease state-owned aquatic lands to comply with the provisions of this chapter;

(2) Require lessees and sublessees to operate according to the plan of operations and to keep the plan current in compliance with this chapter; and

(3) Include in its leases provisions that a violation by the lessee or sublessee of the provisions of this chapter may be grounds for termination of the lease. [1991 c 200 § 1101.]

NOTES:

Effective dates--Severability--1991 c 200: See RCW 90.56.901 and 90.56.904.

RCW 90.48.390 Coastal protection fund--Established--Moneys credited to--Use. The coastal protection fund is established to be used by the department as a revolving fund for carrying out the purposes of restoration of natural resources under this chapter and chapter 90.56 RCW. To this fund there shall be credited penalties, fees, damages, charges received pursuant to the provisions of this chapter and chapter 90.56 RCW, compensation for damages received under this chapter and chapter 90.56 RCW, and an amount equivalent to one cent per gallon from each marine use refund claim under RCW 82.36.330.

Moneys in the fund not needed currently to meet the obligations of the department in the exercise of its powers, duties, and functions under RCW 90.48.142, 90.48.366, 90.48.367, and 90.48.368 shall be deposited with the state treasurer to the credit of the fund. [1991 sp.s. c 13 § 84; 1991 c 200 § 815; 1989 c 388 § 7; 1989 c 262 § 3; 1971 ex.s. c 180 § 4.]

NOTES:

Effective dates--Severability--1991 sp.s. c 13: See notes following RCW 18.08.240.

Effective dates--Severability--1991 c 200: See RCW 90.56.901 and 90.56.904.

Intent--Application--Captions--Severability--1989 c 388: See notes following RCW 90.56.010.

Findings--1989 c 262: See note following RCW 90.48.142.

RCW 90.48.400 Coastal protection fund--Disbursal of moneys from. (1) Moneys in the coastal protection fund shall be disbursed for the following purposes and no others:

(a) Environmental restoration and enhancement projects intended to restore or enhance environmental, recreational, archaeological, or aesthetic resources for the benefit of Washington's citizens;

(b) Investigations of the long-term effects of oil spills; and

(c) Development and implementation of an aquatic land geographic information system.

(2) The director may allocate a portion of the fund to be devoted to research and development in the causes, effects, and removal of pollution caused by the discharge of oil or other hazardous substances.

(3) A steering committee consisting of representatives of the departments of ecology, fish and wildlife, and natural resources, and the parks and recreation commission shall authorize the expenditure of the moneys collected under RCW 90.48.366 through 90.48.368, after consulting impacted local agencies and local and tribal governments.

(4) Agencies may not be reimbursed from the coastal protection fund for the salaries and benefits of permanent employees for routine operational support. Agencies may only be reimbursed under this section if money for reconnaissance and damage assessment activities is unavailable from other sources. [1994 c 264 § 93; 1992 c 73 § 30; 1991 c 200 § 816; 1990 c 116 § 14. Prior: 1989 c 388 § 8; 1989 c 262 § 4; 1971 ex.s. c 180 § 5.]

NOTES:

Effective dates--Severability--1992 c 73: See RCW 82.23B.902 and 90.56.905.

Effective dates--Severability--1991 c 200: See RCW 90.56.901 and 90.56.904.

Findings--Severability--1990 c 116: See notes following RCW 90.56.210.

Intent--Application--Captions--Severability--1989 c 388: See notes following RCW 90.56.010.

Findings--1989 c 262: See note following RCW 90.48.142.

RCW 90.48.420 Water quality standards affected by forest practices--Department of ecology solely responsible for water quality standards--Forest practices regulations--Promulgation--Examination--Enforcement procedures. (1) The department of ecology, pursuant to powers vested in it previously by chapter 90.48 RCW and consistent with the policies of said chapter and RCW 90.54.020(3), shall be solely responsible for establishing water quality standards for waters of the state. On or before January 1, 1975, the department of ecology shall examine existing regulations containing water quality standards and other applicable rules and regulations of said department pertaining to waters of the state affected by nonpoint sources of pollution arising from forest practices and, when it appears appropriate to the department of ecology, modify said regulations. In any such examination or modification the department of ecology shall consider such factors, among others, as uses of the receiving waters, diffusion, down-stream cooling, and reasonable transient and short-term effects resulting from forest practices.

Promulgation of forest practices regulations by the department of ecology and the forest practices board, shall be accomplished so that compliance with such forest practice regulations will achieve compliance with water pollution control laws.

(2) The department of ecology shall monitor water quality to determine whether revisions in such water quality standards or revisions in such forest practices regulations are necessary to accomplish the foregoing result, and either promulgate appropriate revisions to such water quality standards or propose appropriate revisions to such forest practices regulations or both.

(3) Notwithstanding any other provisions of chapter 90.48 RCW or of the rules and regulations promulgated thereunder, no permit system pertaining to nonpoint sources of pollution arising from forest practices shall be authorized, and no civil or criminal penalties shall be imposed with respect to any forest practices conducted in full compliance with the applicable provisions of RCW 76.09.010 through 76.09.280, forest practices regulations, and any approvals or directives of the department of natural resources thereunder.

(4) Prior to the department of ecology taking action under statutes or regulations relating to water quality, regarding violations of water quality standards arising from forest practices, the department of ecology shall notify the department of natural resources. [1975 1st ex.s. c 200 § 13; 1974 ex.s. c 137 § 30.]

NOTES:

Effective dates--1974 ex.s. c 137: See RCW 76.09.925.

Severability--1974 ex.s. c 137: See RCW 76.09.935.

Forest practices: Chapter 76.09 RCW.

Right of entry to administer this section: RCW 76.09.160.

RCW 90.48.425 Forest practices act and regulations relating to water quality protection to be utilized to satisfy federal water pollution act. The forest practices act, chapter 76.09 RCW, and the forest practices regulations adopted thereunder relating to water quality protection shall be utilized to satisfy the planning and program requirements of sections 208, 209, and 305 of the federal Water Pollution Control Act, as regards silvicultural activities, unless it is determined by the department of ecology that extraordinary conditions exist which make forest practices regulations unsuitable to satisfy such federal requirements. [1975 1st ex.s. c 200 § 14.]

NOTES:

Provisions of state law pertaining to federal clean water act: RCW 90.48.260, 90.48.262.

RCW 90.48.430 Watershed restoration projects--Approval process--Waiver of public review. A permit, certification, or other approval required by the department for a watershed restoration project as defined in RCW 89.08.460 shall be processed in compliance with RCW 89.08.450 through 89.08.510. Public review of proposed watershed restoration projects may be shortened or waived by the department. [1995 c 378 § 15.]

RCW 90.48.445 Aquatic noxious weed control--Water quality permits--Definition. (1) The director shall issue or approve water quality permits for use by federal, state, or local governmental agencies and licensed applicators for the purpose of using, for aquatic noxious weed control, herbicides and surfactants registered under state or federal pesticide control laws. The issuance of the permits shall be subject only to compliance with: Federal and state pesticide label requirements, the requirements of the federal insecticide, fungicide, and rodenticide act, the Washington pesticide control act, the Washington pesticide application act, and the state environmental policy act; and applicable requirements established in an option or options recommended for controlling the noxious weed by a final environmental impact statement published under chapter 43.21C RCW by the department prior to May 5, 1995, by the department of agriculture, or by the department of agriculture jointly with other state agencies. This section may not be construed as requiring the preparation of a new environmental impact statement to replace a final environmental impact statement published before May 5, 1995.

(2) The director of ecology may not utilize this permit authority to otherwise condition or burden weed control efforts. The director's authority to issue water quality modification permits for activities other than the application of surfactants and approved herbicides, to control aquatic noxious weeds, is unaffected by this section.

(3) As used in this section, "aquatic noxious weed" means an aquatic weed on the state noxious weed list adopted under RCW 17.10.080. [1995 c 255 § 3.]

NOTES:

Severability--Effective date--1995 c 255: See RCW 17.26.900 and 17.26.901.

RCW 90.48.450 Discharges from agricultural activity--Consideration to be given as to whether enforcement action would contribute to conversion of land to nonagricultural use--Minimize the possibility. (1) Prior to issuing a notice of violation related to discharges from agricultural activity on agricultural land, the department shall consider whether an enforcement action would contribute to the conversion of agricultural land to nonagricultural uses. Any enforcement action shall attempt to minimize the possibility of such conversion.

(2) As used in this section:

(a) "Agricultural activity" means the growing, raising, or production of horticultural or viticultural crops, berries, poultry, livestock, grain, mint, hay and dairy products.

(b) "Agricultural land" means at least five acres of land devoted primarily to the commercial production of livestock or agricultural commodities. [1981 c 297 § 31.]

NOTES:

Legislative finding, intent--1981 c 297: See note following RCW 70.94.640.

Severability--1981 c 297: See note following RCW 15.36.201.

RCW 90.48.455 Discharge of chlorinated organics--Engineering reports by pulp and paper mills--Permits limiting discharge. (1) The department may require each pulp mill and paper mill discharging chlorinated organics to conduct and submit an engineering report on the cost of installing technology designed to reduce the amount of chlorinated organic compounds discharged into the waters of the state. The department shall allow at least twenty-four months from June 11, 1992, for each pulp mill and each paper mill to submit an engineering report.

(2) The department may not issue a permit establishing limits to the discharge of chlorinated organic compounds by a pulp mill or a paper mill under RCW 90.48.160 or 90.48.260 until at least nine months after receiving an engineering report from a kraft mill and at least fifteen months after receiving an engineering report from a sulfite mill.

(3) Nothing in this section shall apply to dioxin compounds. [1992 c 201 § 1.]

RCW 90.48.465 Water discharge fees. (1) The department shall establish annual fees to collect expenses for issuing and administering each class of permits under RCW 90.48.160, 90.48.162, and 90.48.260. An initial fee schedule shall be established by rule within one year of March 1, 1989, and thereafter the fee schedule shall be adjusted no more often than once every two years. This fee schedule shall apply to all permits, regardless of date of issuance, and fees shall be assessed prospectively. All fees charged shall be based on factors relating to the complexity of permit issuance and compliance and may be based on pollutant loading and toxicity and be designed to encourage recycling and the reduction of the quantity of pollutants. Fees shall be established in amounts to fully recover and not to exceed expenses incurred by the department in processing permit applications and modifications, monitoring and evaluating compliance with permits, conducting inspections, securing laboratory analysis of samples taken during inspections, reviewing plans and documents directly related to operations of permittees, overseeing performance of delegated pretreatment programs, and supporting the overhead expenses that are directly related to these activities.

(2) The annual fee paid by a municipality, as defined in 33 U.S.C. Sec. 1362, for all domestic wastewater facility permits issued under RCW 90.48.162 and 90.48.260 shall not exceed the total of a maximum of fifteen cents per month per residence or residential equivalent contributing to the municipality's wastewater system. The department shall adopt by rule a schedule of credits for any municipality engaging in a comprehensive monitoring program beyond the requirements imposed by the department, with the credits available for five years from March 1, 1989, and with the total amount of all credits not to exceed fifty thousand dollars in the five-year period.

(3) The department shall ensure that indirect dischargers do not pay twice for the administrative expense of a permit. Accordingly, administrative expenses for permits issued by a municipality under RCW 90.48.165 are not recoverable by the department.

(4) In establishing fees, the department shall consider the economic impact of fees on small dischargers and the economic impact of fees on public entities required to obtain permits for storm water runoff and shall provide appropriate adjustments.

(5) All fees collected under this section shall be deposited in the water quality permit account hereby created in the state treasury. Moneys in the account may be appropriated only for purposes of administering permits under RCW 90.48.160, 90.48.162, and 90.48.260.

(6) Beginning with the biennium ending June 30, 1997, the department shall present a biennial progress report on the use of moneys from the account to the legislature. The report will be due December 31st of odd-numbered years. The report shall consist of information on fees collected, actual expenses incurred, and anticipated expenses for the current and following fiscal years. [1997 c 398 § 2; 1996 c 37 § 3; 1992 c 174 § 17; 1991 c 307 § 1; 1989 c 2 § 13 (Initiative Measure No. 97, approved November 8, 1988).]

NOTES:

Short title--Captions--Construction--Existing agreements--Effective date--Severability--1989 c 2: See RCW 70.105D.900 through 70.105D.921, respectively.

RCW 90.48.480 Reduction of sewer overflows--Plans--Compliance schedule--Report to the legislature. (1) The department of ecology shall work with local governments to develop reasonable plans and compliance schedules for the greatest reasonable reduction of combined sewer overflows. The plan shall address various options, including construction of storage tanks for sewage and separation of sewage and stormwater transport systems. The compliance schedule shall be designed to achieve the greatest reasonable reduction of combined sewer overflows at the earliest possible date. The plans and compliance schedules shall be completed by January 1, 1988. A compliance schedule will be a condition of any waste discharge permit issued or renewed after January 1, 1988.

(2) By September 1, 1987, the department of ecology shall report to the legislature any statutory changes necessary to implement the plans and compliance schedules described in subsection (1) of this section. The report shall include (a) a

recommended date by which all sewage treatment facilities shall achieve the greatest reasonable reduction of combined sewer overflows, and (b) a comprehensive assessment of the total cost to achieve compliance, the projected need and recommended distribution of local, state, and federal funding, and the availability of local, state, and federal funding. A thorough discussion of the potential funding sources shall accompany the report. [1985 c 249 § 2.]

RCW 90.48.490 Sewage treatment facilities--Plans to upgrade or construct. Plans for upgrading sewage treatment facilities and plans for new sewage treatment facilities shall address the greatest reasonable reduction of combined sewer overflows and implementation of pretreatment standards. [1985 c 249 § 3.]

RCW 90.48.495 Water conservation measures to be considered in sewer plans. The department of ecology shall require sewer plans to include a discussion of water conservation measures considered or underway and their anticipated impact on public sewer service. [1989 c 348 § 10.]

NOTES:

Severability--1989 c 348: See note following RCW 90.54.020.

Rights not impaired--1989 c 348: See RCW 90.54.920.

RCW 90.48.500 Pollution Disclosure Act of 1971. See chapter 90.52 RCW.

RCW 90.48.520 Review of operations before issuance or renewal of wastewater discharge permits--Incorporation of permit conditions. In order to improve water quality by controlling toxicants in wastewater, the department of ecology shall in issuing and renewing state and federal wastewater discharge permits review the applicant's operations and incorporate permit conditions which require all known, available, and reasonable methods to control toxicants in the applicant's wastewater. Such conditions may include, but are not limited to: (1) Limits on the discharge of specific chemicals, and (2) limits on the overall toxicity of the effluent. The toxicity of the effluent shall be determined by techniques such as chronic or acute bioassays. Such conditions shall be required regardless of the quality of receiving water and regardless of the minimum water quality standards. In no event shall the discharge of toxicants be allowed that would violate any water quality standard, including toxicant standards, sediment criteria, and dilution zone criteria. [1987 c 500 § 1.]

RCW 90.48.900 Severability--1945 c 216. Should any section or provision of this act be held invalid by any court of competent jurisdiction, the same shall not affect the validity of the act as a whole or any part thereof other than that portion so held to be invalid. [1945 c 216 § 23.]

RCW 90.48.901 Severability--1967 c 13. If any provision of this 1967 amendatory act or its application to any person or circumstance is held invalid the remainder of the act or the application of the provision to other persons or circumstances is not affected. [1967 c 13 § 30.]

RCW 90.48.902 Severability--1970 ex.s. c 88. If any provision of this 1970 amendatory act, or its application to any person or circumstance is held invalid, the remainder of the act, or the application of the provision to other persons or circumstances is not affected. [1970 ex.s. c 88 § 15.]

RCW 90.48.903 Severability--1971 ex.s. c 180. If any provision of this 1971 amendatory act, or its application to any person or circumstance is held invalid, the remainder of the act, or the application of the provision to other persons or circumstances is not affected. [1971 ex.s. c 180 § 12.]

RCW 90.48.904 Severability--1989 c 262. If any provision of this act or its application to any person or circumstance is held invalid, the remainder of the act or the application of the provision to other persons or circumstances is not affected. [1989 c 262 § 6.]

RCW 90.48.906 Short title--1971 ex.s. c 180. This 1971 amendatory act may be cited as the "Coastal Waters Protection Act of 1971". [1971 ex.s. c 180 § 13.]

APPENDIX 11

CHAPTER 173–201A WAC

WATER QUALITY STANDARDS FOR SURFACE WATERS OF THE STATE OF WASHINGTON

Last Update: 11/18/97

WAC 173–201A–010 Introduction.

(1) The purpose of this chapter is to establish water quality standards for surface waters of the state of Washington consistent with public health and public enjoyment thereof, and the propagation and protection of fish, shellfish, and wildlife, pursuant to the provisions of chapter 90.48 RCW and the policies and purposes thereof.

(2) This chapter shall be reviewed periodically by the department and appropriate revisions shall be undertaken.

(3) The water use and quality criteria set forth in WAC 173–201A–030 through 173–201A–140 are established in conformance with present and potential water uses of the surface waters of the state of Washington and in consideration of the natural water quality potential and limitations of the same. Compliance with the surface water quality standards of the state of Washington require compliance with chapter 173–201A WAC, Water quality standards for surface waters of the state of Washington, and chapter 173–204 WAC, Sediment management standards.

[Statutory Authority: Chapter 90.48 RCW. 92–24–037 (Order 92–29), § 173–201A–010, filed 11/25/92, effective 12/26/92.]

WAC 173–201A–020 Definitions. The following definitions are intended to facilitate the use of chapter 173–201A WAC:

"Action value" means a total phosphorus (TP) value established at the upper limit of the trophic states in each ecoregion. Exceedance of an action value indicates that a problem is suspected. A lake–specific study may be needed to confirm if a nutrient problem exits.

"Acute conditions" are changes in the physical, chemical, or biologic environment which are expected or demonstrated to result in injury or death to an organism as a result of short–term exposure to the substance or detrimental environmental condition.

"AKART" is an acronym for "all known, available, and reasonable methods of prevention, control, and treatment." AKART shall represent the most current methodology that can be reasonably required for preventing, controlling, or abating the pollutants associated with a discharge. The concept of AKART applies to both point and nonpoint sources of pollution. The term "best management practices," typically applied to nonpoint source pollution controls is considered a subset of the AKART requirement. "*The Stormwater Management Manual for the Puget Sound Basin*" (1992), may be used as a guideline, to the extent appropriate, for developing best management practices to apply AKART for storm water discharges.

"Background conditions" means the biological, chemical, and physical conditions of a water body, outside the area of influence of the discharge under consideration. Background sampling locations in an enforcement action would be up–gradient or outside the area of influence of the discharge. If several discharges to any water body exist, and enforcement action is being taken for possible violations to the standards, background sampling would be undertaken immediately up–gradient from each discharge. When assessing background conditions in the headwaters of a disturbed watershed it may be necessary to use the background conditions of a neighboring or similar watershed as the reference conditions.

"Best management practices (BMP)" means physical, structural, and/or managerial practices approved by the department that, when used singularly or in combination, prevent or reduce pollutant discharges.

"Biological assessment" is an evaluation of the biological condition of a water body using surveys of aquatic community structure and function and other direct measurements of resident biota in surface waters.

"Bog" means those wetlands that are acidic, peat forming, and whose primary water source is precipitation, with little, if any, outflow.

"Carcinogen" means any substance or agent that produces or tends to produce cancer in humans. For implementation of this chapter, the term carcinogen will apply to substances on the United States Environmental Protection Agency lists of A (known human) and B (probable human) carcinogens, and any substance which causes a significant increased incidence of benign or malignant tumors in a single, well conducted animal bioassay, consistent with the weight of evidence approach specified in the United States Environmental Protection Agency's Guidelines for Carcinogenic Risk Assessment as set forth in 51 FR 33992 et seq. as presently published or as subsequently amended or republished.

"Chronic conditions" are changes in the physical, chemical, or biologic environment which are expected or demonstrated to result in injury or death to an organism as a result of repeated or constant exposure over an extended period of time to a substance or detrimental environmental condition.

"Created wetlands" means those wetlands intentionally created from nonwetland sites to produce or replace natural wetland habitat.

"Critical condition" is when the physical. chemical, and biological characteristics of the receiving water environment interact with the effluent to produce the greatest potential adverse impact on aquatic biota and existing or characteristic water uses. For steady–state discharges to riverine systems the critical condition may be assumed to be equal to the 7Q10 flow event unless determined otherwise by the department.

"Damage to the ecosystem" means any demonstrated or predicted stress to aquatic or terrestrial organisms or communities of organisms which the department reasonably concludes may interfere in the health or survival success or natural structure of such populations. This stress may be due to, but is not limited to, alteration in habitat or changes in water temperature, chemistry, or turbidity, and shall consider the potential build up of discharge constituents or temporal increases in habitat alteration which may create such stress in the long term.

"Department" means the state of Washington department of ecology.

"Director" means the director of the state of Washington department of ecology.

"Drainage ditch" means that portion of a designed and constructed conveyance system that serves the purpose of transporting surplus water; this may include natural water courses or channels incorporated in the system design, but does not include the area adjacent to the water course or channel.

"Ecoregions" are defined using EPAs *Ecoregions of the Pacific Northwest* Document No. 600/3–86/033 July 1986 by Omernik and Gallant.

"Fecal coliform" means that portion of the coliform group which is present in the intestinal tracts and feces of warm-blooded animals as detected by the product of acid or gas from lactose in a suitable culture medium within twenty-four hours at 44.5 plus or minus 0.2 degrees Celsius.

"Geometric mean" means either the nth root of a product of n factors, or the antilogarithm of the arithmetic mean of the logarithms of the individual sample values.

"**Ground water exchange**" means the discharge and recharge of ground water to a surface water. Discharge is inflow from an aquifer, seeps or springs that increases the available supply of surface water. Recharge is outflow downgradient to an aquifer or downstream to surface water for base flow maintenance. Exchange may include ground water discharge in one season followed by recharge later in the year.

"**Hardness**" means a measure of the calcium and magnesium salts present in water. For purposes of this chapter, hardness is measured in milligrams per liter and expressed as calcium carbonate ($CaCO_3$).

"**Irrigation ditch**" means that portion of a designed and constructed conveyance system that serves the purpose of transporting irrigation water from its supply source to its place of use; this may include natural water courses or channels incorporated in the system design, but does not include the area adjacent to the water course or channel.

"**Lakes**" shall be distinguished from riverine systems as being water bodies, including reservoirs, with a mean detention time of greater than fifteen days.

"**Lake-specific study**" means a study intended to quantify existing nutrient concentrations, determine existing characteristic uses for lake class waters, and potential lake uses. The study determines how to protect these uses and if any uses are lost or impaired because of nutrients, algae, or aquatic plants. An appropriate study must recommend a criterion for total phosphorus (TP), total nitrogen (TN) in µg/l, or other nutrient that impairs characteristic uses by causing excessive algae blooms or aquatic plant growth.

"**Mean detention time**" means the time obtained by dividing a reservoir's mean annual minimum total storage by the thirty-day ten-year low-flow from the reservoir.

"**Migration or translocation**" means any natural movement of an organism or community of organisms from one locality to another locality.

"**Mixing zone**" means that portion of a water body adjacent to an effluent outfall where mixing results in the dilution of the effluent with the receiving water. Water quality criteria may be exceeded in a mixing zone as conditioned and provided for in WAC 173–201A–100.

"**Natural conditions**" or "**natural background levels**" means surface water quality that was present before any human-caused pollution. When estimating natural conditions in the headwaters of a disturbed watershed it may be necessary to use the less disturbed conditions of a neighboring or similar watershed as a reference condition.

"**Nonpoint source**" means pollution that enters any waters of the state from any dispersed land-based or water-based activities, including but not limited to atmospheric deposition, surface water runoff from agricultural lands, urban areas, or forest lands, subsurface or underground sources, or discharges from boats or marine vessels not otherwise regulated under the National Pollutant Discharge Elimination System program.

"Permit" means a document issued pursuant to RCW 90.48.160 et seq. or RCW 90.48.260 or both, specifying the waste treatment and control requirements and waste discharge conditions.

"pH" means the negative logarithm of the hydrogen ion concentration.

"Pollution" means such contamination, or other alteration of the physical, chemical, or biological properties, of any waters of the state, including change in temperature, taste, color, turbidity, or odor of the waters, or such discharge of any liquid, gaseous, solid, radioactive, or other substance into any waters of the state as will or is likely to create a nuisance or render such waters harmful, detrimental, or injurious to the public health, safety, or welfare, or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or to livestock, wild animals, birds, fish, or other aquatic life.

"Primary contact recreation" means activities where a person would have direct contact with water to the point of complete submergence including, but not limited to, skin diving, swimming, and water skiing.

"Secondary contact recreation" means activities where a person's water contact would be limited (wading or fishing) to the extent that bacterial infections of eyes, ears, respiratory or digestive systems, or urogenital areas would normally be avoided.

"Shoreline stabilization" means the anchoring of soil at the water's edge, or in shallow water, by fibrous plant root complexes; this may include long-term accretion of sediment or peat, along with shoreline progradation in such areas.

"Storm water" means that portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes, and other features of a storm water drainage system into a defined surface water body, or a constructed infiltration facility.

"Storm water attenuation" means the process by which peak flows from precipitation are reduced and runoff velocities are slowed as a result of passing through a surface waterbody.

"Surface waters of the state" includes lakes, rivers, ponds, streams, inland waters, saltwaters, wetlands and all other surface waters and water courses within the jurisdiction of the state of Washington.

"Temperature" means water temperature expressed in degrees Celsius (°C).

"Treatment wetlands" means those wetlands intentionally constructed on nonwetland sites and managed for the primary purpose of wastewater or storm water treatment. Treatment wetlands are considered part of a collection and treatment system, and generally are not subject to the criteria of this chapter.

"Trophic state" means a classification of the productivity of a lake ecosystem. Lake productivity depends on the amount of biologically available nutrients in water and sediments and may be based on total phosphorus (TP). Secchi depth and chlorophyll-a measurements may be used to improve the trophic state classification of a lake. Trophic states used in this rule include, from least to most nutrient rich, ultra-oligotrophic, oligotrophic, lower mesotrophic, upper mesotrophic, and eutrophic.

"Turbidity" means the clarity of water expressed as nephelometric turbidity units (NTU) and measured with a calibrated turbidimeter.

"Upwelling" means the natural process along Washington's Pacific Coast where the summer prevailing northerly winds produce a seaward transport of surface water. Cold, deeper more saline waters rich in nutrients and low in dissolved oxygen, rise to replace the surface water. The cold oxygen deficient water enters Puget Sound and other coastal estuaries at depth where it displaces the existing deep water and eventually rises to replace the surface water. Such surface water replacement results in an overall increase in salinity and nutrients accompanied by a depression in dissolved oxygen. Localized upwelling of the deeper water of Puget Sound can occur year-round under influence of tidal currents, winds, and geomorphic features.

"USEPA" means the United States Environmental Protection Agency.

"Wetlands" means areas that are inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands do not include those artificial wetlands intentionally created from nonwetland sites, including, but not limited to, irrigation and drainage ditches, grass-lined swales, canals, detention facilities, wastewater treatment facilities, farm ponds. and landscape amenities, or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street, or highway. Wetlands may include those artificial wetlands intentionally created from nonwetland areas to mitigate the conversion of wetlands. (Waterbodies not included in the definition of wetlands as well as those mentioned in the definition are still waters of the state.)

"Wildlife habitat" means waters of the state used by, or that directly or indirectly provide food support to, fish, other aquatic life, and wildlife for any life history stage or activity.
[Statutory Authority: Chapter 90.48 RCW and 40 CFR 131. 97–23–064 (Order 94–19). § –201A–020. filed 11/18/97. effective 12/19/97. Statutory Authority: Chapter 90.48 RCW. 92–24–037 (Order 92–29). § 173–201A–020. filed 11/25/92. effective 12/26/92.]

WAC 173–201A–030 General water use and criteria classes. The following criteria shall apply to the various classes of surface waters in the state of Washington:

(1) **Class AA (extraordinary).**

(a) General characteristic. Water quality of this class shall markedly and uniformly exceed the requirements for all or substantially all uses.

(b) Characteristic uses. Characteristic uses shall include, but not be limited to, the following:

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

(ii) Stock watering.

(iii) Fish and shellfish:

Salmonid migration, rearing, spawning, and harvesting.

Other fish migration, rearing, spawning, and harvesting.

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

Crustaceans and other shellfish (crabs, shrimp, crayfish, scallops, etc.) rearing, spawning, and harvesting.

(iv) Wildlife habitat.

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

(vi) Commerce and navigation.

(c) Water quality criteria:

(i) Fecal coliform organisms:

(A) Freshwater — fecal coliform organism levels shall both not exceed a geometric mean value of 50 colonies/100 mL and not have more than 10 percent of all samples obtained for calculating the geometric mean value exceeding 100 colonies/100 mL.

(B) Marine water — fecal coliform organism levels shall both not exceed a geometric mean value of 14 colonies/100 mL, and not have more than 10 percent of all samples obtained for calculating the geometric mean value exceeding 43 colonies/100 mL.

(ii) Dissolved oxygen:

(A) Freshwater — dissolved oxygen shall exceed 9.5 mg/L.

(B) Marine water — dissolved oxygen shall exceed 7.0 mg/L. When natural conditions, such as upwelling, occur, causing the dissolved oxygen to be depressed near or below 7.0 mg/L, natural dissolved oxygen levels may be degraded by up to 0.2 mg/L by human-caused activities.

(iii) Total dissolved gas shall not exceed 110 percent of saturation at any point of sample collection.

(iv) Temperature shall not exceed 16.0°C (freshwater) or 13.0°C (marine water) due to human activities. When natural conditions exceed 16.0°C (freshwater) and 13.0°C (marine water), 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 $t=23/(T+5)$ (freshwater) or $t=8/(T-4)$ (marine water). Incremental temperature increases resulting from nonpoint source activities shall not exceed 2.8°C.

For purposes hereof, "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.

(v) pH shall be within the range of 6.5 to 8.5 (freshwater) or 7.0 to 8.5 (marine water) with a human-caused variation within the above range of less than 0.2 units.

(vi) Turbidity shall not exceed 5 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10 percent increase in turbidity when the background turbidity is more than 50 NTU.

(vii) Toxic, radioactive, or deleterious material concentrations shall be below those which have the potential either singularly or cumulatively to adversely affect characteristic water uses, cause acute or chronic conditions to the most sensitive biota dependent upon those waters, or adversely affect public health, as determined by the department (see WAC 173–201A–040 and 173–201A–050).

(viii) Aesthetic values shall not be impaired by the presence of materials or their effects, excluding those of natural origin, which offend the senses of sight, smell, touch, or taste.

(2) **Class A (excellent).**

(a) General characteristic. Water quality of this class shall meet or exceed the requirements for all or substantially all uses.

(b) Characteristic uses. Characteristic uses shall include, but not be limited to, the following:

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

(ii) Stock watering.

(iii) Fish and shellfish:

Salmonid migration, rearing, spawning, and harvesting.

Other fish migration, rearing, spawning, and harvesting.

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

Crustaceans and other shellfish (crabs, shrimp, crayfish, scallops, etc.) rearing, spawning, and harvesting.

(iv) Wildlife habitat.

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

(vi) Commerce and navigation.

(c) Water quality criteria:

(i) Fecal coliform organisms:

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

(B) Marine water - fecal coliform organism levels shall both not exceed a geometric mean value of 14 colonies/100 mL, and not have more than 10 percent of all samples obtained for calculating the geometric mean value exceeding 43 colonies/100 mL.

(ii) Dissolved oxygen:

(A) Freshwater - dissolved oxygen shall exceed 8.0 mg/L.

(B) Marine water - dissolved oxygen shall exceed 6.0 mg/L. When natural conditions, such as upwelling, occur, causing the dissolved oxygen to be depressed near or below 6.0 mg/L, natural dissolved oxygen levels may be degraded by up to 0.2 mg/L by human-caused activities.

(iii) Total dissolved gas shall not exceed 110 percent of saturation at any point of sample collection.

(iv) Temperature shall not exceed 18.0°C (freshwater) or 16.0°C (marine water) due to human activities. When natural conditions exceed 18.0°C (freshwater) and 16.0°C (marine water), 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) (freshwater) or t=12/(T-2) (marine water). Incremental temperature increases resulting from nonpoint source activities shall not exceed 2.8°C.

For purposes hereof, "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.

(v) pH shall be within the range of 6.5 to 8.5 (freshwater) or 7.0 to 8.5 (marine water) with a human-caused variation within the above range of less than 0.5 units.

(vi) Turbidity shall not exceed 5 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10 percent increase in turbidity when the background turbidity is more than 50 NTU.

(vii) Toxic, radioactive, or deleterious material concentrations shall be below those which have the potential either singularly or cumulatively to adversely affect characteristic water uses, cause acute or chronic conditions to the most sensitive biota dependent upon those waters, or adversely affect public health, as determined by the department (see WAC 173–201A–040 and 173–201A–050).

(viii) Aesthetic values shall not be impaired by the presence of materials or their effects, excluding those of natural origin, which offend the senses of sight, smell, touch, or taste.

(3) **Class B (good).**

(a) General characteristic. Water quality of this class shall meet or exceed the requirements for most uses.

(b) Characteristic uses. Characteristic uses shall include, but not be limited to, the following:

(i) Water supply (industrial and agricultural).

(ii) Stock watering.

(iii) Fish and shellfish:

Salmonid migration, rearing, and harvesting.

Other fish migration, rearing, spawning, and harvesting.

Clam, oyster, and mussel rearing and spawning.

Crustaceans and other shellfish (crabs, shrimp, crayfish, scallops, etc.) rearing, spawning, and harvesting.

(iv) Wildlife habitat.

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

(vi) Commerce and navigation.

(c) Water quality criteria:

(i) Fecal coliform organisms:

(A) Freshwater - fecal coliform organism levels shall both not exceed a geometric mean value of 200 colonies/100 mL, and not have more than 10 percent of all samples obtained for calculating the geometric mean value exceeding 400 colonies/100 mL.

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

(ii) Dissolved oxygen:

(A) Freshwater — dissolved oxygen shall exceed 6.5 mg/L.

(B) Marine water — dissolved oxygen shall exceed 5.0 mg/L. When natural conditions, such as upwelling, occur, causing the dissolved oxygen to be depressed near or below 5.0 mg/L, natural dissolved oxygen levels may be degraded by up to 0.2 mg/L by human-caused activities.

(iii) Total dissolved gas shall not exceed 110 percent of saturation at any point of sample collection.

(iv) Temperature shall not exceed 21.0°C (freshwater) or 19.0°C (marine water) due to human activities. When natural conditions exceed 21.0°C (freshwater) and 19.0°C (marine water), 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 $t=34/(T+9)$ (freshwater) or $t=16/(T)$ (marine water). Incremental temperature increases resulting from nonpoint source activities shall not exceed 2.8°C.

For purposes hereof, "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.

(v) pH shall be within the range of 6.5 to 8.5 (freshwater) and 7.0 to 8.5 (marine water) with a human-caused variation within the above range of less than 0.5 units.

(vi) Turbidity shall not exceed 10 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 20 percent increase in turbidity when the background turbidity is more than 50 NTU.

(vii) Toxic, radioactive, or deleterious material concentrations shall be below those which have the potential either singularly or cumulatively to adversely affect characteristic water uses, cause acute or chronic conditions to the most sensitive biota dependent upon those waters, or adversely affect public health, as determined by the department (see WAC 173–201A–040 and 173–201A–050).

(viii) Aesthetic values shall not be reduced by dissolved, suspended, floating, or submerged matter not attributed to natural causes, so as to affect water use or taint the flesh of edible species.

(4) **Class C (fair).**

(a) General characteristic. Water quality of this class shall meet or exceed the requirements of selected and essential uses.

(b) Characteristic uses. Characteristic uses shall include, but not be limited to, the following:

(i) Water supply (industrial).

(ii) Fish (salmonid and other fish migration).

(iii) Recreation (secondary contact recreation, sport fishing, boating, and aesthetic enjoyment).

(iv) Commerce and navigation.

(c) Water quality criteria - marine water:

(i) Fecal coliform organism levels shall both not exceed a geometric mean value of 200 colonies/100 mL, and not have more than 10 percent of all samples obtained for calculating the geometric mean value exceeding 400 colonies/100 mL.

(ii) Dissolved oxygen shall exceed 4.0 mg/L. When natural conditions, such as upwelling, occur, causing the dissolved oxygen to be depressed near or below 4.0 mg/L, natural dissolved oxygen levels may be degraded by up to 0.2 mg/L by human-caused activities.

(iii) Temperature shall not exceed 22.0°C due to human activities. When natural conditions exceed 22.0°C, no temperature increases will be allowed which will raise the receiving water temperature by greater than 0.3°C.

Incremental temperature increases shall not, at any time, exceed $t=20/(T+2)$.

For purposes hereof, "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.

(iv) pH shall be within the range of 6.5 to 9.0 with a human-caused variation within a range of less than 0.5 units.

(v) Turbidity shall not exceed 10 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 20 percent increase in turbidity when the background turbidity is more than 50 NTU.

(vi) Toxic, radioactive, or deleterious material concentrations shall be below those which have the potential either singularly or cumulatively to adversely affect characteristic water uses, cause acute or chronic conditions to the most sensitive biota dependent upon those waters, or adversely affect public health, as determined by the department (see WAC 173–201A–040 and 173–201A–050).

(vii) Aesthetic values shall not be interfered with by the presence of obnoxious wastes, slimes, aquatic growths, or materials which will taint the flesh of edible species.

(5) **Lake class.**

(a) General characteristic. Water quality of this class shall meet or exceed the requirements for all or substantially all uses.

(b) Characteristic uses. Characteristic uses shall include, but not be limited to, the following:

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

(ii) Stock watering.

(iii) Fish and shellfish:

Salmonid migration, rearing, spawning, and harvesting.

Other fish migration, rearing, spawning, and harvesting.

Clam and mussel rearing, spawning, and harvesting.

Crayfish rearing, spawning, and harvesting.

(iv) Wildlife habitat.

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

(vi) Commerce and navigation.

(c) Water quality criteria:

(i) Fecal coliform organism levels shall both not exceed a geometric mean value of 50 colonies/100 mL, and not have more than 10 percent of all samples obtained for calculating the geometric mean value exceeding 100 colonies/100 mL.

(ii) Dissolved oxygen - no measurable decrease from natural conditions.

(iii) Total dissolved gas shall not exceed 110 percent of saturation at any point of sample collection.

(iv) Temperature - no measurable change from natural conditions.

(v) pH - no measurable change from natural conditions.

(vi) Turbidity shall not exceed 5 NTU over background conditions.

(vii) Toxic, radioactive, or deleterious material concentrations shall be below those which have the potential either singularly or cumulatively to adversely affect characteristic water uses, cause acute or chronic conditions to the most sensitive biota dependent upon those waters, or adversely affect public health, as determined by the department (see WAC 173–201A–040 and 173–201A–050).

(viii) Aesthetic values shall not be impaired by the presence of materials or their effects, excluding those of natural origin, which offend the senses of sight, smell, touch, or taste.

(6) **Establishing lake nutrient criteria.**

(a) The following table shall be used to aid in establishing nutrient criteria:

(Table 1) The ecoregional and trophic-state action values for establishing nutrient criteria:

Coast Range, Puget Lowlands, and Northern Rockies Ecoregions:		
Trophic State	**If Ambient TP (µg/) Range of Lake is:**	**Then criteria should be set at:**
Ultra-oligotrophic	0-4	4 or less
Oligotrophic	>4-10	10 or less
Lower mesotrophic	>10-20	20 or less
	Action Value	
	>20	lake specific study may be initiated
Cascades Ecoregion:		
Trophic State	**If Ambient TP (µg/) Range of Lake is:**	**Then criteria should be set at:**
Ultra-oligotrophic	0-4	4 or less
Oligotrophic	>4-10	10 or less
	Action Value	
	>10	lake specific study may be initiated
Columbia Basin Ecoregion:		
Trophic State	**If Ambient TP (µg/) Range of Lake is:**	**Then criteria should be set at:**
Ultra-oligotrophic	0-4	4 or less
Oligotrophic	>4-10	10 or less
Lower mesotrophic	>10-20	20 or less
Upper mesotrophic	>20-35	35 or less
	Action Value	
	>35	lake specific study may be initiated.

Lakes in the Willamette, East Cascade Foothills, or Blue Mountain ecoregions do not have recommended values and need to have lake-specific studies in order to receive criteria as described in (c)(i) of this subsection.

(b) The following actions are recommended if ambient monitoring of a lake shows the epilimnetic total phosphorus concentration, as shown in Table 1 of this section, is below the action value for an ecoregion:

(i) Determine trophic status from existing or newly gathered data. The recommended minimum sampling to determine trophic status is calculated as the mean of four or more samples collected from the epilimnion between June through September in one or more consecutive years. Sampling must be spread throughout the season.

(ii) Propose criteria at or below the upper limit of the trophic state; or

(iii) Conduct lake-specific study to determine and propose to adopt appropriate criteria as described in (c) of this subsection.

(c) The following actions are recommended if ambient monitoring of a lake shows total phosphorus to exceed the action value for an ecoregion shown in Table 1 of this section or where recommended ecoregional action values do not exist:

(i) Conduct a lake-specific study to evaluate the characteristic uses of the lake. A lake-specific study may vary depending on the source or threat of impairment. Phytoplankton blooms, toxic phytoplankton, or excessive aquatic plants, are examples of various sources of impairment. The following are examples of quantitative measures that a study may describe: Total phosphorus, total nitrogen, chlorophyll-a, dissolved oxygen in the hypolimnion if thermally stratified, pH, hardness, or other measures of existing conditions and potential changes in any one of these parameters.

(ii) Determine appropriate total phosphorus concentrations or other nutrient criteria to protect characteristic lake uses. If the existing total phosphorus concentration is protective of characteristic lake uses, then set criteria at existing total phosphorus concentration. If the existing total phosphorus concentration is not protective of the existing characteristic lake uses, then set criteria at a protective concentration. Proposals to adopt appropriate total phosphorus criteria to protect characteristic uses must be developed by considering technical information and stakeholder input as part of a public involvement process equivalent to the Administrative Procedure Act (chapter 34.05 RCW).

(iii) Determine if the proposed total phosphorus criteria necessary to protect characteristic uses is achievable. If the recommended criterion is not achievable and if the characteristic use the criterion is intended to protect is not an existing use, then a higher criterion may be proposed in conformance with 40 CFR part 131.10.

(d) The department will consider proposed lake-specific nutrient criteria during any water quality standards rule making that follows development of a proposal. Adoption by rule formally establishes the criteria for that lake.

(e) Prioritization and investigation of lakes by the department will be initiated by listing problem lakes in a watershed needs assessment, and scheduled as part of the water quality program's watershed approach to pollution control. This prioritization will apply to lakes identified as warranting a criteria based on the results of a lake-specific study, to lakes warranting a lake-specific study for establishing criteria, and to lakes requiring restoration and pollution control measures due to exceedance of an established criterion. The adoption of nutrient criteria are generally not intended to apply to lakes or ponds with a surface area smaller than five acres; or to ponds wholly contained on private property owned and surrounded by a single landowner; and nutrients do not drain or leach from these lakes or private ponds to the detriment of other property owners or other water bodies; and do not impact designated uses in the lake. However, if the landowner proposes criteria the department may consider adoption.

(f) The department may not need to set a lake-specific criteria or further investigate a lake if existing water quality conditions are naturally poorer (higher TP) than the action value and uses have not been lost or degraded, per WAC 173–201A–070(2).

[Statutory Authority: Chapter 90.48 RCW and 40 CFR 131. 97–23–064 (Order 94–19). § 173–201A–030, filed 11/18/97, effective 12/19/97. Statutory Authority: Chapter 90.48 RCW. 92–24–037 (Order –29). § 173–201A–030, filed 11/25/92, effective 12/26/92.]

WAC 173–201A–040 Toxic substances.

(1) Toxic substances shall not be introduced above natural background levels in waters of the state which have the potential either singularly or cumulatively to adversely affect characteristic water uses, cause acute or chronic toxicity to the most sensitive biota dependent upon those waters, or adversely affect public health, as determined by the department.

(2) The department shall employ or require chemical testing, acute and chronic toxicity testing, and biological assessments, as appropriate, to evaluate compliance with subsection (1) of this section and to ensure that aquatic communities and the existing and characteristic beneficial uses of waters are being fully protected.

(3) The following criteria shall be applied to all surface waters of the state of Washington for the protection of aquatic life. The department may revise the following criteria on a state-wide or waterbody-specific basis as needed to protect aquatic life occurring in waters of the state and to increase the technical accuracy of the criteria being applied. The department shall formally adopt any appropriate revised criteria as part of this chapter in accordance with the provisions established in chapter 34.05 RCW, the Administrative Procedure Act. The department shall ensure there are early opportunities for public review and comment on proposals to develop revised criteria. Values are µg/L for all substances except Ammonia and Chloride which are mg/L:

	Freshwater		Marine Water	
Substance	Acute	Chronic	Acute	Chronic
Aldrin/Dieldrin	2.5a	0.0019b	0.71a	0.0019b
Ammonia (un-ionized NH3) hh	f.c	g.d	0.233h.c	0.035h.d
Arsenic dd	360.0c	190.0d	69.0c.ll	36.0d.cc.ll
Cadmium dd	i.c	j.d	42.0c	9.3d
Chlordane	2.4a	0.0043b	0.09a	0.004b
Chloride (Dissolved) k	860.0h.c	230.0h.d	-	-
Chlorine (Total Residual)	19.0c	11.0d	13.0c	7.5d
Chlorpyrifos	0.083c	0.041d	0.011c	0.0056d
Chromium (Hex) dd	15.0c.l.ii	10.0d.jj	1,100.0c.l.ll	50.0d.ll
Chromium (Tri) gg	m.c	n.d	-	-
Copper dd	o.c	p.d	4.8c.ll	3.1d.ll
Cyanide ee	22.0c	5.2d	1.0c.mm	-
DDT (and metabolites)	1.1a	0.001b	0.13a	0.001b
Dieldrin/Aldrin e	2.5a	0.0019b	0.71a	0.0019b
Endosulfan	0.22a	0.056b	0.034a	0.0087b
Endrin	0.18a	0.0023b	0.037a	0.0023b
Heptachlor	0.52a	0.0038b	0.053a	0.0036b
Hexachlorocyclohexane (Lindane)	2.0a	0.08b	0.16a	-
Lead dd	q.c	r.d	210.0c.ll	8.1d.ll
Mercury s	2.1c.kk.dd	0.012d.ff	1.8c.ll.dd	0.025d.ff
Nickel dd	t.c	u.d	74.0c.ll	8.2d.ll
Parathion	0.065c	0.013d	-	-
Pentachlorophenol (PCP)	w.c	v.d	13.0c	7.9d
Polychlorinated Biphenyls (PCBs)	2.0b	0.014b	10.0b	0.030b
Selenium	20.0c.ff	5.0d.ff	290c.ll.dd	71.0d.x.ll.dd
Silver dd	y.a	-	1.9a.ll	-
Toxaphene	0.73c.z	0.0002d	0.21c.z	0.0002d
Zinc dd	aa.c	bb.d	90.0c.ll	81.0d.ll

Notes to Table:

a. An instantaneous concentration not to be exceeded at any time.

b. A 24-hour average not to be exceeded.

c. A 1-hour average concentration not to be exceeded more than once every three years on the average.

d. A 4-day average concentration not to be exceeded more than once every three years on the average.

e. Aldrin is metabolically converted to Dieldrin. Therefore, the sum of the Aldrin and Dieldrin concentrations are compared with the Dieldrin criteria.

f. Shall not exceed the numerical value given by:

$$0.52 \div (FT)(FPH)(2)$$

where:

$FT = 10^{[0.03(20\text{-}TCAP)]}$: $TCAP \leq T \leq 30$
$FT = 10^{[0.03(20\text{-}T)]}$: $0 \leq T \leq TCAP$
$FPH = 1 : 8 \leq pH \leq 9$
$FPH = (1 + 10^{(7.4\text{-}pH)}) \div 1.25 : 6.5 \leq pH \leq 8.0$
TCAP = 20°C: Salmonids present.
TCAP = 25°C: Salmonids absent.

g. Shall not exceed the numerical value given by:

$$0.80 \div (FT)(FPH)(RATIO)$$

where:

$RATIO = 13.5 : 7.7 \leq pH \leq 9$

$RATIO = (20.25 \times 10^{(7.7\text{-}pH)}) \div (1 + 10^{(7.4\text{-}pH)}) : 6.5 \leq pH \leq 7.7$

where: FT and FPH are as shown in (f) above except:
TCAP = 15°C: Salmonids present.
TCAP = 20°C: Salmonids absent.

h. Measured in milligrams per liter rather than micrograms per liter.

i. $\leq (0.944)(e^{(1.128[\ln(\text{hardness})]-3.828)})$ at hardness = 100. Conversion factor (CF) of 0.944 is hardness dependent. CF is calculated for other hardnesses as follows: CF = 1.136672 - [(In hardness)(0.041838)].

j. $\leq (0.909)(e^{(0.7852[\ln(\text{hardness})]-3.490)})$ at hardness = 100. Conversions factor (CF) of 0.909 is hardness dependent. CF is calculated for other hardnesses as follows: CF = 1.101672 - [(In hardness)(0.041838)].

k. Criterion based on dissolved chloride in association with sodium. This criterion probably will not be adequately protective when the chloride is associated with potassium, calcium, or magnesium, rather than sodium.

l. Salinity dependent effects. At low salinity the 1-hour average may not be sufficiently protective.

m. $\leq (0.316)e^{(0.8190[\ln(\text{hardness})]+3.688)}$

n. $\leq (0.860)e^{(0.8190[\ln(\text{hardness})]+1.561)}$

o. $\leq (0.960)(e^{(0.9422[\ln(\text{hardness})]-1.464)})$

p. $\leq (0.960)(e^{(0.8545[\ln(\text{hardness})]-1.465)})$

q. $\leq (0.791)(e^{(1.273[\ln(\text{hardness})]-1.460)})$ at hardness = 100. Conversion factor (CF) of 0.791 is hardness dependent. CF is calculated for other hardnesses as follows: CF = 1.46203 - [(In hardness)(0.145712)].

r. $\leq (0.791)(e^{(1.273[\ln(\text{hardness})] -4.705)})$ at hardness = 100. Conversion factor (CF) of 0.791 is hardness dependent. CF is calculated for other hardnesses as follows: CF = 1.46203 - [(ln hardness)(0.145712)].

s. If the four-day average chronic concentration is exceeded more than once in a three-year period, the edible portion of the consumed species should be analyzed. Said edible tissue concentrations shall not be allowed to exceed 1.0 mg/kg of methylmercury.

t. $\leq (0.998)(e^{(0.8460[\ln(\text{hardness})] +3.3612)})$

u. $\leq (0.997)(e^{(0.8460[\ln(\text{hardness})] +1.1645)})$

v. $\leq e^{[1.005(\text{pH}) -5.290]}$

w. $\leq e^{[1.005(\text{pH}) -4.830]}$

x. The status of the fish community should be monitored whenever the concentration of selenium exceeds 5.0 $\mu g/l$ in salt water.

y. $\leq (0.85)(e^{(1.72[\ln(\text{hardness})] -6.52)})$

z. Channel Catfish may be more acutely sensitive.

aa. $\leq (0.978)(e^{(0.8473[\ln(\text{hardness})] +0.8604)})$

bb. $\leq (0.986)(e^{(0.8473[\ln(\text{hardness})] +0.7614)})$

cc. Nonlethal effects (growth, C-14 uptake, and chlorophyll production) to diatoms (Thalassiosira aestivalis and Skeletonema costatum) which are common to Washington's waters have been noted at levels below the established criteria. The importance of these effects to the diatom populations and the aquatic system is sufficiently in question to persuade the state to adopt the USEPA National Criteria value (36 $\mu g/L$) as the state threshold criteria, however, wherever practical the ambient concentrations should not be allowed to exceed a chronic marine concentration of 21 $\mu g/L$.

dd. These ambient criteria in the table are for the dissolved fraction. The cyanide criteria are based on the weak acid dissociable method. The metals criteria may not be used to calculate total recoverable effluent limits unless the seasonal partitioning of the dissolved to total metals in the ambient water are known. When this information is absent, these metals criteria shall be applied as total recoverable values, determined by back-calculation, using the conversion factors incorporated in the criterion equations. Metals criteria may be adjusted on a site-specific basis when data are made available to the department clearly demonstrating the effective use of the water effects ratio approach established by USEPA, as generally guided by the procedures in USEPA *Water Quality Standards Handbook*, December 1983, as supplemented or replaced. Information which is used to develop effluent limits based on applying metals partitioning studies or the water effects ratio approach shall be identified in the permit fact sheet developed pursuant to WAC 173–220–060 or 173–226–110, as appropriate, and shall be made available for the public comment period required pursuant to WAC 173–220–050 or 173–226–130(3), as appropriate.

ee. The criteria for cyanide is based on the weak and dissociable method in the 17th Ed. *Standard Methods for the Examination of Water and Wastewater*, 4500-CN I, and as revised (see footnote dd, above).

ff. These criteria are based on the total-recoverable fraction of the metal.

gg. Where methods to measure trivalent chromium are unavailable, these criteria are to be represented by total-recoverable chromium.

hh. Tables for the conversion of total ammonia to un-ionized ammonia for freshwater can be found in the USEPA's Quality Criteria for Water, 1986. Criteria concentrations based on total ammonia for marine water can be found in USEPA *Ambient Water Quality Criteria for Ammonia (Saltwater)*-1989, EPA440/5-88-004, April 1989.

ii. Conversion factor to calculate dissolved metal concentration is 0.982.

jj. Conversion factor to calculate dissolved metal concentration is 0.962.

kk. Conversion factor to calculate dissolved metal concentration is 0.85.

ll. Marine conversion factors (CF) used for calculating dissolved metals concentrations. Conversion factors are applicable to both acute and chronic criteria for all metals except mercury. CF for mercury is applicable to the acute criterion only. Conversion factors are already incorporated into the criteria in the table. Dissolved criterion = criterion x CF

Metal	CF
Arsenic	1.000
Cadmium	0.994
Chromium (VI)	0.993
Copper	0.83
Lead	0.951
Mercury	0.85
Nickel	0.990
Selenium	0.998
Silver	0.85
Zinc	0.946

mm. The cyanide criteria are: 9.1μg/l chronic and 2.8μg/l acute and are applicable only to waters which are east of a line from Point Roberts to Lawrence Point, to Green Point to Deception Pass; and south from Deception Pass and of a line from Partridge Point to Point Wilson.

(4) *USEPA Quality Criteria for Water, 1986* shall be used in the use and interpretation of the values listed in subsection (3) of this section.

(5) Concentrations of toxic, and other substances with toxic propensities not listed in subsection (3) of this section shall be determined in consideration of *USEPA Quality Criteria for Water, 1986*, and as revised, and other relevant information as appropriate. Human health-based water quality criteria used by the state are contained in 40 CFR 131.36 (known as the National Toxics Rule).

(6) Risk-based criteria for carcinogenic substances shall be selected such that the upper-bound excess cancer risk is less than or equal to one in one million.

[Statutory Authority: Chapter 90.48 RCW and 40 CFR 131. 97-23-064 (Order 94-19), § 173-201A-040, filed 11/18/97, effective 12/19/97. Statutory Authority: Chapter 90.48 RCW. 92-24-037 (Order -29), § 173-201A-040, filed 11/25/92, effective 12/26/92.]

NOTES:

Reviser's note: The brackets and enclosed material in the text of the above section occurred in the copy filed by the agency.

WAC 173–201A–050 Radioactive substances.

(1) Deleterious concentrations of radioactive materials for all classes shall be as determined by the lowest practicable concentration attainable and in no case shall exceed:

(a) 1/12.5 of the values listed in WAC 246–221–290 (Column 2, Table II, effluent concentrations, rules and regulations for radiation protection); or

(b) USEPA Drinking Water Regulations for radionuclides, as published in the Federal Register of July 9, 1976, or subsequent revisions thereto.

(2) Nothing in this chapter shall be interpreted to be applicable to those aspects of governmental regulation of radioactive waters which have been preempted from state regulation by the Atomic Energy Act of 1954, as amended, as interpreted by the United States Supreme Court in the cases of *Northern States Power Co. v. Minnesota 405 U.S. 1035 (1972) and Train v. Colorado Public Interest Research Group, 426 U.S. 1 (1976)*.

[Statutory Authority: Chapter 90.48 RCW and 40 CFR 131. 97–23–064 (Order 94–19), § 173–201A–050, filed 11/18/97, effective 12/19/97. Statutory Authority: Chapter 90.48 RCW. 92–24–037 (Order 92–29), § 173–201A–050, filed 11/25/92, effective 12/26/92.]

WAC 173–201A–060 General considerations. The following general guidelines shall apply to the water quality criteria and classifications set forth in WAC 173–201A–030 through 173–201A–140 hereof:

(1) At the boundary between waters of different classifications, the water quality criteria for the higher classification shall prevail.

(2) In brackish waters of estuaries, where the fresh and marine water quality criteria differ within the same classification, the criteria shall be applied on the basis of vertically averaged salinity. The freshwater criteria shall be applied at any point where ninety-five percent of the vertically averaged daily maximum salinity values are less than or equal to one part per thousand. Marine criteria shall apply at all other locations; except that the marine water quality criteria shall apply for dissolved oxygen when the salinity is one part per thousand or greater and for fecal coliform organisms when the salinity is ten parts per thousand or greater.

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

(4)(a) The water quality criteria herein established for total dissolved gas shall not apply when the stream flow exceeds the seven-day, ten-year frequency flood.

(b) The total dissolved gas criteria may be adjusted to aid fish passage over hydroelectric dams when consistent with a department approved gas abatement plan. This gas abatement plan must be accompanied by fisheries management and physical and biological monitoring plans. The elevated total dissolved gas levels are intended to allow increased fish passage without causing more harm to fish populations than caused by turbine fish passage. The specific allowances for total dissolved gas exceedances are listed as special conditions for sections of the Snake and Columbia rivers in WAC 173–201A–130 and as shown in the following exemption:

Special fish passage exemption for sections of the Snake and Columbia rivers: When spilling water at dams is necessary to aid fish passage, total dissolved gas must not exceed an average of one hundred fifteen percent as measured at Camas/Washougal below Bonneville dam or as measured in the forebays of the next downstream dams. Total dissolved gas must also not exceed an average of one hundred twenty percent as measured in the tailraces of each dam. These averages are based on the twelve highest hourly readings in any one day of total dissolved gas. In addition, there is a maximum total dissolved gas one hour average of one hundred twenty-five percent, relative to atmospheric pressure, during spillage for fish passage. These special conditions for total dissolved gas in the Snake and Columbia rivers are viewed as temporary and are to be reviewed by the year 2003.

(c) Nothing in these special conditions allows an impact to existing and characteristic uses.

(5) Waste discharge permits, whether issued pursuant to the National Pollutant Discharge Elimination System or otherwise, shall be conditioned so the discharges authorized will meet the water quality standards.

(a) However, persons discharging wastes in compliance with the terms and conditions of permits shall not be subject to civil and criminal penalties on the basis that the discharge violates water quality standards.

(b) Permits shall be subject to modification by the department whenever it appears to the department the discharge violates water quality standards. Modification of permits, as provided herein, shall be subject to review in the same manner as originally issued permits.

(6) No waste discharge permit shall be issued which results in a violation of established water quality criteria, except as provided for under WAC 173–201A–100 or 173–201A–110.

(7) Due consideration will be given to the precision and accuracy of the sampling and analytical methods used as well as existing conditions at the time, in the application of the criteria.

(8) The analytical testing methods for these criteria shall be in accordance with the *"Guidelines Establishing Test Procedures for the Analysis of Pollutants"* (40 C.F.R. Part 136) and other or superseding methods published and/or approved by the department following consultation with adjacent states and concurrence of the USEPA.

(9) Nothing in this chapter shall be interpreted to prohibit the establishment of effluent limitations for the control of the thermal component of any discharge in accordance with Section 316 of the federal Clean Water Act (33 U.S.C. 1251 et seq.).

(10) The primary means for protecting water quality in wetlands is through implementing the antidegradation procedures section (WAC 173–070).

(a) In addition to designated uses, wetlands may have existing beneficial uses that are to be protected that include ground water exchange, shoreline stabilization, and storm water attenuation.

(b) Water quality in wetlands is maintained and protected by maintaining the hydrologic conditions, hydrophytic vegetation, and substrate characteristics necessary to support existing and designated uses.

(c) Wetlands shall be delineated using the Washington State Wetlands Identification and Delineation Manual, in accordance with WAC 173–22–035.

[Statutory Authority: Chapter 90.48 RCW and 40 CFR 131. 97–23–064 (Order 94–19), § 173–201A–060, filed 11/18/97, effective 12/19/97. Statutory Authority: Chapter 90.48 RCW. 92–24–037 (Order 92–29), § 173–201A–060, filed 11/25/92, effective 12/26/92.]

WAC 173–201A–070 Antidegradation. The antidegradation policy of the state of Washington, as generally guided by chapter 90.48 RCW, Water Pollution Control Act, and chapter 90.54 RCW, Water Resources Act of 1971, is stated as follows:

(1) Existing beneficial uses shall be maintained and protected and no further degradation which would interfere with or become injurious to existing beneficial uses shall be allowed.

(2) 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.

(3) Water quality shall be maintained and protected in waters designated as outstanding resource waters in WAC 173–201A–080.

(4) Whenever waters are of a higher quality than the criteria assigned for said waters, the existing water quality shall be protected and pollution of said waters which will reduce the existing quality shall not be allowed, except in those instances where:

(a) It is clear, after satisfactory public participation and intergovernmental coordination, that overriding considerations of the public interest will be served;

(b) All wastes and other materials and substances discharged into said waters shall be provided with all known, available, and reasonable methods of prevention, control, and treatment by new and existing point sources before discharge. All activities which result in the pollution of waters from nonpoint sources shall be provided with all known, available, and reasonable best management practices; and

(c) When the lowering of water quality in high quality waters is authorized, the lower water quality shall still be of high enough quality to fully support all existing beneficial uses.

(5) Short-term modification of water quality may be permitted as conditioned by WAC 173–201A–110.

[Statutory Authority: Chapter 90.48 RCW. 92–24–037 (Order 92–29), § 173–201A–070, filed 11/25/92, effective 12/26/92.]

WAC 173–201A–080 Outstanding resource waters. Waters meeting one or more of the following criteria shall be considered for outstanding resource water designation. Designations shall be adopted in accordance with the provisions of chapter 34.05 RCW, Administrative Procedure Act.

(1) Waters in national parks, national monuments, national preserves, national wildlife refuges, national wilderness areas, federal wild and scenic rivers, national seashores, national marine sanctuaries, national recreation areas, national scenic areas, and national estuarine research reserves;

(2) Waters in state parks, state natural areas, state wildlife management areas, and state scenic rivers;

(3) Documented aquatic habitat of priority species as determined by the department of wildlife;

(4) Documented critical habitat for populations of threatened or endangered species of native anadromous fish;

(5) Waters of exceptional recreational or ecological significance.

[Statutory Authority: Chapter 90.48 RCW. 92–24–037 (Order 92–29), § 173–201A–080, filed 11/25/92, effective 12/26/92.]

WAC 173-201A-100 Mixing zones.

(1) The allowable size and location of a mixing zone and the associated effluent limits shall be established in discharge permits, general permits, or orders, as appropriate.

(2) A discharger shall be required to fully apply AKART prior to being authorized a mixing zone.

(3) Mixing zone determinations shall consider critical discharge conditions.

(4) No mixing zone shall be granted unless the supporting information clearly indicates the mixing zone would not have a reasonable potential to cause a loss of sensitive or important habitat, substantially interfere with the existing or characteristic uses of the water body, result in damage to the ecosystem, or adversely affect public health as determined by the department.

(5) Water quality criteria shall not be violated outside of the boundary of a mixing zone as a result of the discharge for which the mixing zone was authorized.

(6) The size of a mixing zone and the concentrations of pollutants present shall be minimized.

(7) The maximum size of a mixing zone shall comply with the following:

(a) In rivers and streams, mixing zones, singularly or in combination with other mixing zones, shall comply with the most restrictive combination of the following (this size limitation may be applied to estuaries having flow characteristics that resemble rivers):

(i) Not extend in a downstream direction for a distance from the discharge port(s) greater than three hundred feet plus the depth of water over the discharge port(s), or extend upstream for a distance of over one hundred feet;

(ii) Not utilize greater than twenty-five percent of the flow; and

(iii) Not occupy greater than twenty-five percent of the width of the water body.

(b) In estuaries, mixing zones, singularly or in combination with other mixing zones, shall:

(i) Not extend in any horizontal direction from the discharge port(s) for a distance greater than two hundred feet plus the depth of water over the discharge port(s) as measured during mean lower low water; and

(ii) Not occupy greater than twenty-five percent of the width of the water body as measured during mean lower low water. For the purpose of this section, areas to the east of a line from Green Point (Fidalgo Island) to Lawrence Point (Orcas Island) are considered estuarine, as are all of the Strait of Georgia and the San Juan Islands north of Orcas Island. To the east of Deception Pass, and to the south and east of Admiralty Head, and south of Point Wilson on the Quimper Peninsula, is Puget Sound proper, which is considered to be entirely estuarine. All waters existing within bays from Point Wilson westward to Cape Flattery and south to the North Jetty of the Columbia River shall also be categorized as estuarine.

(c) In oceanic waters, mixing zones, singularly or in combination with other mixing zones, shall not extend in any horizontal direction from the discharge port(s) for a distance greater than three hundred feet plus the depth of water over the discharge port(s) as measured during mean lower low water. For the purpose of this section, all marine waters not classified as estuarine in (b)(ii) of this subsection shall be categorized as oceanic.

(d) In lakes, and in reservoirs having a mean detention time greater than fifteen days, mixing zones shall not be allowed unless it can be demonstrated to the satisfaction of the department that:

(i) Other siting, technological, and managerial options that would avoid the need for a lake mixing zone are not reasonably achievable;

(ii) Overriding considerations of the public interest will be served; and

(iii) All technological and managerial methods available for pollution reduction and removal that are economically achievable would be implemented prior to discharge. Such methods may include, but not be limited to, advanced waste treatment techniques.

(e) In lakes, and in reservoirs having a mean detention time greater than fifteen days, mixing zones, singularly or in combination with other mixing zones, shall comply with the most restrictive combination of the following:

(i) Not exceed ten percent of the water body volume;

(ii) Not exceed ten percent of the water body surface area (maximum radial extent of the plume regardless of whether it reaches the surface); and

(iii) Not extend beyond fifteen percent of the width of the water body.

(8) Acute criteria are based on numeric criteria and toxicity tests approved by the department, as generally guided under WAC 173–201A–040 (1) through (5), and shall be met as near to the point of discharge as practicably attainable. Compliance shall be determined by monitoring data or calibrated models approved by the department utilizing representative dilution ratios. A zone where acute criteria may be exceeded is allowed only if it can be demonstrated to the department's satisfaction the concentration of, and duration and frequency of exposure to the discharge, will not create a barrier to the migration or translocation of indigenous organisms to a degree that has the potential to cause damage to the ecosystem. A zone of acute criteria exceedance shall singularly or in combination with other such zones comply with the following maximum size requirements:

(a) In rivers and streams, a zone where acute criteria may be exceeded shall comply with the most restrictive combination of the following (this size limitation may also be applied to estuaries having flow characteristics resembling rivers):

(i) Not extend beyond ten percent of the distance towards the upstream and downstream boundaries of an authorized mixing zone, as measured independently from the discharge port(s);

(ii) Not utilize greater than two and one-half percent of the flow; and

(iii) Not occupy greater than twenty-five percent of the width of the water body.

(b) In oceanic and estuarine waters a zone where acute criteria may be exceeded shall not extend beyond ten percent of the distance established in subsection (7)(b) of this section as measured independently from the discharge port(s).

(9) Overlap of mixing zones.

(a) Where allowing the overlap of mixing zones would result in a combined area of water quality criteria nonattainment which does not exceed the numeric size limits established under subsection (7) of this section, the overlap may be permitted if:

(i) The separate and combined effects of the discharges can be reasonably determined; and

(ii) The combined effects would not create a barrier to the migration or translocation of indigenous organisms to a degree that has the potential to cause damage to the ecosystem.

(b) Where allowing the overlap of mixing zones would result in exceedance of the numeric size limits established under subsection (7) of this section, the overlap may be allowed only where:

(i) The overlap qualifies for exemption under subsections (12) and (13) of this section; and

(ii) The overlap meets the requirements established in (a) of this subsection.

(10) Storm water:

(a) Storm water discharge from any "point source" containing "process wastewater" as defined in 40 C.F.R. Part 122.2 shall fully conform to the numeric size criteria in subsections (7) and (8) of this section and the overlap criteria in subsection (9) of this section.

(b) Storm water discharges not described by (a) of this subsection may be granted an exemption to the numeric size criteria in subsections (7) and (8) of this section and the overlap criteria in subsection (9) of this section, provided the discharger clearly demonstrates to the department's satisfaction that:

(i) All appropriate best management practices established for storm water pollutant control have been applied to the discharge.

(ii) The proposed mixing zone shall not have a reasonable potential to result in a loss of sensitive or important habitat, substantially interfere with the existing or characteristic uses of the water body, result in damage to the ecosystem, or adversely affect public health as determined by the department; and

(iii) The proposed mixing zone shall not create a barrier to the migration or translocation of indigenous organisms to a degree that has the potential to cause damage to the ecosystem.

(c) All mixing zones for storm water discharges shall be based on a volume of runoff corresponding to a design storm approved by the department. Exceedances from the numeric size criteria in subsections (7) and (8) of this section and the overlap criteria in subsection (9) of this section due to precipitation events greater than the approved design storm may be allowed by the department, if it would not result in adverse impact to existing or characteristic uses of the water body or result in damage to the ecosystem, or adversely affect public health as determined by the department.

(11) Combined sewer overflows complying with the requirements of chapter 173–245 WAC, may be allowed an average once per year exemption to the numeric size criteria in subsections (7) and (8) of this section and the overlap criteria in subsection (9) of this section, provided the discharge complies with subsection (4) of this section.

(12) Exceedances from the numeric size criteria in subsections (7) and (8) of this section and the overlap criteria in subsection (9) of this section may be considered by the department in the following cases:

(a) For discharges existing prior to November 24, 1992, (or for proposed discharges with engineering plans formally approved by the department prior to November 24, 1992);

(b) Where altering the size configuration is expected to result in greater protection to existing and characteristic uses;

(c) Where the volume of water in the effluent is providing a greater benefit to the existing or characteristic uses of the water body due to flow augmentation than the benefit of removing the discharge, if such removal is the remaining feasible option; or

(d) Where the exceedance is clearly necessary to accommodate important economic or social development in the area in which the waters are located.

(13) Before an exceedance from the numeric size criteria in subsections (7) and (8) of this section and the overlap criteria in subsection (9) of this section may be allowed under subsection (12) of this section, it must clearly be demonstrated to the department's satisfaction that:

(a) AKART appropriate to the discharge is being fully applied;

(b) All siting, technological, and managerial options which would result in full or significantly closer compliance that are economically achievable are being utilized; and

(c) The proposed mixing zone complies with subsection (4) of this section.

(14) Any exemptions granted to the size criteria under subsection (12) of this section shall be reexamined during each permit renewal period for changes in compliance capability. Any significant increase in capability to comply shall be reflected in the renewed discharge permit.

(15) The department may establish permit limits and measures of compliance for human health based criteria (based on lifetime exposure levels), independent of this section.

(16) Sediment impact zones authorized by the department pursuant to chapter 173–204 WAC, Sediment management standards, do not satisfy the requirements of this section.

[Statutory Authority: Chapter 90.48 RCW. 92–24–037 (Order 92–29), § 173–201A–100, filed 11/25/92, effective 12/26/92.]

WAC 173–201A–110 Short-term modifications. The criteria and special conditions established in WAC 173–201A–030 through 173–201A–140 may be modified for a specific water body on a short-term basis when necessary to accommodate essential activities, respond to emergencies, or to otherwise protect the public interest, even though such activities may result in a temporary reduction of water quality conditions below those criteria and classifications established by this regulation. Such activities must be conditioned, timed, and restricted (i.e., hours or days rather than weeks or months) in a manner that will minimize water quality degradation to existing and characteristic uses. In no case will any degradation of water quality be allowed if this degradation significantly interferes with or becomes injurious to characteristic water uses or causes long-term harm to the environment.

(1) A short-term modification may be issued in writing by the director or his/her designee to an individual or entity proposing the aquatic application of pesticides, including but not limited to those used for control of federally or state listed noxious and invasive species, and excess populations of native aquatic plants, mosquitoes, burrowing shrimp, and fish, subject to the following terms and conditions:

(a) A short-term modification will in no way lessen or remove the project proponent's obligations and liabilities under other federal, state and local rules and regulations.

(b) A request for a short-term modification shall be made to the department on forms supplied by the department. Such request shall be made at least thirty days prior to initiation of the proposed activity, and after the project proponent has complied with the requirements of the State Environmental Policy Act (SEPA);

(c) A short-term modification shall be valid for the duration of the activity requiring modification of the criteria and special conditions in WAC 173-201A–030 through 173–201A–140, or for one year, whichever is less. Ecology may authorize a longer duration where the activity is part of an ongoing or long-term operation and maintenance plan, integrated pest or noxious weed management plan, waterbody or watershed management plan, or restoration plan. Such a plan must be developed through a public involvement process consistent with the Administrative Procedure Act (chapter 34.05 RCW) and be in compliance with SEPA, chapter 43.21C RCW, in which case the standards may be modified for the duration of the plan, or for five years, whichever is less;

(d) Appropriate public notice as determined and prescribed by the director or his/her designee shall be given, identifying the pesticide, applicator, location where the pesticide will be applied, proposed timing and method of application, and any water use restrictions specified in USEPA label provisions;

(e) The pesticide application shall be made at times so as to:

(i) Minimize public water use restrictions during weekends; and

(ii) Avoid public water use restrictions during the opening week of fishing season, Memorial Day weekend, Independence Day weekend, and Labor Day weekend;

(f) Any additional conditions as may be prescribed by the director or his/her designee.

(2) A short-term modification may be issued for the control or eradication of noxious weeds identified as such in accordance with the state noxious weed control law, chapter 17.10 RCW, and Control of spartina and purple loosestrife, chapter 17.26 RCW. Short-term modifications for noxious weed control shall be included in a water quality permit issued in accordance with RCW 90.48.445, and the following requirements:

(a) Water quality permits for noxious weed control may be issued to the Washington state department of agriculture (WSDA) for the purposes of coordinating and conducting noxious weed control activities consistent with their responsibilities under chapter 17.10 and 17.26 RCW. Coordination may include noxious weed control activities identified in a WSDA integrated noxious weed management plan and conducted by individual landowners or land managers.

(b) Water quality permits may also be issued to individual landowners or land managers for noxious weed control activities where such activities are not covered by a WSDA integrated noxious weed management plan.

(3) The turbidity criteria established under WAC 173–201A–030 shall be modified to allow a temporary mixing zone during and immediately after necessary in-water or shoreline construction activities that result in the disturbance of in-place sediments. A temporary turbidity mixing zone is subject to the constraints of WAC 173–201A–100 (4) and (6) and is authorized only after the activity has received all other necessary local and state permits and approvals, and after the implementation of appropriate best management practices to avoid or minimize disturbance of in-place sediments and exceedances of the turbidity criteria. A temporary turbidity mixing zone shall be as follows:

(a) For waters up to 10 cfs flow at the time of construction, the point of compliance shall be one hundred feet downstream from activity causing the turbidity exceedance.

(b) For waters above 10 cfs up to 100 cfs flow at the time of construction, the point of compliance shall be two hundred feet downstream of activity causing the turbidity exceedance.

(c) For waters above 100 cfs flow at the time of construction, the point of compliance shall be three hundred feet downstream of activity causing the turbidity exceedance.

(d) For projects working within or along lakes, ponds, wetlands, estuaries, marine waters or other nonflowing waters, the point of compliance shall be at a radius of one hundred fifty feet from activity causing the turbidity exceedance.

[Statutory Authority: Chapter 90.48 RCW and 40 CFR 131. 97-23-064 (Order 94-19), § 173-201A-110, filed 11/18/97, effective 12/19/97. Statutory Authority: Chapter 90.48 RCW. 92-24-037 (Order 92-29), § 173-201A-110, filed 11/25/92, effective 12/26/92.]

WAC 173-201A-120 General classifications. General classifications applying to various surface water bodies not specifically classified under WAC -201A-130 or 173-201A-140 are as follows:

(1) All surface waters lying within national parks, national forests, and/or wilderness areas are classified Class AA or Lake Class.

(2) All lakes and their feeder streams within the state are classified Lake Class and Class AA respectively, except for those feeder streams specifically classified otherwise.

(3) All reservoirs with a mean detention time of greater than 15 days are classified Lake Class.

(4) All reservoirs with a mean detention time of 15 days or less are classified the same as the river section in which they are located.

(5) All reservoirs established on preexisting lakes are classified as Lake Class.

(6) All unclassified surface waters that are tributaries to Class AA waters are classified Class AA. All other unclassified surface waters within the state are hereby classified Class A.

[Statutory Authority: Chapter 90.48 RCW. 92-24-037 (Order 92-29), § 173-201A-120, filed 11/25/92, effective 12/26/92.]

WAC 173-201A-130 Specific classifications-Freshwater. Specific fresh surface waters of the state of Washington are classified as follows:

(1)	American River.	Class AA
(2)	Big Quilcene River and tributaries.	Class AA
(3)	Bumping River.	Class AA
(4)	Burnt Bridge Creek.	Class A
(5)	Cedar River from Lake Washington to the Maplewood Bridge (river mile 4.1).	Class A
(6)	Cedar River and tributaries from the Maplewood Bridge (river mile 4.1) to Landsburg Dam (river mile 21.6).	Class AA
(7)	Cedar River and tributaries from Landsburg Dam (river mile 21.6) to headwaters. Special condition - no waste discharge will be permitted.	Class AA
(8)	Chehalis River from upper boundary of Grays Harbor at Cosmopolis (river mile 3.1, longitude 123°45'45" W) to Scammon Creek (river mile 65.8).	Class A
(9)	Chehalis River from Scammon Creek (river mile 65.8) to Newaukum River (river mile 75.2). Special condition - dissolved oxygen shall exceed 5.0 mg/L from June 1 to September 15. For the remainder of the year, the dissolved oxygen shall meet Class A criteria.	Class A
(10)	Chehalis River from Newaukum River (river mile 75.2) to Rock Creek (river mile 106.7).	Class A
(11)	Chehalis River, from Rock Creek (river mile 106.7) to headwaters.	Class AA
(12)	Chehalis River, south fork.	Class A
(13)	Chewuch River.	Class AA
(14)	Chiwawa River.	Class AA
(15)	Cispus River.	Class AA

(16)	Clearwater River.	Class A
(17)	Cle Elum River.	Class AA
(18)	Cloquallum Creek.	Class A
(19)	Clover Creek from outlet of Lake Spanaway to inlet of Lake Steilacoom.	Class A
(20)	Columbia River from mouth to the Washington-Oregon border (river mile 309.3). Special conditions - temperature shall not exceed 20.0°C due to human activities. When natural conditions exceed 20.0°C. no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C: nor shall such temperature increases. at any time. exceed 0.3°C due to any single source or 1.1°C due to all such activities combined. Dissolved oxygen shall exceed 90 percent of saturation. Special condition - special fish passage exemption as described in WAC 173–201A–060 (4)(b).	Class A
(21)	Columbia River from Washington-Oregon border (river mile 309.3) to Grand Coulee Dam (river mile 596.6). Special condition from Washington-Oregon border (river mile 309.3) to Priest Rapids Dam (river mile 397.1). Temperature shall not exceed 20.0°C due to human activities. When natural conditions exceed 20.0°C. no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C: nor shall such temperature increases. at any time. exceed t=34/(T+9). Special condition - special fish passage exemption as described in WAC 173–201A–060 (4)(b).	Class A
(22)	Columbia River from Grand Coulee Dam (river mile 596.6) to Canadian border (river mile 745.0).	Class AA
(23)	Colville River.	Class A
(24)	Coweeman River from mouth to Mulholland Creek (river mile 18.4).	Class A
(25)	Coweeman River from Mulholland Creek (river mile 18.4) to headwaters.	Class AA
(26)	Cowlitz River from mouth to base of Riffe Lake Dam (river mile 52.0).	Class A
(27)	Cowlitz River from base of Riffe Lake Dam (river mile 52.0) to headwaters.	Class AA
(28)	Crab Creek and tributaries.	Class B
(29)	Decker Creek.	Class AA
(30)	Deschutes River from mouth to boundary of Snoqualmie National Forest (river mile 48.2).	Class A
(31)	Deschutes River from boundary of Snoqualmie National Forest (river mile 48.2) to headwaters.	Class AA
(32)	Dickey River.	Class A
(33)	Dosewallips River and tributaries.	Class AA
(34)	Duckabush River and tributaries.	Class AA
(35)	Dungeness River from mouth to Canyon Creek (river mile 10.8).	Class A
(36)	Dungeness River and tributaries from Canyon Creek (river mile 10.8) to headwaters.	Class AA
(37)	Duwamish River from mouth south of a line bearing 254° true from the NW corner of berth 3. terminal No. 37 to the Black River (river mile 11.0) (Duwamish River continues as the Green River above the Black River).	Class B
(38)	Elochoman River.	Class A
(39)	Elwha River and tributaries.	Class AA
(40)	Entiat River from Wenatchee National Forest boundary (river mile 20.5) to headwaters.	Class AA
(41)	Grande Ronde River from mouth to Oregon border (river mile 37). Special condition - temperature shall not exceed 20.0°C due to human activities. When natural conditions exceed 20.0°C. no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C: nor shall such temperature increases. at any time. exceed t=34/(T+9).	Class A
(42)	Grays River from Grays River Falls (river mile 15.8) to headwaters.	Class AA

(43)	Green River (Cowlitz County).	Class AA
(44)	Green River (King County) from Black River (river mile 11.0 and point where Duwamish River continues as the Green River) to west boundary of Sec. 27-T21N-R6E (west boundary of Flaming Geyser State Park at river mile 42.3).	Class A
(45)	Green River (King County) from west boundary of Sec. 27-T21N-R6E (west boundary of Flaming Geyser State Park, river mile 42.3) to west boundary of Sec. 13-T21N-R7E (river mile 59.1).	Class AA
(46)	Green River and tributaries (King County) from west boundary of Sec. 13-T21N-R7E (river mile 59.1) to headwaters. Special condition - no waste discharge will be permitted.	Class AA
(47)	Hamma Hamma River and tributaries.	Class AA
(48)	Hanaford Creek from mouth to east boundary of Sec. 25-T15N-R2W (river mile 4.1). Special condition - dissolved oxygen shall exceed 6.5 mg/L.	Class A
(49)	Hanaford Creek from east boundary of Sec. 25-T15N-R2W (river mile 4.1) to headwaters.	Class A
(50)	Hoh River and tributaries.	Class AA
(51)	Hoquiam River (continues as west fork above east fork) from mouth to river mile 9.3 (Dekay Road Bridge) (upper limit of tidal influence).	Class B
(52)	Humptulips River and tributaries from mouth to Olympic National Forest boundary on east fork (river mile 12.8) and west fork (river mile 40.4) (main stem continues as west fork).	Class A
(53)	Humptulips River, east fork from Olympic National Forest boundary (river mile 12.8) to headwaters.	Class AA
(54)	Humptulips River, west fork from Olympic National Forest boundary (river mile 40.4) to headwaters.	Class AA
(55)	Issaquah Creek.	Class A
(56)	Kalama River from lower Kalama River Falls (river mile 10.4) to headwaters.	Class AA
(57)	Klickitat River from Little Klickitat River (river mile 19.8) to boundary of Yakima Indian Reservation.	Class AA
(58)	Lake Washington Ship Canal from Government Locks (river mile 1.0) to Lake Washington (river mile 8.6). Special condition - salinity shall not exceed one part per thousand (1.0 ppt) at any point or depth along a line that transects the ship canal at the University Bridge (river mile 6.1).	Lake Class
(59)	Lewis River, east fork, from Multon Falls (river mile 24.6) to headwaters.	Class AA
(60)	Little Wenatchee River.	Class AA
(61)	Methow River from mouth to Chewuch River (river mile 50.1).	Class A
(62)	Methow River from Chewuch River (river mile 50.1) to headwaters.	Class AA
(63)	Mill Creek from mouth to 13th Street Bridge in Walla Walla (river mile 6.4). Special condition - dissolved oxygen concentration shall exceed 5.0 mg/L.	Class B
(64)	Mill Creek from 13th Street Bridge in Walla Walla (river mile 6.4) to Walla Walla Waterworks Dam (river mile 11.5).	Class A
(65)	Mill Creek and tributaries from city of Walla Walla Waterworks Dam (river mile 21.6) to headwaters. Special condition - no waste discharge will be permitted.	Class AA
(66)	Naches River from Snoqualmie National Forest boundary (river mile 35.7) to headwaters.	Class AA
(67)	Naselle River from Naselle "Falls" (cascade at river mile 18.6) to headwaters.	Class AA
(68)	Newaukum River.	Class A
(69)	Nisqually River from mouth to Alder Dam (river mile 44.2).	Class A
(70)	Nisqually River from Alder Dam (river mile 44.2) to headwaters.	Class AA

(71)	Nooksack River from mouth to Maple Creek (river mile 49.7).	Class A
(72)	Nooksack River from Maple Creek (river mile 49.7) to headwaters.	Class AA
(73)	Nooksack River, south fork, from mouth to Skookum Creek (river mile 14.3).	Class A
(74)	Nooksack River, south fork, from Skookum Creek (river mile 14.3) to headwaters.	Class AA
(75)	Nooksack River, middle fork.	Class AA
(76)	Okanogan River.	Class A
(77)	Palouse River from mouth to south fork (Colfax, river mile 89.6).	Class B
(78)	Palouse River from south fork (Colfax, river mile 89.6) to Idaho border (river mile 123.4). Special condition - temperature shall not exceed 20.0°C due to human activities. When natural conditions exceed 20.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed $t=34/(T+9)$.	Class A
(79)	Pend Oreille River from Canadian border (river mile 16.0) to Idaho border (river mile 87.7). Special condition - temperature shall not exceed 20.0°C due to human activities. When natural conditions exceed 20.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed $t=34/(T+9)$.	Class A
(80)	Pilchuck River from city of Snohomish Waterworks Dam (river mile 26.8) to headwaters.	Class AA
(81)	Puyallup River from mouth to river mile 1.0.	Class B
(82)	Puyallup River from river mile 1.0 to Kings Creek (river mile 31.6).	Class A
(83)	Puyallup River from Kings Creek (river mile 31.6) to headwaters.	Class AA
(84)	Queets River and tributaries.	Class AA
(85)	Quillayute River.	Class AA
(86)	Quinault River and tributaries.	Class AA
(87)	Salmon Creek (Clark County).	Class A
(88)	Satsop River from mouth to west fork (river mile 6.4).	Class A
(89)	Satsop River, east fork.	Class AA
(90)	Satsop River, middle fork.	Class AA
(91)	Satsop River, west fork.	Class AA
(92)	Skagit River from mouth to Skiyou Slough-lower end (river mile 25.6).	Class A
(93)	Skagit River and tributaries (includes Baker, Suak, Suiattle, and Cascade rivers) from Skiyou Slough-lower end, (river mile 25.6) to Canadian border (river mile 127.0). Special condition - Skagit River (Gorge by-pass reach) from Gorge Dam (river mile 96.6) to Gorge Powerhouse (river mile 94.2). Temperature shall not exceed 21°C due to human activities. When natural conditions exceed 21°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C, nor shall such temperature increases, at any time, exceed $t=34/(T+9)$.	Class AA
(94)	Skokomish River and tributaries.	Class AA
(95)	Skookumchuck River from Bloody Run Creek (river mile 21.4) to headwaters.	Class AA
(96)	Skykomish River from mouth to May Creek (above Gold Bar at river mile 41.2).	Class A
(97)	Skykomish River from May Creek (above Gold Bar at river mile 41.2) to headwaters.	Class AA
(98)	Snake River from mouth to Washington-Idaho-Oregon border (river mile 176.1). Special condition:	Class A
(a)	Below Clearwater River (river mile 139.3). Temperature shall not exceed 20.0°C due to human activities. When natural conditions exceed 20.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed $t=34/(T+9)$. Special	

condition - special fish passage exemption as described in WAC 173-201A-060 (4)(b).

(b) Above Clearwater River (river mile 139.3). Temperature shall not exceed 20.0°C due to human activities. When natural conditions exceed 20.0°C, no temperature increases will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed 0.3°C due to any single source or 1.1°C due to all such activities combined.

(99)	Snohomish River from mouth and east of longitude 122°13'40"W upstream to latitude 47°56'30"N (southern tip of Ebey Island at river mile 8.1). Special condition - fecal coliform organism levels shall both not exceed a geometric mean value of 200 colonies/100 mL and not have more than 10 percent of the samples obtained for calculating the mean value exceeding 400 colonies/100 mL.	Class A
(100)	Snohomish River upstream from latitude 47°56'30"N (southern tip of Ebey Island river mile 8.1) to confluence with Skykomish and Snoqualmie River (river mile 20.5).	Class A
(101)	Snoqualmie River and tributaries from mouth to west boundary of Twin Falls State Park on south fork (river mile 9.1).	Class A
(102)	Snoqualmie River, middle fork.	Class AA
(103)	Snoqualmie River, north fork.	Class AA
(104)	Snoqualmie River, south fork, from west boundary of Twin Falls State Park (river mile 9.1) to headwaters.	Class AA
(105)	Soleduck River and tributaries.	Class AA
(106)	Spokane River from mouth to Long Lake Dam (river mile 33.9). Special condition - temperature shall not exceed 20.0°C due to human activities. When natural conditions exceed 20.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed t=34/(T+9).	Class A
(107)	Spokane River from Long Lake Dam (river mile 33.9) to Nine Mile Bridge (river mile 58.0). Special conditions:	Lake Class
(a)	The average euphotic zone concentration of total phosphorus (as P) shall not exceed 25μg/L during the period of June 1 to October 31.	
(b)	Temperature shall not exceed 20.0°C, due to human activities. When natural conditions exceed 20.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time exceed t=34/(T+9).	
(108)	Spokane River from Nine Mile Bridge (river mile 58.0) to the Idaho border (river mile 96.5). Temperature shall not exceed 20.0°C due to human activities. When natural conditions exceed 20.0°C no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time exceed t=34/(T+9).	Class A
(109)	Stehekin River.	Class AA
(110)	Stillaguamish River from mouth to north and south forks (river mile 17.8).	Class A
(111)	Stillaguamish River, north fork, from mouth to Squire Creek (river mile 31.2).	Class A
(112)	Stillaguamish River, north fork, from Squire Creek (river mile 31.2) to headwaters.	Class AA
(113)	Stillaguamish River, south fork, from mouth to Canyon Creek (river mile 33.7).	Class A
(114)	Stillaguamish River, south fork, from Canyon Creek (river mile 33.7) to headwaters.	Class AA
(115)	Sulphur Creek.	Class B
(116)	Sultan River from mouth to Chaplain Creek (river mile 5.9).	Class A
(117)	Sultan River and tributaries from Chaplain Creek (river mile 5.9) to headwaters. Special	Class AA

	condition - no waste discharge will be permitted above city of Everett Diversion Dam (river mile 9.4).	
(118)	Sumas River from Canadian border (river mile 12) to headwaters (river mile 23).	Class A
(119)	Tieton River.	Class AA
(120)	Tolt River, south fork and tributaries from mouth to west boundary of Sec. 31-T26N-R9E (river mile 6.9).	Class AA
(121)	Tolt River, south fork from west boundary of Sec. 31-T26N-R9E (river mile 6.9) to headwaters. Special condition - no waste discharge will be permitted.	Class AA
(122)	Touchet River, north fork from Dayton water intake structure (river mile 3.0) to headwaters.	Class AA
(123)	Toutle River, north fork, from Green River to headwaters.	Class AA
(124)	Toutle River, south fork.	Class AA
(125)	Tucannon River from Umatilla National Forest boundary (river mile 38.1) to headwaters.	Class AA
(126)	Twisp River.	Class AA
(127)	Union River and tributaries from Bremerton Waterworks Dam (river mile 6.9) to headwaters. Special condition - no waste discharge will be permitted.	Class AA
(128)	Walla Walla River from mouth to Lowden (Dry Creek at river mile 27.2).	Class B
(129)	Walla Walla River from Lowden (Dry Creek at river mile 27.2) to Oregon border (river mile 40). Special condition - temperature shall not exceed 20.0°C due to human activities. When natural conditions exceed 20.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed $t=34/(T+9)$.	Class A
(130)	Wenatchee River from Wenatchee National Forest boundary (river mile 27.1) to headwaters.	Class AA
(131)	White River (Pierce-King counties) from Mud Mountain Dam (river mile 27.1) to headwaters.	Class AA
(132)	White River (Chelan County).	Class AA
(133)	Wildcat Creek.	Class A
(134)	Willapa River upstream of a line bearing 70° true through Mailboat Slough light (river mile 1.8).	Class A
(135)	Wishkah River from mouth to river mile 6 (SW 1/4 SW 1/4 NE 1/4 Sec. 21-T18N-R9W).	Class B
(136)	Wishkah River from river mile 6 (SW 1/4 SW 1/4 NE 1/4 Sec. 21-T18N-R9W) to west fork (river mile 17.7).	Class A
(137)	Wishkah River from west fork of Wishkah River (river mile 17.7) to south boundary of Sec. 33-T21N-R8W (river mile 32.0).	Class AA
(138)	Wishkah River and tributaries from south boundary of Sec. 33-T21N-R8W (river mile 32.0) to headwaters. Special condition - no waste discharge will be permitted.	Class AA
(139)	Wynoochee River from mouth to Olympic National Forest boundary (river mile 45.9).	Class A
(140)	Wynoochee River from Olympic National Forest boundary (river mile 45.9) to headwaters.	Class AA
(141)	Yakima River from mouth to Cle Elum River (river mile 185.6). Special condition - temperature shall not exceed 21.0°C due to human activities. When natural conditions exceed 21.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed $t=34/(T+9)$.	Class A
(142)	Yakima River from Cle Elum River (river mile 185.6) to headwaters.	Class AA

[Statutory Authority: Chapter 90.48 RCW and 40 CFR 131. 97-23-064 (Order 94-19), § 173-201A-130, filed 11/18/97, effective 12/19/97. Statutory Authority: Chapter 90.48 RCW. 92-24-037 (Order 92-29), § 173-201A-130, filed 11/25/92, effective 12/26/92.]

WAC 173-201A-140 Specific classifications-Marine water. Specific marine surface waters of the state of Washington are classified as follows:

(1)	Budd Inlet south of latitude 47°04'N (south of Priest Point Park).	Class B
(2)	Coastal waters: Pacific Ocean from Ilwaco to Cape Flattery.	Class AA
(3)	Commencement Bay south and east of a line bearing 258° true from "Brown's Point" and north and west of line bearing 225° true through the Hylebos waterway light.	Class A
(4)	Commencement Bay, inner, south and east of a line bearing 225° true through Hylebos waterway light except the city waterway south and east of south 11th Street.	Class B
(5)	Commencement Bay, city waterway south and east of south 11th Street.	Class C
(6)	Drayton Harbor, south of entrance.	Class A
(7)	Dyes and Sinclair Inlets west of longitude 122°37'W.	Class A
(8)	Elliott Bay east of a line between Pier 91 and Duwamish head.	Class A
(9)	Everett Harbor, inner, northeast of a line bearing 121° true from approximately 47°59'5"N and 122°13'44"W (southwest corner of the pier).	Class B
(10)	Grays Harbor west of longitude 123°59'W.	Class A
(11)	Grays Harbor east of longitude 123°59'W to longitude 123°45'45"W (Cosmopolis Chehalis River, river mile 3.1). Special condition - dissolved oxygen shall exceed 5.0 mg/L.	Class B
(12)	Guemes Channel, Padilla, Samish and Bellingham Bays east of longitude 122°39'W and north of latitude 48°27'20"N.	Class A
(13)	Hood Canal.	Class AA
(14)	Mukilteo and all North Puget Sound west of longitude 122°39' W (Whidbey, Fidalgo, Guemes and Lummi islands and State Highway 20 Bridge at Deception Pass), except as otherwise noted.	Class AA
(15)	Oakland Bay west of longitude 123°05'W (inner Shelton harbor).	Class B
(16)	Port Angeles south and west of a line bearing 152° true from buoy "2" at the tip of Ediz Hook.	Class A
(17)	Port Gamble south of latitude 47°51'20"N.	Class A
(18)	Port Townsend west of a line between Point Hudson and Kala Point.	Class A
(19)	Possession Sound, south of latitude 47°57'N.	Class AA
(20)	Possession Sound, Port Susan, Saratoga Passage, and Skagit Bay east of Whidbey Island and State Highway 20 Bridge at Deception Pass between latitude 47°57'N (Mukilteo) and latitude 48°27'20"N (Similk Bay), except as otherwise noted.	Class A
(21)	Puget Sound through Admiralty Inlet and South Puget Sound, south and west to longitude 122°52'30"W (Brisco Point) and longitude 122°51'W (northern tip of Hartstene Island).	Class AA
(22)	Sequim Bay southward of entrance.	Class AA
(23)	South Puget Sound west of longitude 122°52'30"W (Brisco Point) and longitude 122°51'W (northern tip of Hartstene Island, except as otherwise noted).	Class A
(24)	Strait of Juan de Fuca.	Class AA
(25)	Totten Inlet and Little Skookum Inlet, west of longitude 122°56'32" (west side of Steamboat Island).	Class AA
(26)	Willapa Bay seaward of a line bearing 70° true through Mailboat Slough light (Willapa River, river mile 1.8).	Class A

[Statutory Authority: Chapter 90.48 RCW and 40 CFR 131. 97-23-064 (Order -19). § 173-201A-140, filed 11/18/97, effective 12/19/97. Statutory Authority: Chapter 90.48 RCW. 92-24-037 (Order 92-29). § 173-201A-140, filed 11/25/92, effective 12/26/92.]

WAC 173-201A-150 Achievement considerations. To fully achieve and maintain the foregoing water quality in the state of Washington, it is the intent of the department to apply the various implementation and enforcement authorities at its disposal, including participation in the programs of the federal Clean Water Act (33 U.S.C. 1251 et seq.) as appropriate. It is also the intent that cognizance will be taken of the need for participation in cooperative programs with other state agencies and private groups with respect to the management of related problems. The department's planned program for water pollution control will be defined and revised annually in accordance with section 106 of said federal act. Further, it shall be required that all activities which discharge wastes into waters within the state, or otherwise adversely affect the quality of said waters, be in compliance with the waste treatment and discharge provisions of state or federal law.

[Statutory Authority: Chapter 90.48 RCW. 92-24-037 (Order 92-29). § 173-201A-150, filed 11/25/92, effective 12/26/92.]

WAC 173-201A-160 Implementation.

(1) **Discharges from municipal, commercial, and industrial operations.** The primary means to be used for controlling municipal, commercial, and industrial waste discharges shall be through the issuance of waste disposal permits, as provided for in RCW 90.48.160, 90.48.162, and 90.48.260.

(2) **Miscellaneous waste discharge or water quality effect sources.** The director shall, through the issuance of regulatory permits, directives, and orders, as are appropriate, control miscellaneous waste discharges and water quality effect sources not covered by subsection (1) of this section.

(3) **Nonpoint source and storm water pollution.**

(a) Activities which generate nonpoint source pollution shall be conducted so as to comply with the water quality standards. The primary means to be used for requiring compliance with the standards shall be through best management practices required in waste discharge permits, rules, orders, and directives issued by the department for activities which generate nonpoint source pollution.

(b) Best management practices shall be applied so that when all appropriate combinations of individual best management practices are utilized, violation of water quality criteria shall be prevented. If a discharger is applying all best management practices appropriate or required by the department and a violation of water quality criteria occurs, the discharger shall modify existing practices or apply further water pollution control measures, selected or approved by the department, to achieve compliance with water quality criteria. Best management practices established in permits, orders, rules, or directives of the department shall be reviewed and modified, as appropriate, so as to achieve compliance with water quality criteria.

(c) Activities which contribute to nonpoint source pollution shall be conducted utilizing best management practices to prevent violation of water quality criteria. When applicable best management practices are not being implemented, the department may conclude individual activities are causing pollution in violation of RCW 90.48.080. In these situations, the department may pursue orders, directives, permits, or civil or criminal sanctions to gain compliance with the standards.

(d) Activities which cause pollution of storm water shall be conducted so as to comply with the water quality standards. The primary means to be used for requiring compliance with the standards shall be through best management practices required in waste discharge permits, rules, orders, and directives issued by the department for activities which generate storm water pollution. The consideration and control procedures in (b) and (c) of this subsection apply to the control of pollutants in storm water.

(4) **Allowance for compliance schedules.**

(a) Permits, orders, and directives of the department for existing discharges may include a schedule for achieving compliance with water quality criteria contained in this chapter. Such schedules of compliance shall be developed to ensure final compliance with all water quality-based effluent limits in the shortest practicable time. Decisions regarding whether to issue schedules of compliance will be made on a case-by-case basis by the department. Schedules of compliance may not be issued for new discharges. Schedules of compliance may be issued to allow for:

(i) construction of necessary treatment capability;

(ii) implementation of necessary best management practices;

(iii) implementation of additional storm water best management practices for discharges determined not to meet water quality criteria following implementation of an initial set of best management practices;

(iv) completion of necessary water quality studies; or

(v) resolution of a pending water quality standards' issue through rule-making action.

(b) For the period of time during which compliance with water quality criteria is deferred, interim effluent limitations shall be formally established, based on the best professional judgment of the department. Interim effluent limitations may be numeric or nonnumeric (e.g., construction of necessary facilities by a specified date as contained in an ecology order or permit).

(c) Prior to establishing a schedule of compliance, the department shall require the discharger to evaluate the possibility of achieving water quality criteria via non-construction changes (e.g., facility operation, pollution prevention). Schedules of compliance may in no case exceed ten years, and shall generally not exceed the term of any permit.

[Statutory Authority: Chapter 90.48 RCW and 40 CFR 131. 97–23–064 (Order 94–19). § 173–201A–160. filed 11/18/97. effective 12/19/97. Statutory Authority: Chapter 90.48 RCW. 92–24–037 (Order 92–29). § 173–201A–160. filed 11/25/92. effective 12/26/92.]

WAC 173–201A–170 Surveillance. A continuing surveillance program, to ascertain whether the regulations, waste disposal permits, orders, and directives promulgated and/or issued by the department are being complied with, will be conducted by the department staff as follows:

(1) Inspecting treatment and control facilities.

(2) Monitoring and reporting waste discharge characteristics.

(3) Monitoring receiving water quality.

[Statutory Authority: Chapter 90.48 RCW. 92–24–037 (Order 92–29). § 173–201A–170. filed 11/25/92. effective 12/26/92.]

WAC 173–201A–180 Enforcement. To insure that the provisions of chapter 90.48 RCW, the standards for water quality promulgated herein, the terms of waste disposal permits, and other will be relied upon by the department, in cooperation with the attorney general as it deems appropriate:

(1) Issuance of notices of violation and regulatory orders as provided for in RCW 90.48.120.

(2) Initiation of actions requesting injunctive or other appropriate relief in the various courts of the state as provided for in RCW 90.48.037.

(3) Levying of civil penalties as provided for in RCW 90.48.144.

(4) Initiation of a criminal proceeding by the appropriate county prosecutor as provided for in RCW 90.48.140.

(5) Issuance of regulatory orders or directives as provided for in RCW 90.48.240.

[Statutory Authority: Chapter 90.48 RCW. 92–24–037 (Order 92–29), § 173–201A–180, filed 11/25/92, effective 12/26/92.]

APPENDIX 12

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

P.O. Box 47600 • Olympia, Washington 98504-7600
(360) 407-6000 • TDD Only (Hearing Impaired) (360) 407-6006

May 31, 1996

Mr. Phil Millam
Water Division Director
U.S. Environmental Protection Agency - Region 10
1200 Sixth Avenue
Seattle, WA 98101

Dear Mr. Millam:

In accordance with federal regulations 40 CFR 130.7 and Section 303(d) of the Clean Water Act, the Department of Ecology submits the attached list of waters requiring establishment of Total Maximum Daily Loads (TMDLs). These waters have been selected after an extensive public participation process and numerous internal reviews by Ecology staff. A responsiveness summary of comments received and rationale for decisions is enclosed.

As required, those segments and parameters which have been identified as high priority for establishment of TMDLs are shown in underlined text. All other segments and parameters in the list not shown with underlined text have been identified as a medium priority for establishing TMDLs. These medium priority segments will be re-examined for their priority through the scoping process of our watershed approach to water quality management.

The segments and schedule of TMDLs that are under development or completed is shown in Appendix I of the responsiveness summary. Ecology is also committed to preventing waters from being placed on the list. As such, we are in the process of establishing many TMDLs for waters which are not on the current list.

If you have any questions or if we can clarify any of the information enclosed, please contact Steve Butkus of my staff at (206) 407-6482.

Sincerely,

Michael T. Llewelyn
Program Manager
Water Quality Program

MTL:SB:lmb
Enclosure

1996 Section 303(d) List - May 29, 1996
(Underlined text indicates a high priority for establishing a TMDL)

WATERBODY SEGMENT NUMBER	WATERBODY NAME	PARAMETERS EXCEEDING STANDARDS
WA-01-0010	STRAIT OF GEORGIA	PCBs, Cadmium, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benz(a)anthracene, Chrysene, Benzo(b,k)fluoranthenes, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene, Dibenzofuran.
WA-01-0020	DRAYTON HARBOR	Fecal Coliform.
WA-01-0050	BELLINGHAM BAY (INNER) AND WHATCOM WATERWAY	Mercury, Arsenic, Copper, Lead, Zinc, Acenaphthene, Fluorene, Phenanthrene, Anthracene, 2-Methylnaphthalene, Fluoranthene, Pyrene, Benz(a)anthracene, Chrysene, Benzo(b,k)fluoranthenes, Benzo(a)pyrene, Indeno(1,2,3-c,d)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene, Bis(2-ethylhexyl) Phthalate, Dibenzofuran, PCBs, Phenol, 2,4-Dimethylphenol, Pentachlorophenol, Sediment Bioassay, pH, Fecal Coliform.
WA-01-0070	LUMMI BAY AND HALE PASSAGE	Fecal Coliform.
WA-01-0080	BELLINGHAM BAY (OUTER)	pH.
WA-01-1002	DAKOTA CREEK	Dissolved Oxygen, Fecal Coliform.
WA-01-1010	NOOKSACK RIVER	Chromium, Mercury, Fecal Coliform.
WA-01-1012	TENMILE CREEK	Ammonia-N, Dissolved Oxygen, Temperature, Fecal Coliform.
WA-01-1014	DEER CREEK	Dissolved Oxygen, pH, Fecal Coliform, Ammonia-N.
WA-01-1015	KAMM SLOUGH	Dissolved Oxygen, pH, Fecal Coliform.
WA-01-1016	MORMON DITCH	Dissolved Oxygen, pH, Fecal Coliform.
WA-01-1030	NOOKSACK RIVER, S.F.	Fine Sediment, Instream Flow.
WA-01-1040	NOOKSACK RIVER, S.F.	Fine Sediment, Temperature, Instream Flow.
WA-01-1060	NOOKSACK RIVER, N.F.	Temperature.
WA-01-1080	NOOKSACK RIVER	Fine Sediment.
WA-01-1101	SILVER CREEK	Dissolved Oxygen, Fecal Coliform.
WA-01-1102	UNNAMED CREEK	Dissolved Oxygen, Fecal Coliform.
WA-01-1103	TENNANT CREEK	Dissolved Oxygen, Fecal Coliform.
WA-01-1104	ANDERSON DITCH	Dissolved Oxygen, Fecal Coliform.
WA-01-1110	BERTRAND CREEK	Dissolved Oxygen, Fecal Coliform, Instream Flow.
WA-01-1111	DUFFNER DITCH	Dissolved Oxygen, Temperature.
WA-01-1115	FISHTRAP CREEK	Fecal Coliform, Instream Flow.
WA-01-1116	DOUBLE DITCH DRAIN	Fecal Coliform.
WA-01-1117	BENSON ROAD DITCH	Dissolved Oxygen, Fecal Coliform.
WA-01-1118	DEPOT ROAD DITCH	Dissolved Oxygen, Fecal Coliform.
WA-01-1119	BENDER ROAD DITCH	Dissolved Oxygen, Fecal Coliform.

(Underlined text indicates a high priority for establishing a TMDL)

WATERBODY SEGMENT NUMBER	WATERBODY NAME	PARAMETERS EXCEEDING STANDARDS
WA-01-1120	ANDERSON CREEK	Fine Sediment.
WA-01-1124	HOFF CREEK	Temperature.
WA-01-1145	RACEHORSE CREEK	Fine Sediment, Temperature.
WA-01-1155	BOULDER CREEK	Temperature.
WA-01-1170	CORNELL CREEK	Temperature.
WA-01-1175	GALLOP CREEK	Temperature.
WA-01-1290	HOWARD CREEK	Fine Sediment.
WA-01-1310	CANYON LAKE CREEK	Temperature.
WA-01-1450	CALIFORNIA CREEK	Dissolved Oxygen.
WA-01-2010	SUMAS RIVER	Fecal Coliform.
WA-01-2020	JOHNSON CREEK	Dissolved Oxygen, Fecal Coliform.
WA-01-2030	SUMAS CREEK	Fecal Coliform.
WA-01-2040	PANGBORN CREEK	Dissolved Oxygen, pH, Fecal Coliform.
WA-01-2050	SQUAW CREEK	Fecal Coliform, Dissolved Oxygen, pH.
WA-01-3110	WHATCOM CREEK	Temperature, Fecal Coliform, Pentachlorophenol.
WA-01-3300	LUMMI RIVER	Fecal Coliform.
WA-02-0020	SAN JUANS OUTER WESTSIDE	Fecal Coliform.
WA-03-0020	PADILLA BAY, FIDALGO BAY, AND GUEMES CHANNEL	Bis(2-ethylhexyl) Phthalate, PCB-1254.
WA-03-1010	SKAGIT RIVER	Fecal Coliform.
WA-03-1011	CARPENTER CREEK	Fecal Coliform.
WA-03-1012	FISHER CREEK	Fecal Coliform.
WA-03-1015	SKAGIT RIVER, N.F.	Fecal Coliform.
WA-03-1016	GAGES SLOUGH	Fecal Coliform.
WA-03-1017	NOOKACHAMPS CREEK	Fecal Coliform.
WA-03-1018	HART SLOUGH/ BRICKYARD CREEK	Fecal Coliform.
WA-03-1019	HANSEN CREEK	Fecal Coliform.
WA-03-2010	SAMISH RIVER	Fecal Coliform.
WA-03-2100	FRIDAY CREEK	Fecal Coliform.
WA-03-3000	JOE LEARY SLOUGH	Temperature, Dissolved Oxygen, Fecal Coliform.

WATERBODY SEGMENT NUMBER	WATERBODY NAME	PARAMETERS EXCEEDING STANDARDS
WA-03-3100	INDIAN (BIG) SLOUGH	Temperature, Dissolved Oxygen, Fecal Coliform.
WA-03-3200	NO NAME SLOUGH	Dissolved Oxygen, Fecal Coliform.
WA-03-4000	BROWNS SLOUGH	Fecal Coliform.
WA-03-4100	WILEY SLOUGH	Fecal Coliform.
WA-03-8000	UNNAMED CREEK	Fecal Coliform.
WA-03-9020	BIG LAKE	Total Phosphorus.
WA-03-9040	CAMPBELL LAKE	Total Phosphorus.
WA-03-9110	KETCHUM LAKE	Total Phosphorus.
WA-05-1010	STILLAGUAMISH RIVER	Fecal Coliform, pH, Temperature.
WA-05-1012	JORGENSEN SLOUGH/CHURCH CREEK	Dissolved Oxygen, Fecal Coliform.
WA-05-1015	PORTAGE CREEK	Dissolved Oxygen, Turbidity, Fecal Coliform.
WA-05-1016	FISH CREEK	Fecal Coliform.
WA-05-1020	STILLAGUAMISH RIVER, N.F.	pH, Fecal Coliform.
WA-05-1021	DEER CREEK	Temperature.
WA-05-1023	LITTLE DEER CREEK	Temperature.
WA-05-1025	HIGGINS CREEK	Temperature.
WA-05-1040	STILLAGUAMISH RIVER, S.F.	Fecal Coliform, pH, Temperature.
WA-05-1050	STILLAGUAMISH RIVER, S.F.	Fecal Coliform.
WA-05-9070	LAKE HOWARD	Total Phosphorus.
WA-05-9090	LAKE KI	Total Phosphorus.
WA-05-9110	MARTHA LAKE	Total Phosphorus.
WA-05-9160	SUNDAY LAKE	Total Phosphorus, Total Nitrogen.
WA-06-0010	SARATOGA PASSAGE	PCBs, pH.,
WA-06-0020	PENN COVE	Fecal Coliform.
WA-07-0010	PORT GARDNER AND INNER EVERETT HARBOR	Dissolved Oxygen, pH, Fecal Coliform, PCBs, Sediment Bioassay, Mercury, Zinc, Benzo(b,k)fluoranthenes, Bis(2-ethylhexyl) Phthalate, Di-n-octyl Phthalate, 2-Methylphenol, 2,4-Dimethylphenol, Pentachlorophenol, Benzyl Alcohol, Naphthalene, Acenaphthene, Fluorene, Phenanthrene, 2-Methylnaphthalene, Fluoranthene, Chrysene, Benzo(a)pyrene, Benzo(g,h,i)perylene, Phenol, 4-Methylphenol.
<u>WA-07-1005</u>	<u>STEAMBOAT SLOUGH</u>	Arsenic, <u>Ammonia-N</u>.

WATERBODY SEGMENT NUMBER	WATERBODY NAME	PARAMETERS EXCEEDING STANDARDS
WA-07-1010	SNOHOMISH RIVER	Dissolved Oxygen, Fecal Coliform, Arsenic, Copper, Naphthalene, Acenaphthene, Fluorene, Phenanthrene, 2-Methylnaphthalene, Dibenzofuran.
WA-07-1011	EBEY SLOUGH	pH, Fecal Coliform, Arsenic, Ammonia-N.
WA-07-1012	ALLEN CREEK	Fecal Coliform, Dissolved Oxygen.
WA-07-1015	QUILCEDA CREEK	Dissolved Oxygen, Fecal Coliform.
WA-07-1019	WOOD CREEK (MARSHLANDS)	Dissolved Oxygen.
WA-07-1020	SNOHOMISH RIVER	Temperature, Fecal Coliform.
WA-07-1030	PILCHUCK RIVER	Fecal Coliform.
WA-07-1040	PILCHUCK RIVER	Fecal Coliform, Temperature.
WA-07-1050	SNOHOMISH RIVER	Dissolved Oxygen, Fecal Coliform.
WA-07-1052	FRENCH CREEK	Dissolved Oxygen, Fecal Coliform.
WA-07-1060	SNOQUALMIE RIVER	Temperature.
WA-07-1100	SNOQUALMIE RIVER	Temperature.
WA-07-1104	RAGING RIVER	pH.
WA-07-1106	TOKUL CREEK	Temperature.
WA-07-1120	SNOQUALMIE RIVER, S.F.	Temperature, pH.
WA-07-1140	SNOQUALMIE RIVER, N.F.	Temperature.
WA-07-1160	SKYKOMISH RIVER	Fecal Coliform, Temperature.
WA-07-1163	WOODS CREEK	Fecal Coliform.
WA-07-1195	WALLACE RIVER	Temperature.
WA-07-1200	SKYKOMISH RIVER	Temperature.
WA-07-1201	MAY CREEK	Temperature.
WA-07-9060	BLACKMAN'S LAKE	Total Phosphorus.
WA-07-9190	CRABAPPLE LAKE	Total Phosphorus.
WA-07-9280	LAKE GOODWIN	Total Phosphorus.
WA-07-9440	LAKE LOMA	Total Phosphorus.
WA-07-9680	LAKE SHOECRAFT	Total Phosphorus.
WA-07-9710	SPADA LAKE	Turbidity.
WA-08-1010	JUANITA CREEK	Fecal Coliform.
WA-08-1012	FORBES CREEK	Fecal Coliform.
WA-08-1014	YARROW BAY CREEK	Fecal Coliform.

1996 Section 303(d) List - May 29, 1996
(Underlined text indicates a high priority for establishing a TMDL)

WATERBODY SEGMENT NUMBER	WATERBODY NAME	PARAMETERS EXCEEDING STANDARDS
WA-08-1016	FAIRWEATHER BAY CREEK	Fecal Coliform.
WA-08-1018	KELSEY CREEK	Fecal Coliform, DDT, Heptachlor Epoxide, Dieldrin.
WA-08-1020	THORNTON CREEK	Fecal Coliform.
WA-08-1030	McALEER CREEK	Fecal Coliform.
WA-08-1040	LYON CREEK	Fecal Coliform.
WA-08-1050	SAMMAMISH RIVER	Fecal Coliform.
WA-08-1060	SWAMP CREEK	Dissolved Oxygen, Fecal Coliform.
WA-08-1065	NORTH CREEK	Fecal Coliform.
WA-08-1070	SAMMAMISH RIVER	Fecal Coliform, Temperature, Dissolved Oxygen.
WA-08-1080	SAMMAMISH RIVER	Dissolved Oxygen, Fecal Coliform.
WA-08-1085	LITTLE BEAR CREEK	Fecal Coliform.
WA-08-1090	SAMMAMISH RIVER	Temperature, Fecal Coliform.
WA-08-1095	BEAR-EVANS CREEKS	Dissolved Oxygen, Fecal Coliform, Mercury.
WA-08-1100	SAMMAMISH RIVER	Dissolved Oxygen, Fecal Coliform.
WA-08-1110	ISSAQUAH CREEK SYSTEM	Fecal Coliform, Temperature.
WA-08-1115	TIBBETS CREEK	Temperature, Fecal Coliform.
WA-08-1116	LAUGHING JACOB'S CREEK	Fecal Coliform.
WA-08-1117	PINE LAKE CREEK	Fecal Coliform.
WA-08-1118	ETON CREEK	Fecal Coliform.
WA-08-1120	COAL CREEK	Fecal Coliform.
WA-08-1130	MAY CREEK	Fecal Coliform, Temperature, Copper, Lead, Zinc.
WA-08-1143	CEDAR RIVER	Fecal Coliform.
WA-08-1145	CEDAR RIVER	Fecal Coliform.
WA-08-2100	MERCER SLOUGH	Fecal Coliform, Dieldrin, DDT, 4,4'-DDE, 4,4'-DDD, PCBs.
WA-08-9020	BEAVER LAKE	Total Phosphorus.
WA-08-9070	COTTAGE LAKE	Total Phosphorus.
WA-08-9090	DESIRE LAKE	Total Phosphorus.
WA-08-9150	GREEN LAKE	Total Phosphorus.
WA-08-9170	LARSEN LAKE	Total Phosphorus.
WA-08-9190	MARTHA LAKE	Total Phosphorus.
WA-08-9280	SCRIBER LAKE	Total Phosphorus.

WATERBODY SEGMENT NUMBER	WATERBODY NAME	PARAMETERS EXCEEDING STANDARDS
WA-08-9300	SILVER LAKE	Total Phosphorus.
WA-08-9340	UNION LAKE/LAKE WASHINGTON SHIP CANAL	Sediment Bioassay, PCBs, Dieldrin.
WA-08-9350	LAKE WASHINGTON	Sediment Bioassay, Fecal Coliform.
WA-09-0010	ELLIOTT BAY	Sediment Bioassay, Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Silver, Zinc, 2-Methylnaphthalene, Acenapthene, Fluorene, Phenanthrene, LPAH, Benz(a)anthracene, Benzo(a)pyrene, Benzo(g,h,i)perylene, Benzo(b,k)fluoranthenes, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, HPAH, Butyl Benzyl Phthalate, Bis(2-ethylhexyl)phthalate, Dibenzofuran, PCBs, Phenol, Naphthalene, Acenaphthylene, Anthracene, Pyrene, 1,2-Dichlorobenzene; 1,4-Dichlorobenzene, Hexachlorobenzene, Dimethyl Phthalate, Diethyl Phthalate, Di-n-butyl Phthalate, Hexachlorobutadiene, N-Nitrosodiphenylamine, 2,4-Dimethylphenol, Di-n-octyl Phthalate, Pentachlorophenol, 1,2,4-Trichlorobenzene, 2-Methylphenol, 4-Methylphenol, Benzyl Alcohol, Benzoic Acid, Fecal Coliform.
WA-09-1000	LONGFELLOW CREEK	Fecal Coliform.
WA-09-1005	FAUNTLEROY CREEK	Fecal Coliform.
WA-09-1010	DUWAMISH WATERWAY AND RIVER	Copper, Lead, Zinc, PAHs, PCBs, Dissolved Oxygen, pH, Fecal Coliform, Cadmium, Mercury, Arsenic, Silver, Chromium, Naphthalene, 2-Methylnaphthalene, Anthracene, 1,2,4-Trichlorobenzene, Chrysene, Pyrene, Benz(a)anthracene, Benzo(b,k)fluoranthenes, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene, Hexachlorobenzene, Diethyl Phthalate, N-Nitrosodiphenylamine, Fluorene, Fluoranthene, Phenanthene, Acenaphthene, Dimethyl Phthalate, Benzoic Acid, Butyl Benzyl Phthalate, 1,4-Dichlorobenzene, Dibenzofuran, Phenol, 4-Methylphenol, 2,4-Dimethylphenol, Benzyl Alcohol, Bis(2-ethylhexyl)phthalate, Sediment Bioassay.
WA-09-1015	SPRINGBROOK (MILL) CREEK	Fecal Coliform, Temperature, Dissolved Oxygen, Sediment Bioassay, Cadmium, Copper, Mercury, Zinc.
WA-09-1020	GREEN RIVER	Mercury, Chromium, Temperature, Dissolved Oxygen, Fecal Coliform.
WA-09-1022	HILL (MILL) CREEK	Dissolved Oxygen, Temperature, Ammonia-N, Cadmium, Fecal Coliform, Zinc, Chromium.
WA-09-1026	SOOS CREEK	Fecal Coliform, Dissolved Oxygen, Temperature, Mercury.
WA-09-1028	NEWAUKUM CREEK	Dissolved Oxygen, Fecal Coliform.
WA-09-1030	GREEN RIVER	Temperature.
WA-09-1040	GREEN RIVER	Fecal Coliform.
WA-09-1041	GALE CREEK	Temperature.
WA-09-1050	SMAY CREEK	Temperature.
WA-09-2000	DES MOINES CREEK	Fecal Coliform.
WA-09-2010	COLD SPRINGS CREEK	Fecal Coliform.

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WATERBODY SEGMENT NUMBER	WATERBODY NAME	PARAMETERS EXCEEDING STANDARDS
WA-09-2020	REDONDO CREEK	Fecal Coliform.
WA-09-2030	LAKOTA CREEK	Fecal Coliform.
WA-09-2040	JOE'S CREEK	Fecal Coliform.
WA-09-9120	LAKE HICKS (GARRETT LAKE)	Total Phosphorus.
WA-09-9160	LAKE MERIDIAN	Total Phosphorus.
WA-09-9210	LAKE NUMBER TWELVE	Exotic Aquatic Plants.
WA-10-0010	COMMENCEMENT BAY (OUTER)	Arsenic, Cadmium, Copper, Lead, Mercury, Silver, Zinc, Naphthalene, Acenaphthene, Fluorene, Phenanthrene, Fluoranthene, Diethyl Phthalate, Di-n-butyl Phthalate, Butyl Benzyl Phthalate, Bis(2-ethylhexyl) Phthalate, Dibenzofuran, N-Nitrosodiphenylamine, PCBs, Phenol, 2-Methylphenol, 2,4-Dimethylphenol, Benzyl Alcohol, Benzoic Acid.
WA-10-0020	COMMENCEMENT BAY (INNER)	Fecal Coliform, Sediment Bioassay, Bis(2-ethylhexyl)phthalate, Hexachlorbenzene, PCBs, Dieldrin, Copper, Arsenic, Lead, Zinc, Mercury, Hexachlorobutadiene, Butyl Benzyl Phthalate, Phenanthrene, Anthracene, Dibenzo(a,h)anthracene, Pyrene, Fluorene, Fluoranthene, Benz(a)anthracene, Chrysene, Acenaphthene, 1,2,4-Trichlorobenezene, Benzo(a)pyrene, Indeno(1,2,3-c,d)pyrene, 2-Methylnaphthalene, Dibenzofuran, Benzo(g,h,i)perylene, Naphthalene, 1,4-Dichlorobenzene, Dimethyl Phthalate, 2,4-Dimethylphenol, Cadmium, Chromium, Di-n-butyl Phthalate, Benzyl Alcohol, Phenol, 2-Methylphenol, Pentachlorophenol.
WA-10-0030	THEA FOSS (CITY) WATERWAY	Copper, Lead, Mercury, Zinc, Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Phenanthrene, 2-Methylnaphthalene, LPAH, Fluoranthene, Pyrene, Benz(a)anthracene, Chrysene, Total Benzofluoranthenes, Indeno(1,2,3-c,d)pyrene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene, HPAH, 1,2-Dichlorobenzene, Dimethyl Phthalate, Butyl Benzyl Phthalate, Bis(2-ethylhexyl) Phthlate, PCBs.
WA-10-1011	HYLEBOS CREEK	Fecal Coliform.
WA-10-1012	FIFE DITCH	Ammonia-N, Dissolved Oxygen, Fecal Coliform.
WA-10-1013	HYLEBOS CREEK, W.F.	Fecal Coliform.
WA-10-1015	WAPATO CREEK	Fecal Coliform, Dissolved Oxygen, Instream Flow.
WA-10-1020	PUYALLUP RIVER	Fecal Coliform.
WA-10-1021	CLEAR CREEK	Fecal Coliform.
WA-10-1022	SWAN CREEK	Fecal Coliform.
WA-10-1025	CLARKS CREEK	Fecal Coliform.
WA-10-1026	UNNAMED CREEK	Fecal Coliform.
WA-10-1028	MEEKER DITCH	Fecal Coliform.
WA-10-1030	WHITE RIVER	Fecal Coliform, pH, Instream Flow.

WATERBODY SEGMENT NUMBER	WATERBODY NAME	PARAMETERS EXCEEDING STANDARDS
WA-10-1032	BOISE CREEK	Temperature.
WA-10-1041	SCATTER CREEK	Temperature.
WA-10-1043	CLEARWATER RIVER	Temperature.
WA-10-1046	GREENWATER RIVER	Temperature.
WA-10-1060	PUYALLUP RIVER	Instream Flow.
WA-10-1070	PUYALLUP RIVER	Instream Flow.
WA-10-1081	VOIGHTS CREEK	Temperature.
WA-10-1085	SOUTH PRAIRIE CREEK	Fecal Coliform.
WA-11-1010	NISQUALLY RIVER	Fecal Coliform.
WA-11-1026	OHOP CREEK	Fecal Coliform.
WA-11-9040	CLEAR LAKE	Total Phosphorus.
WA-11-9090	HARTS LAKE	Total Phosphorus.
WA-11-9150	OHOP LAKE	Total Phosphorus.
WA-12-1110	CHAMBERS CREEK	Fecal Coliform, PCBs, Temperature.
WA-12-1115	CLOVER CREEK	Fecal Coliform, Dissolved Oxygen, Temperature.
WA-12-9010	AMERICAN LAKE	Total Phosphorus.
WA-12-9060	SNAKE LAKE	Total Phosphorus, Dissolved Oxygen, Fecal Coliform.
WA-12-9080	STEILACOOM LAKE	Sediment Bioassay, Total Phosphorus.
WA-13-0010	HENDERSON INLET	Fecal Coliform.
WA-13-0020	BUDD INLET (OUTER)	Fecal Coliform, Dissolved Oxygen, Total Nitrogen, pH.
WA-13-0030	BUDD INLET (INNER)	PAHs, PCBs, Chromium, Copper, Mercury, Zinc, Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, 2-Methylnaphthalene, Fluoranthene, Pyrene, Benz(a)anthracene, Benzo(b,k)fluoranthenes, Benzo(a)pyrene, Indeno(1,2,3-c,d)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene, Butyl Benzyl Phthalate, Bis(2-ethylhexyl) Phthalate, Dibenzofuran, Sediment Bioassay, Benz(a)anthracene, Benzo(b)fluorene, Benzo(k)fluorene, Chrysene, Dissolved Oxygen, Total Nitrogen, pH, Fecal Coliform.
WA-13-1010	DESCHUTES RIVER	Temperature, pH, Fecal Coliform, Mercury.
WA-13-1015	AYER (ELWANGER) CREEK	Fecal Coliform, pH, Dissolved Oxygen.
WA-13-1020	DESCHUTES RIVER	Temperature, pH.
WA-13-1022	REICHEL CREEK	Fecal Coliform.
WA-13-1024	HUCKLEBERRY CREEK	Temperature.
WA-13-1300	INDIAN CREEK	Fecal Coliform.
WA-13-1350	MOXLIE CREEK	Fecal Coliform.

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WATERBODY SEGMENT NUMBER	WATERBODY NAME	PARAMETERS EXCEEDING STANDARDS
WA-13-1380	MISSION CREEK	Fecal Coliform.
WA-13-1400	DOBBS CREEK	Fecal Coliform, pH.
WA-13-1500	WOODLAND CREEK	Temperature, Fecal Coliform, Dissolved Oxygen, Turbidity, Instream Flow.
WA-13-1600	WOODARD CREEK	Dissolved Oxygen, pH, Fecal Coliform.
WA-13-1700	SLEEPY (LIBBEY) CREEK	Fecal Coliform, pH, Dissolved Oxygen.
WA-13-9020	CAPITOL LAKE (NORTH ARM)	Total Phosphorus.
WA-13-9030	CAPITOL LAKE (SOUTH ARM)	Total Phosphorus.
WA-13-9120	PATTERSON (PATTISON) LAKE (NORTH ARM)	Total Phosphorus.
WA-13-9200	WARD LAKE	PCB-1260.
WA-14-0010	SQUAXIN, PEALE, AND PICKERING PASSAGES	pH.
WA-14-0020	ELD INLET	Fecal Coliform.
WA-14-0050	SHELTON HARBOR (INNER)	Fecal Coliform.
WA-14-0100	HAMMERSLEY INLET	Fecal Coliform.
WA-14-0110	OAKLAND BAY	Fecal Coliform, Dissolved Oxygen.
WA-14-1190	PIERRE CREEK	Fecal Coliform.
WA-14-1195	BURNS CREEK	Fecal Coliform.
WA-14-1200	SCHNEIDER CREEK	Fecal Coliform.
WA-14-1600	GOLDSBOROUGH CREEK	Fecal Coliform.
WA-14-1650	SHELTON CREEK	Fecal Coliform.
WA-14-1800	UNCLE JOHN CREEK	Fecal Coliform.
WA-14-1850	CAMPBELL CREEK	Fecal Coliform.
WA-14-2010	TWANOH FALLS CREEK	pH.
WA-14-2020	UNNAMED CREEK	pH.
WA-14-2030	HAPPY HALLOW CREEK	Fecal Coliform.
WA-15-0020	EAGLE HARBOR	PAHs, Mercury, Arsenic, Naphthalene, Fluoranthene, Acenaphthene, Phenanthrene, Anthracene, Fluorene, PCB-1254, Benzo(a)pyrene, Benz(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene.
WA-15-0030	PORT ORCHARD, AGATE PASSAGE, AND RICH PASSAGE	PCBs, Dissolved Oxygen.

WATERBODY SEGMENT NUMBER	WATERBODY NAME	PARAMETERS EXCEEDING STANDARDS
WA-15-0040	SINCLAIR INLET	Sediment Bioassay, PCBs, Phenol, 2,4-Dimethylphenol, Phenanthrene, Fluoranthene, Indeno(1,2,3-c,d)pyrene, Benzo(g,h,i)perylene, Bis(2-ethylhexyl) Phthalate, Benzoic Acid, Benz(a)anthracene, Chrysene, 1,4-Dichlorobenzene, Butyl Benzyl Phthalate, 4-Methylphenol, Mercury, Arsenic, Cadmium, Copper, Lead, Zinc, Aldrin, Dieldrin.
WA-15-0050	DYES INLET AND PORT WASHINGTON NARROWS	PCBs, Bis(2-ethylhexyl) Phthalate, Phenol, Cadmium, Mercury, Silver, Antimony, Arsenic, Sediment Bioassay, Bis(2-ethylhexyl) Phthalate, 3,3'-Dichlorobenzidine, Benz(a)anthracene, Benzo(b)fluoranthene, Chrysene, Pentachlorophenol, Fecal Coliform.
WA-15-0060	CARR INLET	Dissolved Oxygen, Fecal Coliform.
WA-15-0070	HENDERSON BAY	Fecal Coliform.
WA-15-0080	PORT GAMBLE BAY	PCBs, Dieldrin.
WA-15-0100	LIBERTY BAY	PCBs, Bis(2-ethylhexyl) Phthalate, Benzoic Acid, Phenol, 4-Methylphenol, Fecal Coliform.
WA-15-0120	QUARTERMASTER HARBOR	PCBs, Dieldrin.
WA-15-1015	PURDY CREEK	Fecal Coliform.
WA-15-1060	LITTLE MISSION CREEK	pH.
WA-15-1300	MINTER CREEK	Fecal Coliform.
WA-15-1350	LITTLE MINTER CREEK	Fecal Coliform.
WA-15-1400	BURLEY CREEK	Fecal Coliform.
WA-15-1450	BEAR CREEK	Fecal Coliform.
WA-15-2010	UNION RIVER	Fecal Coliform.
WA-15-2030	DOGFISH CREEK	Fecal Coliform, Turbidity.
WA-15-2033	GROVERS CREEK	Fecal Coliform.
WA-15-2040	STIMSON CREEK	Fecal Coliform.
WA-15-2050	SHOOFLY CREEK	Fecal Coliform.
WA-15-3000	MAYO CREEK	pH, Temperature, Fecal Coliform.
WA-15-3010	UNNAMED CREEK	pH, Fecal Coliform.
WA-15-3020	RAVINE CREEK	Fecal Coliform.
WA-15-3030	PRIVATE CREEK	pH, Fecal Coliform.
WA-15-3040	LAGOON CREEK	pH.
WA-15-3050	PICNIC CREEK	Fecal Coliform, pH.
WA-15-4000	GORST CREEK	Fecal Coliform.
WA-15-4100	WRIGHT CREEK	Fecal Coliform.

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WATERBODY SEGMENT NUMBER	WATERBODY NAME	PARAMETERS EXCEEDING STANDARDS
WA-15-4200	BLACKJACK CREEK	Fecal Coliform.
WA-15-4400	ANNAPOLIS CREEK	Fecal Coliform.
WA-15-4900	BEAVER CREEK	Fecal Coliform.
WA-15-5000	CLEAR CREEK	Fecal Coliform.
WA-15-5100	BARKER CREEK	Fecal Coliform.
WA-15-7000	BIG BEEF CREEK	Temperature.
WA-15-9150	KITSAP LAKE	Total Phosphorus.
WA-16-1010	SKOKOMISH RIVER	Fecal Coliform.
WA-16-1013	PURDY CREEK	Fecal Coliform.
WA-16-1014	WEAVER CREEK	Fecal Coliform.
WA-16-1015	TEN ACRE CREEK	Fecal Coliform.
WA-16-1016	HUNTER CREEK	Fecal Coliform.
WA-16-1020	SKOKOMISH RIVER, N.F.	Temperature, Instream Flow.
WA-17-0010	DABOB BAY AND QUILCENE BAY	Fecal Coliform.
WA-17-0020	PORT TOWNSEND AND KILISUT HARBOR	Dissolved Oxygen.
WA-17-0030	PORT TOWNSEND	PCBs.
WA-17-0050	SEQUIM BAY	Dissolved Oxygen, pH, PAHs, Fecal Coliform.
WA-17-1000	MARPLE CREEK	Fish Habitat.
WA-17-1001	JACKSON CREEK	Fish Habitat.
WA-17-1010	BIG QUILCENE RIVER	Instream Flow, Fish Habitat.
WA-17-2200	CHICKEN COOP CREEK	Fecal Coliform.
WA-17-3010	CHIMACUM CREEK	Fecal Coliform, Temperature.
WA-17-4000	JOHNSON CREEK	Fecal Coliform.
WA-17-5000	TARBOO CREEK	Temperature.
WA-18-0020	PORT ANGELES HARBOR	Dissolved Oxygen, PCBs.
WA-18-1010	DUNGENESS RIVER	Instream Flow.
WA-18-1012	MATRIOTTI CREEK	Fecal Coliform.
WA-18-1020	DUNGENESS RIVER	Instream Flow.
WA-18-1100	BELL CREEK	Fecal Coliform.
WA-18-1300	CASSALARY CREEK	Fecal Coliform.

WATERBODY SEGMENT NUMBER	WATERBODY NAME	PARAMETERS EXCEEDING STANDARDS
WA-18-1600	BAGLEY CREEK	Fecal Coliform.
WA-18-1900	DRY CREEK	Temperature.
WA-18-2010	ELWHA RIVER	Temperature, PCB-1254.
WA-19-2020	LITTLE HOKO RIVER	Temperature.
WA-19-2500	SEKIU RIVER	Temperature.
WA-19-2600	SEKIU RIVER, N.F.	Temperature.
WA-19-2700	SEKIU RIVER, S.F.	Temperature.
WA-19-4500	DEEP CREEK	Temperature, Fine Sediment.
WA-19-5000	CLALLAM RIVER	Temperature.
WA-20-1020	SOLDUCK RIVER	Temperature, Dissolved Oxygen.
WA-20-1030	BOGACHIEL RIVER	Temperature, Dissolved Oxygen.
WA-20-1033	MAXFIELD CREEK	Temperature.
WA-20-1035	LAKE CREEK	Temperature, Dissolved Oxygen.
WA-20-1037	BEAVER CREEK	Temperature.
WA-20-1050	CALAWAH RIVER, N.F.	Temperature.
WA-20-1052	FAHNESTOCK CREEK	Temperature.
WA-20-1053	UPPER COOL CREEK	Temperature.
WA-20-1054	DEVILS CREEK	Temperature.
WA-20-2090	FISHER CREEK	Temperature.
WA-20-2100	SPLIT CREEK	Temperature.
WA-20-2110	LINE CREEK	Temperature.
WA-20-2150	NOLAN CREEK	Temperature.
WA-20-2200	ANDERSON CREEK	Temperature.
WA-20-2270	WINFIELD CREEK	Temperature.
WA-20-2275	ELK CREEK	Temperature.
WA-20-2280	ALDER CREEK	Temperature.
WA-20-2300	WILLOUGHBY CREEK	Temperature.
WA-20-2330	ROCK CREEK	Temperature.
WA-20-2350	TOWER CREEK	Temperature.
WA-20-2400	MAPLE CREEK	Temperature.
WA-20-2500	OWL CREEK	Temperature.

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WATERBODY SEGMENT NUMBER	WATERBODY NAME	PARAMETERS EXCEEDING STANDARDS
WA-20-2600	CANYON CREEK	Temperature.
WA-20-5010	COAL CREEK	Temperature.
WA-20-5100	DICKEY RIVER, W.F.	Temperature.
WA-20-5200	DICKEY RIVER, E.F.	Temperature.
WA-20-5300	DICKEY RIVER, N.F.	Temperature.
WA-20-6210	CROOKED CREEK, N.F.	Temperature.
WA-21-1100	COAL CREEK	Temperature.
WA-21-2010	HOQUIAM RIVER	Temperature.
WA-21-3000	KALALOCH CREEK	Temperature.
WA-21-4000	JOE CREEK	Dissolved Oxygen, Fecal Coliform.
WA-22-0020	GRAYS HARBOR (OUTER)	Fecal Coliform.
WA-22-0030	GRAYS HARBOR (INNER)	Fecal Coliform.
WA-22-1010	HUMPTULIPS RIVER	Temperature.
WA-22-4020	WYNOOCHEE RIVER	Temperature.
WA-22-4025	BLACK CREEK	Temperature.
WA-22-4040	CHEHALIS RIVER	Fecal Coliform, Temperature.
WA-22-4045	WILDCAT CREEK	Temperature.
WA-22-4085	RABBIT CREEK	Temperature.
WA-22-9030	DUCK LAKE	Total Phosphorus.
WA-23-1010	CHEHALIS RIVER	Fecal Coliform.
WA-23-1018	SCATTER CREEK	pH, Fecal Coliform.
WA-23-1019	LINCOLN CREEK	Fecal Coliform.
WA-23-1020	CHEHALIS RIVER	PCBs, Fecal Coliform.
WA-23-1023	SALZER CREEK	Fecal Coliform.
WA-23-1026	COAL CREEK	Fecal Coliform.
WA-23-1027	DILLENBAUGH CREEK	Fecal Coliform.
WA-23-1028	BERWICK CREEK	Fecal Coliform.
WA-23-1030	SKOOKUMCHUCK RIVER	pH.
WA-23-1070	NEWAUKUM RIVER	Fecal Coliform.
WA-23-1080	NEWAUKUM RIVER, N.F.	Fecal Coliform.
WA-23-1100	CHEHALIS RIVER	pH, Fecal Coliform.

WATERBODY SEGMENT NUMBER	WATERBODY NAME	PARAMETERS EXCEEDING STANDARDS
WA-23-1104	BUNKER CREEK	Fecal Coliform.
WA-23-1106	CHEHALIS RIVER, S.F.	Fecal Coliform.
WA-23-1108	ELK CREEK	Fecal Coliform.
WA-23-1110	CHEHALIS RIVER	pH, Fecal Coliform.
WA-23-2060	DEMPSEY CREEK	Dissolved Oxygen, Fecal Coliform.
WA-23-9010	BLACK LAKE	Total Phosphorus.
WA-24-0020	WILLAPA BAY	Fecal Coliform, pH.
WA-24-1010	NORTH RIVER	Fecal Coliform.
WA-24-1011	SMITH CREEK	Temperature.
WA-24-1020	CEDAR RIVER	Fecal Coliform.
WA-24-1030	GRAYLAND DITCH	Dissolved Oxygen, Fecal Coliform.
WA-24-1050	PIONEER CREEK	Temperature.
WA-24-1080	TUTTLE CREEK	pH.
WA-24-2020	WILLAPA RIVER	Temperature, Dissolved Oxygen, pH, Fecal Coliform.
WA-24-2030	WILLAPA RIVER	Fecal Coliform, Temperature.
WA-24-2037	FORKS CREEK	Temperature.
WA-24-3010	NASELLE RIVER	Temperature.
WA-24-3020	NASELLE RIVER	Temperature.
WA-25-1015	GRAYS RIVER, W.F.	Temperature.
WA-25-3010	ELOCHOMAN RIVER	Temperature.
WA-25-3300	ABERNATHY CREEK	Temperature.
WA-25-3500	GERMANY CREEK	Temperature.
WA-25-5010	LONGVIEW DITCHES	Dissolved Oxygen, Fecal Coliform, Turbidity, Lead.
WA-25-9010	LAKE SACAJAWEA	Total Phosphorus.
WA-26-1020	COWEEMAN RIVER	Temperature, Dissolved Oxygen, pH, Fecal Coliform.
WA-26-1023	GOBLE CREEK	Temperature.
WA-26-1025	MULHOLLAND CREEK	Temperature.
WA-26-1026	BAIRD CREEK	Temperature.
WA-26-1030	COWEEMAN RIVER	Temperature.
WA-26-1040	COWLITZ RIVER	Temperature, pH, Fecal Coliform.
WA-26-1050	TOUTLE RIVER	Fecal Coliform.

WATERBODY SEGMENT NUMBER	WATERBODY NAME	PARAMETERS EXCEEDING STANDARDS
WA-26-1087	HERRINGTON CREEK	Temperature.
WA-26-1096	CINNABAR CREEK	Temperature, pH, Dissolved Oxygen.
WA-26-1110	CISPUS RIVER	Temperature.
WA-26-1115	CISPUS RIVER, N.F.	Temperature.
WA-26-1118	CISPUS RIVER	Temperature.
WA-26-1119	EAST CANYON CREEK	Temperature.
WA-26-1122	SILVER CREEK	Temperature.
WA-26-9110	SILVER LAKE	Total Phosphorus.
WA-27-1010	KALAMA RIVER	Temperature, pH.
WA-27-1012	HATCHERY (FALLERT) CREEK	Temperature.
WA-27-2020	LEWIS RIVER, E.F.	Temperature, pH, Fecal Coliform.
WA-27-2022	McCORMICK CREEK	Temperature, Fecal Coliform.
WA-27-2024	LOCKWOOD CREEK	Fecal Coliform.
WA-27-2025	MASON CREEK	Fecal Coliform.
WA-27-2026	ROCK CREEK (NORTH)	Fecal Coliform.
WA-27-2030	LEWIS RIVER, E.F.	Fecal Coliform.
WA-27-2032	YACOLT CREEK	Fecal Coliform.
WA-27-2034	ROCK CREEK (SOUTH)	Fecal Coliform.
WA-27-2100	MUDDY RIVER	Temperature.
WA-27-2140	CLEARWATER CREEK	Temperature.
WA-28-1010	LAKE RIVER	Temperature, Fecal Coliform.
WA-28-1020	SALMON CREEK	Fecal Coliform, Turbidity, Temperature.
WA-28-1023	COUGAR CANYON CREEK	Dissolved Oxygen, Fecal Coliform.
WA-28-1025	MILL CREEK	Fecal Coliform.
WA-28-1026	CURTIN CREEK	Fecal Coliform.
WA-28-1027	WEAVER (WOODIN) CREEK	Chlorine, Fecal Coliform.
WA-28-1030	LAKE RIVER	Temperature, Fecal Coliform.
WA-28-1040	BURNT BRIDGE CREEK	pH, Dissolved Oxygen, Temperature, Fecal Coliform.
WA-28-2020	LACAMAS CREEK	pH, Temperature, Dissolved Oxygen, Fecal Coliform.
WA-28-2023	CHINA DITCH	Dissolved Oxygen, Fecal Coliform, Temperature, pH.
WA-28-2024	FIFTH PLAIN CREEK	pH, Dissolved Oxygen, Fecal Coliform, Temperature.

WATERBODY SEGMENT NUMBER	WATERBODY NAME	PARAMETERS EXCEEDING STANDARDS
WA-28-2025	SHANGHAI CREEK	pH, Dissolved Oxygen, Temperature.
WA-28-2026	MATNEY CREEK	pH, Dissolved Oxygen, Fecal Coliform, Temperature.
WA-28-3010	GIBBONS CREEK	Fecal Coliform.
WA-29-1025	BEAR CREEK	Temperature.
WA-29-1028	EIGHTMILE CREEK	Temperature.
WA-29-1030	TROUT CREEK	Temperature.
WA-29-3010	WHITE SALMON RIVER	Fecal Coliform.
WA-29-3015	RATTLESNAKE CREEK	Temperature, Fecal Coliform.
WA-29-3016	INDIAN CREEK	Temperature.
WA-29-3030	TROUT LAKE CREEK	Fecal Coliform.
WA-30-1018	SWALE CREEK	Temperature, Instream Flow.
WA-30-1020	LITTLE KLICKITAT RIVER	Instream Flow, Temperature.
WA-30-1021	BOWMAN CREEK	Instream Flow.
WA-30-1022	MILL CREEK	Instream Flow.
WA-30-1023	BLOCKHOUSE CREEK	Instream Flow.
WA-30-1025	BLOODGOOD CREEK	Instream Flow.
WA-30-1027	LITTLE KLICKITAT RIVER, WEST PRONG	Temperature.
WA-30-1028	LITTLE KLICKITAT RIVER, EAST PRONG	Temperature.
WA-30-1029	BUTLER CREEK	Temperature.
WA-32-1010	WALLA WALLA RIVER	Temperature, pH, Fecal Coliform, Instream Flow, Chlordane, Dieldrin, 4,4'-DDT, 4,4'-DDE, Heptachlor Epoxide, Hexachlorobenzene, PCBs, Heptachlor.
WA-32-1020	TOUCHET RIVER	Temperature, pH, Fecal Coliform.
WA-32-1025	TOUCHET RIVER, N.F. (E.F.)	Temperature.
WA-32-1030	WALLA WALLA RIVER	Instream Flow.
WA-32-1050	WALLA WALLA RIVER	Instream Flow.
WA-32-1060	MILL CREEK	Dissolved Oxygen, Instream Flow, Chlorine, Total Phosphorus, Total Nitrogen.
WA-32-1070	MILL CREEK	Temperature, pH, Fecal Coliform.
WA-32-1080	WALLA WALLA RIVER	Instream Flow.
WA-33-1010	SNAKE RIVER	Dieldrin, 4,4'-DDE, PCBs, Total Dissolved Gas, Dissolved Oxygen, pH, Temperature.

WATERBODY SEGMENT NUMBER	WATERBODY NAME	PARAMETERS EXCEEDING STANDARDS
WA-34-1010	PALOUSE RIVER	Fecal Coliform, Temperature, Dissolved Oxygen, Ammonia-N, Chromium, 4,4'-DDE, Heptachlor Epoxide, PCBs, pH.
WA-34-1015	ROCK CREEK	Temperature, pH, Fecal Coliform.
WA-34-1017	PINE CREEK	pH, Dissolved Oxygen, Temperature.
WA-34-1020	PALOUSE RIVER, S.F.	Fecal Coliform, Temperature, pH, Dissolved Oxygen.
WA-34-1024	MISSOURI FLAT CREEK	Dissolved Oxygen.
WA-34-1025	PARADISE CREEK	Fecal Coliform, Temperature, Dissolved Oxygen, Ammonia-N.
WA-34-1030	PALOUSE RIVER	Temperature, Ammonia-N, Dissolved Oxygen, pH, Fecal Coliform.
WA-34-1032	SILVER CREEK	Dissolved Oxygen, Ammonia-N, Chlorine.
WA-34-3010	UNION FLAT CREEK	Temperature.
WA-34-4010	REBEL FLAT CREEK	Chlorine, Dissolved Oxygen, Fecal Coliform.
WA-34-9245	MEDICAL LAKE	Total Phosphorus.
WA-35-1010	SNAKE RIVER	Total Dissolved Gas, DDT, 4,4'-DDE, Dieldrin.
WA-35-1020	SNAKE RIVER	Temperature, pH.
WA-35-1030	ASOTIN CREEK	Fecal Coliform.
WA-35-2010	TUCANNON RIVER	Fecal Coliform, Temperature.
WA-35-2013	PATAHA CREEK	Fecal Coliform.
WA-35-2024	CUMMINGS CREEK	Temperature.
WA-35-2030	TUCANNON RIVER	Temperature.
WA-35-3010	GRANDE RONDE RIVER	Temperature, Fecal Coliform.
WA-36-1010	ESQUATZEL COULEE	Temperature, pH, Dissolved Oxygen.
WA-36-3000	EAST POTHOLES CANAL	pH, Dissolved Oxygen, Temperature.
WA-36-3010	SCOOTENEY WASTEWAY	Temperature, pH, Dissolved Oxygen.
WA-36-1100	ELTOPIA BRANCH CANAL	Temperature.
WA-37-1010	YAKIMA RIVER	Temperature, pH, Fecal Coliform, Turbidity, Instream Flow, Ammonia-N, DDT, 4,4'-DDE, 4,4'-DDD, PCB-1254, PCB-1260, Endosulfan, Heptachlor, Heptachlor Expoxide, Parathion, Endrin, Aldrin, Dieldrin.
WA-37-1012	SNIPES CREEK	DDT, Dissolved Oxygen, Temperature.
WA-37-1014	SPRING CREEK	DDT.
WA-37-1020	YAKIMA RIVER	Temperature, Instream Flow, PCB-1260, DDT, 4,4'-DDE, Dieldrin.
WA-37-1024	GRANGER DRAIN	DDT, 4,4'-DDE, 4,4'-DDD, Dieldrin, Endosulfan, Temperature, Dissolved Oxygen, pH, Ammonia-N, Fecal Coliform.
WA-37-1030	SULPHUR CREEK WASTEWAY	DDT, 4,4'-DDE, 4,4'-DDD, Dieldrin, Endosulfan, Temperature.

WATERBODY SEGMENT NUMBER	WATERBODY NAME	PARAMETERS EXCEEDING STANDARDS
WA-37-1040	YAKIMA RIVER	Fecal Coliform.
WA-37-1047	WIDE HOLLOW CREEK	DDT, 4,4'-DDE, 4,4'-DDD, Dieldrin, Endosulfan, Temperature, Dissolved Oxygen, Fecal Coliform.
WA-37-1048	MOXEE DRAIN (BIRCHFIELD DRAIN)	DDT, 4,4'-DDE, 4,4'-DDD, Chlorpyrifos, Dieldrin, Endosulfan, Malathion, Temperature, Dissolved Oxygen, pH, Fecal Coliform.
WA-37-2105	SPRING CREEK	Temperature.
WA-37-9030	GIFFIN LAKE	Total Phosphorus.
WA-38-1010	NACHES RIVER	Temperature, pH.
WA-38-1015	COWICHE CREEK	Temperature, Instream Flow.
WA-38-1016	COWICHE CREEK, N.F.	Temperature, Fecal Coliform.
WA-38-1017	COWICHE CREEK, S.F.	Temperature, Fecal Coliform.
WA-38-1018	REYNOLDS CREEK	Temperature.
WA-38-1019	YAKIMA TIETON MAIN CANAL	Fecal Coliform.
WA-38-1035	RATTLESNAKE CREEK	Temperature.
WA-38-1036	LITTLE RATTLESNAKE CREEK	Temperature.
WA-38-1037	RATTLESNAKE CREEK	Temperature.
WA-38-1041	GOLD CREEK	Temperature.
WA-38-1060	AMERICAN RIVER	Temperature.
WA-38-1070	BUMPING RIVER	Temperature.
WA-38-1080	LITTLE NACHES RIVER	Temperature.
WA-38-1081	CROW CREEK	Temperature.
WA-38-1086	MATHEW CREEK	Temperature.
WA-38-1088	BEAR CREEK	Temperature.
WA-38-1091	BLOWOUT CREEK	Temperature.
WA-38-2110	NILE CREEK, N.F.	Temperature.
WA-38-3000	TIETON RIVER, S.F.	Temperature.
WA-38-9080	MYRON LAKE	Ammonia-N.
WA-39-1010	YAKIMA RIVER	DDT, 4,4'-DDE, Dieldrin.
WA-39-1012	WENAS CREEK	Instream Flow.
WA-39-1020	WILSON CREEK	Temperature, Fecal Coliform.
WA-39-1025	NANEUM CREEK	Temperature.

WATERBODY SEGMENT NUMBER	WATERBODY NAME	PARAMETERS EXCEEDING STANDARDS
WA-39-1030	YAKIMA RIVER	DDT, 4,4'-DDE.
WA-39-1032	CHERRY CREEK	Temperature, DDT, 4,4'-DDE, Dieldrin.
WA-39-1034	COOKE CREEK	Dissolved Oxygen, Temperature, Fecal Coliform.
WA-39-1037	CRYSTAL CREEK	pH.
WA-39-1050	CLE ELUM RIVER	Temperature.
WA-39-1053	THORP CREEK	Temperature.
WA-39-1055	COOPER RIVER	Temperature.
WA-39-1057	WAPTUS RIVER	Temperature.
WA-39-1060	YAKIMA RIVER	Temperature, Dissolved Oxygen.
WA-39-1070	YAKIMA RIVER	Temperature.
WA-39-1073	BIG CREEK	Temperature, Instream Flow.
WA-39-1075	CABIN CREEK	Temperature.
WA-39-1077	LOG CREEK	Temperature.
WA-39-1110	SELAH DITCH	Ammonia-N, Chlorine, Dissolved Oxygen.
WA-39-1300	GALE CREEK	Temperature.
WA-39-1350	MEADOW CREEK	Temperature.
WA-39-1390	GOLD CREEK	Temperature.
WA-39-1400	SWAUK CREEK	Temperature.
WA-39-1420	SWAUK CREEK	Temperature.
WA-39-1425	WILLIAMS CREEK	Temperature.
WA-39-1435	BLUE CREEK	Temperature.
WA-39-1440	IRON CREEK	Temperature.
WA-39-1500	TANEUM CREEK	Instream Flow.
WA-39-1520	TANEUM CREEK	Temperature.
WA-39-1558	LOOKOUT CREEK	Temperature.
WA-39-1570	TANEUM CREEK, S.F.	Temperature.
WA-39-2000	TEANAWAY RIVER	Instream Flow, Temperature.
WA-39-2100	TEANAWAY RIVER, W.F.	Temperature.
WA-39-2150	TEANAWAY RIVER, M.F.	Temperature.
WA-39-2155	STAFFORD CREEK	Temperature.
WA-39-2200	TEANAWAY RIVER, N.F.	Temperature.

WATERBODY SEGMENT NUMBER	WATERBODY NAME	PARAMETERS EXCEEDING STANDARDS
WA-39-2250	TEANAWAY RIVER, N.F.	Temperature.
WA-39-2300	TEANAWAY RIVER, W.F.	Temperature.
WA-39-2350	TEANAWAY RIVER, W.F.	Temperature.
WA-39-3000	MANASTASH CREEK	Instream Flow.
WA-39-3020	MANASTASH CREEK, S.F.	Temperature.
WA-39-3025	MANASTASH CREEK, S.F.	Temperature.
WA-41-1010	CRAB CREEK	Temperature, pH, Fecal Coliform, Dieldrin, DDT, 4,4'-DDE, PCB-1254, PCB-1260.
WA-41-1016	CRAB CREEK LATERAL	Temperature.
WA-41-1018	RED ROCK COULEE	Temperature, pH, Dissolved Oxygen.
WA-41-1030	CRAB CREEK	Temperature.
WA-41-1110	WINCHESTER WASTEWAY	pH, Temperature.
WA-41-1120	FRENCHMAN HILLS WASTEWAY	Temperature, pH.
WA-41-2010	ROCKY FORD CREEK	pH, Dissolved Oxygen, Temperature.
WA-41-3000	EAST POTHOLES CANAL	Temperature, Dissolved Oxygen.
WA-41-3500	LIND COULEE	Temperature, pH, Dissolved Oxygen.
WA-41-4000	WEST CANAL	Temperature.
WA-41-4500	W645 WASTEWAY	Temperature, Dissolved Oxygen.
WA-41-5000	SAND HALLOW CREEK	Temperature, pH.
WA-41-9250	MOSES LAKE	Total Phosphorus, Total Nitrogen.
WA-41-9280	POTHOLES RESERVOIR	Dieldrin.
WA-42-2000	MAIN CANAL	Temperature, Dissolved Oxygen.
WA-43-4000	CRAB CREEK	pH.
WA-43-9160	WEST MEDICAL LAKE	Fecal Coliform, Ammonia-N.
WA-45-1010	WENATCHEE RIVER	Temperature, pH, Instream Flow.
WA-45-1011	MISSION CREEK	DDT (total), 4,4'-DDT, 4,4'-DDE, Fecal Coliform, Instream Flow.
WA-45-1012	MISSION CREEK	Temperature.
WA-45-1013	PESHASTIN CREEK	Temperature, Instream Flow.
WA-45-1014	PESHASTIN CREEK	Temperature.
WA-45-1015	ICICLE CREEK	Instream Flow.
WA-45-1017	ICICLE CREEK	Temperature, Dissolved Oxygen, pH.

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WATERBODY SEGMENT NUMBER	WATERBODY NAME	PARAMETERS EXCEEDING STANDARDS
WA-45-1020	WENATCHEE RIVER	Temperature, pH, Dissolved Oxygen, Instream Flow.
WA-45-1100	BRENDER CREEK	Dissolved Oxygen, Fecal Coliform.
WA-45-1200	CHUMSTICK CREEK	Dissolved Oxygen, pH, Fecal Coliform, Instream Flow.
WA-45-1900	CHIWAUKUM CREEK	Temperature.
WA-45-3000	MASON CREEK	Temperature.
WA-45-4000	LITTLE WENATCHEE RIVER	Temperature.
WA-46-1010	ENTIAT RIVER	pH, Temperature, Instream Flow.
WA-47-1010	CHELAN RIVER	Fecal Coliform.
WA-47-1012	FIRST CREEK	Dissolved Oxygen.
WA-47-1014	MITCHELL CREEK	pH.
WA-47-1020	RAILROAD CREEK	Arsenic.
WA-47-1030	STEHEKIN RIVER	Arsenic.
WA-47-9020	LAKE CHELAN	4,4'-DDE, PCBs, pH.
WA-47-9037	ROSES (ALKALI) LAKE	4,4'-DDE.
WA-48-1010	METHOW RIVER	Temperature.
WA-48-1020	METHOW RIVER	Instream Flow.
WA-48-1021	BEAVER CREEK	Instream Flow.
WA-48-1030	TWISP RIVER	Temperature, Instream Flow.
WA-48-1040	METHOW RIVER	Instream Flow.
WA-48-1050	METHOW RIVER	Instream Flow, Temperature.
WA-48-1052	CHEWACK RIVER	Instream Flow.
WA-48-1059	WOLF CREEK	Instream Flow.
WA-48-1060	METHOW RIVER	Instream Flow.
WA-48-1061	EARLY WINTERS CREEK	Instream Flow.
WA-49-1010	OKANOGAN RIVER	Temperature, Dissolved Oxygen, pH, 4,4'-DDE, 4,4'-DDD, PCBs.
WA-49-1020	OKANOGAN RIVER	Temperature, Dissolved Oxygen.
WA-49-1021	SALMON CREEK	Instream Flow.
WA-49-1030	SIMILKAMEEN RIVER	Temperature, pH.
WA-49-1040	OKANOGAN RIVER	Temperature, Dissolved Oxygen, pH.
WA-49-9260	OSOOYOS LAKE	4,4'-DDE, 4,4'-DDD.
WA-52-2920	O'BRIEN CREEK, S.F.	pH.

WATERBODY SEGMENT NUMBER	WATERBODY NAME	PARAMETERS EXCEEDING STANDARDS
WA-52-4000	SANPOIL RIVER, N.F.	Fecal Coliform.
WA-53-4300	COTTONWOOD CREEK	Chlorine, Ammonia-N.
WA-53-9010	CRESCENT BAY LAKE	Ammonia-N.
WA-54-1010	SPOKANE RIVER	Temperature, pH, PCBs, 4,4'-DDE, Dieldrin, Sediment Bioassay, Dissolved Oxygen.
WA-54-1015	CHAMOKANE CREEK	Temperature.
WA-54-1020	SPOKANE RIVER	Zinc, Chromium, PCBs, pH, Ammonia-N, Total Phosphorus, Fecal Coliform.
WA-54-9040	LONG LAKE	DDT, 4,4'-DDE, 4,4'-DDD, Heptachlor, Heptachlor Epoxide, Aldrin, Dieldrin, PCBs.
WA-55-1010	LITTLE SPOKANE RIVER	Fecal Coliform, Temperature, Dissolved Oxygen, PCBs, pH.
WA-55-1011	DEADMAN CREEK	Temperature, pH.
WA-55-1012	DRAGOON CREEK	Fecal Coliform, Dissolved Oxygen.
WA-56-1010	HANGMAN CREEK	Temperature, pH, 4,4'-DDE, Fecal Coliform, Dissolved Oxygen.
WA-57-1010	SPOKANE RIVER	Cadmium, Zinc, Mercury, PCBs, Sediment Bioassay, Temperature, Dissolved Oxygen.
WA-57-9020	NEWMAN LAKE	Total Phosphorus.
WA-58-2000	SHERMAN CREEK	Temperature.
WA-58-2500	SHERMAN CREEK, S.F:	Temperature.
WA-59-1010	COLVILLE RIVER	Temperature, Fecal Coliform, Ammonia-N, Chloride, pH, Dissolved Oxygen.
WA-59-2600	MILL CREEK, S.F.	Fecal Coliform.
WA-59-2800	MILL CREEK, N.F.	pH.
WA-59-3000	LITTLE PEND OREILLE RIVER	pH.
WA-59-3995	ADDY CREEK	pH.
WA-59-4000	STENSGAR CREEK	Dissolved Oxygen, Fecal Coliform.
WA-59-5000	BLUE CREEK	Dissolved Oxygen, Fecal Coliform.
WA-59-6000	CHEWELAH CREEK	pH.
WA-59-6010	CHEWELAH CREEK, S.F.	Fecal Coliform, Dissolved Oxygen, pH, Temperature.
WA-59-6057	BAYLEY CREEK, W.F.	pH.
WA-59-6110	COTTONWOOD CREEK	Fecal Coliform.
WA-59-7000	SHEEP CREEK	Dissolved Oxygen, Fecal Coliform.
WA-59-9070	GILLETTE LAKE	Fecal Coliform.

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WATERBODY SEGMENT NUMBER	WATERBODY NAME	PARAMETERS EXCEEDING STANDARDS
WA-59-9180	STARVATION LAKE	Total Phosphorus.
WA-60-1015	MARTIN CREEK	Fecal Coliform.
WA-60-1016	EAST DEER CREEK	pH.
WA-60-1018	DEEP CREEK	pH.
WA-60-1019	DEEP CREEK	Dissolved Oxygen.
WA-60-2050	ST. PETER CREEK	Fecal Coliform.
WA-60-2100	LAMBERT CREEK	Fecal Coliform.
WA-60-2250	TROUT CREEK, N.F.	Fecal Coliform.
WA-60-3100	BOULDER CREEK, S.F.	Dissolved Oxygen, Temperature, Fecal Coliform.
WA-60-3170	U.S. CREEK	pH.
WA-60-3250	PIERRE CREEK	pH.
WA-60-3252	FISHER CREEK	Dissolved Oxygen.
WA-60-4000	INDEPENDENT CREEK	Dissolved Oxygen.
WA-60-6000	LONE RANCH CREEK	Fecal Coliform.
WA-60-6400	COTTONWOOD CREEK	Fecal Coliform.
WA-60-6530	TONATA CREEK	pH, Fecal Coliform.
WA-61-5000	FLAT CREEK	Fecal Coliform.
WA-61-5100	CROWN CREEK	pH, Fecal Coliform.
WA-61-7000	DEEP CREEK	pH.
WA-61-7100	DEEP CREEK, S.F.	Temperature.
WA-61-7200	SNACKOUT CREEK	Dissolved Oxygen, pH, Fecal Coliform.
WA-61-7250	MEADOW CREEK	pH, Fecal Coliform.
WA-61-7340	SILVER CREEK	pH.
WA-61-7400	ROCKY CREEK	Dissolved Oxygen.
WA-61-8910	CEDAR CREEK, E.F.	pH.
WA-62-1010	PEND OREILLE RIVER	pH, Aldrin, Dieldrin, Heptachlor, Heptachlor Epoxide, DDT, 4,4'-DDE, 4,4'-DDD.
WA-62-1020	PEND OREILLE RIVER	Temperature, pH.
WA-62-1960	LOST CREEK	Temperature, pH, Fecal Coliform.
WA-62-2210	LECLERC CREEK, WEST BRANCH	Dissolved Oxygen.
WA-62-3000	SKOOKUM CREEK	Fecal Coliform.

WATERBODY SEGMENT NUMBER	WATERBODY NAME	PARAMETERS EXCEEDING STANDARDS
WA-62-3100	NOISY CREEK	pH.
WA-62-3310	IONE CREEK	Temperature.
WA-62-3500	SLATE CREEK	pH.
WA-62-4000	BRACKET CREEK	Fecal Coliform.
WA-CR-1010	COLUMBIA RIVER	Sediment Bioassay, Total Dissolved Gas, PCB-1254, Arsenic, 4,4'-DDE, Dieldrin, Bis(2-ethylhexyl) Phthalate, Temperature, Dissolved Oxygen, pH, Fecal Coliform.
WA-CR-1020	COLUMBIA RIVER	Mercury, Temperature, Sediment Bioassay, Total Dissolved Gas, pH.
WA-CR-1026	COLUMBIA RIVER	Total Dissolved Gas, Sediment Bioassay.
WA-CR-1028	COLUMBIA RIVER	Sediment Bioassay.
WA-CR-1030	COLUMBIA RIVER	Total Dissolved Gas, pH.
WA-CR-1040	COLUMBIA RIVER	Water Column Bioassay, Total Dissolved Gas, Temperature, pH.
WA-CR-1050	COLUMBIA RIVER	Temperature, Total Dissolved Gas, PCBs.
WA-CR-1060	FRANKLIN D. ROOSEVELT LAKE	PCBs, Sediment Bioassay, Total Dissolved Gas, pH, Fecal Coliform, Temperature, Dissolved Oxygen.
WA-PS-0010	SKAGIT BAY AND SIMILK BAY	Fecal Coliform, PCBs.
WA-PS-0020	PORT SUSAN	Fecal Coliform, PCBs.
WA-PS-0030	POSSESSION SOUND (NORTH)	Fecal Coliform, Arsenic, Cadmium, Copper, Lead, Mercury, Zinc, Naphthalene, Acenaphthene, Fluorene, Phenanthrene, 2-Methylnaphthalene, Bis(2-ethylhexyl) Phthalate, Dibenzofuran, Phenol, 2-Methylphenol, 4-Methylphenol, 2,4-Dimethylphenol, Benzyl Alcohol, pH, Dissolved Oxygen.
WA-PS-0070	TACOMA NARROWS	PCBs, Dieldrin.
WA-PS-0090	CASE INLET AND DANA PASSAGE	Dissolved Oxygen, pH, Fecal Coliform.
WA-PS-0100	HOOD CANAL (NORTH)	Copper, Lead, Mercury, Zinc, Acenaphthene, Anthracene, Benz(a)anthracene, Benzo(a)pyrene, Total Benzofluoranthenes, Benzo(g,h,i)perylene, Chrysene, Fluoranthene, Indeno(1,2,3-c,d)pyrene, Phenanthrene, Pyrene, 4-Methylphenol, Pentachlorophenol, Dibenzo(a,h)anthracene, Dibenzofuran, Bis(2-ethylhexyl)phthalate.
WA-PS-0210	SAMISH BAY	Fecal Coliform.
WA-PS-0230	PUGET SOUND (N-CENTRAL) AND USELESS BAY	PCBs.
WA-PS-0240	PUGET SOUND (CENTRAL)	Fecal Coliform.
WA-PS-0250	HOOD CANAL (SOUTH)	Fecal Coliform.
WA-PS-0260	GREAT BEND/LYNCH COVE	Dissolved Oxygen, pH, Fecal Coliform.

WATERBODY SEGMENT NUMBER	WATERBODY NAME	PARAMETERS EXCEEDING STANDARDS
WA-PS-0270	PUGET SOUND (S-CENTRAL) AND EAST PASSAGE	Ammonia-N, Fecal Coliform.
WA-PS-0290	NISQUALLY REACH/DRAYTON PASSAGE	Fecal Coliform.

APPENDIX 13

STATE OF WASHINGTON
WATERBODY SEGMENT IDENTIFICATION LIST

SEGMENT NUMBER	WATERBODY NAME	SEGMENT DESCRIPTION	CLASS
		THE JURISDICTION OF THE YAKAMA INDIAN NATION)	
WA-37-1060	WANITY SLOUGH	MOUTH AT TOPPENISH CREEK RM 6.5 TO HEADWATERS AT YAKIMA RM 106.8 (THE SEGMENT IS ENTIRELY UNDER THE JURISDICTION OF THE YAKAMA INDIAN NATION)	RA
WA-37-1100	TOPPENISH CREEK, N.F.	MOUTH AT TOPPENISH CREEK RM 55.4 TO HEADWATERS ON LOST HORSE PLATEAU. (SEGMENT IS ENTIRELY UNDER THE JURISDICTION OF THE YAKAMA INDIAN NATION)	RAA
WA-37-1590	PANTHER CREEK	MOUTH AT TOPPENISH CREEK RM 69.2 TO HEADWATERS ON LOST HORSE PLATEAU. (STREAM IS ENTIRELY UNDER THE JURISDICTION OF THE YAKAMA INDIAN NATION)	RA
WA-37-2000	AHTANUM CREEK	MOUTH AT YAKIMA RM 106.9 TO CONFLUENCE OF N.F. AND S.F. (RM 23.1). (THE SEGEMNT IS PARTIALLY UNDER THE JURISDICTION OF THE YAKAMA INDIAN NATION)	RA
WA-37-2100	BACHELOR CREEK	MOUTH AT AHTANUM CREEK RM 3.2 TO DITCH INTAKE FROM AHTANUM CREEK RM 18.9	RA
WA-37-2105	SPRING CREEK	MOUTH AT BACHELOR CREEK RM 2.0 (NEAR HATCHERY) TO HEADWATERS	RA
WA-37-2110	BOWMAN DITCH	MOUTH AT BACHELOR CREEK RM 3.5 (NEAR AHTANUM ROAD-WEST OF AIRPORT) TO HEADWATERS (NEAR WILEY CITY)	RA
WA-37-2200	AHTANUM CREEK, S.F.	MOUTH AT AHTANUM CREEK RM 23.1 TO HEADWATERS. (SEGMENT IS PARTIALLY UNDER THE JURSIDICTION OF THE YAKAMA INDIAN NATION)	RA
WA-37-2300	AHTANUM CREEK, N.F.	MOUTH AT AHTANUM CREEK RM 23.1 TO HEADWATERS ON DARLAND MOUNTAIN	RA
WA-37-9005	BOS LAKE	TRS 9N-22E-21	LAK
WA-37-9010	BYRON LAKE	LAT/LONG = 461134/1195304 TRS = 08N-23E-12 ELEV = 0 FT MEAN DEPTH = 0 FT MAX DEPTH = 6 FT VOLUME = 0 AF	LAK
WA-37-9020	FREEWAY LAKE	LAT/LONG = 463739/1203021 TRS = 13N-19E-07 ELEV = 0 FT MEAN DEPTH = 14 FT MAX DEPTH = 21 FT VOLUME = 347 AF	LAK
WA-37-9030	GIFFIN LAKE	LAT/LONG = 461439/1210148 TRS = 09N-22E-23 ELEV = 0 FT MEAN DEPTH = 4 FT MAX DEPTH = 7 FT VOLUME = 377 AF	LAK
WA-37-9040	HORSESHOE LAKE	LAT/LONG = 461458/1200336 TRS = 09N-22E-22 ELEV = 0 FT MEAN DEPTH = 1 FT MAX DEPTH = 2 FT VOLUME = 19 AF	LAK
WA-37-9050	HORSESHOE LAKE	LAT/LONG = 461359/1200043 TRS = 09N-22E-25 ELEV = 0 FT MEAN DEPTH = 2 FT MAX DEPTH = 6 FT VOLUME = 180 AF	LAK
WA-37-9055	McWORTER LAKE	TRS 10N-27E-15	LAK
WA-37-9060	MORGAN LAKE	LAT/LONG = 461416/1200031 TRS = 09N-22E-25 ELEV = 0 FT MEAN DEPTH = 2 FT MAX DEPTH = 4 FT VOLUME = 91 AF	LAK
WA-37-9070	OLEYS (WASHINGTON) LAKE	LAT/LONG = 461634/1195925 TRS = 09N-23E-07 ELEV = 0 FT MEAN DEPTH = 2 FT MAX DEPTH = 2 FT VOLUME = 26 AF	LAK
WA-38-1010	NACHES RIVER	MOUTH AT YAKIMA RM 116.3 TO TIETON RIVER (RM 17.5)	RA
WA-38-1015	COWICHE CREEK	MOUTH AT NACHES RM 2.7 TO HEADWATERS (INCLUDES BOTH N.F.(19.1 MILES) AND S.F. (25.2 MILES))	RA
WA-38-1016	COWICHE CREEK, N.F.	MOUTH AT COWICHE CREEK RM 7.5 TO HEADWATERS	RA
WA-38-1017	COWICHE CREEK, S.F.	MOUTH AT COWICHE CREEK RM 75. TO HEADWATERS	RA
WA-38-1018	REYNOLDS CREEK	MOUTH AT S.F. COWICHE RM 11.8 TO HEADWATERS ON STORBACH MOUNTAIN	RA
WA-38-1020	TIETON RIVER	MOUTH AT NACHES RM 17.5 TO RIMROCK LAKE DAM	RAA
WA-38-1026	HAUSE CREEK	MOUTH AT TIETON RM 18.0 TO HEADWATERS	RAA
WA-38-1030	NACHES RIVER	TIETON RIVER (RM 17.5) TO NATIONAL FOREST BOUNDARY (RM 35.7)	RA
WA-38-1035	RATTLESNAKE CREEK	MOUTH AT NACHES RM 27.8 TO NATIONAL FOREST BOUNDRY (RM 1.2)	RA
WA-38-1036	LITTLE RATTLESNAKE	MOUTH AT RATTLESNAKE CREEK RM 1.1 TO NATIONAL FOREST BOUNDARY (RM 5.0)	RA

STATE OF WASHINGTON
WATERBODY SEGMENT IDENTIFICATION LIST

SEGMENT NUMBER	WATERBODY NAME	SEGMENT DESCRIPTION	CLASS
		DEPTH = 8 FT MAX DEPTH = 26 FT VOLUME = 163 AF	
WA-36-9210	WASHTUCNA LAKE	LAT/LONG = 463850/1182955 TRS = 13N-34E-01 ELEV = 0 FT MEAN DEPTH = 4 FT MAX DEPTH = 9 FT VOLUME = 225 AF	LAK
WA-36-9220	WEIR LAKE	LAT/LONG = 464126/1190823 TRS = 14N-29E-23 ELEV = 0 FT MEAN DEPTH = 20 FT MAX DEPTH = 81 FT VOLUME = 2860 AF	LAK
WA-37-1010	YAKIMA RIVER	MOUTH AT COLUMBIA RM 335.2 TO TOPPENISH CREEK (RM 80.4). (RM 59.8 TO TOP OF SEGMENT IS PARTIALLY UNDER THE JURISDICTION OF THE YAKAMA INDIAN NATION)	RA
WA-37-1011	BENTON CREEK	MOUTH AT YAKIMA RM 29.8 TO HEADWATERS NEAR KENNEDY ROAD	RA
WA-37-1012	SNIPES CREEK	MOUTH AT YAKIMA RM 41.8 (DOWNSTREAM OF PROSSER) TO HEADWATERS	RA
WA-37-1013	DAYS CREEK	MOUTH AT YAKIMA RM 35.0 TO HEADWATERS NEAR TRUHLICKA ROAD	RA
WA-37-1014	SPRING CREEK	MOUTH AT YAKIMA RM 41.8 TO HEADWATERS	RA
WA-37-1019	YAKIMA TIETON MAIN CANAL	MOUTH AT N.F. COWICHE CREEK RM 8.4 IN FRENCH CANYON TO OUTFLOW AT HEADWORKS ON TIETON RM 14.2	RA
WA-37-1020	YAKIMA RIVER	TOPPENISH CREEK (RM 80.4) TO SUNNYSIDE DAM BRIDGE (RM 103.8). (THIS ENTIRE SEGMENT IS PARTIALLY UNDER THE JURISDICTION OF THE YAKAMA INDIAN NATION)	RA
WA-37-1023	DERUYTHER CREEK	MOUTH AT GRANGER DRAIN NEAR PRICE ROAD TO HEADWATERS NEAR INDEPENDANCE ROAD	RA
WA-37-1024	GRANGER DRAIN	MOUTH AT YAKIMA RM 83 (AT GRANGER) TO HEADWATERS	RA
WA-37-1025	MARION DRAIN	MOUTH AT YAKIMA RM 82.9 (NEAR GRANGER) TO HEADWATERS NEAR LABBEE AIRPORT. (THE SEGMENT IS ENTIRELY UNDER THE JURISDICTION OF THE YAKAMA INDIAN NATION)	RA
WA-37-1030	SULPHUR CREEK WASTEWAY	MOUTH AT YAKIMA RM 61.0 TO WASTEWAY HEADWATERS	RA
WA-37-1035	STATUS CREEK	MOUTH AT YAKIMA RM 69.6 TO HEADWATERS (THE SEGMENT IS ENTIRELY UNDER THE JURISDICTION OF THE YAKAMA INDIAN NATION)	RA
WA-37-1037	DRY CREEK	MOUTH AT STATUS CREEK RM 18.7 TO HEADWATERS. INCLUDES N.F., M.F. AND S.F. (STREAM IS ENTIRELY UNDER THE JURISDICTION OF THE YAKAMA INDIAN NATION)	RA
WA-37-1039	KUSSHI CREEK	MOUTH AT STATUS CREEK RM 37.2 TO HEADWATERS. INCLUDES N.F. AND S.F. (STREAM IS ENTIRELY UNDER THE JURISIDCTION OF THE YAKAMA INDIAN NATION)	RA
WA-37-1040	YAKIMA RIVER	SUNNYSIDE DAM BRIDGE (RM 103.8) TO NACHES RIVER (RM 116.3). (THE SEGMENT FORM RM 103.8 TO 106.9 IS PARTIALLY UNDER THE JURISDICTION OF THE YAKAMA INDIAN NATION)	RA
WA-37-1047	WIDE HOLLOW CREEK	MOUTH AT YAKIMA RM 104.7 TO HEADWATERS	RA
WA-37-1048	MOXEE (BIRCHFIELD) DRAIN	MOUTH AT YAKIMA RM 107.6 (NEAR UNION GAP) TO HEADWATERS ALONG BIRCHFIELD ROAD	RA
WA-37-1050	TOPPENISH CREEK	MOUTH AT YAKIMA RM 80.4 (SOUTH OF GRANGER) TO HEADWATERS (THE SEGMENT IS ENTIRELY UNDER THE JURISDICTION OF THE YAKAMA INDIAN NATION).	RA
WA-37-1054	MILL CREEK	MOUTH AT TOPPENISH CREEK RM 30.9 TO HEADWATERS ON WHISKEY JIM FLAT. (STREAM IS ENTIRELY UNDER THE JURISDICTION OF THE YAKAMA INDIAN NATION)	RA
WA-37-1055	SIMCOE CREEK	MOUTH AT TOPPENISH CREEK RM 32.7 TO THE CONFLUENCE OF THE N.F. AND S.F. (RM 18.9). (STREAM IS ENTIRELY UNDER THE JUSISDICTION OF THE YAKAMA INDIAN NATION)	RA
WA-37-1057	YESMOWIT CREEK	MOUTH AT SIMCOE CREEK RM 14.0 TO HEADWATERS. (STREAM IS ENTIRELY UNDER	RA

LOWER YAKIMA RIVER SUSPENDED SEDIMENT TMDL

USEPA Submittal Document

DEPARTMENT OF ECOLOGY
State of Washington

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VOLUME 3

Publication # 98-10-202 - Vol. 3

LOWER YAKIMA RIVER VALLEY

WASHINGTON STATE DEPARTMENT OF ECOLOGY

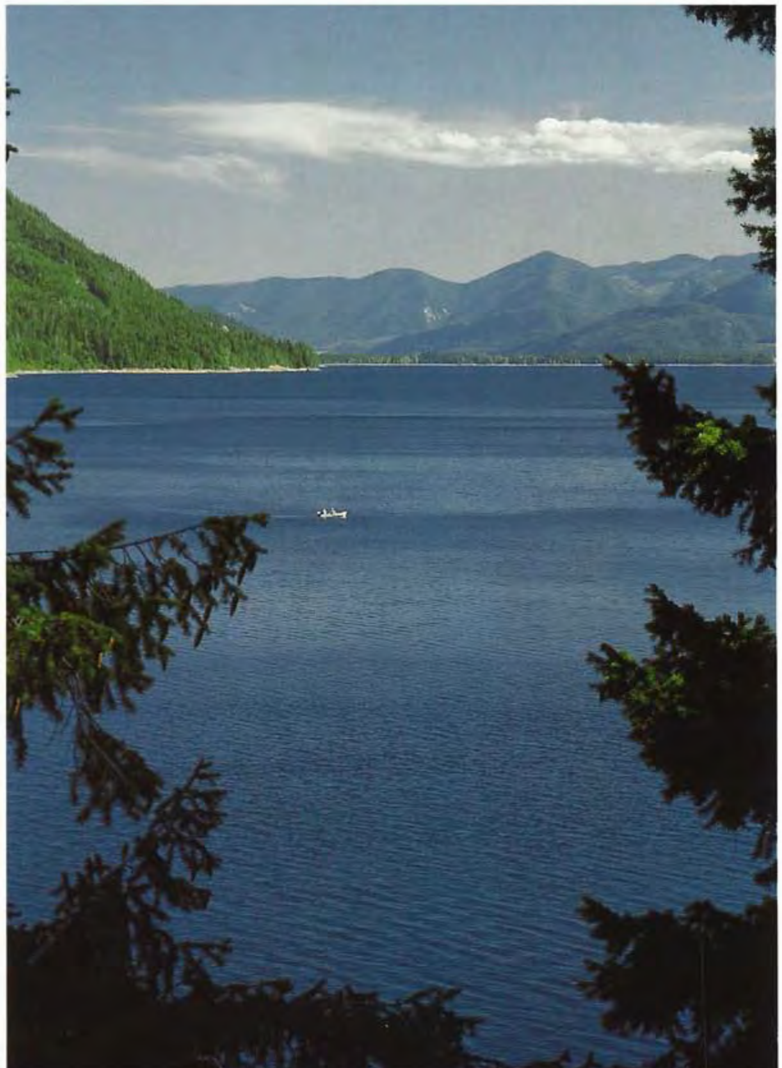
Prepared by the Washington Department of Ecology

August 1998

APPENDIX 14

PERSISTENCE OF THE DDT PESTICIDE IN THE YAKIMA RIVER BASIN WASHINGTON

U.S. GEOLOGICAL SURVEY CIRCULAR 1090



Persistence of the DDT Pesticide in the Yakima River Basin Washington

By

Joseph F. Rinella, Pixie A. Hamilton, and Stuart W. McKenzie
Graphic design and layout by Joan M. Rubin

U.S. GEOLOGICAL SURVEY CIRCULAR 1090

U.S. DEPARTMENT OF THE INTERIOR
BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY
Dallas L. Peck, Director

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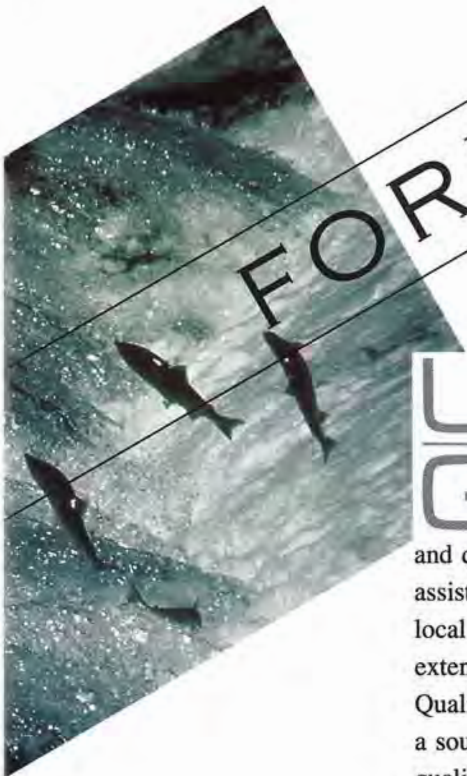
FOREWORD



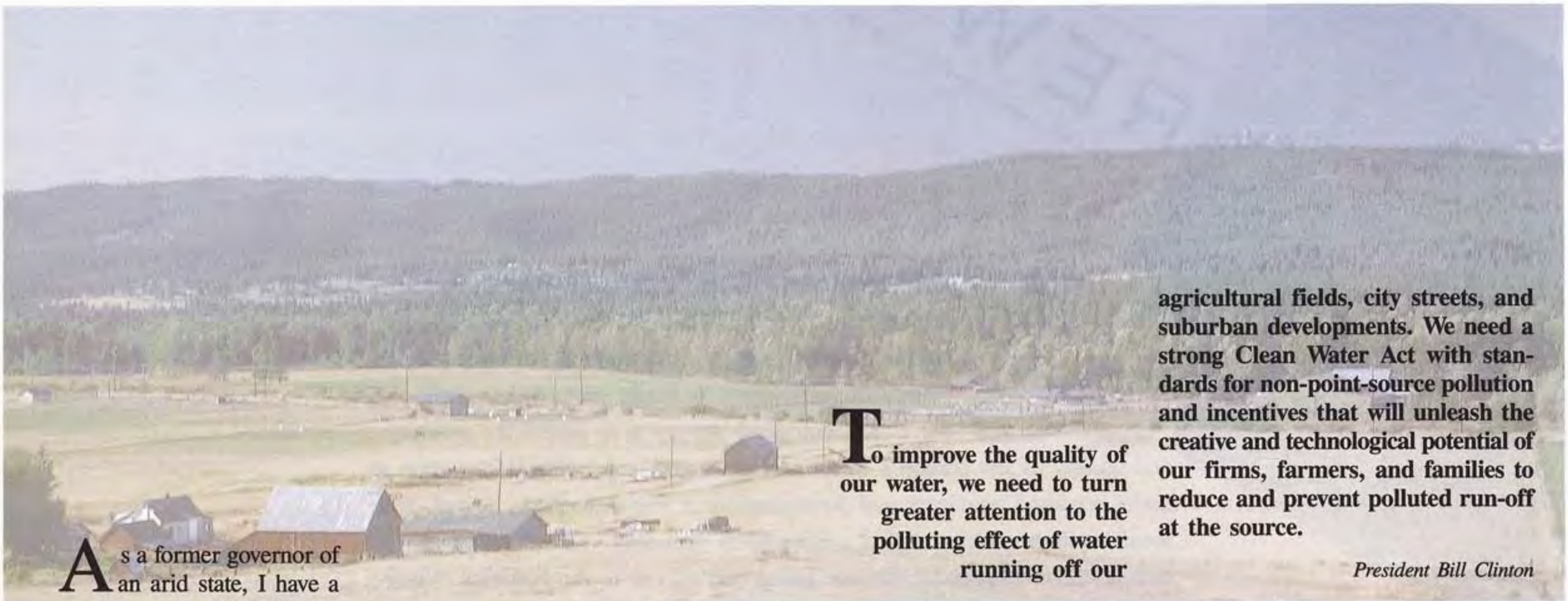
Established in 1879, the U.S. Geological Survey (USGS) has provided scientific information on the Nation's water, energy, and mineral resources for the benefit of Americans. A major part of the mission of the U.S. Geological Survey is to assess the quantity and quality of the Nation's water resources and to provide information to assist resource managers and policymakers at Federal, State, Tribal, and local levels in making sound management decisions. To a significant extent, these responsibilities are being carried out in the National Water-Quality Assessment (NAWQA) Program, whose goals include providing a sound understanding of the natural and human factors that affect water quality.

The NAWQA Program will include investigations in 60 study areas throughout the Nation that represent a variety of geologic, hydrologic, climatic, and cultural conditions. These studies are building blocks for understanding regional differences in physical, chemical, and biological characteristics of the Nation's ground water and surface water. An important goal of the program is to ensure that key findings are available to the public so that they can be aware of the quality of the Nation's water resources.

This report is part of a series of nontechnical publications based on results from the NAWQA Program. The purpose of these publications is to describe key findings from the individual investigations and to relate those findings to water-quality issues of regional and national concern. By disseminating this information, the U.S. Geological Survey seeks to increase awareness of water-quality concerns when considering the Nation's environmental issues.

Director

DDT IN OUR E
A NATIONAL AND

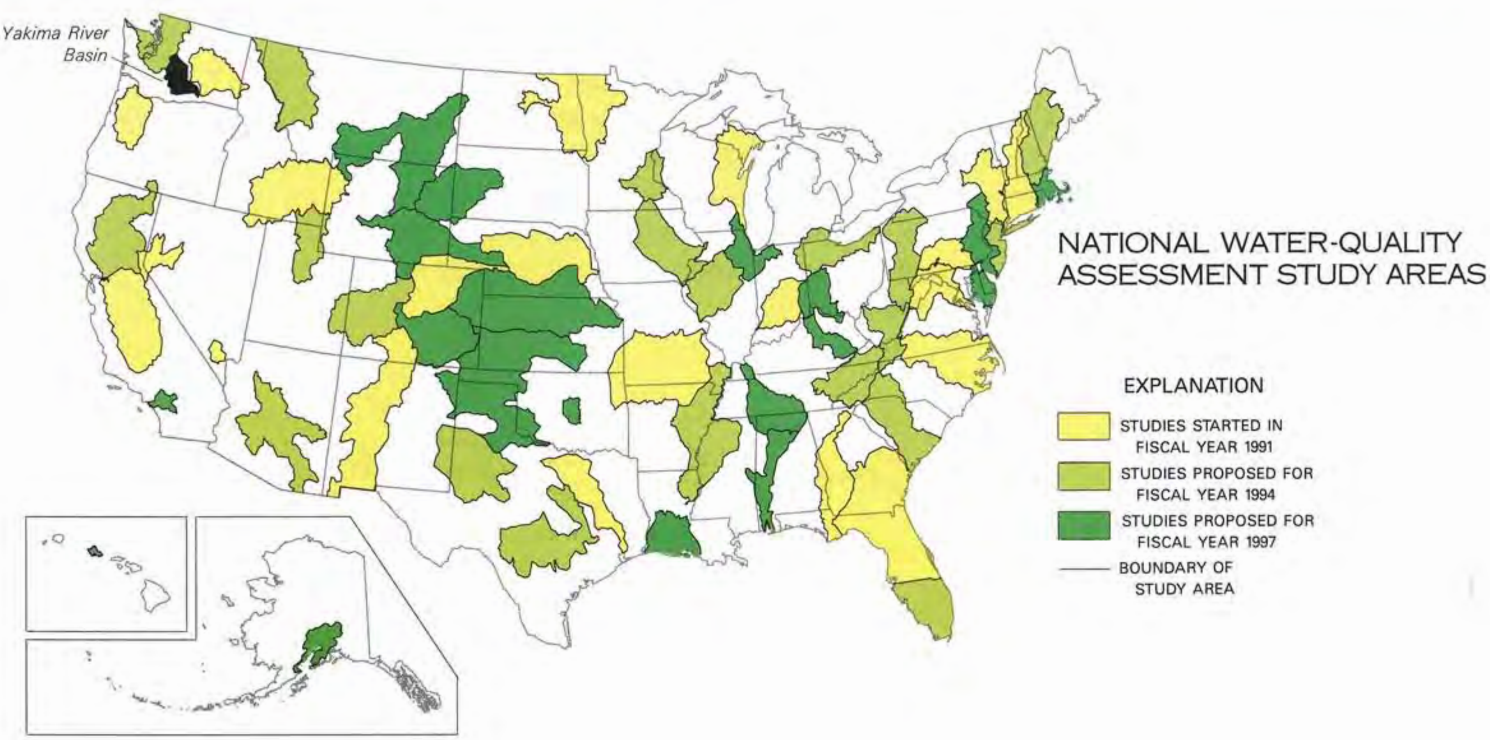


As a former governor of an arid state, I have a special appreciation for the value of water resources. Unless we have sufficient supplies of good quality water when and where we need it—and understand how natural and human conditions affect water quality—we cannot wisely manage this vital resource. As part of the National Water-Quality Assessment, the U.S. Geological Survey will continue to work with state and local agencies to assess and protect our Nation's water resources.

Bruce Babbitt, Secretary
U.S. Department of the Interior

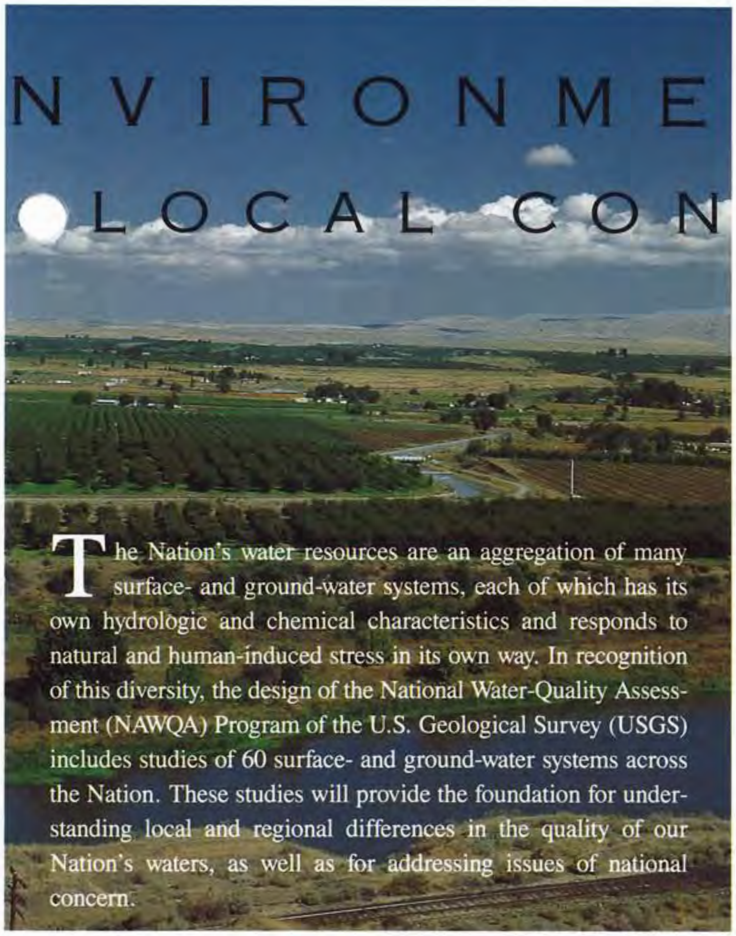
To improve the quality of our water, we need to turn greater attention to the polluting effect of water running off our agricultural fields, city streets, and suburban developments. We need a strong Clean Water Act with standards for non-point-source pollution and incentives that will unleash the creative and technological potential of our firms, farmers, and families to reduce and prevent polluted run-off at the source.

President Bill Clinton



NVIRONMENT . . .

LOCAL CONCERN



The Nation's water resources are an aggregation of many surface- and ground-water systems, each of which has its own hydrologic and chemical characteristics and responds to natural and human-induced stress in its own way. In recognition of this diversity, the design of the National Water-Quality Assessment (NAWQA) Program of the U.S. Geological Survey (USGS) includes studies of 60 surface- and ground-water systems across the Nation. These studies will provide the foundation for understanding local and regional differences in the quality of our Nation's waters, as well as for addressing issues of national concern.

KEY CONCERNS

Where do DDT and its breakdown products DDE and DDD [Total DDT (T-DDT) = DDT + DDE + DDD] occur? In agricultural soils? In stream water? In stream sediment? In fish? In birds and mammals?

What are the sources of T-DDT in the basin? How does T-DDT enter streams?

Have concentrations of T-DDT decreased in stream water and fish since the ban on the production and distribution of DDT in 1972?

How do concentrations of T-DDT in fish in the Yakima River Basin compare with concentrations elsewhere in the Nation?

Are T-DDT concentrations of concern relative to human health and fish predators in the Yakima River Basin?

A major national concern is the degradation of water quality that results from nonpoint sources of pollution, such as agricultural runoff that contains fertilizers and pesticides. Although crop yields are improved greatly by applications of fertilizers and pesticides, the increased production often comes with a price that is measured in terms of effects on human health, streams, fish, and other wildlife. One of the first studies in the National Water-Quality Assessment Program was done to characterize these effects on streams and fish in the Yakima River Basin.[1] Soil, water, sediment, and fish were sampled for a variety of chemicals that have been and (or) continue to be used in the basin.

This report focuses on the occurrence of one of these chemicals in the Yakima River Basin—the insecticide DDT. Even though two decades have passed since its production and distribution was banned (1972), DDT and its breakdown products DDE and DDD are still widely dispersed in the environment. Concentrations of DDT, DDE, and DDD remain elevated in agricultural soils, stream water, suspended and streambed sediment, and fish in the Yakima River Basin. Elevated concentrations of these compounds are a continued concern of residents, resource managers, and policymakers in the basin. Why? Because its broad toxicity can affect many organisms other than insects for which it was designed, such as fish and birds. Its persistence in the environment can lead to dangerous accumulations and adversely affect the reproductive capabilities of birds and other wildlife. And, its cancer-causing potential can possibly affect human health.

[1]The U.S. Geological Survey is preparing a detailed interpretive report on the occurrence of DDT and 90 other pesticides in the Yakima River Basin.

THE YAKIMA

...just as the water sustains life since time immemorial, so does the force that drives the salmon to complete its life cycle; thus renewing our past quest for life...

Clifford Moses, Chairman,
Roads, Irrigation, and Land Committee,
Yakima Tribal Council

YAKIMA RIVER BASIN

Drainage area: 6,155 square miles
Population: 250,000 (1990)

EXPLANATION

YAKIMA INDIAN RESERVATION

BOUNDARY OF DRAINAGE BASIN

CANAL—Arrow indicates direction of flow

DDT: BANNED BUT NOT FORGOTTEN

Use of DDT was prevalent for about three decades after its introduction in the early 1940's. As in most agricultural areas of the world, crop yields in the Yakima River Basin were improved by widespread applications. However, after its adverse effects on birds and other wildlife and its cancer-causing potential became well known, the production and distribution of DDT was banned nationwide by the U.S. Environmental Protection Agency in 1972.

Only days after DDT was banned, another chemical, known as dicofol (trade names such as Kelthane, Acarin, Hilfol, Mitigan, and Cekudifol), was registered with the U.S. Environmental Protection Agency as an agent that would kill mites, particularly on citrus and cotton crops. Dicofol originally contained as much as 15 percent DDT. Since about the mid-1980's, U.S. manufacturers of dicofol have pledged to reduce DDT concentrations to 0.1 percent. Although application of dicofol was approved for hops (new plantings only), mint, and apples in the basin, little of the compound has been used because target pests have become resistant.

Does the banning of DDT 20 years ago and the minimal use of dicofol mean that DDT is no longer a threat in the Yakima River Basin? Probably not because some of the characteristics that made DDT desirable as an insecticide make it a potential hazard in the environment for many decades. The persistence of DDT and its breakdown products assure a long-lasting presence in soil, streams, fish, birds, and other animals.

HAZARDOUS TRAITS OF DDT

BROAD TOXICITY. DDT and its breakdown products, DDE and DDD [Total DDT (T-DDT) = DDT + DDE + DDD], affect many organisms other than insects for which it was designed, such as clams, fish, and birds.

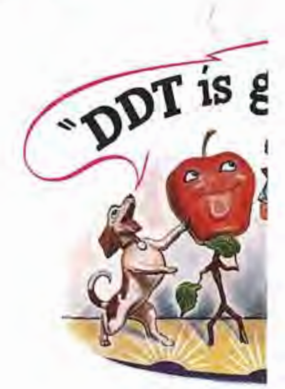
PERSISTENT. T-DDT is chemically stable and is not readily broken down by microorganisms, heat, or ultraviolet light. T-DDT can, therefore, persist in soil, water, sediment, and animal tissue for years.

LOW SOLUBILITY IN WATER AND HIGH ACCUMULATION IN FAT. T-DDT is relatively insoluble in water. However, T-DDT is stored readily in the fatty tissue in animals, where it is resistant to metabolic breakdown.

FOOD-CHAIN EFFECT. Once in streams, T-DDT makes its way into streambed sediment and into plants and animals at the base of the food chain. Fish acquire T-DDT through uptake in food, by feeding on, for example, smaller fish or stream invertebrates (aquatic insects, snails, and clams). Fish also accumulate T-DDT directly from water passing over their gills. Terrestrial animals and birds eat the contaminated fish and invertebrates, and so on up the food chain.

CROP YIELDS IN THE YAKIMA RIVER BASIN HAVE BEEN, AND CONTINUE TO BE, IMPROVED BY THE WIDESPREAD APPLICATIONS OF PESTICIDES.

S O M E D



What is DDT?

DDT is a general-purpose insecticide.

What are DDE and DDD?

DDT breaks down to other compounds DDE (in the presence of oxygen) and DDD (in the absence of oxygen).

What is the chemical composition of the DDT compounds?

DDT compounds are chlorinated hydrocarbons (also known as an organochlorines) that consist of carbon, chlorine, and hydrogen.

D D T— **D**ichloro**D**iphenyl**T**richloroethane
D D E—**D**ichloro**D**iphenyldichloro**E**thylene
D D D—**D**ichloro**D**iphenyl**D**ichloroethane

What are the possible effects on human health?

DDT and its breakdown products [Total DDT (T-DDT = DDT + DDE + DDD] can affect the human nervous system, liver, kidneys, and skin. The compounds have been classified as probable human carcinogens (compounds that cause cancer) by the U.S. Environmental Protection Agency.

How much is too much for human consumption?

The U.S. Environmental Protection Agency has not set a standard for the protection of human health against which T-DDT concentrations in water or fish can be compared. This report presents preliminary and theoretical degrees of risk that reflect the lifetime (considered to be 70 years) chance of contracting cancer from consumption of T-DDT in water or fish. Risk calculations are based on the current (1993) understanding of the cancer-causing potency of T-DDT (extrapolated from studies by the U.S. Environmental Protection Agency of the effects on laboratory animals). The calculations include some uncertainty because of limited information on human fish-consumption rates and the toxicity of T-DDT (see p. 17 through 20 for further explanation of human risk).

Consumption of water—Daily consumption of 2 quarts of drinking water with a T-DDT concentration of 0.1 microgram per liter[3] by a 150-pound person over a 70-year lifetime corresponds to an incremental increase in cancer risk of 1 per 1 million people.

Consumption of fish—Weekly consumption of one 5-ounce serving of fish filets with a T-DDT concentration of 0.01 microgram per gram[4] of fish by a 150-pound person over a 70-year lifetime corresponds to an incremental increase in cancer risk of 1 per 1 million people.

The Food and Drug Administration established an action level of 5 micrograms of T-DDT per gram of whole fish (wet weight). Action levels are established to regulate levels of contaminants in human food and animal feed sold to the public. Action levels do not apply to consumers of noncommercial, locally caught fish, such as sport fishermen and their families.

GOOD FOR FRUITS—Bigger apples, juicier fruits that are free of unsightly worms . . . all benefits resulting from DDT dusts and sprays.

The most conspicuous effect of T-DDT has been on the reproductive capabilities of fish-eating birds, such as the great blue heron and the bald eagle. Studies have shown that elevated concentrations result in thin egg shells that break easily in the nest.

FOR THE HOME—Helps to make healthier, more comfortable homes . . . protects your family from dangerous insect pests. Use DDT powders and sprays as directed . . . then watch the bugs "bite the dust"!

How much is too much for aquatic life and fish predators?

The chronic-toxicity criterion for T-DDT in water for the protection of freshwater aquatic life, established by the U.S. Environmental Protection Agency and adopted by the Washington State Department of Ecology, is 0.001 microgram per liter.

The guideline for the protection of fish predators, established by the National Academy of Sciences, is 1 microgram of T-DDT per gram of a whole fish (wet weight).

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[3]One microgram is equal to one-millionth of a gram or one-thousandth of a milligram, and a milligram is equal to the weight of about six crystals of salt. One microgram per liter also is expressed as one part per billion (analogous to about one person in China).

[4]One microgram per gram is equal to one part per million (analogous to about one person in the State of Idaho).

D T F A C T S :

The great expectations held for DDT have been realized. During 1946, exhaustive scientific tests have shown that, when properly used, DDT kills a host of destructive insect pests, and is a benefactor of all humanity.

D FOR ROW CROPS—*25 more barrels of potatoes per acre* . . . actual DDT tests have shown crop increases like this! DDT dusts and sprays help truck farmers pass these gains along to you.

GOOD FOR STEERS—Beef grows meatier nowadays . . . for it's a scientific fact that—compared to untreated cattle—beef-steers gain up to 50 pounds extra when protected from horn flies and many other pests with DDT insecticides.

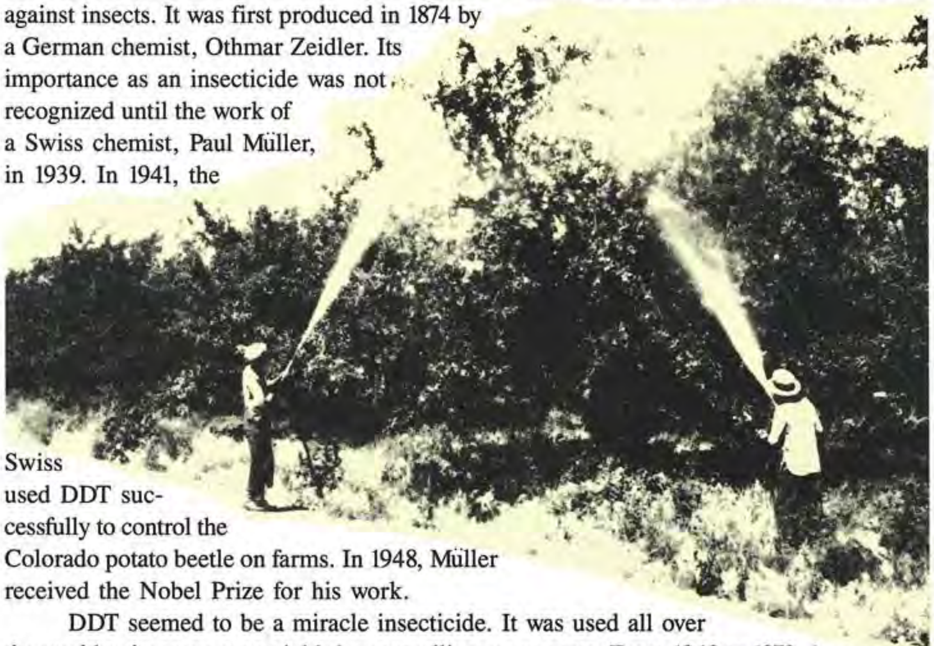
EXCERPTS FROM A FULL-PAGE COLOR ADVERTISEMENT FOR DDT IN THE JUNE 30, 1947 TIME MAGAZINE.

THE HISTORY OF DDT

FROM MIRACLE TO MENACE

"DDT was a miracle: Highly toxic to insects, virtually insoluble in water . . . it seemed to be the universal solution to insect problems."

DDT was the first of a family of synthetic chemicals that revolutionized man's war against insects. It was first produced in 1874 by a German chemist, Othmar Zeidler. Its importance as an insecticide was not recognized until the work of a Swiss chemist, Paul Müller, in 1939. In 1941, the Swiss used DDT successfully to control the Colorado potato beetle on farms. In 1948, Müller received the Nobel Prize for his work.



DDT seemed to be a miracle insecticide. It was used all over the world to improve crop yields by controlling many pests. From 1940 to 1970, more than 4 billion pounds were used, with 80 percent used in agriculture. Production reached its maximum in the United States in 1961 when 160 million pounds were manufactured; this accounted for nearly one-fourth of the Nation's insecticide use. DDT also was an effective control for insects that carried diseases, such as malaria and yellow fever. It was used during World War II by Allied Forces to control mosquitoes and as a personal insecticide in clothes to control lice. In the 1950's and 1960's, municipal foggers traveled the roads and sprayed DDT into the air to eliminate mosquitoes; gasoline-powered lawn mowers were adapted to drip DDT into the hot exhaust system to assure temporary relief from mosquitoes in the homeowner's yard.

The DDT miracle, however, was short lived. Its broad toxicity affected many organisms other than insects for which it was designed, such as fish and birds. Its persistence led to dangerous accumulations in animals. By the 1960's, the "food-chain effect" (accumulation of DDT and its breakdown products in organisms from low to high in the food chain) began to attract public attention. The most conspicuous effects were on the reproductive capabilities of birds. The peregrine falcon, for instance, disappeared from extensive parts of its North American range. These environmental problems and potential health risks associated with DDT were described in *Silent Spring* by the distinguished biologist Rachel Carson. The book sparked interest among citizens all over the country and laid the groundwork for the decision by the U.S. Environmental Protection Agency to ban the production and distribution of DDT a decade later (1972).

George Woodwell,
Science, November 1984

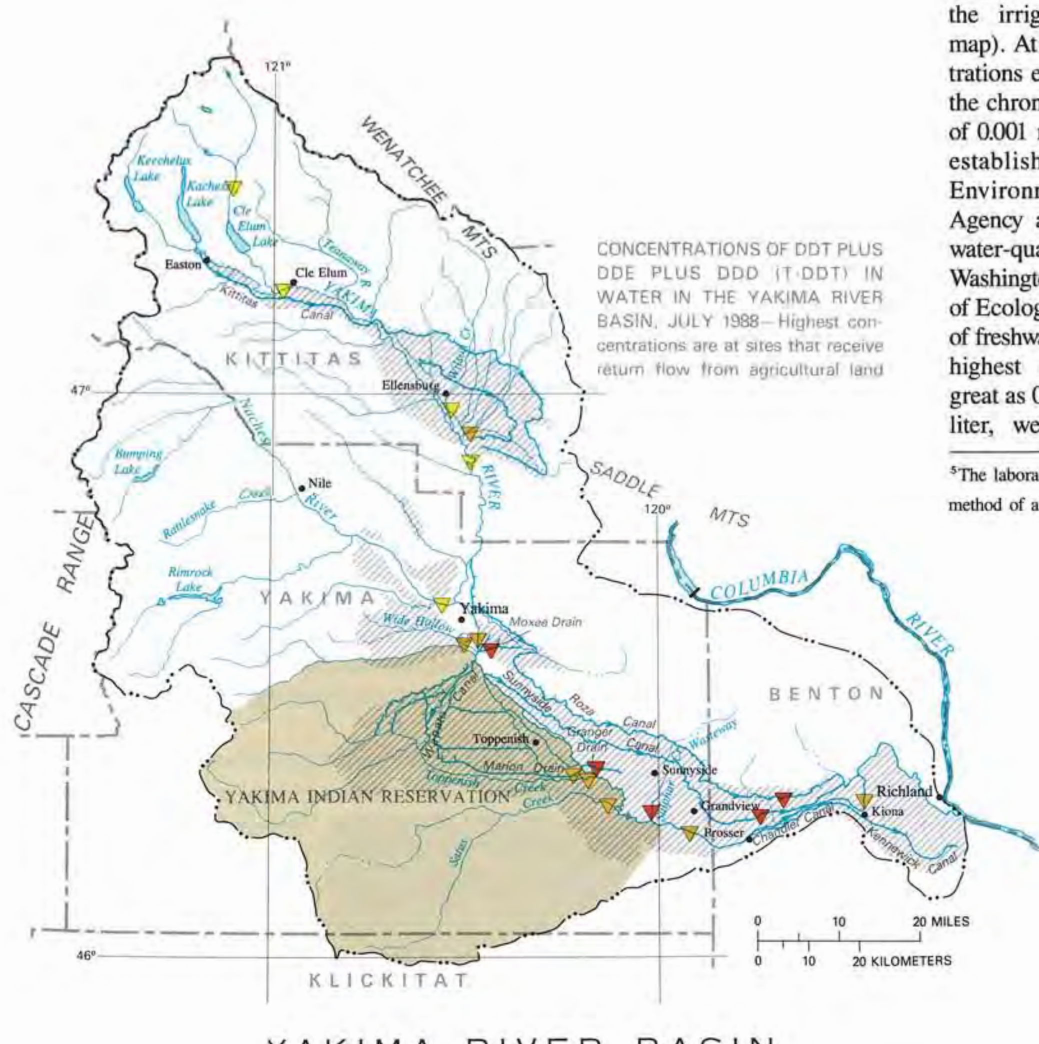
IS DDT CONTAMI
IN THE YAKI

IS DDT IN THE STREAMS? HOW WIDESPREAD IS IT?

In July 1988, DDT and its breakdown products [Total DDT (T-DDT) = DDT + DDE + DDD] were detected in water at 13 of the 18 sites (about 72 percent) sampled in the main stem and tributaries of the Yakima River during the irrigation season (see map). At all 13 sites, concentrations equaled or exceeded the chronic-toxicity criterion of 0.001 microgram per liter established by the U.S. Environmental Protection Agency and adopted as the water-quality standard by the Washington State Department of Ecology for the protection of freshwater aquatic life. The highest concentrations, as great as 0.120 microgram per liter, were in agricultural-return flows. The lowest concentrations of T-DDT in stream water in July 1988 were in the forested headwaters of the basin. These concentrations were below the chronic-toxicity criterion and the laboratory-reporting level.[5]

In July 1988, T-DDT concentrations in water in the main stem of the Yakima River varied from place to place. The highest concentrations were in the lower 110 miles of the river where the basin is farmed intensively and where main-stem flow is dominated by return flow from agricultural land. Because of diversions for irrigation, main-stem flow provides minimal dilution of

[5] The laboratory reporting level is the lowest reliable concentration for a particul method of analysis that is reported by the laboratory.



CONCENTRATIONS OF DDT PLUS DDE PLUS DDD (T-DDT) IN WATER IN THE YAKIMA RIVER BASIN, JULY 1988—Highest concentrations are at sites that receive return flow from agricultural land

YAKIMA RIVER BASIN

EXPLANATION

IRRIGATED AREA

YAKIMA INDIAN RESERVATION

BOUNDARY OF DRAINAGE BASIN

CANAL—Arrow indicates direction of flow

CONCENTRATIONS OF DDT PLUS DDE PLUS DDD (T-DDT), IN MICROGRAMS PER LITER—The chronic-toxicity criterion for T-DDT established by the U.S. Environmental Protection Agency for the protection of freshwater aquatic life is 0.001 microgram per liter

- None detected
- 0.001 to 0.01
- Greater than 0.01

contaminants from the relatively large return flows from agricultural land. Concentrations near the mouth of the river at Kiona were not as high as those sampled in the river where tributaries that carry agricultural-return flow enter the main stem, probably because of dilution and the settling out of T-DDT associated with the sediment.

Concentrations of T-DDT were high in streambed sediment at sites that received return flows from agricultural land. Samples collected in Wide Hollow Creek during 1987–90 showed a maximum concentration of 2.[illegible] micrograms of T-DDT per gram of streambed sediment.

DO CONCENTRATIONS OF T-DDT VARY DURING THE YEAR?

Throughout 1988–89, T-DDT concentrations exceeded the chronic-toxicity criterion for the protection of freshwater aquatic life in several agricultural-return flows (Moxee Drain, Wide Hollow Creek, Granger Drain, and Sulphur Creek Wasteway). The concentrations ranged from 0.003 to 0.120 microgram per liter. Concentrations were highest during peak irrigation and heavy rainfall in the agricultural areas. Although lower than those of the agricultural-return flows, concentrations in the Yakima River at Kiona equaled or exceeded the chronic-toxicity criterion in 9 of 10 samples that were collected year-round in 1988–89.

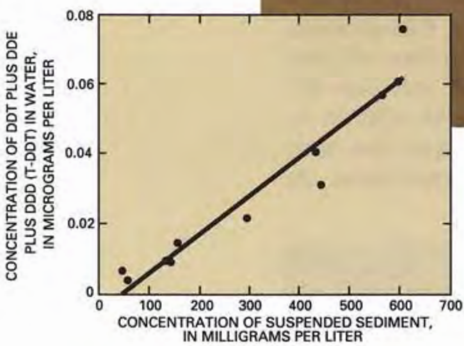
RIDGE AND FURROW IRRIGATION PROMOTES SURFACE RUNOFF OF AGRICULTURAL SOILS TO THE STREAMS.

WHAT IS THE SOURCE OF T-DDT IN STREAMS?

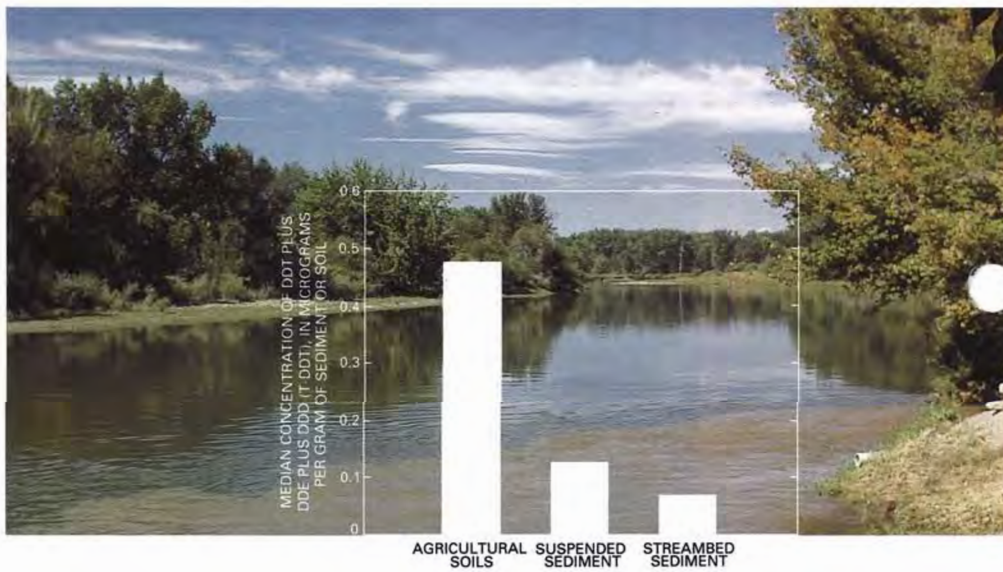
Are elevated concentrations of T-DDT in streams a vestige from the past or is T-DDT presently entering streams? Analyses of water samples collected from May 1988 through December 1989 indicate that runoff of agricultural soils is a near-continuous source of T-DDT to the Yakima River. During peak irrigation and periods of heavy rainfall, contaminated agricultural soils erode from fields into the streams. Some of this soil remains suspended in the water. The amount of T-DDT in the water is directly related to the amount of suspended sediment (see graph). A portion of the suspended particles settles out and carries some T-DDT to the stream bottom. Some T-DDT dissolves in the water. Dissolved T-DDT is released directly from suspended and streambed sediment. Some T-DDT also dissolves in runoff that enters streams from agricultural land.

Analyses of a few samples of agricultural soils show that concentrations of T-DDT are about four times higher than concentrations of T-DDT in the suspended sediment in the water and streambed sediment (see bar chart). Apparently, soil eroded from agricultural land is the major source of T-DDT in streams. Because of the large reservoir of T-DDT in agricultural soils, the compounds are likely to be present in stream water and stream sediment for many decades.

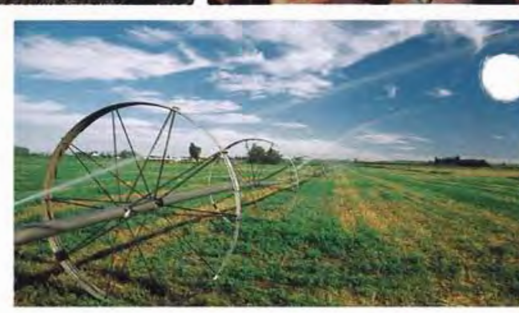
TURBID STREAM WATER AT THE JUNCTION OF GRANGER DRAIN AND THE YAKIMA RIVER, WHICH RESULTS FROM SURFACE RUNOFF OF AGRICULTURAL SOILS DURING PEAK IRRIGATION AND PERIODS OF HEAVY RAINFALL.



CONCENTRATIONS OF SUSPENDED SEDIMENT AND DDT PLUS DDE PLUS DDD (T-DDT) IN WATER IN MOXEE DRAIN, 1988-89–The amount of T-DDT in the water is directly related to the amount of suspended sediment in the water

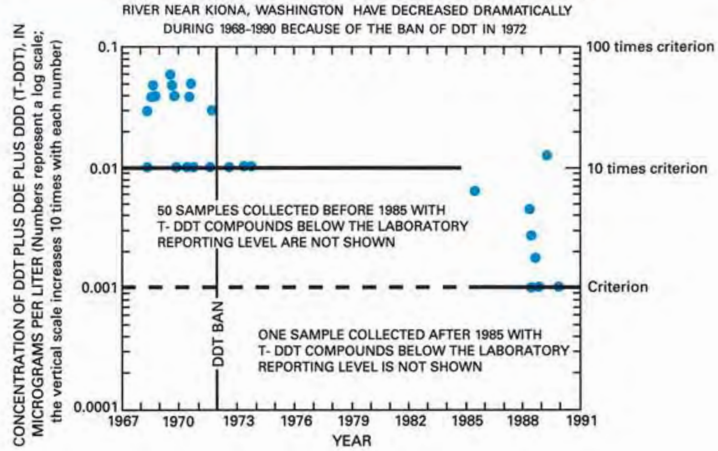


CONCENTRATIONS OF DDT PLUS DDE PLUS DDD (T-DDT) IN AGRICULTURAL SOILS ARE AT LEAST FOUR TIMES HIGHER THAN THOSE IN SUSPENDED AND STREAMBED SEDIMENT–Each bar represents a median; the number of samples with concentrations above the "median concentration" equals the number of samples with concentrations below it



Concentrations of T-DDT in the Yakima River have decreased since the ban on DDT in 1972. Concentrations in the main stem at Kiona decreased from about 0.06 microgram per liter in 1969 to generally less than 0.01 microgram per liter in 1990 (see graph). However, the 1990 level is still as much as 10 times higher than the chronic-toxicity criterion for the protection of freshwater aquatic life established by the U.S. Environmental Protection Agency. The long-term decrease in concentrations of T-DDT in stream water results, in part, from decreased concentrations of T-DDT in agricultural soils. In addition, the decrease in concentrations of T-DDT in stream water probably is a consequence of reduced soil erosion from agricultural fields and less suspended sediment. Over the past 20–30 years, erosion of soils in the Yakima River Basin has been reduced because (1) irrigation practices have changed (from less use of ridge and furrow irrigation to more use of sprinkler and drip irrigation), (2) cropping patterns have changed (fewer acres are used to grow row crops, such as sugar beets, potatoes, corn, and beans, and more acres are used to grow permanent crops, such as apples, pears, and grapes), and (3) cover crops of grasses and grains have been planted in orchards and vineyards. Data for T-DDT in soils or suspended sediment in the early 1970's are not available to confirm the relations. Long-term trends in T-DDT concentrations at other sites in the Yakima River and in agricultural-return flows are unknown because historical data are lacking.

CONCENTRATIONS OF DDT PLUS DDE PLUS DDD (T-DDT) IN THE YAKIMA RIVER NEAR KIONA, WASHINGTON HAVE DECREASED DRAMATICALLY DURING 1968-1990 BECAUSE OF THE BAN OF DDT IN 1972



EXPLANATION

— LABORATORY REPORTING LEVEL–The laboratory reporting level is the lowest reliable concentration for a particular method of analysis. As methods improve, the reporting level is lowered, such as in 1985

– – CHRONIC-TOXICITY CRITERION FOR T-DDT–Established by the U.S. Environmental Protection Agency for protection of freshwater aquatic life

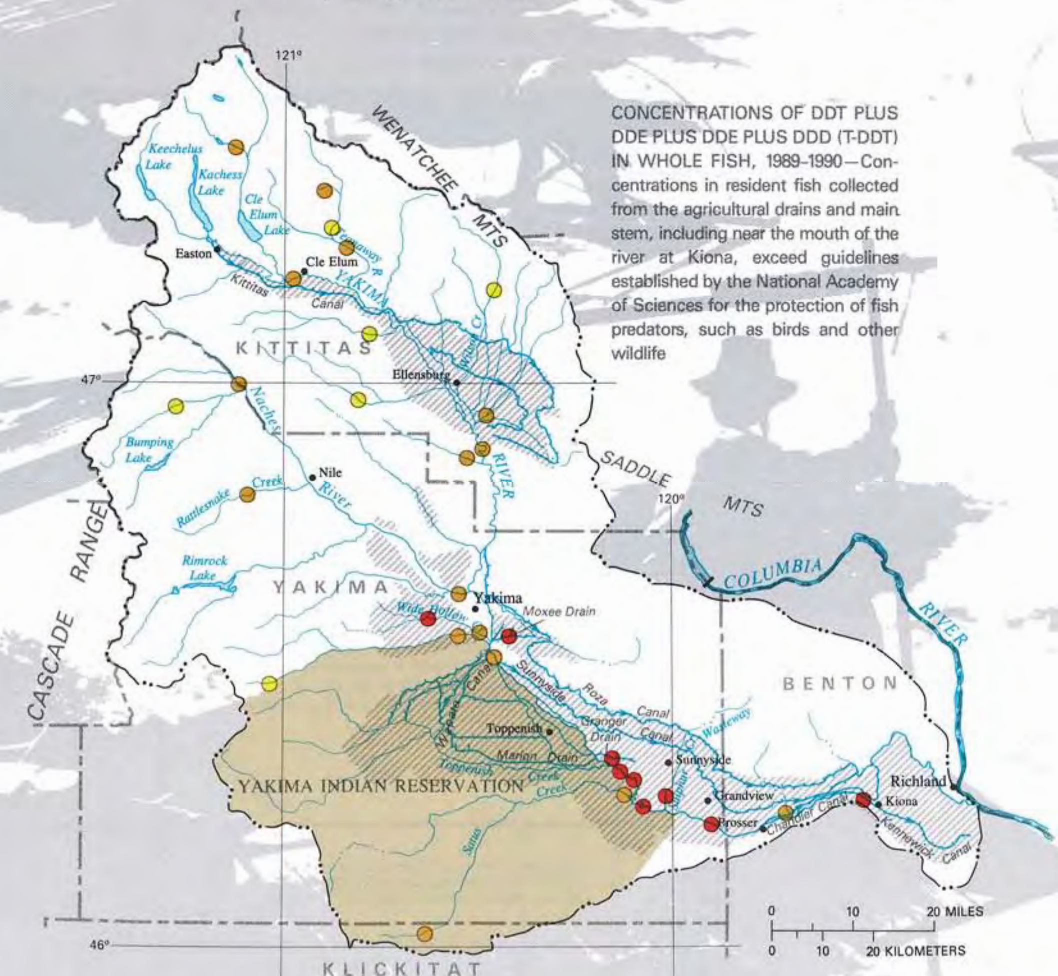
● CONCENTRATIONS OF T-DDT AT OR ABOVE THE LABORATORY REPORTING LEVEL

IS DDT CONTA IN THE YAKIMA

WHAT IS THE SOURCE OF DDT IN FISH?

Fish acquire some DDT and its breakdown products [Total DDT (T-DDT) = DDT + DDE + DDD] through uptake in food, by feeding on, for example, stream invertebrates or smaller fish that have fed on contaminated plants. Fish also accumulate T-DDT directly from water passing over their gills. T-DDT is stored in the fatty tissue of the fish and is not readily metabolized (broken down). The accumulation of T-DDT depends, in part, on fat content—fish with a low fat content do not accumulate as much T-DDT as fish with a high fat content—and, in part, on age, sex, species, and availability of food.

PREPARATION OF MOUNTAIN WHITEFISH FOR TISSUE ANALYSIS.



CONCENTRATIONS OF DDT PLUS DDE PLUS DDE PLUS DDD (T-DDT) IN WHOLE FISH, 1989-1990—Concentrations in resident fish collected from the agricultural drains and main stem, including near the mouth of the river at Kiona, exceed guidelines established by the National Academy of Sciences for the protection of fish predators, such as birds and other wildlife

YAKIMA RIVER BASIN

EXPLANATION

- IRRIGATED AREA
- YAKIMA INDIAN RESERVATION
- BOUNDARY OF DRAINAGE BASIN
- CANAL—Arrow indicates direction of flow

CONCENTRATIONS OF DDT PLUS DDE PLUS DDD (T-DDT) IN MICROGRAMS PER GRAM, WET WEIGHT—The National Academy of Sciences guideline to protect fish predators equals 1 microgram of T-DDT per gram of whole fish, wet weight

- Less than 0.01
- 0.01 to 1
- Greater than 1

YAKIMA INDIANS COLLECTING FISH NEAR UMTANUM, WASHINGTON, FOR MEASUREMENT AND ANALYSIS OF RESIDENT FISH POPULATIONS IN THE YAKIMA RIVER.

MINATING FISH RIVER BASIN?

The Yakima River supports a complex web of human activities and fishery and wildlife needs that depend on a healthy river system. Man requires high-quality water for drinking and recreation, and ample quantities for irrigation and industry. The river also provides habitat for (1) wildlife that live and feed along the banks, (2) fish that reside in or migrate to and from the basin, and (3) millions of microscopic aquatic organisms at the bottom of the food chain. Water is the link to life, and we need to continue daily efforts to sustain a healthy river system, while we efficiently meet our water needs.

Mike Llewelyn, Olympia, Washington
Washington State Department of Ecology

U.S. GEOLOGICAL SURVEY HYDROLOGISTS COLLECTING FISH SAMPLES FOR TISSUE ANALYSIS FROM RATTLESNAKE CREEK NEAR NILE, WASHINGTON.

ARE CONCENTRATIONS OF T-DDT DETECTABLE IN FISH THROUGHOUT THE BASIN?

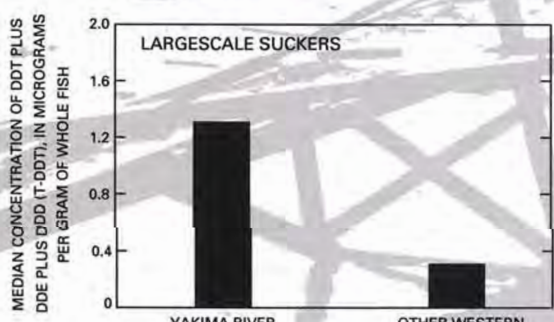
Samples of resident fish collected in 1989–90 at 31 sites in the basin, including pristine headwater sites, show that T-DDT is detectable in fish throughout most of the basin.[6] Concentrations of T-DDT are lowest (less than or equal to 0.01 microgram of T-DDT per gram of whole fish, wet weight) in species that reside in the headwaters, such as rainbow trout. Concentrations are highest (a maximum of 4.8 micrograms of T-DDT per gram of whole fish, wet weight) in species that reside in agricultural-return flows and in the lower 110 miles of the Yakima River where main-stem flow is dominated by agricultural-return flow, such as largescale suckers, mountain whitefish, bridgelip suckers, and chiselmouth. Concentrations in fish collected from agricultural-return flows and the main stem in the lower valley, including near the mouth of the river at Kiona, exceeded guidelines established by the National Academy of Sciences for the protection of fish predators (1 microgram of T-DDT per gram of whole fish, wet weight).

Data collected by the U.S. Geological Survey in 1989-90 do not include fish samples for T-DDT in migrating salmon and steelhead trout in the Yakima River Basin. Previous studies (1985) by the Washington State Department of Ecology indicate that concentrations of T-DDT were substantially lower in young, ocean-bound salmon and steelhead trout than in the adults of resident species, such as largescale suckers. Downstream migrating spring salmon and steelhead smolts (young fish) intercepted at Prosser had concentrations of 0.57 and 0.10 microgram of T-DDT per gram of whole fish, respectively. These concentrations fall in the middle to lower range of those observed in resident fish in the basin and below the recommended maximum guideline for the protection of fish predators.

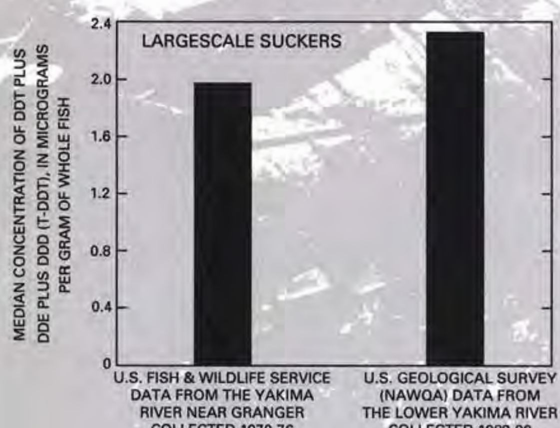
[6] All analyses of fish collected by the U.S. Geological Survey during 1989-90 were performed by a U.S. Fish and Wildlife Service contract laboratory.

HOW DO CONCENTRATIONS OF T-DDT IN FISH IN THE YAKIMA RIVER BASIN COMPARE WITH CONCENTRATIONS IN FISH IN OTHER STREAMS THROUGHOUT THE NATION?

Fish in the Yakima River Basin have among the highest concentrations of T-DDT in the Nation, as suggested by a comparison of this study with a national study of fish collected by the U.S. Fish and Wildlife Service at 112 stations in major rivers in 1984–85. The median concentration of T-DDT in largescale suckers collected in 1989-90 in the main stem and agricultural return-flows of the Yakima River Basin (about 1.3 micrograms of T-DDT per gram of whole fish) is greater than concentrations of T-DDT in fish collected by the U.S. Fish and Wildlife Service at 103 of the stations (more than 90 percent). Concentrations of T-DDT in largescale suckers in the main stem and agricultural return-flows in the basin are about four times higher than concentrations of T-DDT in largescale suckers in 13 other western streams sampled from 1970 to 1986 by the U.S. Fish and Wildlife Service (see bar chart). The highest average concentrations of T-DDT in the Nation were in fish collected in 1984-85 by the U.S. Fish and Wildlife Service from the Yazoo River in Mississippi (greater than 5 micrograms of T-DDT per gram of whole fish). Other concentrations of greater than 1 microgram of T-DDT per gram of whole fish (guideline for the protection of fish predators) were in fish from intensively farmed areas of the Arkansas and lower Colorado Rivers, the Rio Grande, and Lakes Michigan and Ontario.



CONCENTRATIONS OF DDT PLUS DDE PLUS DDD (T-DDT) IN LARGESCALE SUCKERS IN THE YAKIMA RIVER BASIN (NAWQA DATA) ARE ABOUT FOUR TIMES HIGHER THAN IN LARGESCALE SUCKERS IN THIRTEEN OTHER WESTERN STREAMS (U.S. FISH AND WILDLIFE SERVICE DATA)



CONCENTRATIONS OF DDT PLUS DDE PLUS DDD (T-DDT) IN LARGESCALE SUCKERS FROM 1970 THROUGH 1976 ARE SIMILAR TO THOSE OBSERVED IN 1989-90

Each bar of the graphs represents a median; the number of samples with concentrations above the "median concentration" equals the number of samples with concentrations below it. The National Academy of Sciences guideline to protect fish predators equals 1 microgram of T-DDT per gram of whole fish, wet weight

Nationwide, concentrations of DDT in freshwater fish are lower now than at any time since monitoring of organochlorine pesticides was initiated in the 1960's, in keeping with the removal of DDT from the marketplace. U. S. Geological Survey findings for the National Water-Quality Assessment of the Yakima River, which suggest relatively stable, high concentrations over the past decade, imply that the soils and sediments of the Yakima watershed harbor a sizeable mass of residual DDT.

Christopher J. Schmitt
U.S. Fish and Wildlife Service Contaminant Biomonitoring Program

ARE CONCENTRATIONS OF T-DDT CHANGING IN FISH?

Data collected at 112 stations in major rivers across the nation by the U.S. Fish and Wildlife Service in 1976 and 1984–85 indicate that concentrations of T-DDT in fish showed no significant changes at 91 stations, decreased at 20, and increased at 1. The concentrations in largescale suckers collected in the lower Yakima River by the U.S. Geological Survey in 1989–90 were similar to those collected near Granger in the lower Yakima River by the U.S. Fish and Wildlife Service from 1970 through 1976 (see bar chart). This similarity suggests that even though total concentrations of T-DDT in stream water have declined, the amount of T-DDT in the basin (including in the water, sediment, and invertebrates) remains high enough to maintain elevated concentrations in fish.

IMPLICATIONS OF FINDINGS ON MANAGEMENT OF DDT IN THE YAKIMA RIVER BASIN

It is important to understand that estimating risks from exposures to pollutants involves many uncertainties and assumptions. These uncertainties and assumptions span the entire development of risk predictions, ranging from determining the concentrations of pollutants in water and fish to estimating the levels of human exposure. The U.S. Environmental Protection Agency is encouraged by the apparent reduction in T-DDT concentrations in streams during the last 20 years. However, we are concerned that T-DDT residues are still present in fish. This concern stems from the knowledge that people are eating locally caught fish in the Yakima River

Basin, sometimes in substantial amounts. Therefore, we feel it is important to further control the inputs of T-DDT to streams in the basin through the efforts of farmers, soil conservation districts, and others to minimize soil erosion and irrigation water runoff.

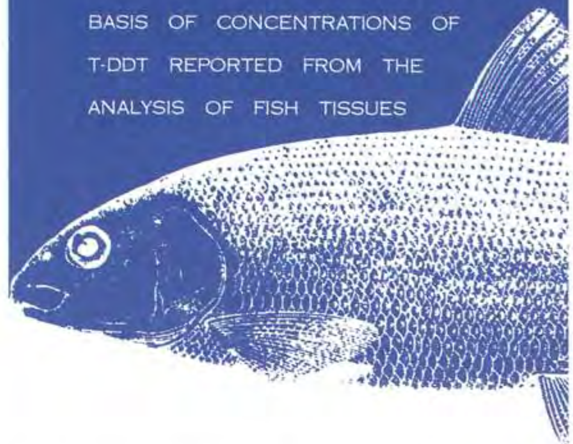
Charles E. Findley
U.S. Environmental Protection Agency, Region 10, Director, Water Division

Even though two decades have passed since its production and distribution was banned, DDT and its breakdown products [Total DDT (T-DDT) = DDT + DDE + DDD] are still widely dispersed in the environment. Concentrations of T-DDT remain elevated in agricultural soil, stream water, suspended and streambed sediment, and fish in the Yakima River Basin. Concentrations in water commonly exceed the chronic-toxicity criterion for the protection of freshwater aquatic life, which was established by the U.S. Environmental Protection Agency and adopted as the water-quality standard by the Washington State Department of Ecology. Concentrations of T-DDT in fish in the basin are among the highest in the Nation and commonly exceed the guideline for the protection of fish predators established by the National Academy of Sciences. Highest concentrations in water and fish occur in agricultural-return flows in the lower 110 river miles in the basin.

Are concentrations of T-DDT of concern relative to human health in the Yakima River Basin? Currently (1993), no standards for the protection of human health exist against which T-DDT concentrations in water or fish tissue can be compared. Preliminary and theoretical degrees of risk reflect the lifetime chance of contracting cancer from consumption of T-DDT in water or fish tissue. A "lifetime" generally is considered to be 70 years. Calculated risks are only theoretical estimates that provide guidance to agencies that regulate water quality or protect human health and information for identifying potential health concerns to researchers and the public. The risks are calculated on the basis of current understanding of the cancer-causing potency of T-DDT (extrapolated from U.S. Environmental Protection Agency studies of laboratory animals, primarily rats and mice). These calculations include some uncertainty and assumptions, including possible differences in toxicological response of humans and laboratory animals to T-DDT and are based on limited information on relevant factors, such as fish-consumption rates. A human-health impact analysis is being conducted by the Washington State Department of Health to assess if T-DDT concentrations reported in this study pose a health threat to people who consume fish from the Yakima River Basin.

I M P L I C

THE WASHINGTON STATE DEPARTMENT OF HEALTH HAS DETERMINED THAT A HUMAN-HEALTH IMPACT ANALYSIS SHOULD BE CONDUCTED TO DETERMINE IF CONCENTRATIONS OF T-DDT IN FISH IN THE YAKIMA RIVER BASIN POSE A THREAT TO HUMAN HEALTH. THIS DETERMINATION WAS MADE ON THE BASIS OF CONCENTRATIONS OF T-DDT REPORTED FROM THE ANALYSIS OF FISH TISSUES



WHAT DO THESE FINDINGS MEAN TO PEOPLE WHO DRINK THE WATER?

In June 1989, treated Naches River water from the city of Yakima Treatment Plant was sampled; no data were available for treated river water at Cle Elum. The concentration of T-DDT in the drinking-water supply was 0.00036 microgram of T-DDT per liter. Daily consumption of 2 quarts of city of Yakima drinking water by a 150-pound person over a 70-year lifetime corresponds to an incremental increase in cancer risk of about 4 per 1 billion people (see inset on human risks). T-DDT concentrations are low in the drinking-water supply because the intake is located upstream from intense agriculture and because the treatment process used by the facility removes most of the sediment and, thus, most of the T-DDT associated with the sediment.

RESIDENTS ENJOYING THE BEAUTY AND EXCITEMENT OF THE YAKIMA RIVER.

WHAT DO THESE FINDINGS ME..N

Samples of resident fish collected in 1989–90 in the Yakima River Basin show that T-DDT is detectable in fish throughout most of the basin. Concentrations of T-DDT in all fish collected in 1989–90 are below an action level of 5 micrograms of T-DDT per gram of food that has been established by the Food and Drug Administration to regulate concentrations in human food and animal feed sold to the public. The action level represents the limit at which the Food and Drug Administration can remove products from the market. Action levels do not apply to consumers of noncommercial, locally caught fish, such as sport fishermen and their families.

Concentrations of T-DDT are lowest (about 0.01 microgram of T-DDT per gram of whole fish, or an estimated concentration of about 0.008 microgram of T-DDT per gram of fish filet[7]) in species that reside in the near-pristine forested headwaters, such as rainbow trout from the Teanaway River. Consumption of one 5-ounce serving of rainbow trout per week over a 70-year lifetime corresponds to an incremental increase in cancer risk of about 1 per 1 million people (see inset, on human risks).

Concentrations of T-DDT are highest in species that reside in agricultural-return flows and in the lower 110 miles of the Yakima River, such as largescale suckers and mountain whitefish. Human-health risks associated with ingestion of T-DDT in fish in the lower 110 miles of the Yakima River are, there[illegible], higher than those asso[illegible]d with ingestion of T-DDT in

IN THE NATIONAL WATER-QUALITY ASSESSMENT STUDY AND RESULTS OF PRELIMINARY RISK-ASSESSMENT CALCULATIONS. THE WASHINGTON STATE DEPARTMENT OF HEALTH CURRENTLY (1993) IS WORKING ON THIS PROJECT AND WILL BE ISSUING A SEPARATE PUBLIC-HEALTH STATEMENT ON THE HEALTH EFFECTS THAT MAY RESULT FROM CONSUMPTION OF FISH IN THE YAKIMA RIVER BASIN.

GLEN PATRICK
WASHINGTON STATE DEPARTMENT OF HEALTH

T… PEOPLE WHO EAT THE FISH?

fish from the headwaters of the basin. The highest concentration of T-DDT in Yakima fish occurred in Sulphur Creek Wasteway (4.8 micrograms of T-DDT per gram of whole fish or an estimated 2.6 micrograms of T-DDT per gram of filet). The incremental increase in cancer risk associated with this concentration is 250 per 1 million people. Concentrations of T-DDT in mountain whitefish and large-scale suckers near the mouth of the Yakima River at Kiona ranged from 1.7 to 2.8 micrograms of T-DDT per gram of whole fish, or an estimated average concentration of 1.4 micrograms of T-DDT per gram of fish filet. Consumption of one 5-ounce serving of mountain whitefish or largescale sucker fr… the lower Yakima River pe… week over a 70-year lifetime corresponds to an incremental increase in cancer risk of about 130 per 1 million people.

Human-health risks associated with ingestion of T-DDT in fish in the Naches River are higher than those associated with ingestion of treated Naches River water from the city of Yakima Treatment Plant. The concentration of T-DDT in mountain whitefish from the mouth of the Naches River was 0.75 microgram of T-DDT per gram of whole fish, or an estimated concentration of about 0.60 microgram of T-DDT per gram of fish filet. Consumption of one 5-ounce serving of mountain whitefish from the Naches River per week over a 70-year lifetime corresponds to an incremental increase in cancer risk of about 60 per 1 million people (see inset on human risks).

[7]Concentrations in fish filets are less than concentrations in whole fish because fat is less in filets than in whole fish and T-DDT is stored mostly in the fat. Relative concentrations in fish filets are estimated from data collected by the Washington State Department of Ecology in 1983. Analyses for fish filets collected in October 1991 by the U.S. Geological Survey are not expected to be complete until 1993.

ESTIMATED RISKS ASSOCIATED WITH SELECTED HUMAN ACTIVITIES

Lifetime Chance of Death (50 years)[8]

Motor vehicle accident	17,000 in 1 million
Drowning	2,500 in 1 million
Fire	2,000 in 1 million
Electrocution	370 in 1 million
Lightning	35 in 1 million

Lifetime Chance of Contracting Cancer (70 years)

Cigarette smoking[8]	80,000 in 1 million
Air pollution[8]	1,000 in 1 million
Five ounces of largescale sucker from Sulphur Creek Wasteway per week	250 in 1 million[9]
Five ounces of mountain whitefish from the Yakima River at Kiona per week	130 in 1 million[9]
One-half gallon whole milk per week[8]	100 in 1 million
Two ounces of peanut butter per week[8]	80 in 1 million
Five ounces of mountain whitefish from the mouth of the Naches River per week	60 in 1 million[9]
Five ounces of rainbow trout from the Teanaway River per week	1 in 1 million[9]
Two quarts of city of Yakima drinking water per day	0.004 in 1 million[10]

[8]Crouch, E. A., and Wilson, R., 1984, [in] Rodricks, J., and Tardiff, R., eds., Assessment and Management of Chemical Risks: American Chemical Society, Washington D.C.

[9]Number represents risk associated with T-DDT only. Additional contaminants (such as other organic compounds or trace elements) might be associated with fish in the Yakima River Basin that increase human-health risks.

[10]Equal to 4 in 1 billion.

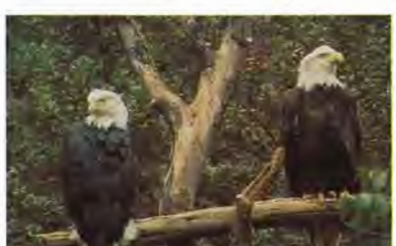
TROUT FISHERMAN IN THE YAKIMA RIVER.

DURING A STUDY IN 1986 AND 1987, THE U.S. FISH AND WILDLIFE SERVICE, IN COOPERATION WITH THE ARMY CORPS OF ENGINEERS, FOUND HIGH CONCENTRATIONS OF DDE AND PCBS IN BALD EAGLE EGGS FROM NESTS ALONG THE COLUMBIA RIVER. THE HIGH CONCENTRATIONS OF DDE WERE FOUND TO BE ASSOCIATED WITH SIGNIFICANT EGGSHELL THINNING AND POOR REPRODUCTIVE SUCCESS OF BALD EAGLES NESTING ALONG THE RIVER. PRODUCTIVITY LEVELS OF EAGLES FROM THE COLUMBIA RIVER DURING 1987–91 WERE 30 TO MORE THAN 50 PERCENT LOWER THAN LEVELS FOUND IN STATEWIDE SURVEYS OF EAGLES NESTING IN OREGON AND WASHINGTON. WHILE PRODUCTIVITY LEVELS OF EAGLES ALONG THE COLUMBIA RIVER ARE VERY LOW, LEVELS OF NESTING POPULATIONS IN THE TWO STATES ARE NEARING SOME OF THE RECOVERY GUIDELINES REQUIRED TO REMOVE THE SPECIES FROM THE ENDANGERED SPECIES LIST.

MARVIN L. PLENERT, REGIONAL DIRECTOR, REGION 1,
U.S. FISH AND WILDLIFE SERVICE

DOES T-DDT AFFECT FISH PREDATORS?

Concentrations of T-DDT in fish collected from agricultural-return flows and the main stem of the Yakima River, including near the mouth at Kiona, exceed guidelines (1 microgram of T-DDT per gram of whole fish) established by the National Academy of Sciences for the protection of fish predators, such as the bald eagle. Information is not available on concentrations of T-DDT in fish predators that reside in the Yakima River Basin. Recent studies by the U.S. Fish and Wildlife Service, however, show elevated concentrations of DDE in bald eagle eggs from birds that nest near the mouth of the Columbia River. The Yakima River, which is located about 300 miles above the mouth of the Columbia River, is one of several sources in Washington and Oregon that are contributors of T-DDT to the Columbia River.



Water-quality improvement is a high priority goal of the USDA Soil Conservation Service. With the technical potential to achieve "zero" return flows from irrigated agriculture, we can significantly reduce both sediment-borne and in-solution contamination of surface water. This is especially true of DDT and its breakdown products, DDE and DDD.

Lynn A. Brown, State Conservationist, Soil Conservation Service

EROSION CONTROL PROGRAMS, INCLUDING MULCHING FURROWS WITH STRAW, USING SPRINKLER AND DRIP IRRIGATION, AND PLANTING COVER CROPS OF GRASSES IN ORCHARDS, HAVE BEEN IMPLEMENTED BY FARMERS IN THE YAKIMA RIVER BASIN.

WILL T-DDT CONTAMINATION IN STREAMS AND FISH IN THE YAKIMA RIVER BASIN CONTINUE?

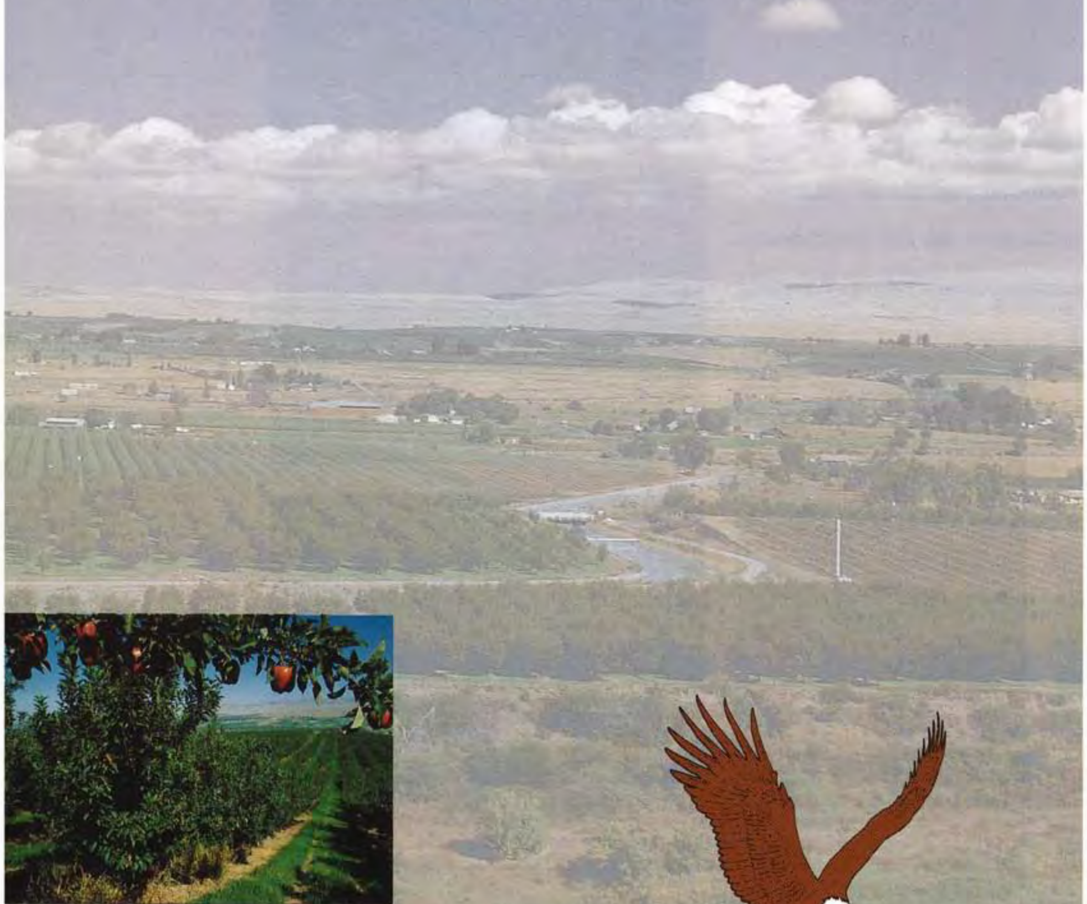
T-DDT contamination of streams and fish is an ongoing process, in part, because contaminated soils are eroded during the irrigation season and periods of heavy rainfall in agricultural areas. The presence of T-DDT in agricultural soils is attributed to historic applications and to the persistent chemical makeup of the compounds. Information to assess the environmental persistence and fate of DDT and its breakdown products in the agricultural soils in the Yakima River Basin is insufficient; the amount of time it takes for DDT compounds to break down in the soils depends on environmental conditions, soil type, and many complex chemical processes.[11] It is, therefore, difficult to quantify when T-DDT contamination in the streams and fish in the Yakima River Basin will subside or end. Results of this study indicate, however, that chemical breakdown of T-DDT is slow because, despite the ban on the production and distribution of DDT in 1972, concentrations of T-DDT in the Yakima River near Kiona commonly exceeded the chronic-toxicity criterion for the protection of freshwater aquatic life between 1972 and 1990. The contaminated agricultural soils could, therefore, provide a large and long-term reservoir of T-DDT to streams and fish in the Yakima River Basin for decades to come.

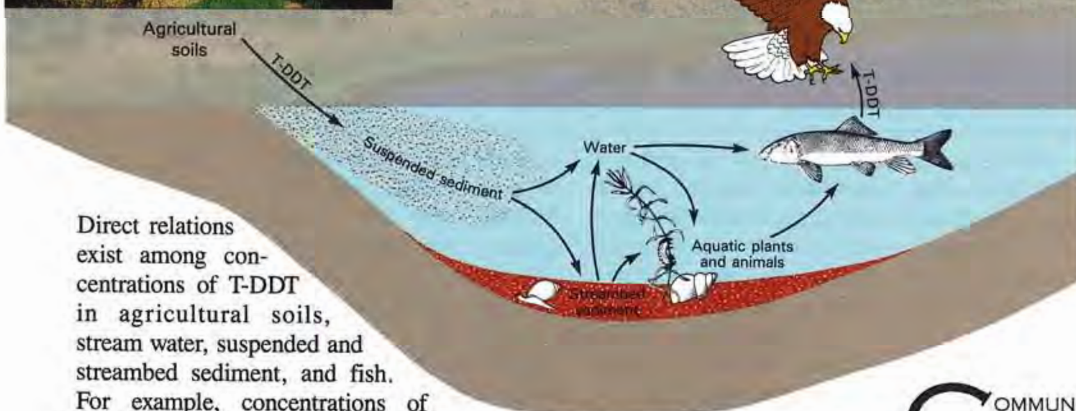
Federal, State, Tribal, and local programs have been implemented in the basin to reduce erosion of contaminated soils, thereby reducing the amount of T-DDT that enters streams. Over the past 20–30 years, erosion has been reduced because irrigation practices and cropping patterns have changed and cover crops of grasses and grains have been planted in orchards and vineyards. Erosion-control programs implemented in the basin within the last 10 years include mulching furrows with straw and irrigating with underground drip units. These newest methods help maintain adequate soil moisture and help promote less tillage and surface runoff. The erosion-control programs, which have been provided with technical and cost assistance from local Conservation Districts, the Agricultural Stabilization and Conservation Service, and the Soil Conservation Service, have been implemented by farmers. Such programs will help reduce the amounts of suspended sediment and T-DDT that enter streams.

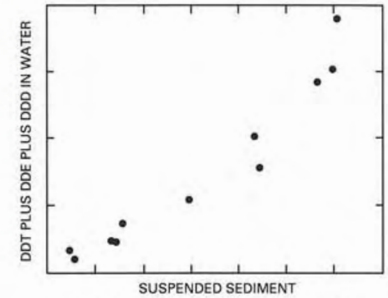
[11]Callahan, M. and others, Water-related environmental fate of 129 priority pollutants: U.S. Environmental Protection Agency Report 440/4-79-029a, v. 1.

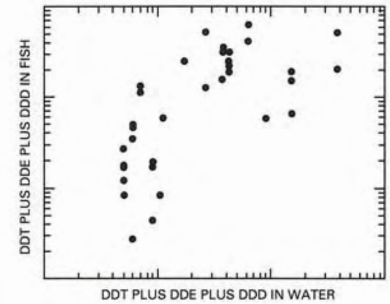
IMPLICATIONS

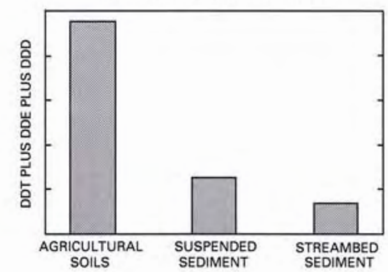
IMPLICATIONS OF FINDINGS ON SAMPLING AND RESEARCH STRATEGIES

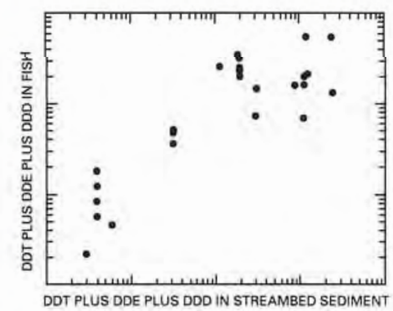












Direct relations exist among concentrations of T-DDT in agricultural soils, stream water, suspended and streambed sediment, and fish. For example, concentrations of T-DDT in stream water are directly related to concentrations of suspended sediment in the water, and those in fish are correlated with concentrations in stream water and sediment. These relations imply that knowledge of concentrations of T-DDT in one medium provides an estimate of concentrations in other media. For example, analyses of streambed sediment might be used to estimate relative accumulation in fish. Such relations can be useful for optimizing resources required for monitoring T-DDT in the Yakima and other river basins.

The continuous replenishment and widespread dispersal of T-DDT among different media in the Yakima River Basin has raised concern by researchers of many disciplines (fish biologists, health scientists, soil scientists, water-resource managers, and hydrologists). Coordination and cooperation among agencies and organizations at all levels are essential to implement and maintain an effective program to assess where T-DDT occurs and to determine the sources in the Yakima River Basin.

COMMUNICATION AND COORDINATION AMONG THE U.S. GEOLOGICAL SURVEY AND OTHER INTERESTED SCIENTISTS AND WATER-MANAGEMENT PERSONNEL ARE IMPORTANT COMPONENTS OF THE NATIONAL WATER-QUALITY ASSESSMENT PROGRAM. TO MAKE BEST USE OF THE RESOURCES AVAILABLE, WE ARE COMMITTED TO FOSTER INFORMATION EXCHANGE AND COOPERATION AMONG ALL RELEVANT AGENCIES THROUGH THE DURATION OF THIS LONG-TERM PROGRAM. EVERY LEVEL OF GOVERNMENT AND THE PRIVATE SECTOR HAS A ROLE TO PLAY.

PHILIP COHEN, CHIEF HYDROLOGIST, WATER RESOURCES DIVISION, U.S. GEOLOGICAL SURVEY

A COORDINATED EFFORT

Coordination among agencies and organizations at all levels is essential to understanding the distribution and variability of T-DDT in the Yakima River Basin. This publication was coordinated with the following Federal, State, Tribal, and local agencies and non-profit organizations. These organizations also provide reports on many aspects of the Yakima River Basin, including the distribution of surface water, chemical quality of the water, biological studies, and general water resources. General information on water resources can be obtained by writing to:

FEDERAL ORGANIZATIONS

U.S. Army Corps of Engineers		
North Pacific Division	P.O. Box 2870 Portland, OR 97208-2870	503-326-3736
U.S. Department of Agriculture		
Forest Service	301 Yakima St., P.O. Box 811 Wenatchee, WA 98807-0811	509-662-4335
Soil Conservation Service	1606 Perry St., Suite F Yakima, WA 98902	509-454-5736
U.S. Department of Energy		
Bonneville Power Administration Public Information Center	P.O. Box 12999 Portland, OR 97212	800-622-4519
U.S. Department of the Interior		
Bureau of Indian Affairs	P.O. Box 632, Fort R Toppenish, WA 98948	509-865-2255
Bureau of Reclamation	1150 N. Curtis Rd., Mail Code 140 Boise, ID 83706-1234	208-378-5020
Fish and Wildlife Service	3704 Griffin Lane, SE. Suite 102 Olympia, WA 98501	206-753-9440
Geological Survey	1201 Pacific Avenue Suite 600 Tacoma, WA 98402	206-593-6510
U.S. Environmental Protection Agency, Region 10		
Water Division	1200 Sixth Avenue Seattle, WA 98101	206-553-8514

YAKIMA INDIAN NATION

Environmental Protection Program	P.O. Box 151 Toppenish, WA 98948	509-865-5121

WASHINGTON STATE AGENCIES

Department of Agriculture Pesticide Management	P.O. Box 42560 Olympia, WA 98504-2589	206-753-5064
Department of Ecology Public Disclosure	106 S. 6th Ave. Yakima, WA 98902-3387	509-454-7658
Department of Fisheries Habitat Management Div.	P.O. Box 43155 Olympia, WA 98504	206-753-6650
Department of Health Office of Toxic Substances	Airdustrial Center, Bldg. 4 P.O. Box 47825 Olympia, WA 98504	206-753-1930
Department of Natural Resources Photo and Map Sales	P.O. Box 47031 Olympia, WA 98504-7031	206-753-5338
Department of Wildlife	2802 Fruitvale Blvd. Yakima, WA 98902	509-575-2740

Much appreciation is extended to U.S. Geological Survey employees for their expertise in the production of illustrations by Leslie J. Robinson and James O. Whitmer; type composition by Shirlie A. McManus; and photography by David F. Usher.

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Gregory K. Scott, Nature Photos, Gilman, Wisconsin
Bureau of Reclamation
Central Washington Agricultural Museum
Columbia River Inter-Tribal Fish Commission
U.S. Fish and Wildlife Service
Yakima Valley Museum and Historical Society

LOCAL AND INTERSTATE AGENCIES, UNIVERSITIES, AND NONPROFIT ORGANIZATIONS

Benton Conservation District	618 8th St. Prosser, WA 99350	509-786-1923
Benton-Franklin Health District	800 W. Canal Dr. Kennewick, WA 99336	509-582-7761
Central Washington University	Chemistry Dept., Dean Hall Ellensburg, WA 98926	509-963-2811
Columbia River Intertribal Fish Commission	729 NE. Oregon, Suite 200 Portland, OR 97232	503-238-0667
Kittitas County Conservation District	P.O. Box 679 Ellensburg, WA 98926	509-925-5375
Kittitas County Health Department	507 N. Naneum Ellensburg, WA 98926	509-962-7515
Northwest Power Planning Council	851 6th Ave. SW., Suite 1100 Portland, OR 97204	503-222-5161
North Yakima Conservation District	1606 Perry St., Suite F Yakima, WA 98902	509-454-5736
South Yakima Conservation District	P.O. Box 230 Toppenish, WA 98948	509-865-4012
Washington State University at Prosser		
Irrigated Agricultural Research and Extension Center	Box 2953A Prosser, WA 99350	509-786-2226
Washington State University Cooperative Extension		
Benton County	1121 Dudley Ave. Prosser, WA 99350-1399	509-786-5609
Kittitas County	5th and Main, Room 217 Ellensburg, WA 98926-2887	509-962-7507
Yakima County	233 Courthouse Yakima, WA 98901	509-575-4242
Washington Water Research Center		
Washington State University	Pullman, WA 99164	509-335-5531
Yakima Health District	104 N. 1st St. Yakima, WA 98901	509-575-4265
Yakima River Basin Association of Irrigation Districts	P.O. Box 810 Sunnyside, WA 98944	509-837-5141
Yakima Valley Conference of Governments	6 S. 2nd St., Suite 605 Yakima, WA 98901	509-575-4372

Additional information on the National Water-Quality Assessment Program can be obtained by writing to:

Deputy Assistant Chief Hydrologist, NAWQA Program
U.S. Geological Survey
National Center, 12201 Sunrise Valley Drive, MS 413
Reston, Virginia 22092

Suggested Readings:

Hopkins, B.S., Clark, D.K., Schlender, M., and Stinson, M., 1985, Basic water monitoring program, fish tissue and sediment sampling for 1984: Washington State Department of Ecology, Water Quality Investigations Section, Report 85-7, 43 p.

Johnson, Arthur, Norton, Dale, and Yake, William, 1986, Occurrence and significance of DDT compounds and other contaminants in fish, water, and sediment from the Yakima River Basin: Washington State Department of Ecology, Water Quality Investigations Section, Report 86-5, 89 p.

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Schmitt, C.J., Zajicek, J.L., and Peterman, P.H., 1990, National contaminant biomonitoring program—Residues of organochlorine chemicals in U.S. freshwater fish, 1976–84: Archives of Environmental Contamination and Toxicology, v. 19, p. 748–781.

Smith, J.A., Witkowski, P.J., and Fusillo, T.V., 1988, Manmade organic compounds in the surface waters of the United States—A review of current understanding: U.S. Geological Survey Circular 1007, 92 p.

Woodwell, G. M., 1984, Broken eggshells: Science, v. 5, p. 115–117.

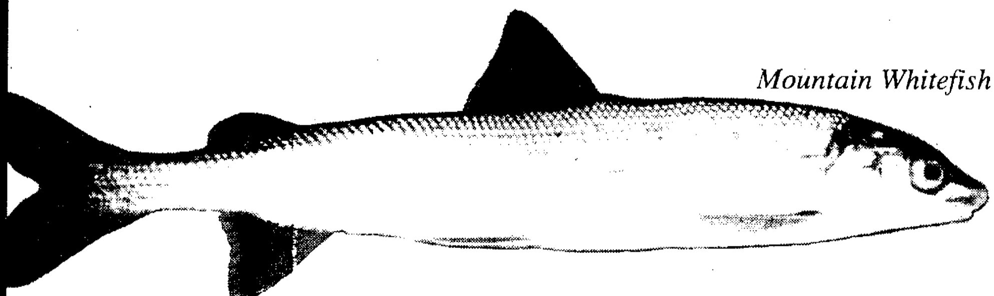
Rinella, Hamilton, and McKenzie—PERSISTENCE OF THE DDT PESTICIDE IN THE YAKIMA RIVER BASIN, WASHINGTON—U.S. Geological Survey Circular 1090

DDT
IN BOTTOM FISH FROM THE
YAKIMA RIVER

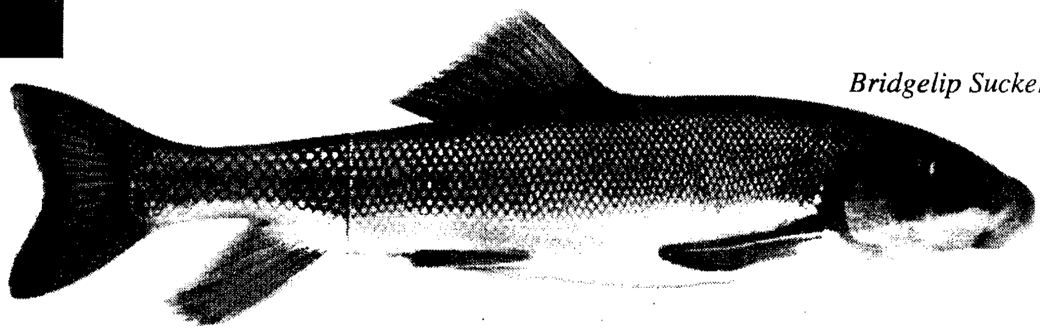
ABOUT DDT:

Starting in the 1940s, the pesticide DDT was widely used to control insects, especially in agriculture. DDT was banned in the United States in 1972. This toxic chemical is slow to breakdown and it persists in the environment today. People are exposed to DDT when they eat foods, such as fish, that have taken in DDT from the environment.

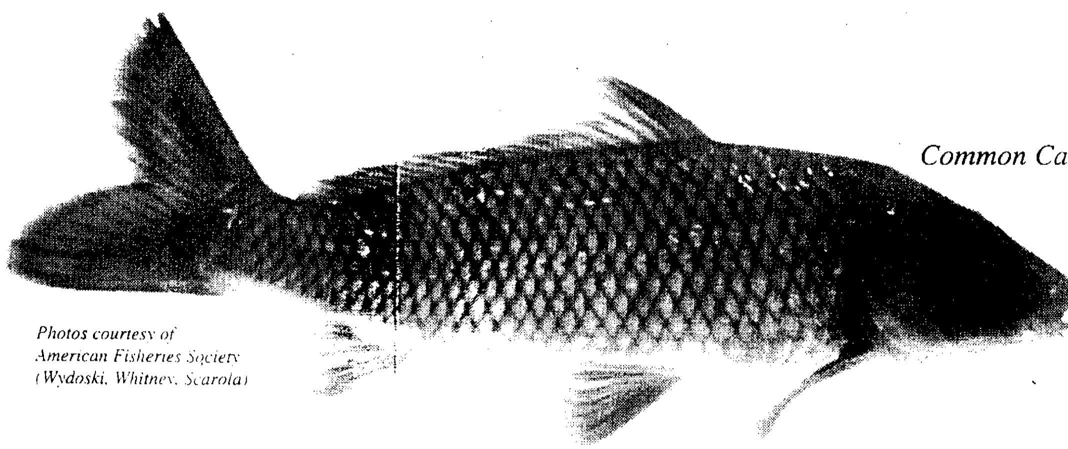
In this pamphlet the term DDT refers to the pesticide DDT plus its breakdown products DDE and DDD.



Mountain Whitefish



Bridgelip Sucker



Common Carp

Photos courtesy of American Fisheries Society (Wydoski, Whitney, Scarola)

FOR MORE INFORMATION CONTACT:

Yakima Health District
104 N. First Street
Yakima, WA 98901
1-800-535-5016

Kittitas County Health Department
507 Nanum
Ellensburg, WA 98926
(509) 962-7698

Benton-Franklin Health District
506 McKenzie
Richland, WA 99352
(509) 582-7761

Washington State Department of Health
Office of Toxic Substances
P.O. Box 47825
Olympia, WA 98504-7825

(360) 586-5403
1-800-525-0127 in Washington

RECOMMENDATION:

Eat fewer bottom fish.

DOH 12/95

DDT

is a pesticide that can be harmful to your health. DDT may be linked to breast cancer and problems with:

- the immune system
- the nervous system
- liver function.

A recent study found high levels of DDT in bottom fish in the Yakima River. DDT builds up in fat tissue. Bottom fish have more fat than other types of fish, and they take in more DDT because of where they feed.

RECOMMENDATIONS:

To reduce your exposure to the pesticide DDT, Washington State Department of Health recommends that you:

- Limit the amount of bottom fish you eat to one meal per week.
- Eat fish such as trout, instead of bottom feeding fish.
- Eat other protein foods, such as beans and rice.

IF YOU EAT BOTTOM FISH:

- Remove the fat along the belly and back of the fish before cooking.
- Do not eat the fish skin.
- Allow the fat to drip off during cooking. Barbeque or broil on a rack—avoid frying.

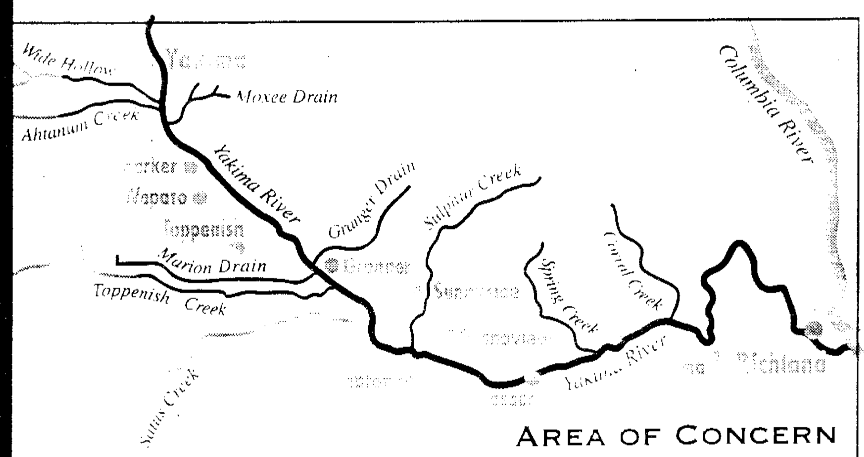
Background

The United States Geological Survey (USGS) studied the water quality in the Yakima River Basin between 1989 and 1991. A variety of fish from many locations along the river and its tributaries were collected as part of this project. Large scale sucker, bridgelip sucker, and mountain whitefish had the highest levels of the pesticide DDT.

USGS turned over the results of their study to the Washington State Department of Health. The Department evaluated how DDT might affect the health of people who eat these fish. It was determined that people who frequently eat bottom fish caught in Yakima River may suffer adverse health effects.

Area of Concern and Type of Fish

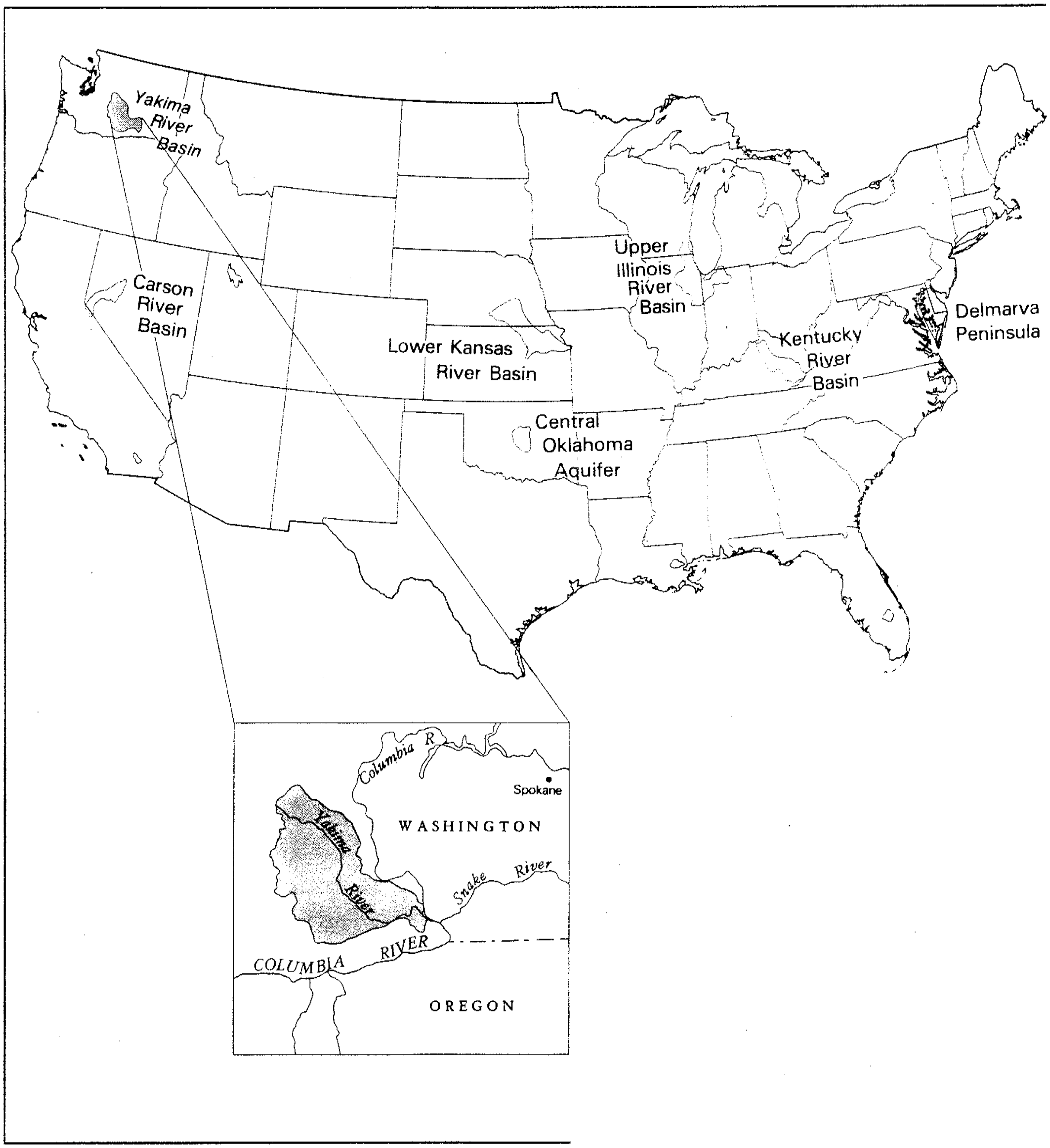
- **The lower Yakima River and agricultural drains, from the city of Yakima to the Columbia River.** Also, creeks and tributaries on the lower Yakima River near the area where they flow into the river.
- **Large scale sucker, bridgelip sucker, and mountain whitefish.** Other bottom fish, such as carp, channel catfish and squaw fish may also have high levels of DDT.



After careful study, the Department of Health makes these recommendations to ensure the safety of people who frequently eat bottom fish from the Yakima River. The Department plans to continue studying this issue by conducting a fish consumption survey in the lower Yakima River basin.

APPENDIX 15

SURFACE-WATER-QUALITY ASSESSMENT OF THE YAKIMA RIVER BASIN, WASHINGTON: PESTICIDE AND OTHER TRACE-ORGANIC-COMPOUND DATA FOR WATER, SEDIMENT, SOIL, AND AQUATIC BIOTA, 1987-91



U.S. GEOLOGICAL SURVEY
Open-File Report 92—644

NATIONAL WATER - QUALITY ASSESSMENT PROGRAM

APPENDIX 16

SURFACE-WATER-QUALITY ASSESSMENT OF THE YAKIMA RIVER BASIN, WASHINGTON: ANALYSIS OF AVAILABLE WATER-QUALITY DATA THROUGH 1985 WATER YEAR

U.S. GEOLOGICAL SURVEY
Open-File Report 91—453

NATIONAL WATER - QUALITY ASSESSMENT PROGRAM

APPENDIX 17

Sunday, March 1, 1998

Yakima Herald-Republi

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It runs through a river

Irrigators hope to clear up dirty water picture before drastic measures taken

By DAVID LESTER
Of the Herald-Republic

During the peak of each irrigation season, 200 tons of dirt wash into the Yakima River every day.

The sediment from irrigation drains and an accompanying cocktail of chemicals, bacteria and elevated temperatures continue to push endangered migratory fish closer to the brink. The river rarely approaches state standards for water quality.

Last week's proposed listing of mid-Columbia steelhead, including the Yakima run, as a threatened species adds to a growing drumbeat for dramatic change in the future use and protection of water. A re-allocation of water, with farmers taking a back seat in favor of instream flows for fish or strict limits on development, are two potential outcomes.

The questions are: Who will control the extent of change, and how it will come about?

In an unprecedented move, irrigators hope they have come up with at least one answer to avoid what observers have called the economic train wreck that is an endangered species listing.

"There are a lot of things going on that have come to bear in the last year or two and our board has said, 'Let's try to control our own destiny,'" said Jim Trull, manager of the Sunnyside Valley Irrigation District.

An umbrella organization created by the Sunnyside and Roza divisions is trying to do just that. Their Board of Joint Control is launching the largest coordinated effort ever to dramatically improve the quality of water in the lower Yakima River.

The two districts, which deliver irrigation water to 175,000 acres between Moxee and Whitstran, have adopted an innovative and aggressive water-quality improvement plan to have water leaving farms bound for the river meet state quality standards in five years.

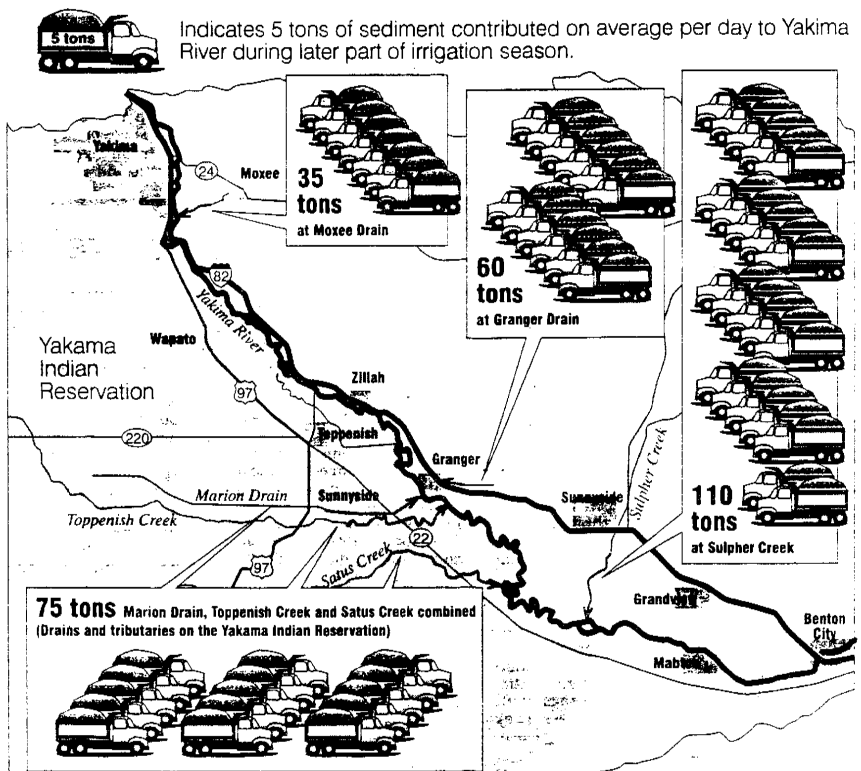
The plan focuses initially on the jointly operated drains and along irrigation canals, but pushes farmers to make on-farm improvements for better water quality.

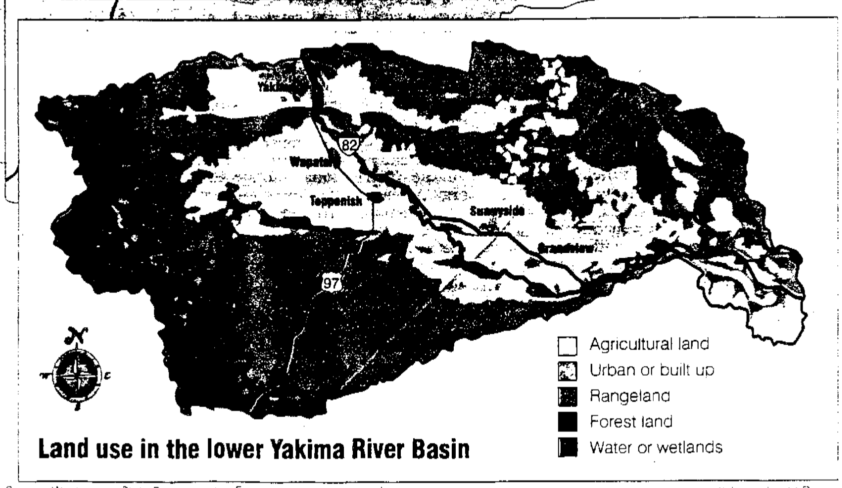
Deep in the policy, however, is the ultimate weapon for compliance — the "velvet hammer," as one manager calls it — the denial of water service.

■ See WATER, Page 11A

Sediment deposits

Total suspended sediment (TSS) loading balance at selected irrigation drains and tributaries in the lower Yakima River Basin during 1995 irrigation season





Source: Washington State Department of Ecology — Yakima Herald-Republic

An average of 200 tons of suspended sediment is spewed into the Yakima River each day during the peak of the irrigation season. Pictured at left is an irrigation canal running parallel to Lateral A.

■ Staff file photo by Roy Musitelli
■ Graphic by Kathy Harestad

Deep in the Board of Joint Control's policy is the ultimate weapon for compliance — the 'velvet hammer,' as one manager calls it — **the denial of water service**

Water/

■ **Continued from 1A**

Cutting off the lifeblood of an agricultural producer won't happen this year, officials caution, since the focus will be on education and assistance. But the fact remains that sooner rather than later, farmers must clean up drain water or at least have a firm idea how they are going to do it.

Farmers identified as having dirty drain water must agree to a cleanup plan before the 1999 irrigation season. Persistent refusal to cooperate means no water.

THAT'S THE Sunnyside-Roza Board of Joint Control's response to looming requirements of the federal Clean Water Act, which is yet to be re-authorized by Congress, and the threat that more migratory fish populations will be listed under the Endangered Species Act.

The Clean Water Act requires states to establish quality standards and implement an improvement plan.

California has been a hotbed of dramatic changes in water allocation, all in the name of protecting migratory fish species. Regulations are on the books in both California and Oregon that prohibit pollution of waterways.

In addition to regulation, citizen and environmental groups are suing the states and irrigators for not having done enough to protect the public resource.

"Part of the reason our board is so aggressive is because we don't need a citizen lawsuit challenging Ecology for not moving rapidly," said Trull of the Sunnyside Valley Irrigation District. "We want to take care of the problem before a solution is forced on us that would be more draconian."

Ron Van Gundy, manager of the Roza Irrigation District, said the districts, not state and federal government, are the logical source to attack poor water quality.

"I don't think they would have the knowledge to deal with it that we do. It would be done more from an enforcement standpoint," he said. "We have been working with them on the best management practices for many years. There has been a lot accomplished, but not everyone's gotten there yet."

Katherine Ransel, co-director of American Rivers Northwest's regional office in Seattle, said the unprecedented move is a logical one given the threats to business-as-usual in irrigation.

"We have the entire Yakima River Basin listed under the Clean Water Act for pollution that violates water quality standards and low flows. There are several pending lawsuits under the Endangered Species Act. If there is any time to get serious about fixing the mess, this is it," she said.

AND QUITE A mess it is.

Recent water sampling in basin drains shows a veritable witches' brew of chemicals, ammonia, bacteria, sediment and high water temperatures that empty into the lower Yakima River every day of the irrigation season.

On average, the major drains on both sides of the Yakima River spew out 200 tons of suspended sediment daily into the river during the peak of the irrigation season. Sulpher Creek, which flows southward to the river east of Sunnyside, carried 110 tons of sediment during sampling in 1995.

DDT, a chemical banned more than 25 years ago, still is detected in all major drains that empty into the Yakima River. Numerous other chemicals also are found.

Washington water quality standards for the stretch of river allow a slight increase in the amount of sediment beyond that measured upstream at the Harrison Road bridge, east of Selah, and at the Nelson bridges over the Naches River. Most days, the lower river is nowhere close to the state standard. The state Ecology Department has reached an agreement with the Environmental Protection Agency to comply with the federal law through a process known as total maximum daily load — the largest amount of specific pollutants that can be present in a river system.

While sediment loads aren't in the state standard, Ecology officials have determined that the amount of sediment in the water is an indicator for the presence of DDT and turbidity or cloudiness of the water, two elements that are in the standard.

Chris Coffin, Ecology project coordinator, said meeting the state standard will require reductions in sediment load from the drains of anywhere from 75 percent to 95 percent.

While the amount of improvement needed is high, Coffin said farmers nearly met the standard during the water-short 1994 season when they were forced to be cautious with the water they used.

"If you pay attention and keep the soil on the ground, it won't end up in the river," he said.

One of the best ways is to modify irrigation systems to sprinkler or drip systems. Settling ponds, vegetative strips to filter water, and other techniques are available for farms where expensive sprinkler systems can't be justified economically.

THE IRRIGATION districts, Coffin said, are the key players in trying to improve water quality.

"This is really an important step for them to come on board and claim ownership of the clean waters," he said.

The two districts have been pointing toward this water quality project for some time. Settlement basins have been dug to hold runoff water so the dirt settles out before reaching the drains. District staff members sampled water twice each month last season at 29 sites at the mouths of drains, diversion points on the two canals and at other locations.

District personnel will be patrolling drains and other waterways as part of their regular duties to pinpoint problem areas and start working with farmers.

Livestock-grazing near drains will be prohibited and farmers will have to maintain buffer zones between cultivated fields and project waterways to reduce the potential for erosion.

"Next year we expect to be well on the road to having it corrected or to have figured out how," Van Gundy said. "We expect everything to be implemented and pretty well taken care of within the five-year period of the TMDL (total maximum daily load) process."

Individual farm plans to reduce pollution will be reviewed and signed off by the joint board. The plans can be devised with the assistance of the districts and the Natural Resource Conservation Service.

The districts are seeking state and federal grants through the Ecology Department, the Bonneville Power Administration and other federal agencies to help finance water quality plans on the farm.

Another issue, in addition to cleaning up water leaving the farm, is keeping water in the river to reduce water temperatures, a problem that landed a number of state waterways on the noncompliance list. Ransel said she is urging state and federal regulators to make increases in instream flows a priority.

Reducing diversions, she argued, can help solve both pollution and high temperature problems.

But the prospect of reduced diversions poses a problem for irrigators.

"Our biggest fear is requiring us to reduce our diversions to dilute the water by having more for instream flows, or simply as a penalty for lack of compliance," Trull said. "We have worked for 30 years to increase the water supply.This would move us backward."

"We have too much at stake to hold our ground and wait until it comes," he added.

CAPITAL PRESS
Jan. 23, 1998

Wash. has a first for clean water

Judicial agreement directs the state to restore health of some 700 water segments

By COOKSON BEECHER
Capital Press Staff Writer

OLYMPIA — Clean water as soon as possible — no ifs, buts or ors about it.

That's the message coming in loud and clear now that a judicial agreement — the first of its kind in the nation — has been hammered out directing the state of Washington to restore the health of nearly 700 water segments, salt and freshwater alike, within the next 15 years.

For farmers and timber owners, the agreement, reached last week, will inject more immediacy into the challenge of tackling water quality issues.

Buffers, fencing to keep livestock from waterways, shade requirements, levels of dissolved oxygen, water temperature, manure-management practices, water quantity, and in some cases, the use of fertilizers and pesticides will be part of the formula to improve water quality.

The agreement is a historical one in that it makes Washington the only state in the nation to embark on developing both TMDLs and an implementation plan.

"Usually states try to weasel out of implementing a plan," said Ecology official Dave Peeler, one of the chief negotiators of the agreement. "But we felt it didn't make sense to do the studies and make estimates about allocations and then not follow through. That would have been a lot of work for nothing."

Ecology officials are quick to point out that had this agreement not ~~been reached~~; the courts would have ordered the Environmental Protection Agency to step in, thus opening up the state to increased federal control. In addition, the timeline for compliance probably would have been much shorter.

In Idaho and Georgia, for example, the courts have imposed timelines of five to seven years. Thanks to this agreement, Washington has 15 years to get its waterways back into healthy shape.

"Landowners such as farmers and timber growers are much better off than if the courts had rendered a decision," said Ecology official Steve Saunders. "Without the agreement, EPA would have taken a much broader swipe. We wanted to keep more state control and therefore more local control in coming up with watershed-based plans."

The recent agreement is the result of a lawsuit launched in 1991 by the Northwest Environmental Advocates and the Northwest Environmental Defense Center against the state's Ecology Department and the EPA. Nationally, there are about 30 states with sim-

Water

(Continued from Page 1)

ilar lawsuits pending.

In filing the suit, the plaintiffs said the environmental agencies had an inadequate program to assess the condition of its water bodies and to develop the required Total Maximum Daily Loads, referred to as TMDLs.

TMDLs are a measurable way to identify sources of pollution in waters that don't meet water quality standards and to determine how much the waters can receive and still remain healthy.

These standards are designed to make sure water can support such uses as swimming, fishing, drinking, habitat and agricultural and industrial supply.

Nina Bell, executive director of Northwest Environmental Advocates, said the agreement shows that the state recognizes how important clean water is to its residents.

"In making these changes," she said, "Ecology has the support of the public who wanted the Clean Water Act in 1972 and, over 25 years later, still want to meet its goals of water clean enough for fish, wildlife and people."

According to Ecology, the leading pollution problems in this state come from non-point sources — or the cumulative effects of many diffuse activities. Fecal coliform bacteria from failing septic systems and poor agricultural practices have been identified as two of the leading pollution problems in Washington's waters.

"The TMDLs will be used to clean up all the sources of water pollution, not just those that come out of an industrial outfall or sewage treatment plant," said Chuck Clarke, EPA's Northwest Regional administrator. He pointed out these standards will be developed through the EPA-Ecology agreement.

In the past six years, Ecology has produced approximately 200 TMDLs. Under this agreement, potentially 1,700 TMDLs will need to be completed. That figure is based on the 666 water segments that do not meet water quality standards multiplied by the types of pollution problems in the waters.

In talking specifically about agriculture, Peeler was quick to recognize the value of the voluntary Best Management Practices that many farmers already have in place.

"We want to build on those," he said, pointing out that farmers will now have to go a step further and begin meeting the standards of the Clean Water Act.

And he was emphatic about the need for all landowners, farmers included, to take the state's commitment to cleaning up its waterways seriously.

"They need to make their plans with this in mind," he said. "This issue is not going to go away."

Jim Jesernig, director of the state's Agriculture Department, called the agreement an important step in improving the state's water quality. But he said state and federal agencies need to be working on the same page when developing watershed plans so that those plans will meet the requirements of both the Clean Water Act and the Endangered Species Act.

"It's important that we don't go off on one tangent or the other and end up with a case of the right hand not knowing what the left hand is doing," he said.

And he warns that citizens need to be actively involved in these watershed plans if they don't want to see federal agencies and the courts stepping in and calling all of the shots.

FRIDAY, JAN. 16, 1998

Rain likely. High of 47. Low of 34.
Weather, A5

CALENDAR
Strictly ballroom
Ballroom troupe performs in Richland. C1

SPORTS
Gary Payton scores 20 points to lead the SuperSonics past the Miami Heat for the 11th straight time in Seattle. B1

Tri-City Herald

1998 Year of the River

Pasco, Kennewick, Richland, Wash.

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http://www.tri-cityherald.com

State puts clean rivers on fast track

Columbia, Snake, Yakima in plan

By MIKE LEE
Herald staff writer

Washington's fish advocates and water users got a big boost Thursday as plans to curb water pollution were unveiled in Olympia.

The plans should mean a dramatic speedup of efforts to clean up contaminated waters, including sections of the Yakima, Snake and Columbia rivers and their tributaries.

"Eventually, people won't have to worry about swimming in raw sewage, the risk of cancer from eating fish and whether fish are able to live in the streams," said Nina Bell, executive director of Northwest Environmental Advocates of Portland.

Thursday's announcement was the result of a lawsuit filed by Northwest Environmental Advocates and the Northwest Environmental Defense Center in 1991. The settlement includes a 15-year timeline adopted by the state Department of Ecology and the U.S. Environmental Protection Agency to identify pollution sources and start cleanup efforts.

Plaintiffs in the suit said the agencies weren't doing enough to stop water pollution as directed by the federal Clean Water Act. Nationally, about 30 states have similar pending lawsuits over their pollution-reduction plans.

■ DAIRIES: Legislators consider bill to keep closer eye on water pollution by cows. Page A3.

Washington is the first state to reach a comprehensive settlement that spells out how the goals will be implemented.

Chuck Clarke, EPA's Northwest regional administrator, praised the plan as the way to restore watersheds to their full potential. Ecology Department Director Tom Fitzsimmons called it a "large and

Please see RIVERS, Page A2 ▶

Rivers

Continued from Page A1

difficult task" but one that will help restore declining fish populations.

Almost 700 water bodies that fail to meet quality standards will be under review until 2014 as the agency figures out how to clean them up. Cleanup efforts will begin on the waters as the plans are completed.

"It is much faster and much more aggressive than what we have been doing previously," said Mary Getchell, Ecology Department spokeswoman.

In the last six years, the agency has completed about 200 studies designed to identify sources of pollution in subpar waters. But in the next 15 years, the Ecology Department will do as many as 1,700 of the so-called "Total Maximum Daily Load" — or TMDL — studies.

Most of the studies set to begin next year are on the west side of the state, but within five years, Ecology Department inspectors will descend on most regions.

"We do have considerable water quality problems in the Columbia Basin," Getchell said. "We are going to be working on strategies to improve the water quality there. These strategies may very well mean changes to current practices."

Gov. Gary Locke has requested $905,000 from the Legislature to finance the initial phase of the work. That likely will mean 12 more employees making cleanup plans.

Improvements won't come easy, Bell said. "A lot of money is going to have to be spent by public and private entities to follow the requirements of the law."

Parties in the lawsuit reached a prior settlement in the early '90s, but the environmental groups went back to court saying the state didn't live up to its end of the bargain.

"I feel they have a real commitment to this program now that they didn't exhibit then," Bell said.

The settlement also will put increasing pressure on people who pollute by spilling their car oil, overfertilizing their lawns and letting their pets' waste enter state waters. Bell said that by focusing its efforts on municipal systems over the last 20 years, the state has largely neglected to educate citizens about their roles in keeping water clean.

"It's very difficult to clean it up after it's gone into the storm water," she said. "It's much better to do pollution prevention."

Though specific costs and actions have not been determined for many waters, the Yakima River is a good example of how TMDLs work. Last summer, the Ecology Department set up a schedule to reduce sediment and the pesticide DDT. During the next 20 years, it will force farmers to cut sediment-carrying runoff from their fields by 75 to 95 percent in certain river drainages.

For irrigators, this goal means more pressure to continue making changes in farming practices to reduce sediment. In the Yakima Valley, farmers already are being asked to convert from rill irrigation to more efficient methods.

The Sunnyside Valley Irrigation District and the South Yakima Conservation District have efforts under way to educate farmers about irrigation alternatives. SVID is planning workshops early this year to teach farmers about water conservation and new water rules. It also plans to monitor runoff from specific farms starting as soon as this year.

While costs and solutions will be developed along the way, Bell said, "It's quite clear that getting more water back into the streams is going to be necessary, that grazing cannot occur up to the stream bank, and some farming practices are going to have to change."

The TMDL process will force other changes, as well. Cities, for instance, may not be allowed to expand their waste water systems until they complete detailed water quality studies about on how their discharge affects total amounts of pollution in the water.

The new plan also could cut back logging in areas where it would cause lack of shade that would let water temperatures become too hot for fish. Temperature problems are the second leading cause of problems in Washington waters.

The biggest water quality problem statewide is from fecal coliform, which comes from the feces of warm blooded animals. It's of particular concern on the Yakima River, where some dairy farms have been under fire for allowing their wastes to enter the river.

Where fecal coliform is targeted, the Ecology Department could go from farm to farm making sure best management practices are being followed, Getchell said.

■ Reporter Mike Lee can be reached at 582-1542 or via e-mail at mlee@tri-cityherald.com

Go after top polluters

I saw only a couple of the articles on the Yakima River — the junkyard on the island and the feedlot — and I was upset that neither Yakima and Benton counties nor the Washington Department of Ecology have done anything about it.

There are ways to prevent contamination of this pristine river as it leaves Naches, and going after the major polluters is the first step — those obvious violators shown so graphically in your pictures and farmers who account for major discharges to the river.

The practice of rill irrigation needs to have much more serious consequences because the runoff is worse in these cases and could be curbed greatly with better waste management practices. A task force could be appointed to assess all areas of contamination on the Yakima and make recommendations for cleanup yet this year. Then push our legislatures to enact the laws to stop the pollution of this river so the Lower Yakima is just as inviting as the Upper Yakima in the future.

I live above the Yakima River about two miles west of Benton City and envision lots of potential for rafting, canoeing and other recreational activities as the water flows through a series of low-key but fun rapids in this area. But the number of people I saw on this stretch of the river last year was very few. Many people don't get in the water because they are scared of having pesticides and other contaminants leach into their body (my daughters included) — not to mention the brown silt-laden state of the river in the summertime from all the irrigation return runoff.

Bob Swoboda

We all contribute

Really enjoyed the Yakima River presentation. It was balanced and extremely thorough in research, and I think it gives a good idea of what we need to do to keep our rivers clean and usable for everyone from fish all the way to those of us who use irrigation and the electricity that comes with it.

Especially like the posters the Ecology Department has out. That's a good touch to remind us of how everything we do ends up in our rivers.

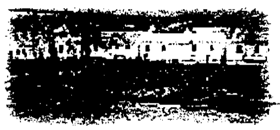
Dan Osborn

Tri-City Herald

The Yakima: A River Wasted

A special report by the Tri-City Herald

Part 1: Resource in Ruin



Part 2: Everyone Contributes

Part 3: Dairies Overload the Valley

Part 4: Solutions in Sight

Tell us what you think

This report on the Yakima River began in November as an investigation of charges that Lower Valley dairy farmers were polluting the river with cow manure.

It soon became clear dairy farms weren't the only ones soiling the river. And it became clear several people and agencies across the state have been seeking solutions for years.

During the last three months, Herald staff writer Mike Lee has spent hundreds of hours talking with representatives from almost every group that uses the river.

Most have gone out of their way to provide information, most notably the state Ecology Department, which runs on the strength of an overloaded but committed staff.

In all, about 60 people were interviewed, some several times. And the information collected - conservation service reports, Ecology Department studies, news clippings and assorted background information - makes a stack at least a foot high.

Some information came through two Freedom of Information Act requests, special petitions seeking access to government files.

Much of the information conflicts, and some of it is highly technical. Our goal was to provide a reader-friendly primer about the river's state and a look at what is being done to fix it.

It took much longer than expected. Every new person interviewed seemed to add a complexity or suggest a direction previously unexplored. And so the series grew in scope.

We invite your response to the articles by writing or calling. Send letters to A River Wasted, P.O. Box 2608, Tri-Cities, WA 99302-2608. Send electronic mail to yakima@tri-cityherald.com. Or voice your thoughts on the Herald's inTouch line. Call 736-7000, then press RIVR (7487).

Tri-City Herald

The Yakima: A River Wasted

Once-clear 'Tapteal' has cloudy future

Herald/Bob Brawdy

A bright patchwork of crops covers most of the Yakima Valley, as does a 1,900-mile system of irrigation canals. Irrigation water that washes off the fields carries large amounts of dirt and chemicals into the river, endangering fish and their habitat.

From its source high in the Cascade Mountains, the Yakima River runs 150 miles to Richland, a sinew of life-giving water stretching through 450,000 acres of irrigated farmland.

Without the river, the farms would shrivel. It is their lifeblood and the reason the land yields a cornucopia of produce.

In the spring, the snow-swollen Yakima seems an eternal resource, a brown flood, often of breathtaking proportion.

The rush of water means food, jobs and prosperity. Yakima Valley farmers produce a variety of fruit and vegetables matched by few other regions nationwide. Their apples, wine grapes and hops are known worldwide.

And the Valley's wide open spaces have attracted enough dairy cows to transform it almost overnight into the state's dairy leader.

But by fall, creating this bounty reduces the freshets of spring to a dirty, polluted trickle over diversion dams, water weighted with fish-choking dirt and laden with chemicals from farms.

American Indians once called it Tapteal - the river that runs clean - because they drank from its banks and ate its abundant fish. The river was central to their culture and religion. It was life itself.

Today, the tribes aren't the only ones who worry what the next 10 years will bring to a watershed poisoned with multiple sources of pollution.

The Yakima River has been subject to just about every kind of evil humans inflict on nature - overuse, misunderstanding and carelessness chief among them.

Fish with toxic flesh and a river that sometimes more resembles an open sewer are the legacy.

Water quality is a question of competing values. Do we - the people who live here - care more about paying low sewer rates or about having a river that is safe for swimming? Do we value more rows of apple trees above more water for salmon? Do we desire cheap milk at the expense of clean water?

State and federal governments are pushing for answers in the form of legislation to limit what goes into the river. They are starting new programs to stop pollution. They are putting Yakima Valley cities and farms on notice to clean up their wastes.

But though the federal Clean Water Act was signed 25 years ago, many problems remain. The future of the Yakima River won't be determined by another bit of legislation.

It will take a concerted effort by the people of the Northwest to keep a river filled with waste from becoming forever a river ruined.

Tri-City Herald

The Yakima: A River Wasted

For centuries, Yakima has been lifeblood of everything in its reach

Herald/André Ranieri

The Yakima River, at left in this aerial photo of its delta, flows 150 miles from the Cascades to its confluence with the Columbia River in Richland. Along the way, the Yakima provides water for many farms and homes but becomes laden with mud, dairy wastes and chemicals.

Bill Flower's connection to the Yakima River runs deep.

Ancestors of the Yakima County commissioner pioneered Central Washington and settled in the Yakima Valley to farm.

"Water was the hope that brought them to the Yakima Valley. Without water there was really nothing," he said, as a fire warmed his back at the Stone Mountain Brewery in Sunnyside.

Even today, Flower said, "It's our lifeblood. It's the foundation of our existence."

The diversity of farms that blossomed in the desert gives the 4-million-acre Yakima Basin a status like few other growing regions in America. Its 450,000 irrigated acres produce a cornucopia of crops: hops, apples, grapes, mint and dozens of other fruits and vegetables.

About 40 percent of the Yakima Basin is forested, and another 40 percent is range land. Only 15 percent is cropland, according to the Yakima River Watershed Council, a grass-roots group trying to come up with solutions to water shortages.

The U.S. Bureau of Reclamation "runs" the river by controlling flows from six reservoirs in the upper part of the basin. Annual precipitation in the Cascade Mountains - the north and west edge of the watershed - is about 140 inches, compared with about 8 inches a year in the Lower Valley.

The Yakama Indian Nation occupies about 800,000 acres of the Valley. Another 1.7 million acres are privately owned, and the U.S. government owns 1.5 million acres, or 38 percent of the land.

In its most recent draft of a proposed water-use policy, the Yakima River Watershed Council tells the condensed story of the basin:

Interest in the Yakima River for irrigation started in the mid-1800s when Catholic priests started pulling a bit of water from Ahtanum Creek near Yakima.

For the next 50 years, private canal companies popped up and started delivering water, a trend that peaked when the Northern Pacific Railroad built the Sunnyside diversion dam in 1891.

By 1902, the river was irrigating 121,000 acres in the basin. But without reservoirs, irrigators already were looking at water shortages. So the Bureau of Reclamation started the Yakima Project, building six dams and reservoirs, the last of which was Lake Cle Elum in 1933.

It still wasn't enough. More than 1 million acre-feet of storage capacity couldn't meet drought-year demand. That led to the landmark 1945 Consent Decree in "Kittitas Reclamation District vs. Sunnyside Valley Irrigation District." The ruling established junior - proratable -and senior - nonproratable - water rights holders and has controlled water delivery since.

About the start of World War II. the Roza irrigation canal crossed the Valley, more or less parallel to the river from northwest to southeast. That opened more land to farms. "It almost helped (create) a climatic change," Flower said.

The Yakima Valley became a destination for veterans seeking the rural life and the American dream. "It was their opportunity ... to create an estate for themselves and their families." Flower said.

From 1950 through the '70s. irrigation grew and Valley agriculture blossomed into a $750 million industry.

And more fields meant more water use - and less water in the river. The state Ecology Department estimates irrigators divert 80 to 90 percent of the river's water, some of which returns to the river through drains after it washes off fields.

In 1977, competing uses came to a head in a court decision called Aquavella - just one of many court battles over water usage. The Yakama tribe asked to have its water rights quantified. That led to setting the minimum in-stream flows needed for fish survival.

Twenty years later, fish still are at the center of the questions about the Yakima River, as shown by Thursday's proposal to list Mid-Columbia steelhead as a federally protected species.

Tri-City Herald

The Yakima: A River Wasted

Pollution widespread and far reaching

The Yakima River carries life to the people and farms of the Lower Valley, but during the past few decades, it's been choked nearly to death.

Sections of the river are potentially dangerous.

Swimming, boating and other water activities in parts of the lower river could lead to stomach illnesses, cautions a recent state Department of Ecology report.

That's because parts of the river are loaded with coliform bacteria from animal and human feces. The bacteria enter the river primarily from failing septic systems and dairy cow manure and indicate the possible presence of other disease-causing organisms.

"In general, we tell people, 'Don't drink that water.' " said Mary Jo Mengarelli, public health administrator for Yakima Neighborhood Health Services in Yakima. She said swimming in the river also is considered unhealthy.

"It's polluted water by its nature of flowing from one end of the Valley to the other," Mengarelli said. "There are dead animals in it, human waste, animal waste ...."

Water near Mabton is so full of fecal bacteria, "I wouldn't stick my big toe in there," said Steve Butkus, state Ecology Department water quality expert.

But fecal bacteria is hardly the river's only problem. Its lower half also is loaded with chemicals and pesticides, choked with mud and drying up from too many irrigation diversions.

The water that remains gets too hot for fish to thrive in the summer and lacks enough oxygen for much aquatic life.

Millions of dollars have been spent to clean the river - but its once-great salmon and steelhead runs remain precariously low.

Bill Yallup Sr., chairman of the tribal council for the Yakama Indian Nation, mourns how fish and clean water have been sacrificed for agriculture.

"In the songs our people sing to us today, ... we are told of many things the (salmon) has to go through to get back to its place of birth. You can imagine what they are now going through over and above what they had to go through 1,000 years ago - the pollution, the dams, the overharvesting."

And those fish that manage to cling to life have been shown to contain some of the highest levels in the nation of the long-banned toxic pesticide DDT.

"I don't eat them. No way - not out of the Yakima," said Pat Ruane, an avid fisherman and hunter along the Yakima. "You couldn't make me eat one."

There's plenty of blame to go around - inefficient irrigation systems, dairy farmers who allow cow manure to leak into drainage ditches, overloaded septic systems, runoff from Cascade Mountains mines, overfertilized lawns and stream-side junk piles leaching metals and chemicals.

American Rivers, a national environmental group, has listed the Yakima as one of the nation's 10 most endangered rivers a few times in the last decade, said Katherine Ransel, co-director of the group's Seattle office.

She calls it a "classic example of a degraded Western river" and often uses it to illustrate the problems facing water bodies. Ransel worries about the "poison soup" of chemicals that mix in the Yakima - but she's equally concerned that so much water is sucked from the river.

"There are places that the river is literally dry and the fish can't jump over that."

Scott Woodward, 47, a Richland High School teacher whose home overlooks the river delta, spent most of his summer days as a child in the river. "It became a junkyard," he said. "I think people just basically gave up on it ever being nice again."

But he believes the river is salvageable - if people stop dropping everything from couches to motor oil into it. And he thinks it's not as nasty as it was when he was young.

Then, Woodward said, it was a sewer with thick, brown foam floating in places and a sulfurous smell. "When you breathed in, you could actually feel it - its thick air."

Thankfully, none of the Valley's cities takes drinking water from the Lower Yakima. All are on wells. However, some suspect the Valley's migrant workers use river water for drinking, bathing and washing cars.

While there has been no drastic turnaround in how people are damaging the river, there is a sense among those trying to restore it the problems may have hit a low point.

"I am not sure they are getting any worse," said Jim Trull, manager of the Sunnyside Valley Irrigation District. "We have kind of reached a point of equilibrium. We have kind of rolled up our sleeves and said, 'Let's see what we can do.' "

The road to clean water could seem more arduous next year when the National Marine Fisheries Service is likely to list Mid-Columbia steelhead as a federally protected species, following Thursday's proposal.

Like many others in the Valley, Mel Wagner, chairman of the Yakima River Watershed Council, fears the potential Endangered Species Act listing. The council believes a listing could double or triple the amount of water required in the river for fish, further complicating river management.

Gov. Gary Locke, in a recent speech about the sad state of Washington's fish runs, said endangered species listings can potentially limit how residents use their land and water - even whether they can use fertilizer on their lawns.

Ransel predicts rationing of irrigation water. "The courts are very clear that if there is not enough water in the river for anadromous fish, then you are in violation of water quality standards."

Compliance is a daunting task.

It's difficult and expensive to identify who's responsible for the poor water quality - and, therefore, who should pay to clean it up. That's because much of the pollution runs off with storm water or irrigation overflow and is all mixed in the river.

About 30 years ago, there was a big push to regulate industrial and municipal sources of dirty water, said Max Linden, Ecology Department water quality officer in Yakima.

As a result, for the last few decades, the major improvements in waste water treatment plants have been made, and fewer of the Yakima River's water quality problems have been caused by cities and industries.

Still, more than 200 cities, gravel pits, fruit processors and other industrial sources are permitted to dump their waste into the river.

While the majority of the discharges meet state standards, Ecology Department reports show a few chronic problems in the Lower Valley.

In the first half of 1997, Prosser repeatedly pumped water into the river that had sediment and fecal coliform bacteria levels well above state standards, Ecology Department records show. The city is working on plans for a new sewer treatment plant.

Mabton, West Richland and Benton City also failed to meet water quality standards in the past two years.

Now, the state is taking on the difficult job of identifying polluters who don't discharge water directly into the river. The work primarily means cracking down on agriculture, which accounts for the majority of the river's problems.

"The agricultural community was not looked at that closely," Linden said. "There's a long way to go."

Statewide, Ecology Department studies show agriculture accounts for one-third of water pollution - and it accounts for 57 percent of the water quality problems in the troubled streams that can't support things like swimming and fish migration.

In 1997, Ecology outlined a 20-year program in the Lower Yakima Basin to reduce sediment-carrying runoff, which muddies the water and carries pesticides, including DDT. Complying with that plan will cost millions - some of which will be paid by farmers who are forced to upgrade their irrigation systems.

And if farmers don't clean up their act, they'll lose irrigation water, says the board of joint control for the Roza and Sunnyside irrigation districts.

Fecal coliform is the biggest stream problem statewide, and it's a huge concern in the Yakima Basin.

At Mabton, the water exceeded state coliform standards in six out of seven tests, making it one of the six most polluted spots in the state for coliform.

Wide Hollow Creek feeds into the Yakima River at Union Gap. All of the water sampled there for the Ecology Department report failed to meet federal standards for fecal coliform. At nearby Parker, water failed to meet standards for fecal coliform in more than 25 percent of the tests.

Coliform tests don't show a direct correlation to disease, but the state uses them as a measure of potential problems. "It's the best indicator we have right now," said agency spokeswoman Mary Getchell.

Dairy cows are a major source of the fecal bacteria in the Yakima. And much of the dairy waste appears to come from a handful of dairies.

A Freedom of Information Act request by the Tri-City Herald turned up two Lower Valley dairy operators whose farms repeatedly have spilled manure into irrigation drains that return water to the river.

Though state enforcement actions against dairy farms have been lax, there are signs this may change. And citizens groups are showing a growing impatience with the mess.

In November, a group of Valley residents joined with an Oregon law firm and told 10 Sunnyside-area dairies they would be sued for violating the federal Clean Water Act.

The Community Association for Restoration of the Environment plans to file 10 complaints in federal court by March - though leaders say some of the dairies already are making improvements in managing their waste.

And the state Legislature is considering this session forcing improvements in dairy waste management.

Two similar bills introduced this winter would force regular inspections at dairy farms. At present, the state investigates dairy waste problems only when there are complaints.

Despite the Yakima River's chronic problems, there's guarded optimism. Several plans are afoot to increase the amount of water in the river and to reduce muddy runoff.

And farmers seem to be responding despite the high cost of change.

Environmental groups in the Tri-Cities are cleaning up the Yakima River Delta. And some of the Valley's municipal waste water treatment plants are being overhauled.

But clearly, salvaging the Yakima River is far from done. It will take decades of careful work to make up for the decades of carelessness.

"Even though we have a Clean Water Act, who lives by it?" Yallup asks. "Not too many people."

Tri-City Herald

The Yakima: A River Wasted

Salmon runs fail as Yakima River nurtures farms

Herald/Bob Brawdy

More than a dozen dams like this one at Prosser divert water from the Yakima River to irrigate one of the nation's most productive growing regions.

The Yakima River already was being dammed, drained and polluted when Bill Yallup Sr. first fished at Wanawish.

But in the early 1930s, the river was relatively young - it hadn't suffered the indignities that have come with another 60 years of sediment, pesticides and faulty sewage treatment plants.

And the salmon thrived, not to their historic levels, but enough to entice Yakama Indians like Yallup to set up a long house near present-day Horn Rapids.

Now chairman of the Yakama Indian Nation Tribal Council, Yallup still returns to Wanawish occasionally, but it's different.

"There are a lot less fish. You are fishing for about 5 percent or less of what it used to be. Sometimes, there are no fish there at all. ... It's getting worse every year."

So bad that, at traditional salmon ceremonies, Yakamas might get just one slice each of their ancestral food.

Still, they love the river more than ever, Yallup said. And they feel sorry for it.

In the early 1800s, the Yakima River brimmed each year with more than 900,000 salmon and steelhead, according to the Bonneville Power Administration.

But by 1994, the runs had dwindled to just 7,000 fish.

Summer chinook and sockeye salmon are gone.

And the spring chinook salmon run has declined from historic runs of 200,000 to just a few thousand.

Even the resident fish are more scarce, said longtime fisherman and Richland teacher Tim Ruane. As children, he and his brother Pat floated the Yakima and caught bass, catfish or bluegill with nearly every cast.

Now, "You really have to work hard to find the fish," Ruane said. "The places I used to fish, I just can't anymore. The river is clogged with weeds."

No longer can the brothers float the river in summer because the water is too low. And they rarely eat fish they catch for fear of ingesting toxic chemicals that wash off upriver farms.

For anglers, the destitute river means less entertainment. For American Indians, it signifies the sickness of "progress" at the cost of nature.

"In the path of civilization, natural indigenous species have been made extinct," said Moses Squeochs, environmental program manager for the Yakamas. "We all say the Northwest is a beautiful country, but in reality, it has been severely scarred, degraded, abused."

This grim legacy has led the National Marine Fisheries Service to consider listing Mid-Columbia steelhead under the Endangered Species Act, as it did with upper Columbia steelhead in 1997. The agency also has proposed federal protection of several coastal chinook runs. Once plans are finalized next year, NMFS could force massive changes across the Northwest in everything from dam operations to urban growth in an effort to save the fish.

This spring, the agency also expects to announce whether it will propose Northwest coastal chinook salmon runs for threatened or endangered status. If chinook are proposed for listing, it would take another year of gathering data before a decision is made.

Endangered species listings could force more changes in recreational fishing, but Jim Cummins, district biologist for the state Fish and Wildlife Department, doesn't expect drastic measures - at least at first.

Steelhead fishing already is banned on the Yakima. But Cummins said it might be necessary to reduce trout fishing on upriver tributaries because small steelhead look just like their river-bound relatives.

The biggest concern with a federal endangered species listing for those who are trying to rebuild the Yakima River is it would take control of the river out of their hands.

Walt George, longtime Valley resident and chairman of the South Yakima Conservation District's board, said, "It will only complicate the issue. It doesn't give us much latitude to work on the problems."

Though the future of fish on the Yakima is uncertain, reasons for the declining runs are clear - and numerous.

Squeochs said white settlers "very haphazardly instituted 'progress' " in ways that were disrespectful to the native people "and the Earth itself."

Starting with the Pomona dam in 1880 and the Sunnyside dam about 10 years later, the river was made less and less fish-friendly. Many fish were trapped in irrigation canals before screens were erected to keep them out, and irrigation diversions left other fish high and dry.

"In the Yakima system, the dams kill fish, but pollution is the prime problem," Yallup said.

Cummins said the biggest hazard to fish today is lack of water. Low water makes it easier for predators to catch fish. And the Yakima's summer dribble warms up faster than it would with two or three times the water. This is especially bad for fall chinook.

Tests at Kiona dating back to 1989 show the river regularly reaches more than 70 degrees in July and August. Fish survival is poor much above 65 degrees.

Sediment also hurts fish. Dirt washed off fields can suffocate eggs that are laid in the gravel. And fecal coliform bacteria contamination, while not directly hurting fish, usually is associated with nutrients that cause high algae growth, sucking oxygen away from fish.

There are plenty of hazards for young salmon and steelhead once they leave the Yakima, said Kurt Beardslee of the conservation group Washington Trout. But conditions within the basin have a lot to do with how many fish will return and spawn.

Hatchery fish on the Yakima now have a poor life expectancy. Only 20 percent of the hatchery fish released in the upper reaches of the river and its tributaries make it as far downstream as Prosser - let alone complete the arduous journey to the ocean and back, Cummins said.

The Yakima River forms the northeast boundary of the Yakama Indian Nation reservation from near Union Gap to Mabton, and the tribe is deeply concerned. What remains of the once-abundant salmon runs continues to play an important part in the Yakamas' diet, culture and religion.

Squeochs said American Indians are worried about salmon in many Columbia River tributaries, but he said the Yakima is a major one the Yakamas are working hard to fortify.

"The Yakima River stands to be one of the best places to exert a very intense restoration plan," he said.

The Yakamas are concentrating efforts on Satus Creek, a major tributary in the Lower Valley. By reducing grazing and logging, they hope to make the Satus pristine again.

They also have a "plant a tree, save a fish" program in which school children planted some 200 cuttings along Toppenish Creek. The trees should provide shade to keep water temperatures down and potentially decrease the amount of sediment runoff, providing better fish habitat.

"We are attempting to set an example, to be a role model," Squeochs said. "Hopefully, we can convince others to respect our efforts and cooperate with us."

Squeochs said the tribes need help from dairy farmers and irrigators. "They have got to tidy up, clean up their act."

He's not the only one who believes the river can be nurtured back to life.

Jim Esget of the Bureau of Reclamation in Yakima said a lot of work could make the Lower Yakima another Hanford Reach - now the best spot on the Columbia River for spawning fall chinook salmon.

The bureau also is developing plans to keep more water in the river for fish.

The new Cle Elum Supplementation and Research Facility, a state-of-the-art fish hatchery, also provides hope. The Bonneville Power Administration paid for the 15-acre, $15.8 million hatchery, which also was supported by the state Fish and Wildlife Department, the Yakamas and the Northwest Power Planning Council.

Between 1982 and 1996, said BPA spokeswoman Crystal Ball, almost $64 million was spent on the Yakima-Klickitat fish production program.

At Cle Elum, eggs are hatched and raised in an environment that closely mirrors the river. Human contact is kept to a minimum, and just about everything possible is done to convince the fish they are in the wild. At full production, the facility will produce 810,000 salmon smolts a year - building hope for strong returns by 2003.

Sportsman Ruane is one of those who dreams of a healthy lower river - something like the upper reaches, which are known as one of the best fly fishing areas in the state.

"The potential of this river to produce fish is incredible."

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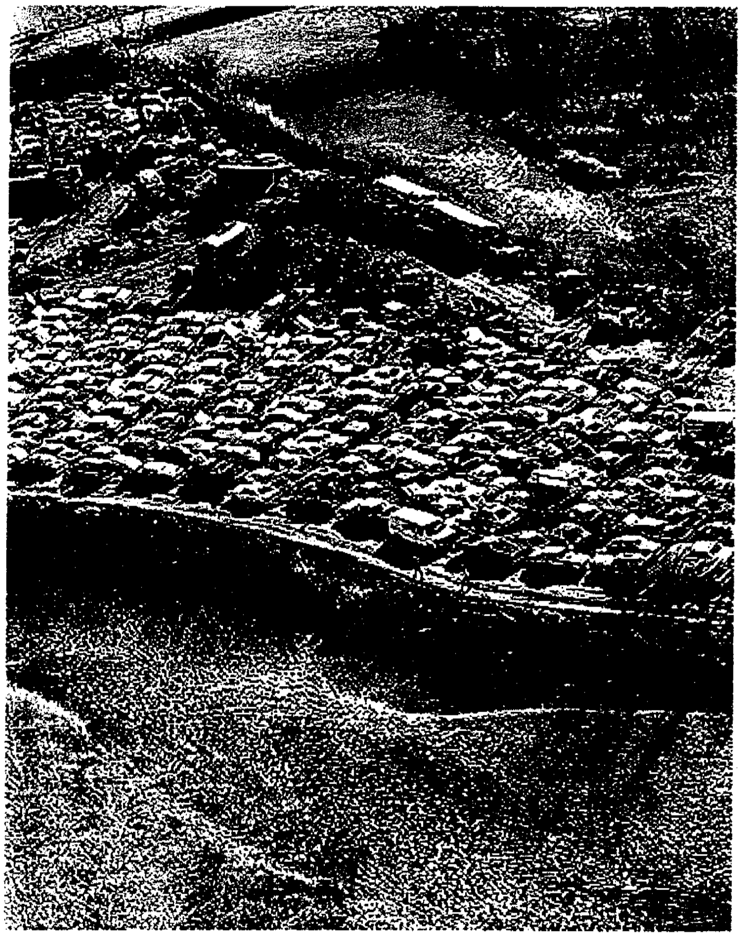
Tri-City Herald

The Yakima: A River Wasted

All share blame for Yakima's pollution



Herald/Bob Brawdy

This junkyard sits on an island between two forks of the Yakima River near the Wapato exit on Interstate 82. When the river rises, it collects metals and toxic liquids such as oil, radiator fluid and battery acid.

While it's easy to fault farmers for Yakima River water quality problems, they aren't the only ones making a mess of things.

Chances are, everyone who lives in the Valley deserves some of the blame.

Overfertilized lawns, failing septic systems, car washing, pet wastes and cars that drip oil also degrade the region's streams and rivers.

"Everybody is at fault," said Walt George, chairman of the South Yakima Conservation District Board. "We are all the problem. People are the problem with the environment."

While municipal and industrial systems have their challenges to meet new standards, lots of water used by humans never makes it to a waste water treatment plant.

One potentially big problem is failing septic systems that add fecal coliform bacteria counts to the Yakima River.

Bill Flower, Yakima County commissioner, said unincorporated areas without sewer service are being watched carefully. "We don't see the septic systems as failing at this point, but they are systems we are monitoring," he said. "Nobody wants to have septic (waste) in the river. So far, we're OK, but we continue to watch."

He doesn't have to look far for such problems. It wasn't long ago when a Yakima-area water district extended its service because sewers in outlying areas were backing up and fouling drinking water.

And in the early 1990s, septic tank problems came to a head in Buena, just upstream from Zillah. A combination of shallow wells, a water table elevated by irrigation and faulty septic tanks led to widespread contamination of drinking water, said Larry Fenster, environmental health specialist at the Yakima Health District.

A waste water treatment plant was built with state money. "We rarely get a call about Buena anymore," Fenster said.

Parker, near Union Gap, faces similar problems, but Fenster said the health district hasn't had many complaints in the last few years. He said it's up to residents to test their own wells - though the agency is working on a tracking system.

Fenster said he doesn't see an obvious pattern with drinking water problems in the Lower Valley. "It's really sporadic where we get the bad samples."

And he said it's not easy to tell if septic waste is seeping to the river.

But George said the South Yakima Conservation District's tests in 1991 found elevated fecal coliform counts in the irrigation return drain that runs underground below Outlook.

He suspects waste from septic systems was leaking into the drain then, and that it's still leaking into the drain. The conservation district reported its test results to the county health district. "But they haven't done anything out at Outlook," George said. "I don't think anything has changed."

Gordon Kelly, environmental health manager for the Yakima Health District, said, "As far as we know, there is not any greater concern with Outlook than any other community."

There are other, less obvious ways that just about everyone fouls the water:

-- Putting more fertilizer on lawns than necessary.

Rainfall carries the extra nutrients to the river where they do the same thing they do in yards - make plants - in this case, algae - grow. Decaying algae uses oxygen fish need. And it can cover the water, forcing swimmers and anglers elsewhere.

-- Using phosphate soaps to wash cars.

The waste water flows into surface waters. And most soap contains phosphates that feed algae.

-- Not treating storm water runoff.

In Eastern Washington, most older developments don't have silt traps or sediment basins for storm water. Because the region is so dry, dust gathers on roads, cars and parking lots.

When it does rain, the concentrated dust washes into drains that often flow right into the river or a tributary. And sediment, whether from a cornfield or a mall parking lot, can suffocate fish eggs.

Often, the runoff also carries oil spilled from cars. According to the Ecology Department, one pint of oil can make a slick larger than a football field and destroy animal habitat.

But much more than a pint flows into the country's water bodies, the agency reports. Americans spill about 180 million gallons of used oil each year - 16 times the amount spilled by the Exxon Valdez in Alaska.

An especially bad threat to the Yakima River sits along Interstate 82 near Toppenish. A car junkyard straddles branches of the river on Yakama Indian Nation land.

Moses Squeochs, environmental program manager for the Yakamas, said the tribes have been trying to get the land cleaned up for quite a while, especially given their efforts to restore fish habitat.

The junkyard sits in a flood plain, meaning when the river rises enough, it washes car fluids into the river.

"We have received many complaints about that place from a lot of people," Squeochs said. "We're continuing to try to find a way to address it."

-- Not controlling pet wastes.

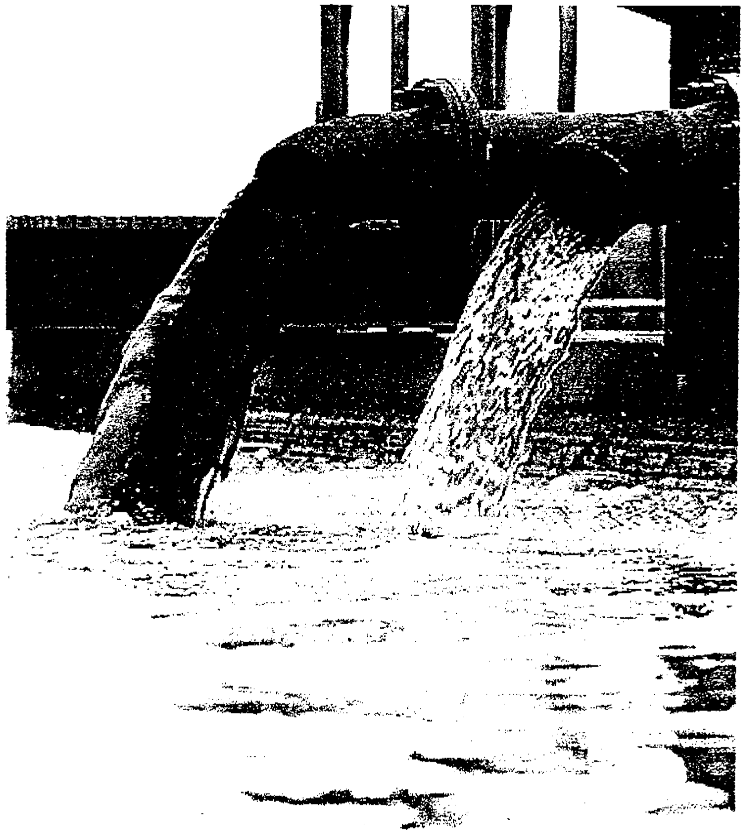
Just like dairy waste, waste from smaller animals carries bacteria that can make people sick. Of course, concern about pet waste is larger in cities such as Seattle, where it is estimated dogs and cats produce the same amount of waste as the people of Kennewick each year.

Unless people take care to clean up after their pets, that waste doesn't go through treatment - it washes into the rivers and streams along with everything else.

Tri-City Herald

The Yakima: A River Wasted

Cities sometimes pump soiled water into river



Herald/Bob Brawdy

Clear and murky water mix in a ditch at the Granger waste water treatment plant, showing the difference between water that has been treated once and water that has been treated twice.

Several Lower Yakima Valley cities are struggling - sometimes unsuccessfully - to clean their sewage properly before it spews into the Yakima River.

Mabton, Prosser, West Richland and Benton City pumped polluted water into the river last year, state Ecology Department records show. Some of the sewage treatment plants failed to kill enough fecal coliform bacteria, while others left too much sediment in their discharges.

And in some cases, the cities didn't do tests properly that would make it clear just what they were pumping into the river.

Lower Valley towns totaled about 200 waste water violations - most of which were minor - from July 1996 to June 1997, the most recent period records are available for.

In spite of the violations, polluters rarely are penalized. An overburdened state inspection program concentrates on seeking voluntary compliance rather than on assessing penalties.

The good news is Lower Valley towns and industrial processors have gotten much closer to meeting the ever-tougher clean water rules the state has adopted over the past two decades.

The state has issued permits for about 220 waste water discharges on the Lower Yakima River, most of which are fruit and vegetable processors.

State records show that while the industrial treatment plants didn't always completely clean their discharges - called "effluent" - violations by any given company generally have been minor.

Taken as a group, however, the industries sometimes dump large amounts of sediment and chlorine into the river, which makes water less habitable for fish.

Also, the industries aren't always held accountable because the Ecology Department is stretched thin enforcing municipal and industrial waste water codes, said Robert Barwin, water quality program manager in Yakima.

The agency has just one person responsible for enforcing clean water laws for more than 500 waste water dischargers in a region that covers the central part of the state.

Barwin said because of the shortage of resources, the agency tries to make the best investment of energy and time. He likens it to a police officer stopping the worst speeders, not those who are going 5 mph over the limit.

Dan Wrye, Ecology Department waste water expert in Olympia, added that some dischargers -such as some fruit processors and small Lower Valley cities - put such a tiny volume into the river, their violations don't merit extensive measures to fix because they are "environmentally inconsequential."

When the agency does act, it usually tries to produce a change, not punish, he said. "We've found that an informal approach ... sets the stage for permittees to willingly comply with laws, rather than setting up a confrontation that can result in an appeal and delayed compliance."

Despite levying only a handful of minor penalties on the Yakima recently, the state has forced waste water treatment facilities to clean up their effluent rigorously, said Rick Frye of the Ecology Department's water quality program in Yakima.

"We've really done a bang-up job in the last 15 years on upgrading the municipal and industrial plants in all of Washington," he said.

Standards are getting so tight, in fact, some towns complain the water they return to the river must be several times cleaner than what's already flowing down river.

Not true, said Phelps Freeborn, who handles Lower Yakima sewage treatment plants for the Ecology Department. In most cases, he said, "The river is comparable with or, perhaps, a bit better than their effluent."

Sometimes, the soiled river is much better.

In Washington, sewage plant operators test their water and report the results monthly to the state. In 1996, 38 percent of waste water facilities reported at least one violation, Wrye said.

A 1996 Ecology Department report on the Valley's municipal sewer plants concluded, "several sites needed better maintenance practices, (and) several were understaffed."

And there have been accidents.

In Prosser, floodwaters in early 1996 broke two waste water lines across the Yakima River and released a reported 400,000 gallons of sewage. No fine was levied because the city couldn't have prevented the flood.

Two years before, more than 11,000 gallons of untreated sewage spewed into the river when a rope clogged Mabton's sewer line, a city memo shows.

But the biggest challenge for Lower Yakima Valley cities is handling ever-increasing loads with aging treatment systems. "The treatment plants have had trouble keeping up with the growth," Frye said. "They are adding pieces faster than they ever thought of adding pieces."

The state requires cities to start expanding their treatment plants once they hit 85 percent of capacity.

In the 1970s and 1980s, upgrades weren't as big of a deal as they are today because federal money often paid 90 percent of the costs. But now, about the best a city can hope for is getting a low-interest loan from the state.

"The free money is gone, and that's one of the things that is hard for the small towns," Frye said. "We are suddenly having people pay $50 a month for their hookup to the sewer when they used to be paying $10 to $15."

Take Mabton, a town of about 1,400 people west of Prosser with a sewer plant that needs a $2.2 million overhaul. The assessed valuation for the entire town is just $15.4 million, according to the Yakima County Assessor's Office.

The city's aging sewer system frequently fails to clean the water properly. State records show that between July 1996 and July 1997, its discharge into the Yakima River didn't meet standards in at least one category every month.

Often, Mabton's effluent carried about twice the amount of fecal bacteria it's supposed to have. And rarely did the plant remove enough sediment.

"The equipment was getting old, getting worn out," said Wayne Beeman, public works superintendent, of a system that was upgraded in 1975 and designed to last 20 years.

The town has been working on its upgrade plan for six years, but even with a few hefty grants, it still needs more money. "It takes a long time to get the money together," Beeman said.

Beeman said plans are to start the plant overhaul this year. He said the cost to residents will be determined by whether the city gets more grants.

West Richland's sewer system also has struggled to keep up with population growth, but with more progress.

In 1994, the Ecology Department scolded West Richland for regularly allowing too much fecal coliform bacteria and sediment into the river, saying parts of the town's system were "severely overloaded."

Freeborn said his agency threatened West Richland with a growth moratorium if its effluent wasn't cleaned up. The city built a new sewage treatment plant that includes an ultraviolet light chamber, the latest technology to kill bacteria.

"They took the message, and they moved forward. They did it fast. They did it well," Freeborn said. "You pull a glass of water out of there and it looks clear."

However, there still are problems with the town's old south lagoon. Ecology Department records show that from July 1996 to July 1997, West Richland's effluent often carried about 10 times the permissible amount of fecal coliform bacteria.

Dennis Wright, public works director, said the city is planning to spend $140,000 on new monitoring stations and chlorination treatment to address the problem.

Benton City also has struggled to keep its return water clean - and will continue to have trouble with its outdated lagoon system, Freeborn said.

Last year, the city completed a $40,000 upgrade to monitor water coming into the plant, but Freeborn predicts more upgrades will be needed within the next five to 10 years. "It's not so much if there are problems, it's where they are."

Though some sewer plants are faulty by present standards, Frye said, they are far better than they were when the Clean Water Act was passed in the early 1970s.

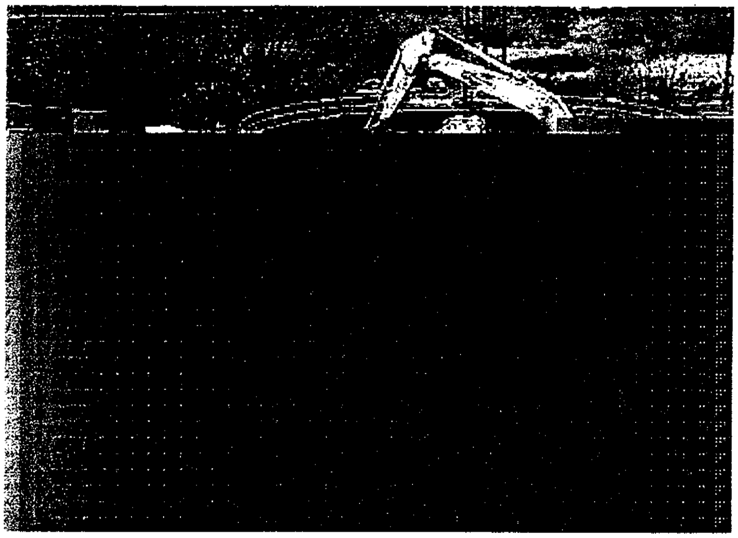
Prosser, for instance, has seen the amount of sediment it can put into the river decrease from 900 milligrams per liter to 100 milligrams per liter in the last decade. In another three years, its effluent should contain just 10 milligrams per liter, Frye said.

"That has to have an impact in improving the river," he said. "The river gets better as you clean up the individual discharges going into it."

Tri-City Herald

The Yakima: A River Wasted

Prosser struggles with pollution as state agency applies pressure



Herald/Andre Ranieri

Work began earlier this year on the primary clarifier at the beleaguered Prosser waste water treatment plant. This vital piece of equipment has been broken for almost a year and contributed to the city's continued trouble meeting state clean-water guidelines. City officials say work could be done in September.

A decrepit sewer plant choking on too much industrial waste water has put Prosser on notice to clean up its act - or else.

The state Ecology Department and the federal Environmental Protection Agency are pushing for costly improvements to the town's sewer plant, which has a chronic history of pouring polluted water into the Yakima River.

The message is coming through loud and clear in Prosser, where municipal sewage combines with millions of gallons of food processors' waste water to create a brew that is particularly tough to clean.

"It's probably the biggest issue facing this community," said City Administrator Ken Carter. "And it will continue to be."

During the next three years, the city expects to spend about $4 million for a complete overhaul of the sewer plant, which treats about 1 million gallons a day.

The price depends on whether the town's huge potato processing plant, Twin City Foods, can take over treatment of its waste. The company now accounts for about one-third of the city's waste water.

If Twin City falters, Prosser's costs will balloon to design a plant that can accommodate sometimes-overwhelming industrial waste flows. And the community of 4,800 people just doesn't have that kind of money.

"Sewer bills for our citizens and commercial businesses are high already," Carter said. "It's going to be a tremendous burden on the community."

In the 1980s, an estimated 85 percent of Prosser's waste water came from industrial plants. That's dropped to about 55 percent through the years as the industries have built treatment systems and learned to conserve water.

But industrial waste water still puts the town in a tight spot.

Because of the food processors. Prosser needs sewer capacity for a town three or four times as large, Carter said. The wastes - which include water, dirt and pulp - also are difficult for the city to treat.

Not only can industry waste flows vary widely day to day, but they also contain varying amounts of solids at different times. And the chemical reaction of potato waste mixed with city sewage creates a product much more difficult to treat than the two products separately.

"The only way we have of controlling it is putting a plug in their line," Carter said. "You hate to do that with a business because that puts them out of business."

Until the early 1990s. industries cowed Prosser into taking their waste water - even if the city didn't have the ability to treat it well, said Phelps Freeborn of the Ecology Department in Yakima.

"With the industries driving the town the way they did, they dictated terms," he said. "A business says, 'We provide 500 jobs for your town. Treat us well or we will move.' "

Freeborn said Carter's staff is making progress on the problem. Still, "It's taken a long time to get the industries to work with the city," he said.

To hear waste management officials talk about Prosser's problems, it seems water quality violations are narrowly averted every few weeks.

Sometimes, they aren't.

A town memo shows that between July 1996 and March 1997, the sewer plant allowed too much sediment to pass through 83 times.

And in 1991, Prosser was fined $18,250 for water quality problems - what Robert Barwin of the Ecology Department calls an extraordinary measure.

Violations were coming at the rate of several per quarter - and at least some of them weren't being reported, the state alleged.

In the last few years, the state could have fined Prosser again for dumping soiled water, said Barwin, the water quality program manager in Yakima.

"They have a noose around their necks," he said, noting late summer and fall 1997 reports showed significant improvements.

"It's pretty clear that if they have a relapse. ... they have got to deal with industrial users or we are going to have to deal with everybody in an enforcement (action)."

Usually, when the Ecology Department wants to play hardball, it takes away a town's ability to grow by stopping sewer expansions, Barwin said. But he said the state is being patient with Prosser because "everyone is doing their level best" to fix the system. Besides, he said, a fine would take away money the city needs for planned improvements.

But Prosser's poor track record caused concern at the EPA, which monitors the state's largest 90 waste water systems. EPA now requires the Ecology Department to submit quarterly reports to prove Prosser is cleaning its water enough.

The city's sewer system could get major relief by the end of 1998, when Twin City Foods is to begin operating a new multimillion dollar secondary treatment system. But so far, the company is struggling to meet strict state requirements for its effluent.

Cliff McGhan, Twin City Foods plant manager, said the system will allow the company to discharge its waste water directly to the river.

Currently, Twin City discharges about 500,000 gallons a day of waste water. It is treated first at what McGhan calls the company's "very fragile" primary system, which removes large solids before the water is sent to the city.

Carter said the city already is benefiting from Washington Frontier Juice, another of the largest waste water sources in town, which recently switched to its own treatment system.

Prosser's biggest other problem is its sewer treatment plant has been patched together during the last 50 years. In early 1997, the city lost its ancient clarifier - which skims the large muck from the top of the sewage treatment tank.

The breakdown caused repeated problems meeting state standards for sediment, fecal coliform bacteria and biochemical oxygen demand, which is an important measure of how good the water is for fish.

Ecology Department records show on several occasions the water Prosser returned to the river in the first half of 1997 had more fecal bacteria than the state allows. In one seven-day period, the fecal count was 23 times what is allowable.

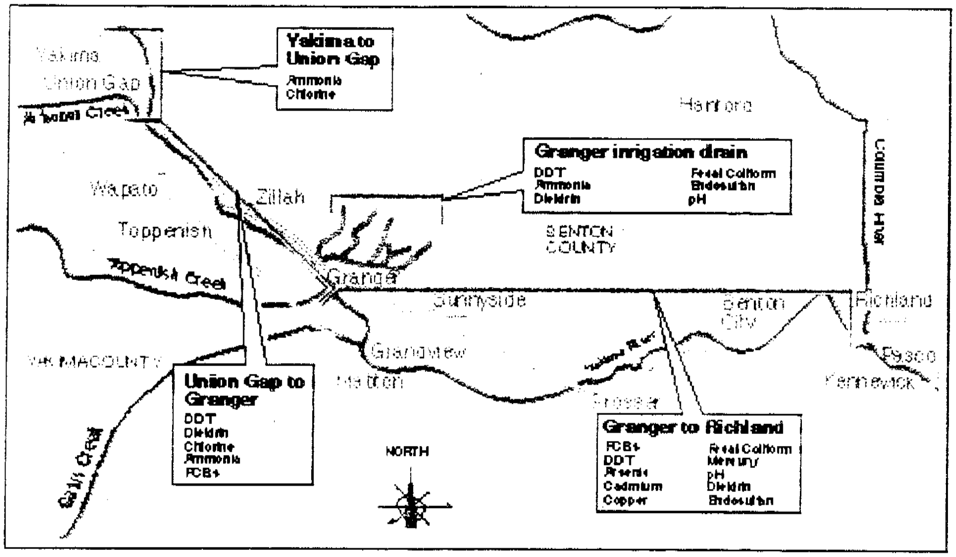
In late January, the city council agreed to spend almost $300,000 for a new clarifier that is to be operating in September.

At least until then - and probably until the entire system is overhauled - Prosser will continue to struggle. "This has probably taken more of my time in five years than any other issue," Carter said. "For a small community, it's very difficult."

Tri-City Herald

The Yakima: A River Wasted

Many pollutants added as Yakima River runs east



Herald/Sherry Emery

Herald/Sherry Emery

As the Yakima River winds through the Lower Valley, it's loaded with an increasing variety of pollutants.

The following pollutants were among those found on the Lower Yakima River during a 1997 state Ecology Department report.

Kim Sherwood, agency water quality engineer, helped with the layman's definitions:

-- **Endosulfan** - A popular pesticide for apple crops since DDT was banned. It becomes concentrated through the food chain and can harm humans and aquatic insects.

-- **Dieldrin** - A recently banned pesticide used on row crops. Same concerns as Endosulfan.

-- **Mercury** - Closed cinnabar mines on the Naches River have open holes that water passes through on the way to the river. Water picks up mercuric sulfide, a heavy, bright red mineral, and carries it to the river. Mercury is a continuing problem because some mine holes still are open. But Sherwood said mercury is not a major source of concern because it hasn't showed up in fish. Fungicides with mercury also contribute to the amount in the river.

-- **Copper** - Humans leave it everywhere. For instance, eroding copper tubing in old water coolers can load plenty of copper into the waste water system. It's toxic to plants and fish.

-- **Cadmium** - Comes from impure zinc, often used in galvanizing metals. It's relatively toxic to plants - but a lot of it is caught in waste water treatment systems.

-- **PCBs** - Polychlorinated biphenyls. These cancer-causing compounds come from an oil used in electrical transformers, many of which weren't disposed of properly. PCBs accumulate in fats and can become highly concentrated in the food chain.

-- **DDT** - Banned in 1972, this cancer-causing chemical and its derivatives DDE and DDD also are heavily concentrated in the food chain. Tests have shown significant amounts in Yakima River whitefish and suckers.

-- **Ammonia** - A natural byproduct of animal and human urine and also used in refrigerants. Highly toxic to fish. "Two gallons of it in the river will kill the fish for miles," Sherwood said.

-- **Chlorine** - Used in waste water treatment to kill bacteria. Not a high-priority concern for state ecology officials, but alternate ways of cleaning water are being developed. It is toxic to aquatic life even at low levels.

-- **Fecal coliform bacteria** - Comes from manure, failing septic systems, pet waste and storm water. Its presence shows pathogens may be in the water, but high fecal counts don't necessarily mean a human health risk.

Other important barometers of water quality that are of concern in the Yakima River include:

-- **Dissolved oxygen** - Fish need this to breathe, but they don't always have enough. Lots of bacteria - from storm water runoff, sewage or dairy waste, for instance - can use up oxygen and cause problems for fish.

-- **pH** - The level of acidity or alkalinity. Eastern Washington waters tend to be alkaline, and the Yakima is no exception. Acidic water is a more notable hazard for suffocating fish, but alkaline water can disturb aquatic life.

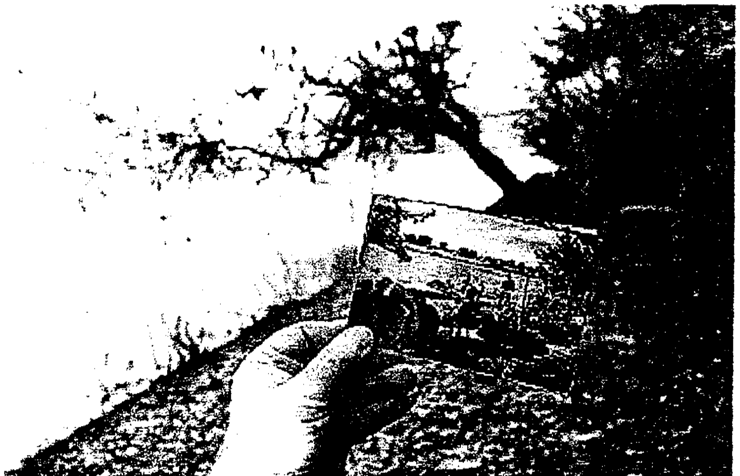
-- **Temperature** - Water normally cools quickly, but when stream banks are stripped of vegetation, water can heat above 68 degrees, which is about the maximum for most Northwest fish. The Yakima often exceeds this temperature. Low and slow water heats more quickly.

-- **Sediment** - Cloudiness caused by suspended dirt. Keeps fish and aquatic insects from breathing properly and can suffocate fish eggs. It also absorbs heat from the sun, warming water. In the Yakima, sediment carrying many farm chemicals is washed off fields by irrigation water and into the river.

Tri-City Herald

The Yakima: A River Wasted

Prosser residents love their river, rely on Yakima for recreation



Herald/Andre Ranieri

Prosser resident Duane Gerking holds up a photo of a summer boat party at his dock that washed away in the 1996 floods. Gerking is an avid river lover and says that in 40 years of water skiing and fishing on the Yakima, he's never heard of anyone getting sick from the polluted water.

PROSSER - The Yakima River is one of the state's most polluted waters, but don't tell that to people in Prosser.

Even if they believe you, chances are it won't keep them from enjoying their waterway.

"I have probably drunk gallons of that river," said Chris Gerking, 72, who lives on a steep bank overlooking the pool created by the Prosser diversion dam.

During the last 40 years, she and her husband, Duane, have become like grandparents to dozens of Prosser children - most of whom they met at their boat dock before it washed away in the 1996 flood.

The couple revel in those steaming summer days of boating, fishing and water skiing, days when children came from every corner of town to get towed a few miles upstream and back, then plopped onto the dock for one of Chris' sandwiches.

Duane, 72, said the green "crappy looking stuff" floating down the river in the summer is just moss that's lifted off rocks.

"It is dirty," he said, "but in 40 years, I haven't heard of anybody getting sick. ... You just don't put it in your mouth."

Health officials don't recommend regular contact with the river water or the irrigation return drains that flow into it, citing animal and human waste as health risks.

But at least one ear, nose and throat specialist in Sunnyside said the polluted river hasn't been linked to many "swimmers ear" infections in recent years.

Susan Price, office administrator for Dr. Dave Riley, said her office gets plenty of kids with summer ear infections, but they also come from swimming in hot tubs and pools, as well as the river.

Whatever the risks, kids often play in the river behind the dam on hot days, said Gordon Miller, a longtime Prosser resident.

Near a public boat ramp a mile or so upstream of the dam, a small herd of sheep has unrestricted access to the river - at least it did this winter.

As for the dead cow that occasionally floats by. "We just ski around it." Duane Gerking said.

In fact, the river's reputation has a benefit for the Gerkings. "Most people don't like to play here because it's too dirty. That gives us more room." Duane said.

Other neighbors along Seventh Street also aren't too worried about the health risks of the river - though they are happy about efforts to curb pollution.

A few doors away. Miller lives in a house with a sunset view across a mirrored pool - a serene scene in any season.

"There's something different every time you look out there." he said. "And the wildlife - we see lots of ducks and geese and occasionally a muskrat or a heron."

Of course. in the summer. residents sometimes also get whiffs of fertilizers or manure - it's hard to pin down exactly what - and algae blooms create scum on the river when the water gets too hot and slow.

But, "It's definitely made progress in the last 10 years," Miller said. "The river is getting cleaner all the time."

Prosser Mayor Herb Schmidt. another Seventh Street resident, also loves living on the river -though he said Prosser hasn't made the most of its waterway because it's been in such bad shape.

"Right now. we do very little to capitalize on a very beautiful river that flows through here." he said. "If we could just get it cleaned up. I am sure more and more people will use it."

Tri-City Herald

The Yakima: A River Wasted

Sediment 'real enemy' of choked river system

Herald file

Heavy equipment removes tons of sediment from the intake of the Kennewick Irrigation District canal near the Prosser diversion dam. The work took place in the summer of 1997 after heavy flooding in 1996 clogged the canal with dirt.

Each day during irrigation season, at least 24 dump-truck loads of soil - 355 tons - are washed off farms and into the Lower Yakima River.

The sediment chokes aquatic life and carries farm chemicals, some of which are toxic to fish.

And dangerous to people.

"The real enemy of the Yakima River is mud," said Kim Sherwood, state Ecology Department water quality expert. "It just fills up the pores in the gravel and ... destroys the homes and habitat of the proper insects and bacteria."

He said dirty water also increases water temperature -sometimes drastically - because sediment soaks up light and heat. The hot dirt then heats the water above what fish can handle.

Dirt also cuts down the amount of light entering the river, which harms the ecosystem. And it makes it harder for fish to move about and find food.

A 1993 study showed Yakima River fish had one of the highest concentrations of the toxic pesticide DDT in the country, prompting the state Health Department to warn people not to eat many bottom fish from the Lower Yakima Basin.

By focusing on DDT, the Ecology Department hopes to galvanize the public against the irrigation practices and erosion that clog the river. The long-lived chemical was banned in 1972 but tenaciously remains in the soils of the Yakima basin and is washed into the river with irrigation runoff.

In an ongoing look at bad water in Washington, the Ecology Department declared in August that sediment in the Yakima must be reduced by 75 to 95 percent. The so-called Total Maximum Daily Load Study set steps for cleaning up river sediment and DDT during the next 20 years.

Unlike most modern pesticides, DDT doesn't break down quickly. Even 25 years after it was banned, it remains among the most-detected pesticides in the river.

More than one person at the Ecology Department admits it's possible people still are using stashes of DDT, which could account for some of its persistence. But the state hasn't spent much effort trying to prove this theory because not much more can be done to regulate DDT, Sherwood said.

Walt George, board chairman for the South Yakima Conservation District, said the biggest culprit behind the sediment problem is rill irrigation, in which water is released at the top of a field and rolls down through the rows.

Excess water is collected at the bottom of the field and reused on other fields, but it also often runs into the river - full of sediment - via return drains.

That's not a big deal for one farm, but with about half of the basin's estimated 450,000 acres being watered that way, there's ample opportunity for trouble.

Typically, the Ecology Department leaves problems with runoff to conservation districts. These nonregulatory agencies assist farmers in creating farm plans that use "best management practices" to control runoff and erosion and provide money for farm improvements through matching grants.

Pat Daly, Benton Conservation District manager, said the Ecology Department rarely steps in and penalizes farmers. "If it's a major problem and I can't resolve it, or it's too big of an issue, then (the Ecology Department) will get involved. But that's unlikely."

She said it's important farmers don't fear her and it's an incentive for them to work with an agency that doesn't penalize. "I need grower trust to do what I need to do."

It's also increasingly important that progress is made, said George, whose South Yakima Conservation District works with about 300 farms.

"(Problems) have gotten more crucial," he said. "We were working on them, but there wasn't so much emphasis put on it as there is now."

And they are making a difference.

In the early 1990s, a study showed the Granger Drain was filled with 163 tons of sediment a day. The 1997 report showed total suspended sediments in the drain were down to 60 tons a day.

Even with matching grants, solutions aren't cheap.

Converting from rill to drip irrigation costs about $1,100 an acre. "There are very few growers who have that kind of money," George said.

Daly estimates there still are 10,000 acres of rill-irrigated land in Benton County - though more farmers are changing to drip and sprinkler systems.

More progressive farmers also are using water monitoring probes to make sure exactly the right amount of water is used on each patch of land and computer systems that help regulate irrigation.

As part of a sediment cleanup program, the Ecology Department plans this year to have two people educating farmers about the best land conservation practices.

Also, the agency is providing irrigators a computer spreadsheet program - dripcost.xls - to figure the costs and benefits of installing and operating a drip irrigation system. The program calculates how profitable the investment will be and how long it will take to repay the loans.

The Benton Conservation District is continuing its irrigation training workshops - with plans to offer some in Spanish - and has an irrigation expert who consults with farmers. Most services are free.

Already this year, the board of joint control for the Roza and Sunnyside Valley irrigation districts held workshops for landowners to learn about erosion-reducing techniques.

District officials see such efforts as vital because farmers eventually could lose their irrigation water if they don't keep their dirt out of the river.

"We're trying to educate first on what we're really facing," said Jim Trull, Sunnyside Valley manager.

It won't be easy to make changes. At January meetings about the new rules, farmers complained the water they received already was loaded with dirt.

"It's a legitimate concern," Trull said, but "it's not a good enough argument for us not to do anything."

One problem in cracking down on farmers who don't control their runoff has been regulators have a hard time figuring out exactly where the pollution is coming from.

But that will change soon. The Roza and Sunnyside board of joint control set policies for 1998 that will force farmers to set plans to eliminate discharges into return drains and ensure their runoff meets the district's water quality standards.

The district also is going to monitor flows that leave each landowner's farm. Where there's too much dirt, farmers will have to put together a schedule to meet standards and start working on it by 1999.

Trull said farmers will face "substantial costs" keeping their dirt out of the water - but he said the biggest cost for farmers would be not doing the improvements they've planned.

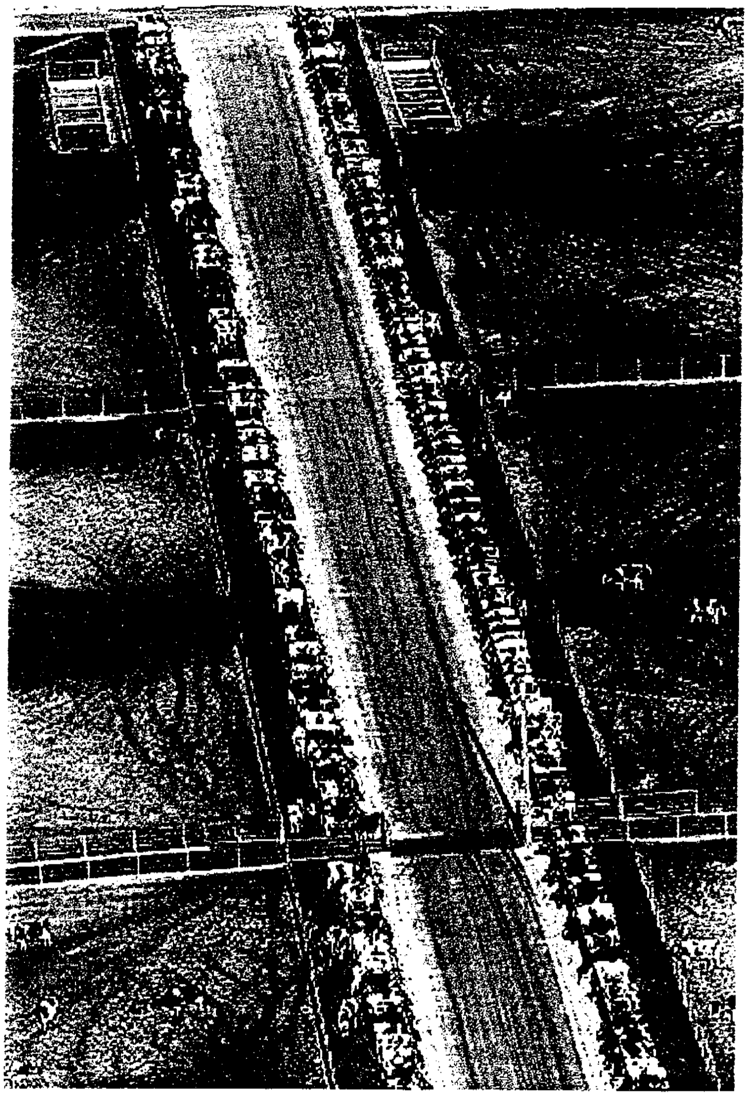
In that case, "The penalty would be that we would not deliver irrigation water to them," Trull said. "That is the hammer."

Even without that, farmers are smart to keep their soil on their land. Said George: "We need to keep the soil on the land for future generations to raise crops on."

Tri-City Herald

The Yakima: A River Wasted

Dairy waste sullies Yakima



Herald/Bob Brawdy

Hundreds of cows line up for feed at a mammoth dairy off Van Belle Road near Outlook. The Yakima Valley is the largest dairy area in the state.

Imagine Seattle and its suburbs plopped into the Lower Yakima Valley - roughly 1.5 million people.

And every time they flush a toilet, the waste flows into big pits along the Yakima River. Most of the time, the waste is taken from the pits and properly treated.

But sometimes, the ponds flood, spilling streams of feces into the river. Other times, lagoon managers simply pump the waste right into ditches that drain to the river.

That's essentially what's been happening in the Lower Yakima Valley for at least 20 years.

Only here, the largest dairy herd in the state and a few farmers are to blame, not a metropolis of people.

The problem has mind-numbing proportions:

A herd of 100 cows produces as much body waste as 2,200 people, according to the South Yakima Conservation District. One mature milking cow makes 265 cubic feet of solid waste a year - enough to fill 10 dump trucks.

And the Yakima Valley has 68,000 dairy cows in Benton and Yakima counties.

Take all of the solid wastes produced by those cows in a year, and you could fill Pasco's 2.7 million gallon water tower on Road 68 about 50 times. And that's not counting the millions of gallons of liquid waste, which is harder to control.

"A dairy with a thousand cows is like a small municipality," explained Max Linden of the state Department of Ecology in Yakima.

But cow manure and urine don't go through a city sewer treatment plant, so when the waste hits a waterway, it carries a full load of bacteria that can make people sick. The waste also is loaded with nutrients that feed oxygen-consuming algae, which, in turn, can suffocate fish.

That's if the wastes aren't handled correctly, of course. And Linden said all indications are most of the Valley's 80 dairies do a decent job of containing their wastes.

But there have been repeated accidents, and there are a few dairies whose waste management could at best be called sloppy. On top of that, state enforcement against those offenders has hardly been aggressive.

New state and federal inspection programs kicked in last year, but dairy farms historically haven't been investigated until there was a complaint. However, lack of penalties doesn't necessarily mean dairy wastes have been properly handled.

"There are so many animals and too few fields to spread the manure on," said Joe Joy, water quality specialist for the Ecology Department in Olympia. "You're bound to have problems."

Only a few waterways in Washington have fecal coliform bacteria contamination as bad as the Granger Drain. The irrigation return canal has about a dozen dairies along its length.

In 1991, tests on the Granger Drain showed a high of 166,000 fecal coliform bacteria colonies per 100 milliliters of water, a sample roughly the size of a glass of wine.

That level of fecal coliform -which indicates other dangerous pathogens also likely are present - grossly exceeds the state surface water standard of 100 colonies per 100 milliliters.

The drain dumps into the Yakima River at Granger, near a public park and a boat launch. "There is a high potential for illness, given these numbers," Joy said.

Ecology Department tests at the Granger Drain in 1995 showed the irrigation season average fecal coliform count was 1,968 colonies per 100 milliliters, well down from the average of 25,750 in 1991 but still far in excess of the standard.

"The drain is in very poor shape, but it's better than it was in 1991," Joy said, noting tests for other waste byproducts like ammonia - from cow urine - seem to show the drain's water at least did not get worse during the first half of the decade.

Scott Abbott, a Sunnyside veterinarian, sums up the attitude of many involved with the industry: "You have to realize there are 80 (dairy) farms in the Valley here. Everything varies from dairy to dairy. I am not going to say every dairy farmer is perfect, but if you look at how things were 30 years ago, I would say that, environmentally, every dairy in the Valley has made great strides to improve things."

But about a dozen Valley dairies keep the Ecology Department's attention because they generate complaints about manure handling, Linden said.

And between 1995 and 1997, two Lower Valley dairy farmers were fined by the state Ecology Department, a rare action the state uses only after gentler methods fail. Those fines capped state case files on the two dairies that are a few hundred pages thick and date back more than 20 years.

"We gave them a lot of chances," said the Department of Ecology's Linden. "Whether right or wrong, that's what we did."

Compliance with pollution laws is expensive for dairy operators. Some farmers have spent more than $100,000 to store their waste, which commonly is held in large lagoons, then sprayed on fields as fertilizer.

Problems usually occur when lagoons overflow or when too much effluent is pumped onto fields and it runs off. In the spring, when manure lagoons are full from storing winter waste, a heavy rain or a rapid snowmelt can flood through the property and carry waste with it.

Floods in 1996 and 1997 scared Yakima Valley dairy farmers, said Laurie Crowe, dairy waste technician at the South Yakima Conservation District. And the publicized intentions of a Lower Valley citizens group to sue 10 area dairies for Clean Water Act violations spurred dairymen, too.

Crowe said she's busier than ever helping dairies create waste management plans. In the last three months, at least 30 dairies have come in for help. Through the years, the conservation district has worked with about 60 of the 80 Lower Valley dairies.

"What I've seen this year is, basically, they are adding extra (waste storage) because of last year's weather. I don't think anyone is in dire need of any structure - they are simply trying to get away from any type of discharge. They just don't want to end up like last year," Crowe said.

During the last 20 years, the Sunnyside Valley Irrigation District has regularly complained to the Ecology Department when its "ditch riders" spotted manure in drains.

Spurred by the Ecology Department's demands for less sediment in the water, the Sunnyside and Roza Board of Joint Control is implementing strict standards in 1998 to protect its waterways.

The board is testing some runoff water from dairies but is concentrating on sediment and pesticide contamination. Still, the board has established buffer zone and fencing guidelines to keep livestock out of the waterways.

"We're trying to be proactive and solve some problems. ... It's too late to be ahead of time," said Jim Trull, district manager.

Tri-City Herald

The Yakima: A River Wasted

Climate, space put Valley at top of industry

Herald/Bob Brawdy

Darigold's $60 million Dairy Fair processes more than a half-million gallons of milk a day. Its presence in Sunnyside has helped the region become the state's dairy leader. The factory offers public tours and lures travelers from Interstate 82 for hefty ice cream cones.

Lots of land, little rain, plenty of food and a huge processing plant have turned the Lower Yakima Valley into the state's top dairy area in the last seven years.

Since 1990, Yakima County's dairy cow population has jumped from almost 26,000 to 66,000, according to state Agriculture Department statistics. Add Benton County's 1,900 dairy cows, and the Yakima Valley tops rival Whatcom County, the state's traditional leader in dairy cattle.

Both regions now account for about one-fourth of the state's dairy cows. In 1996, milk was Washington's second leading agricultural commodity after apples, and the state is the eighth-largest dairy producer in the nation.

The best mark for the start of the Yakima Valley's dairy growth spurt is 1990, when Darigold announced its $60 million processing plant in Sunnyside.

The 150,000-square-foot plant started production two years later and features a retail section known as the Dairy Fair. It's complete with cheese tasting, public tours and the biggest ice cream cones around.

It's not only a tourist attraction but also big business, processing more than a half-million gallons of milk a day.

"The cost of hauling (milk products) became sufficient to justify the production facility over there," said Doug Marshall, Darigold spokesman. "We saw a lot of growth prior to building, and we saw a lot of growth after."

There's no doubt that being close to market has spurred dairy growth in Central Washington. And Marshall expects even more dairies to come to the lower Columbia Basin and Northeastern Oregon.

Some dairy operators might come from the west side of Washington, where population pressure has squeezed out farms. Once-rural towns like Enumclaw are busting with residents who don't want to smell farm animals.

Besides, the east side of the state offers dairies plenty of benefits compared with the west side. Yakima and Lower Columbia Basin dairy farms have grown because they are a cheaper place to farm - they are closer to the food supply, there's more available land, and less rain means fewer problems with waste.

The region looks good enough that some California dairies have moved into the Yakima Valley to escape creeping urbanization of the nation's largest dairy-producing state.

The Yakima Valley also has grown to depend on its dairies, in addition to the crops that have long been its sustenance. "Without agriculture, Sunnyside wouldn't be much of anything," said Scott Abbott, a longtime veterinarian in Sunnyside.

But the state's dairy census also tells another story. The number of dairies in Yakima County is about one-third the number in Whatcom. That's because the average farm in Yakima County is about 700 cows -two or three times the average size in the state. And Yakima County boasts five herds between 3,000 and 5,000 cows, Ecology Department statistics show.

"The typical dairy farmer has had to expand," Marshall said. "The way to operate an efficient dairy is to have a little larger size. You've got to milk more cows."

Debbie Becker, executive director of the state Dairy Federation, said, "It's a matter of increasing in size to stay in business. It's a fact of life."

Expansion also allows some to have more comprehensive animal care. Abbott said that when he started veterinary work more than 12 years ago, he mostly did emergency work. Now, he's virtually an assistant manager at some farms, helping owners develop ways to keep their cows healthy.

One Lower Valley farmer, for instance, equips his cows with bracelets that track movements and milkings. By analyzing the data, the farmer can spot unhealthy animals using a system small-time farmers probably could not afford.

"Unless you are more efficient as a dairy farmer, you are not going to make it in today's society," Marshall said.

While Washington's 1996 milk production was down slightly from 1995, its per-cow production has continued to rise. According to the Department of Agriculture, Washington ranks second in the country with 19,996 pounds of milk produced per cow per year, 3,481 pounds above the national average.

Efficient cows and efficient farmers mean more milk - which is part of the reason the price of milk today is about the same as it was in 1980.

"That's a tremendous success story if you are looking at it as an economist," Marshall said. "If you are looking at it as a dairy farmer, it's discouraging."

For some, the steady prices meant closing doors and looking for other work. In 1990, the state had 1,245 dairies. In December 1997, there were 819. Despite that drastic drop, farm gate receipts for dairy products jumped from $468 million in 1986 to $687 million in 1996.

Abbott, who grew up on a small dairy, said many farmers give up their farms because they offer little financial security. And many children of dairy farmers don't want to go into a career that demands seven-day-a-week attention.

"Let's face it, that's not the way people are interested in working anymore."

In Wisconsin, the nation's one-time dairy capital, farmers are falling like flies. The average age in the industry is nearly 60, and small farms close every week.

It's different in the Yakima Valley, Abbott said. Kids there are going off to college and coming back to the farm, sometimes getting their own farm when their family's herd gets too big.

The big farms have caused divisions in the industry. In Wisconsin, Marshall said, farmers used peer pressure to keep farms small, which led to the decline of the state's industry as farms grew in other states.

But big farms are derided as "factory farms" - as opposed to the quaint family operations that dominated the industry in the past.

"Consumers are demanding low milk prices," Marshall said. "There is kind of a Catch-22: Consumers complain, but if the answer is the so-called 'factory farm,' isn't that what the consumer is demanding?"

Becker defends the Yakima Valley's mega-farms as family farms: "I know the care and concern that goes into these facilities. These people still have their roots in the community, and they are still providing economic growth for the community."

Tri-City Herald

The Yakima: A River Wasted

State doing little to ensure dairy animals aren't polluting river

Herald/Bob Brawdy

Farm animals, pets and wild animals that deposit feces in the river increase the human health risk from drinking the water. Best farm management techniques prevent livestock from reaching rivers. But these cows near Mabton roam the shallows just a few yards from the main stem of the Yakima River.

The state has done a poor job of making sure dairies aren't letting their manure pollute streams and rivers.

Nowhere is that more clear than in the Lower Yakima Valley, where one Ecology Department employee devotes just one-third of his time to inspecting the state's largest dairy herd.

Statewide, the department has had fewer than four people assigned to make sure 800 dairies comply with water quality laws.

Inspectors typically investigate only when someone complains. And fines have been issued only rarely, even when farms have had records of violations going back more than 20 years.

It's a program that is "broken," as the federal Environmental Protection Agency describes it. And the EPA has lost patience with the problem.

In August, the agency's deputy regional administrator came down hard on Washington state. EPA inspectors began doing unannounced checks on dairies in some regions, and they began handing out warnings and fines.

EPA's crackdown apparently has caught the state's attention. State legislators are debating tougher dairy laws. The governor has proposed a budget that would beef up the dairy inspector force. And dairy farmers themselves are working to clean up their waste management.

"It's our hope we don't have to carry out these inspections in perpetuity," said Dave Ragsdale, EPA dairy waste specialist. But he added, "Until they have implemented an effective program, we'll continue doing it."

Ragsdale said the Valley's dairy cow boom in the last decade has caught EPA's attention. But he added, "We really can't make a judgment on the level of compliance until we have done some inspections."

Phil KauzLoric, dairy program coordinator for the Ecology Department, agrees the state's current dairy waste management program "is in need of repair." He said his department believes regular inspections are needed at all dairy farms.

But to do this, the state said it needs more people to enforce the law. A September memo by Megan White, manager of the Ecology Department's water quality program, said, "The need for inspections is greater than the resources available to conduct them."

With its small staff. the Ecology Department has been able to do relatively few farm inspections. From 1995 through 1997. the department handed out just 10 fines for dairy waste violations. Two went to farms in the Yakima Valley.

Although the Ecology Department can impose fines of up to $10.000 a day per violation. no dairy has ever been fined that much.

To date. the most severe penalty the state has imposed on a dairyman for polluting water was levied in December. Edward Koopmans. a former Skagit County farmer. was given a $40.000 fine and four days in jail for repeated violations.

Max Linden of the state Department of Ecology in Yakima explained the state's intent behind efforts to enforce dairy waste management law is to fix problems. not to penalize. He said state code essentially states problems must be chronic to draw fines.

"It may seem in some cases that we're not doing stuff. but we have bigger and broader goals," Linden said.

The state also can require farms that have been a source of water problems to get a National Pollutant Discharge and Elimination System permit. In the Lower Yakima Valley, about eight dairies have been required to get permits. though several are in progress.

The permits are intended to make sure dairies have adequate waste management plans and facilities. They also require the dairies to report any waste spills to the state.

But a permit. Linden acknowledged, is only as good as the people who carry it out. "We put a lot of faith and responsibility on the permit holder," he said. "We can't be there all the time to make sure they are in compliance."

In 1997. the agency asked the Legislature for nine inspectors. which it did not get from budget-conscious lawmakers.

This year. the governor's proposed supplemental budget now before the Legislature includes $771.000 that would pay for 10 more Ecology Department employees to tackle dairy problems and other programs. The number of new employees could change, depending on how many are needed to carry out legislation.

If the budget passes. inspectors would have a more realistic chance to visit each dairy annually. Instead of each inspector being responsible for 235 farms. each inspector would have about 70.

Last year. the Ecology Department started its own "watershed" inspection program for major dairy farm areas. where pollution problems were suspected. In March, the agency plans to finish its review of 50 farms on the Chehalis River in Western Washington. About half the Chehalis farms inspected so far are not handling their waste properly. the agency found.

But coming changes are bigger than any single watershed.

The EPA is calling for state legislation that includes routine compliance inspections. doesn't hinder the Ecology Department's ability to levy penalties and provides enough workers to run the program.

Right now. EPA is taking on that challenge. It started in Whatcom County, the state's longtime dairy leader and a place with known water quality problems.

EPA quickly handed out six fines to Whatcom dairies discharging manure wastes into surface waters. Fines ranged from $11.000 to $22.000. Another 42 of the 64 dairies inspected got warning letters. mostly for waste lagoons that were spilling over or nearly spilling over.

If Whatcom is indicative of the state. "There are probably hundreds of other dairies in Washington that are not doing all that the law requires to keep cow manure out of streams, rivers and other water bodies," said agency spokesman Bob Jacobson.

The Chehalis and Snoqualmie watersheds are targeted by EPA for review. The Yakima isn't on the list yet, but the agency isn't ruling out the possibility.

EPA's Ragsdale said a complaint-driven process like the state had provides little incentive for dairy operators to spend money on changes before problems start.

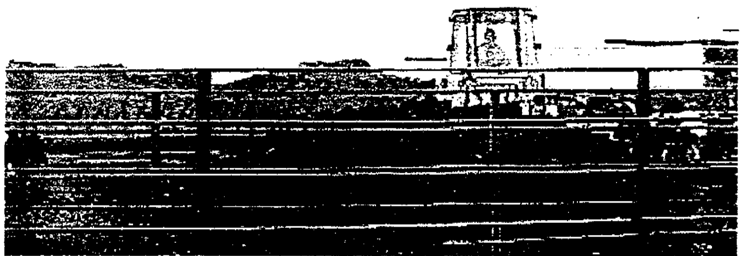
"If you don't come up with a program that's effective. those operators who made the investment ... are at an economic disadvantage," he said. "We owe it to them to make sure the laws are implemented."

Ragsdale said EPA has been trying to educate Washington farmers about clean water for years - but with little success. "We've done everything we could to encourage voluntary compliance. Now we have taken the next step."

Tri-City Herald

The Yakima: A River Wasted

State legislators wrestle to regulate dairy waste



Herald/Bob Brawdy

Managing manure is a full-time job, especially for large dairies like many in the Lower Valley. Some farmers have spent more than $100,000 in the last year to beef up their waste management systems and keep cow feces from reaching the river. The Legislature, too, is trying to come up with solutions.

Washington needs a new dairy waste management law, many Washington politicians have said in recent months.

The question is what will work best to keep waters clean and dairy owners in business.

And the possibility is nothing will happen.

This session, the state Legislature is reviewing two bills designed to stop dairies from soiling state waters. Both proposed laws - one from the Senate and one from the House - would force regular inspections at dairies, something that isn't the case now.

But the bills could be at a stalemate - and late last week, substantive changes were made to the Senate bill by a House committee, further complicating the issue. Each has to pass the other house's agriculture committee, which developed its own bill. Last week, politicians were trying to find a compromise to pass in the few days remaining before the session ends.

Before it was altered, the Senate bill gave farmers several ways to show they are complying with clean water rules. The House version forces all farmers to create a waste management plan within two years. Both drew large crowds in legislative hearings.

Under the current rule, farmers only have to get a permit -designed to ensure they can handle their herd's wastes - when they are shown to be a water polluter. That hasn't happened often, and only a handful of the 80 Yakima Valley dairies have been forced to get permits.

Even with a permit, it's against federal law to dump animal waste into waters. Rules allow exceptions for "catastrophic" or "chronic" weather problems beyond dairies' ability to control.

"I am not sure the federal guidelines are necessarily achievable," said Sen. Dan Swecker, R-Rochester. "But I do know one thing, and that is we can dramatically improve what we're doing."

Last year, the House Agriculture and Ecology Committee worked on new dairy waste rules but never reached agreement.

So Swecker brought the ecology department and the state Dairy Federation together to create a new bill they called the Dairy Industry Compliance Initiative.

At present, polluting dairies generally are turned over to the state conservation commission and local conservation districts. Farms are given six months to complete a waste management plan and 18 months to implement it.

Many say that law doesn't force changes quick enough - and rarely does it result in fines for dairy operators.

Swecker's bill would make each commercial dairy register with the state, but farmers would have choices about how they show their compliance with the law.

The Ecology Department would inspect dairies - starting with the ones that don't have a good waste plan or didn't register.

Swecker said the new rules will start to curb problems right away. "When you make people get permits, the onus is on them to take the initiative and get the job done. ... It is incentive for the farmers to take responsibility and use their own resources to find solutions to the problem. ... but it also has enough teeth to make sure they do that."

Swecker's bill proved to have good bipartisan support at a mid-January hearing where it was backed by environmentalists and farmers alike.

"We have put together a program that will allow us to show that dairy farmers are committed to the Clean Water Act," said Debbie Becker, Dairy Federation executive director.

The House legislation - sponsored by Rep. Gary Chandler, R-Moses Lake, and Rep. Jim Honeyford, R-Sunnyside, among others - also provides for regular farm inspection along with technical assistance to cut pollution.

It would force farms to register with the state by September and start the state inspections by October. And it makes every dairy farmer create a waste management plan by Dec. 1, 2000.

Chandler said last week that the Senate bill isn't tough enough - that the industry will remain mired in negative press as a huge source of water pollution unless it can prove to citizens dairies are clean neighbors.

To do that, he said, it's necessary for all farms to create waste management plans regardless of their pollution history.

The Dairy Federation is lobbying hard against the House bill, on the grounds that it "imposes new layers of regulatory requirements that are extremely costly for producers," according to a federation letter to the Senate in mid-February.

It's not clear what it will cost farmers to comply with new laws - though fines are up to $10,000 a day per violation even under current rules.

"We're hoping (new legislation) will not ultimately put producers out of business," Becker said, noting several Valley dairies spent thousands of dollars in recent months to upgrade their systems.

The federation conducted a survey to determine the economic effect of stricter rules. About one-third of the farmers who returned surveys in late December said they expected to go out of business in the next five years largely because of low milk prices or environmental regulations.

"I knew we were going to see some substantial changes in the industry over the next five years," Becker said, "but I didn't realize it would be that level."

Environmental costs haven't been the reason for dairy consolidation to this point, said Dave Ragsdale, EPA dairy waste specialist in Washington state. But he acknowledged operators now will be faced with a decision to invest in new manure control systems or get out of the business.

Tri-City Herald

The Yakima: A River Wasted

Legacy of dairy industry's waste problems stretches back 2 decades

Herald/Bob Brawdy

This aerial view of DeRuyter Brothers Dairy near Outlook shows how large some Lower Valley dairies have grown in the last decade. The farm has a long history of problems managing waste from about 3,000 cows, according to the state Ecology Department.

Dairy waste from at least two Lower Yakima Valley dairy farms has repeatedly leaked into irrigation drainage ditches since the mid-1970s.

Between August 1995 and June 1997, the state Ecology Department fined the two dairy operators - Henry Bosma and Jake DeRuyter - for substantial water quality violations. Fines totaled about $42,000, three-fourths of which was levied for one violation.

The Tri-City Herald acquired the agency's files on both dairymen through a Freedom of Information Act request. Paperwork about their combined complaints, penalties and correspondence fills several hundred pages and details numerous problems with dairy waste management.

"These are the two that we've been working the hardest with," said Max Linden of the Ecology Department in Yakima.

The intense scrutiny has had an effect on at least one of the dairies.

Bosma said he's recently completed a $125,000 waste management system - including three lagoons that hold more than 49 million gallons of wastes. He's hoping all that work and money will keep the agency - and Valley citizens groups filing Clean Water Act lawsuits - off his back.

He admitted dairies need to do a better job of taking care of their waste and said current state legislation to start a regular inspection program isn't a bad idea.

"Don't think for a moment we are out here trashing things. We live here," Bosma said. "I am as concerned about the environment as anybody else."

DeRuyter did not respond to repeated requests from the Herald to discuss the issue, other than to say his lawyers had directed him not to talk to the media.

In mid-February, the dairy released a statement in response a citizens lawsuit alleging Clean Water Act violations. "We care very much about the environment and about the community and are doing all we can to operate our dairy farm in an environmentally responsible manner."

Alan Fulk at the National Resource Conservation Service, which helps farms develop waste plans, said DeRuyter Brothers has spent "lots of money" improving its waste system in recent months. He would not specify the amount or the projects.

Records show that since 1976. DeRuyter Brothers Dairy of Outlook has had at least 15 verified discharges of manure-contaminated water. according to an Ecology Department letter.

Agency records show the following recent violations for DeRuyter Brothers. which has a state and federal permit based on about 3.000 dairy cows.

-- In January 1995. the Sunnyside Valley Irrigation District reported manure waste from corrals being pumped into a ditch along Van Belle Road even though the dairy had lagoon space available. Drain water nearby had 700.000 colonies of fecal coliform bacteria per 100 milliliters of water - 7.000 times more than is acceptable in state waters.

Though the source of contamination was not proved. DeRuyter Brothers farm was fined $3.000.

-- In 1997. a TV news crew filmed DeRuyter workers pumping manure into an irrigation drain along Chute Road. The dairy was fined $30.000 after it was found it had two empty lagoons that could have taken the waste. DeRuyter agreed to pay but did not admit guilt.

-- A November 1997 Department of Ecology letter said there had been three verified incidents of manure being discharged off DeRuyter Brothers Dairy in the previous two months. In two cases, a machine that sprays effluent onto fields was stuck. and waste was running off the property.

The inspector also noted the fields DeRuyter Brothers was spraying with "significant amounts" of solid and liquid manure had been fallow for two years. No more waste is to be put on a field than can be used by the plants as fertilizer - and state officials said that didn't appear to be the case there.

Bosma. who started dairying in the Valley in 1973. operates H&S Dairy and North Liberty Dairy, which total about 5.500 cows.

His Ecology Department file includes these incidents:

-- In March 1993. the agency verified two complaints of manure discharged to an irrigation drain from North Liberty Dairy. State officials cited the dairy for applying too much waste on a field, and a $6.000 penalty was issued in early 1994.

Bosma said the over-application happened when the man managing the manure spray guns was called off the job because his wife was in labor. The fine was reduced to $3.000 on appeal.

-- Bosma was fined $9.000 for discharging manure-contaminated water to an irrigation drain in April 1996. The penalty was deferred. however. pending completion of a waste management plan.

Because Bosma had more discharges, he was told to pay the fine early this year. He also was slapped with an additional $3.000 fine for permit violations.

-- In January 1997. during a storm that caused problems for many dairies. the Ecology Department verified two cases of manure in drains near Bosma's farm. In September. the drain was "pure green" with manure. Fecal coliform counts reached 480 times the state standard.

"It was clean water going through a dirty ditch," Bosma said. "I am not the only one who uses that ditch."

As for his thick file. Bosma said. "A lot of this stuff isn't verified. And if it is. we address it immediately." He added he wishes people with complaints about his farm management would come to him before going to the Ecology Department.

Bosma said his recently completed waste management system includes three huge lagoons that give him four times the amount of storage required by his farm plan. He added that lots of dairies have made big changes - but they aren't getting the credit they deserve.

Now. all of Bosma's land is sloped toward the lagoons so waste water doesn't run off his land. and he's created a system to keep return water from other farms off his property.

That's the kind of thing the Ecology Department likes to see. "We worked and worked with him." Linden said. "Finally, he got the point."

Tri-City Herald

The Yakima: A River Wasted

Concerned users search for answers

In the fall of 1993, a dozen Yakima Valley water users realized they didn't have enough water to do everything they wanted. And that was before the biggest drought in recent history, which dried up canals and shriveled crops the next year.

Concerned about their future, water users came up with a plan that included building two reservoirs on the upper reaches of the Yakima River - at a cost of at least a few hundred million dollars and undetermined environmental damage.

Meeting first at the Barn restaurant in Prosser, the impromptu committee started knocking about ideas to save irrigation. "We knew we had to do something," said Max Benitz Jr., a Benton County commissioner.

The group's self-imposed mandate: to maintain the Yakima Valley's reputation as one of the nation's best agricultural regions while providing enough clean water to rebuild salmon runs.

That's a lot of water. Irrigators alone divert an average of more than 2 million acre-feet of water each year - enough to cover most of the land in Yakima, Benton and Kittitas counties 6 inches deep.

Three years, countless meetings and almost 500 members later, the Yakima River Watershed Council has what Benitz calls the state's most sophisticated plan to date for dealing with water problems - both quantity and quality.

The plan includes proposals for several watershed restoration efforts, such as community education about water issues, creating a water transfer system that would encourage conservation and building smaller "reregulating reservoirs" along the river to improve the irrigation system's ability to save water.

But the big-ticket item in the council's plan is the addition of the mountain reservoirs at a total price tag likely pushing a half-billion dollars.

This year, the Bureau of Reclamation is to figure updated cost estimates for the reservoirs, study the environmental effects and evaluate how well such a system would meet water needs. After all the drafts and hearings, it will be up to counties to adopt the Watershed Council's recommendations into their comprehensive plans.

By June, the council hopes to have a new draft plan ready for public review. But it probably will be 15 years before irrigators are getting water from new Upper Yakima reservoirs.

That's if the projects are built. The storage idea isn't agreed to by all, said Katherine Ransel, co-director of American Rivers' office in Seattle. She opposes the idea of more Cascade Range reservoirs because of the environmental harm they would do.

"What we need to do is live within our means," said Ransel, who works for the nationwide environmental group that focuses on health of waterways.

And Ransel said the best place to start doing that is by cracking down on irrigators who take more water than they are supposed to. She said savings alone would be a huge step.

Nine irrigation districts now pull water from the upper Yakima and its tributaries, and there are 10 diversions on the lower river. They take between 50 and 100 percent of the water - leaving little for aquatic life.

"You can't separate quantity and quality," said Mel Wagner, chairman of the Watershed Council. "The quality goes down when you get such low flows full of nutrients."

Ray Hennekey, the state Department of Ecology's lead person working with community groups to improve the river, credits the Watershed Council for starting discussions about how to improve the river.

"This whole community is really starting to coalesce around some environmental goals," he said. "People have begun to realize that we ... have to do something different.

"I don't know of anywhere else, certainly not in the state, where all of the (players) are getting together to talk about what is going on."

The council's plans are being spurred by Congress, which budgeted about $10 million in 1998 to finance the Bureau of Reclamation's conservation efforts. Two-thirds of the water saved will go back into the river for fish. The rest can be used by irrigators.

Wagner said federal plans and grass-roots efforts complement each other. Together, they represent the Yakima Valley's best chance at solving its water problems - despite the Watershed Council's hard luck with a $150,000 state grant payment that was frozen by the courts.

Though solutions are years away from being implemented, there's no time to wait, Wagner said. "We're risking our economy, our fish and our health if we wait."

The council's vision was put together with lots of tension and competing ideas from tribes, environmentalists, farmers and county commissioners, among others.

The biggest conflict is over water allocation in low-water years. The plan calls for junior irrigation districts to take 70 percent of their allotment when water is low and leave the rest in the river. By law, senior irrigation districts get first take and their amount cannot be cut.

In addition, water users are required by the federal government to leave 200 cubic feet per second in the river for fish, which means junior irrigation districts sometimes don't get enough to water their crops. For fish, however, 200 cfs is not much - it's well below what Wagner calls the optimum level of about 1,100 cfs.

"Every year, we are playing Russian roulette," Wagner said. "Common sense tells us we need to store a little more."

The Watershed Council's draft plan shoots for a minimum of 700 cfs in the river by building a new reservoir on Squaw Creek and expanding another in the Cascades.

That translates to holding back 625,000 acre-feet of water - 60 percent of which would be diverted for irrigation and 40 percent of which would remain in the river. By saving more water during high-flow seasons, river operators could release it during the late summer and fall when flows usually are low.

According to the study, that much water would satisfy about two-thirds of agricultural and ecological needs. It's the kind of compromise Wagner said must happen to make the most of the river for all users.

Bumping Lake, a relatively small reservoir, was built by the Bureau of Reclamation in 1909 with a capacity of 33,700 acre-feet. The Watershed Council wants to increase the reservoir to 458,000 acre-feet. In 1983, when such a plan was last priced, the cost was $150 million.

Accounting only for general inflation, such a plan could have cost closer to $245 million in 1997. Wagner doesn't quarrel with that estimate and said a feasibility study is high on the priority list for 1998.

The proposed Squaw Creek reservoir would hold 142,000 acre-feet, at a cost of $149 million in 1987. The 1997 inflation-adjusted price was roughly $211 million.

Together, the reservoirs would cost at least $1 million a year to operate, largely because river water would have to be pumped into the Squaw Creek reservoir.

The price tag for the Watershed Council's plans is daunting, but not as much as going without more water.

"People know they will have to ante up," Wagner said. "The government is not going to step up and write a check to solve all these problems."

Tri-City Herald

The Yakima: A River Wasted

Keeping more water in river could solve problems

Herald Andre Ranieri

Scott Manley of the Benton Conservation District takes water samples from a creek near Prosser. Water testing is vital to nurturing the Yakima River Basin because it shows what pollutants are in the water and where they come from. Scientists, lawmakers and others are working together to clean up the water.

Jim Esget's goal is simple: Keep more water in the Yakima River.

Fish runs and farmers should benefit if he succeeds.

As manager of the Yakima River Basin Water Enhancement Project, Esget is coordinating water conservation efforts in the Lower Yakima Valley. Two-thirds of the water saved will go back into the river for fish; irrigators get the rest.

"Significant amounts of water could be saved," said Esget, who works for the U.S. Bureau of Reclamation in Yakima.

The program's goal is to leave another 200 cubic feet per second (cfs) of water in the river through conservation efforts in irrigation districts.

That amount of additional water would make a substantial difference during low-water years, when federal law allows the bureau to drop flows to as low as 200 cfs at Sunnyside, though the target is 300 cfs.

In high-water years, the bureau manages releases from its Cascade Mountain reservoirs to hold Yakima River flows to be no less than 600 cfs.

Few people dispute that 300 cfs is below what's best for fish. Mel Wagner of the Yakima River Watershed Council said fish show dramatic benefits from more water up to about 1,100 cfs, which is about the average winter flow in the lower Yakima.

More water in the river would increase the chances young salmon have to make it to the ocean. Water temperatures would be cooler, pollution would be more diluted, and predators would have a harder time catching the fish.

Jerry Jacoby, bureau conservationist, said his agency's scientists are nearly done with a report on how much water fish need.

The draft doesn't fully answer the question, which means more studies will be needed. Jacoby said it's clear adding up to 200 cfs in the river will help fish, but nobody yet knows if it will be enough to increase fish runs.

The Yakima River Basin Enhancement Project was passed by Congress in 1994 as a way to conserve water for fish and increase the reliability of irrigation systems in low-water years. It was authorized to get $147 million over 10 years, though it's up to Congress to appropriate money each year.

The money is being used to make hardware fixes, evaluate and monitor water-saving plans and help irrigation districts implement them through matching grants.

In fiscal 1998, the Bureau of Reclamation has almost $10 million for project work. President Clinton has requested $11.9 million in his fiscal 1999 budget, said U.S. Rep. Doc Hastings, R-Wash.

Even with all that, "There isn't enough money in the legislation to solve all the problems in the Yakima River," Jacoby said. "But Congress wanted a program that would at least demonstrate what conservation could do."

The first phase of the river enhancement bill involved installing fish ladders at dams and adding fish screens at the mouth of canals to keep migrating salmon smolt from getting lost in them and dying there.

Step two, Esget's current focus, is water conservation and acquisition.

The third phase, already being studied by the citizen-led Yakima River Watershed Council, is developing more water storage in upriver reservoirs.

The bureau is reviewing conservation plans prepared by irrigation districts. But it expects to be hard-pressed to meet a 2002 goal set by the legislation.

Jacoby said the districts probably still are at least a year away from starting to make changes.

The board of joint control for the Roza and Sunnyside irrigation districts plans to have its conservation plan ready early this year, said Jim Trull, Sunnyside Valley Irrigation District manager.

The board's wish list could cost upward of $35 million, with work spread over the next decade. Irrigators would pick up one-third of the tab because they get one-third of the saved water. The federal government would pay the rest.

The joint board is looking at building "equalizing reservoirs" along canals to help operators run the system more precisely. Without these small reservoirs, water that farmers can't use immediately is spilled back into the river.

Putting excess water into the equalizing ponds would allow the district to put it back into the canals as needed.

"If we had reservoirs, they would act like a giant shock absorber," Trull said. "They would provide a way to be more efficient in our water use. It's a very sizable opportunity for savings."

District also are looking at automating water flow through canals so there is a more rapid response to demand, which can change quickly as farmers turn irrigation systems on and off. "We could be diverting the amount of water from the river we need and not have to carry additional water through the system as a buffer," Trull said.

The Bureau of Reclamation's effort also includes an offer to buy water from irrigators who reduce or stop their water use. But so far, few have come forward.

"Farmers don't want to sell their water right," Jacoby said, though he said some have leased water from tributaries to the district. "If they want to stay farmers, there's no reason to sell. That's the only thing that makes their crops grow."

Another element of the bureau's plan is what Esget calls "hardware fixes" - altering dams and equipment that control water flows. In the next few years, for instance, the Cle Elum dam will be studied to see if raising it 3 feet would provide enough storage to substantially improve flow for fish spawning and migration.

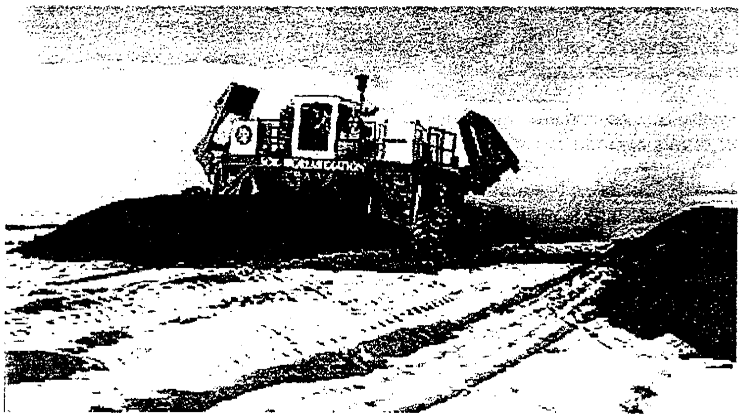
Among the other proposals is reducing water use at the Chandler pumping station near Prosser and catching more water in Lake Kachess reservoir so there is more to release for irrigation in the summer.

Hastings, an ardent supporter of the enhancement project, calls it an "economically and environmentally sensible solution to meeting the growing water demands." He added, "Once fully implemented, it will be of extraordinary benefit to the Yakima Basin."

Tri-City Herald

The Yakima: A River Wasted

Paterson's Watts Brothers farm turns organic to use waste, find niche



Herald/Mike Lee

A giant rototiller at Watts Brothers farm near Paterson turns over tons of dairy cow manure from the Yakima Valley that will be used to fertilize organic crops. This is one way dairy farmers can get rid of their manure in an environmentally friendly fashion.

The Watts Brothers 18,000-acre farm near Paterson is a typical spread of Mid-Columbia irrigated agriculture - typical except for a 20-acre manure composting operation and 2,000 acres of organically grown crops.

The farm's recent turn toward "sustainable agriculture" illustrates how some farmers are moving away from traditional farm chemicals. And it offers one solution for the Yakima Valley's growing dairy waste problem.

The company's budding organic farm has teamed up with the nation's largest all-organic food processor and a Yakima Valley dairy. And to keep growing, Watts needs lots of cow manure - 40,000 tons in 1997.

Organic farming started largely as a market for hippies and health nuts. But the market has ripened today into a relatively broad-based demand for foods not tainted by questions about chemicals.

Even to the Watts brothers, who are longtime conventional farmers, their infant organic operation seems odd. It's something they wouldn't have dreamed of before they started talking with Cascadian Farm about using nature's nutrients to nurture crops.

"Fourteen months ago, if you would have asked me about organic farming, I would have laughed," said Don Watts, who runs the company with his brother Doug. "Times are changing."

Some call the technique "sustainable agriculture" because it doesn't rely on herbicides, pesticides or fertilizers that often carry environmental concerns. Instead, the brothers use dairy manure, compost it on their land and spread it on crops.

The practice relies on the theory that the richer soil will make stronger, healthier plants that are more resistant to many of today's pests. Pest control, however, still is a battle, and a bad case of bugs can take a big bite out of a harvest and drive up the price.

Gene Kahn, president and CEO of Cascadian, said organic farming is "soil building" not "plant feeding." He calls the Watts Brothers' composting program an example of the best in organic practices because it produces high-quality fertilizer. "We do a lot more than just ... dump manure on the ground," he said.

It's a process the brothers are proud of.

"We have a tremendous amount of feedlots and dairies that are clearly having some environmental problems," Don Watts said. "All of the dairies and feedlots are looking for places to get rid of their manure."

The brothers call their system 'smart farming" - staying a bit ahead of the competition and trying to keep a sustainable bottom line.

"It's going to become a very important market." Watts said. "The farmers who can make the transition are the ones who are going to be successful in the future."

And the more who make the change, the more likely others will follow despite the high costs. "If there is an economic opportunity, there is going to be competition." Watts said. "It's the good old American way. We've got to become better than the potential competition."

The Watts farm's new look is not necessarily a popular one with farmers, who Don Watts says are slow to change, just like people in other industries. "There is a lot of resistance."

But what once was the territory of health food stores is becoming the land of mainstream food giants such as Albertson's and Fred Meyer, which carry Cascadian's organic frozen vegetables.

Kahn started organic farming in 1972 on a remote plot near North Cascades National Park in Northwest Washington. At the time, he also was making his own soap and burning kerosene lamps.

After a few years, "the real world set in" on the graduate school dropout - but the farm he started blossomed during the next two decades.

Now, Cascadian is growing at a rate of 50 percent a year, and 1997 sales were expected to be $40 million. Kahn said the industry will continue to grow at 20 percent a year because costs of organic farming are coming down, retailers are getting more interested and financial investments in the industry are picking up.

In an effort to capitalize on the trend, Watts Brothers built a $15 million vegetable processing plant last winter. Cascadian, based in Sedro Woolley, asked the brothers if they wanted to partner in a fast-growing market.

The Wattses started talking about growing 250 acres of organic corn, then they decided to grow about 1,300 acres of corn, peas and potatoes. They soon found they had only scratched the surface.

Organic farming standards require that products sold with an organic label be farmed on new land or land that has not been chemically treated for three years. The Wattses broke new ground for their first fields in 1997 and have marked more Southeast Washington land for conversion to organic ground - a huge commitment in an uncharted industry.

This year, Watts said, the company will farm nearly 2,000 acres organically - 800 of corn, 800 of peas and 300 of potatoes to be processed by Lamb-Weston.

Such big steps are necessary in an industry that has heretofore been largely mom-and-pop businesses. Because of what Watts calls the "unsophisticated" roots of organic farming, suppliers never knew what they would get from season to season and couldn't market effectively or stabilize prices.

Compared with standard farming, of course, organic farming is expensive - somewhere between two and five times greater depending on the product, said Steve Bannworth, vice president of sales for Watts. But customers don't often dicker about price as long as they are assured the farming isn't causing environmental problems, he said.

His job is to sell the "earth-friendly" process, such as manure composting.

Dairy farmers commonly spread their manure on land adjacent to their cow pens, but it's hard to keep runoff contained on the land and stop it from contaminating neighbors' properties.

So Watts Brothers farm hauls in manure from the 6,800-cow Cow Palace Dairy in the Yakima Valley. Once on the Paterson land, the manure is composted in long, black rows that steam in the winter cold as they are turned over by a giant rototiller.

Temperatures build up to 140 degrees inside the piles, killing bacteria and weed seeds, reducing the smell and generally making the manure suitable to spread on cropland.

The Wattses - with 18,000 acres and a management plan - also don't face the same pressures as Yakima Valley dairies do with nearby neighbors.

The compost - high in nitrogen, phosphorous and potassium - is spread on fields that are watered with diluted "waste" water from the processing plant, which uses 350 gallons a minute at full speed.

It all adds up to fewer environmental problems - which is what Kahn said many people want. "Some consumers are saying, 'We're willing to pay a little more, and we want to see agriculture that has a strong environmental benefit associated with it.' "

Tri-City Herald

The Yakima: A River Wasted

Groups work together to revive 'Tapteal'

Herald/Cary Best

Richland. Tapteal Greenway and the Confederated Tribes of the Umatilla Indian Reservation have big plans for this stretch of the Yakima River Delta near Richland. Dennis Rhodes, left, Richland planning manager, and Allen Childs, tribal wildlife biologist, see a bright future for the Chamna nature preserve that includes walking, biking and fishing.

If Lewis and Clark trekked through the Mid-Columbia today, there's little chance they would adopt the name American Indians gave the Yakima River -Tapteal.

The word means "the river that runs clean," so named because tribes drank from its banks, scooped out its freshwater clams and ate its fish, said Carol Craig, spokeswoman for the Yakama tribal fish and wildlife program.

Indeed, if the early white explorers could see the river's delta 190 years after their historic journey through the region, they more likely would call it "Waste-waters."

But that's just the image Richland, Tri-City environmentalists and the Confederated Tribes of the Umatilla Indian Reservation are bent on changing this year as they develop a unique urban wildlife habitat.

Efforts are being concentrated on the Chamna Natural Preserve - 2.5 miles of shoreline and about 275 acres on the north side of the river and within Richland's city limits. The land accounts for about one-fourth of the Yakima Delta, which the tribes and the city are attempting to lease and manage for the Army Corps of Engineers.

When work is done, the fertile flood plain will support fishing, walking, biking and bird watching - and be home to an array of wildlife.

Among the draft plans: picnic tables, restrooms, trails, handicap access trails, a parking area, garbage cans, interpretive signs and identification of cultural and natural resources.

To create those things, the Chamna work group is recommending closing some roads and trails, limiting development to protect wildlife and controlling noxious weeds.

"It's going to be somewhat unique, kind of an urban-wildlife interface," said Allen Childs, wildlife biologist for the Umatilla tribes. The corps, Tapteal Greenway and the state Fish and Wildlife Department also have been involved in the last year of planning.

While public access is limited at most of the tribes' wildlife mitigation areas, the Chamna reserve will remain open to many activities, Childs said. "It's not the type of area that is going to be shut off. People are going to be able to enjoy the area."

Planned uses aren't much different from what's gone on through the years - but they will be managed so human activities don't infringe so much on the ecosystem, Childs explained.

That hasn't been the case in recent history.

"It was really falling into disrepair," said Mike Lilga, president of Tapteal Greenway, a Tri-City conservation group dedicated to restoring the Chamna reserve. "The dumping was incredible."

Like much of the Yakima River, the delta has long suffered from pollution - motor oil, refrigerators, household trash and almost anything else people didn't want was left in the river or on its banks.

Tapteal members have removed several tons of trash, and the city closed the land to vehicles in February 1997 to cut dumping and keep plants from being torn up.

The closure upset off-road groups that used the site and made it hard for disabled people to get to the river. But it has greatly reduced the amount of trash left there - and the area eventually will be reopened, the Chamna planning group said.

Dennis Rhodes, comprehensive planning manager for Richland, said he's hoping to have public hearings on the land-use management plan by early March and complete the plan for the city council's review by April. How fast the plan is finished will be determined by how much it's revised by public feedback.

If things move quickly, vehicles could be allowed in certain areas by July.

"We certainly don't want to keep vehicles out of the area for this whole summer," Rhodes said.

Before cars and trucks can approach the river, however, Rhodes said there needs to be some kind of fencing to keep them on designated roads and parking areas.

Traffic control is his first priority - but within the next five years, he'd like to add a few rustic log amphitheaters and restrooms. The only paving planned is for handicap access trails at the west end of the park.

It's not clear yet how much the improvements will cost, though Rhodes is trying to pull together a budget to present to city boards and the council.

The Umatillas are especially concerned with maintaining wildlife habitat and are paying for upgrades with money from the Northwest Power Planning Council intended for restoring habitat destroyed by the McNary Dam pool, Childs said. That money isn't likely to cover the whole bill, and the city will apply for grants to pay for improvements.

Besides the wildlife, the Umatillas value the delta as an important cultural area and the site of a once-sizable American Indian village.

The area also holds a good deal of history for settlers. In the late 1800s, homesteaders lived on both sides of the river. Ben Rosencrance started operating a 30-foot-tall water wheel near the present Interstate 182 bridge to irrigate sections of what became south Richland.

For Tapteal Greenway, the delta represents a chance to save a swath of "the closest thing we have to natural habitat in the area," Lilga said. As such, it furthers the group's goals of environmental education and the creation of a recreational resource.

In the long run, of course, the groups want to improve the river's water quality - though they realize that will depend a lot on what happens upstream.

Being at the end of a long trough of waste water doesn't make it easy. "The water quality in the Yakima is a big concern," Lilga said. "Our problem, of course, is everything that is dumped in the river passes through Richland, right by Chamna. We get the worst of it, we get it all."

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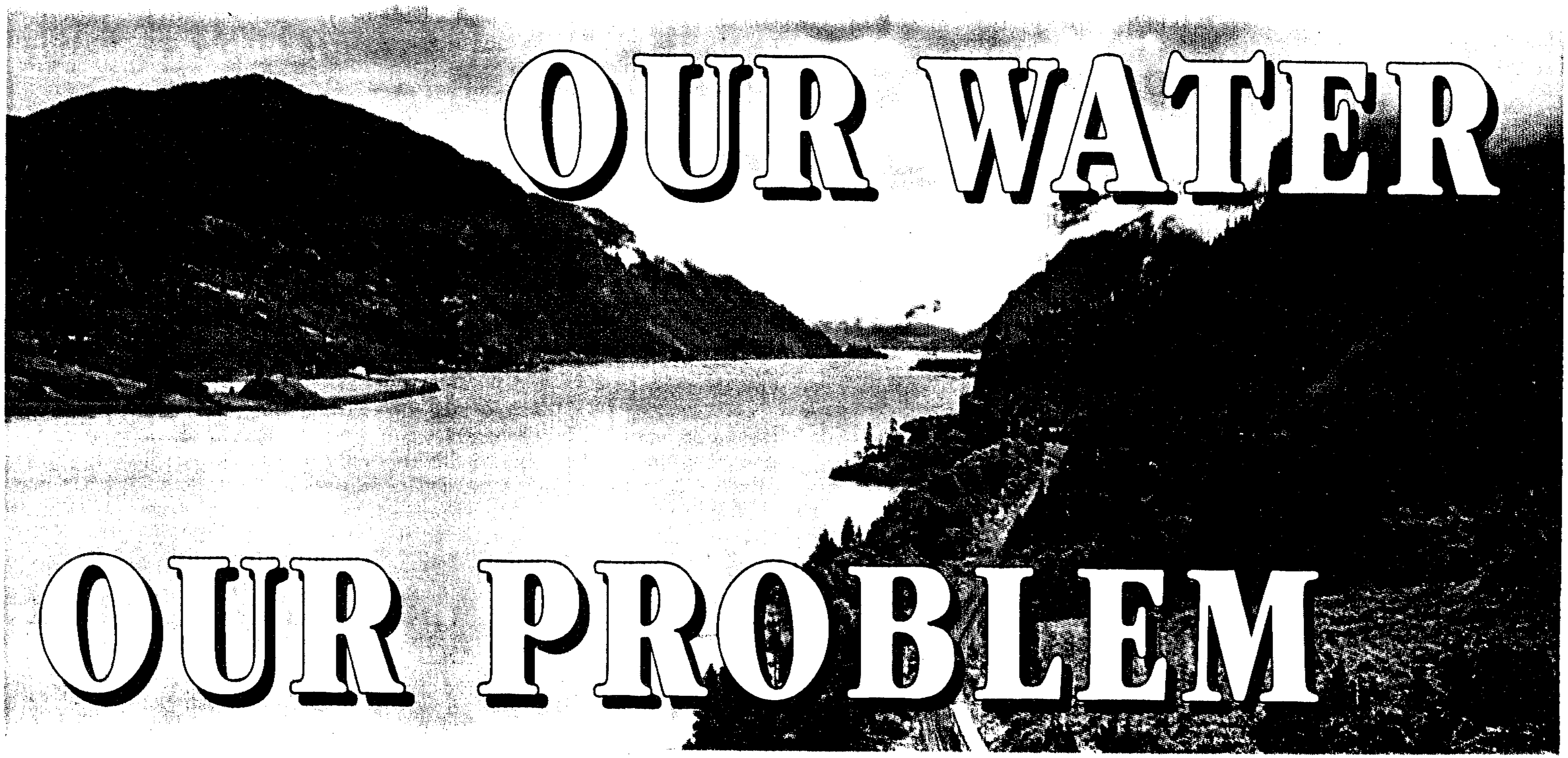

Growers, irrigators and others work to solve Lower Yakima River problems

Major progress is being made in the 'akima Valley to turn the tide on Lower 'akima River pollution problems. Recently, a Department of Ecology study dentified turbidity and the pesticide DDT s the river's highest priority concerns.

"We're making terrific progress in getting people to recognize the problems," aid Chris Coffin, with Ecology's central egional office in Yakima. "Many of the eople who can do the most to solve the roblem have already started working on olutions. We had a slow start, but conser-ation districts, irrigation districts and rowers are picking up momentum. The 'akima River Watershed Council has been nstrumental in getting the word out and ringing all the players together."

"Turbidity," or cloudiness, is an indica-or of suspended sediment. While even ristine rivers carry sediment, too much an clog fish gills, smother eggs, fill in pawning gravels and alter the biology of he stream.

The Ecology study found the chief ause of high turbidity in the Yakima dur-ng irrigation season is soil running off irri-ated farm fields. Many farmers irrigate vith the "furrow" technique, sending free unning water flowing by gravity from the igh to the low end of a field. Often, much f the water runs off the field, and with it oes suspended soil particles that dirty irrigation water for downstream farmers and can eventually end up in tributaries and the Yakima River. During the 1995 irrigation season, the four principal irrigation drains delivered, on average, 251 tons of soil into the river *every day*.

The DDT problem is a result of the soil erosion. Although it was banned in 1972, DDT was used heavily in the Yakima Basin and is still attached to organic molecules in the soil. When contaminated farm soils wash into the river, the associated DDT can build up in the food chain and eventually be consumed by humans. A U.S. Geological Survey study found Yakima River bottom fish (such as white-fish, bass, and suckers) have some of the highest DDT concentrations in the U.S.

The Ecology study and cleanup project on the Lower Yakima River is essentially a watershed plan that addresses specific water quality problems. The federal Clean Water Act requires states to write these cleanup plans for bodies of water that don't meet water quality standards. Federal rules require each plan to 1) define and analyze the problem, 2) evaluate alternative solutions, and 3) describe how the problems will be solved. The rules require public involvement in the process.

Once pollution sources are identified, these plans must set target "loads" that will allow the river to meet water quality standards. The load is the amount of a specific pollutant that a body of water can handle without exceeding water quality standards. Ecology's final *Yakima River Evaluation* report, released in July '97, sets these target loads for sediment. Reducing the sediment will also reduce DDT.

The Yakima River Watershed Council and the irrigation districts are key players in developing and implementing the changes necessary to repair and sustain resources the Yakima River Basin provides. These are local groups working with, not in response to, state and federal agencies in determining the future of the watershed.

Two of the major irrigation districts, Roza Irrigation District and the Sunnyside Valley Irrigation District, created a Joint Board of Control to address water quantity and quality issues. They hired a water quality specialist, began monitoring water quality, and are adopting new policies to change the way irrigation water is used and returned to the river.

"Roza and the Sunnyside District are doing an incredible job," said Coffin. "They are investing time and resources into real solutions that will benefit both agricultural and salmon interests in the watershed."

The districts understand that actions they take to protect water quality can help stave off future listing of Endangered Species, Coffin said. Chinook and steelhead are already listed as "threatened," and more listings are looming on the horizon.

"Besides, cleaning up the silt helps the district's customers," said Coffin. "Most of the complaints we get about sediment pollution come from downstream farmers upset about silt clogging up canals, pumps, filters and sprinkler heads."

For their part, farmers are beginning to convert from furrow irrigation to water-conserving drip or sprinkler methods. This can be an expensive transition. However, not only do they save their soil, but with more precise water application, farmers can cut fertilizer and pesticide use significantly.

Ecology will be hiring two technical assistance and compliance educators ("ditchwalkers") to help farmers improve practices to reduce sediment. Ecology also has developed an electronic spreadsheet program that helps farmers analyze the costs for converting from furrow to drip irrigation.

For more information, contact Chris Coffin at 509/454-7860, e-mail ccof461@ecy.wa.gov.

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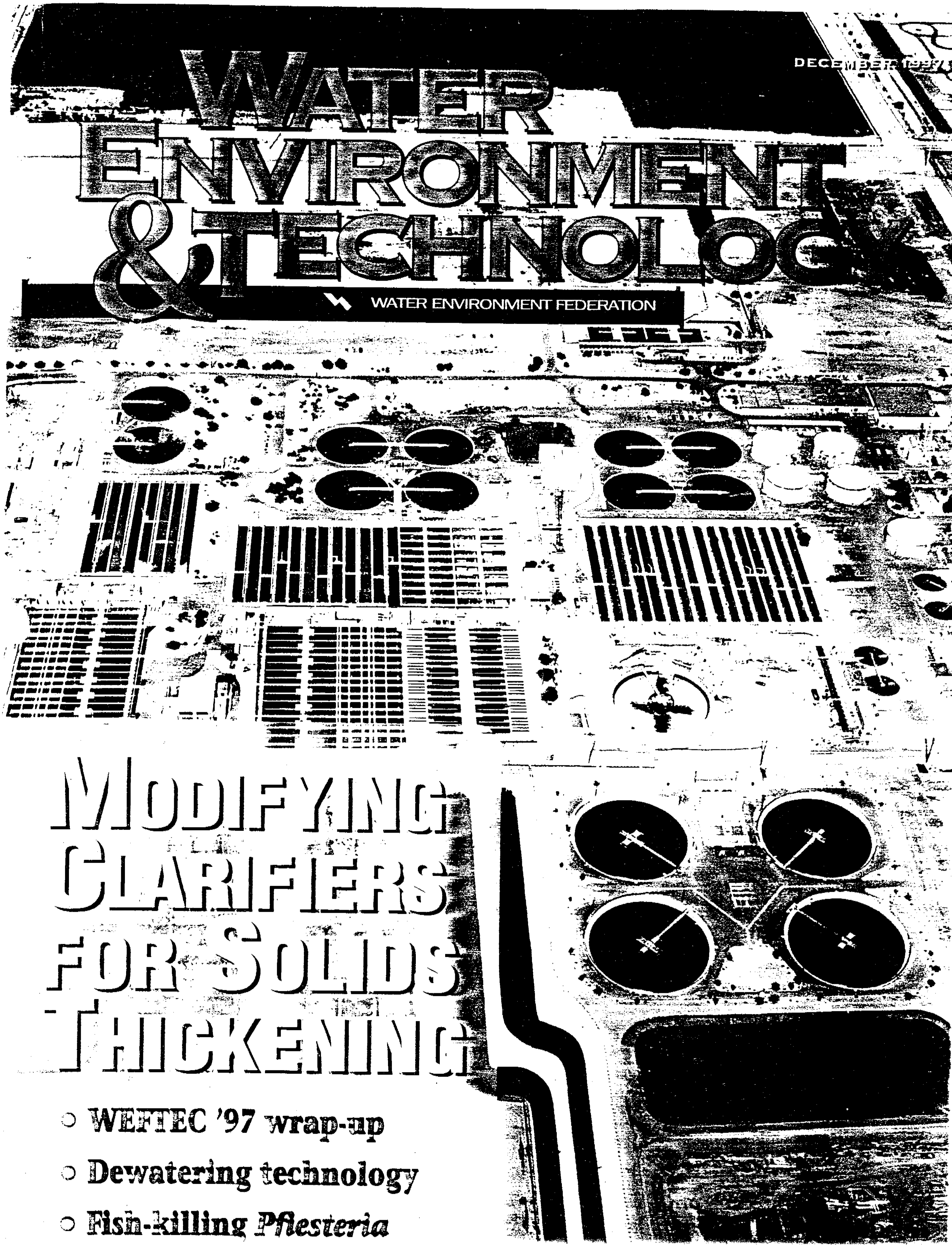
WATER ENVIRONMENT FEDERATION



MODIFYING CLARIFIERS FOR SOLIDS THICKENING

- WEFTEC '97 wrap-up
- Dewatering technology
- Fish-killing *Pfiesteria*

hold point sources accountable only for their proportionate share of pollutant loadings and make other dischargers responsible for their pollutant loadings.

The second concern involved primacy of land use planning, or who determines the suitable uses for a property. According to Mancini, municipalities want the watershed alternative to include provisions ensuring that local authorities will maintain oversight in this area. According to Hall, EPA has agreed to develop "strong language that will hopefully address the municipal caucus concerns."

Other issues that need to be resolved before a watershed alternative document can go forward include

- an environmental caucus request for more language about the benefit of addressing habitat restoration and flow impacts through a watershed approach,
- an environmental caucus concern about proposed language addressing temporary water quality standards, and
- an industrial caucus request to determine whether EPA has adequate legal authority and sufficient knowledge to regulate flow-related impacts.

According to Hall, states and EPA generally support the document in its current form.

—Kellye Kratch, WE&T

STATESIDE

Washington Encourages Farmers to Control Erosion to Yakima River

In an effort to reduce turbidity and dichloro diphenyl trichloroethane (DDT) concentrations in the Yakima River, the Washington State Department of Ecology is encouraging farmers to curb sediment runoff from their land by improving irrigation methods.

The action was prompted by *A Suspended Sediment and DDT Total Maximum Daily Load* (TMDL) *Evaluation Report for the Yakima River*, a Department of Ecology report that concluded the river's high turbidity level negatively affects fish habitats, and that river sediments contain high levels of pesticides, especially DDT. Samples of tissue from bottom-dwelling fish in the lower Yakima River indicate that DDT concentrations in the fish are among the highest in the nation, says Chris Coffin, coordinator for the Department of Ecology Yakima River water quality project. Although DDT was banned in 1972, the persistent pesticide is still present in high concentrations in soils of local farms.

According to the Department of Ecology, most pollution in the lower Yakima River comes from erosion of soil from farms. As a result, farm sediments and the pesticides that adhere to them must be reduced 75% to 95% in some major drains and tributaries to meet water quality improvement goals in Washington's TMDL evaluation report. Every 5 years, there is a different targeted goal for the river. The first goal is to reduce river sediment so turbidity decreases to target levels at specified locations.

Tens of thousands of tons of topsoil erode from farms in the region during an average irrigation season, Coffin says. This erosion occurs, in part, because many farms still irrigate using an "ancient" rill-and-furrow method, which involves running water down plowed channels between rows of crops. To fully saturate the soil, water is left running onto the upper end of the field and out the lower end for several hours, and sometimes days. Steep slopes, high volumes of water, and loose soils contribute to excessive erosion and sedimentation. "Much of this soil is contaminated with residual DDT and ends up in the river," he says.


DEPARTMENT OF ECOLOGY

The goal of the Washington Department of Ecology's Yakima River Suspended Sediment Project is to keep sediment-laden water from contaminating the river. Here, muddy water entering the river from the Granger Dam contrasts with cleaner river water.

One solution is to get farmers to switch to drip or sprinkler irrigation methods that are easier to control, use less water, and reduce or eliminate runoff, keeping DDT on the farms where it can undergo natural degradation, Coffin says.

Under Washington state standards, the lower Yakima River is designated a Class-A waterbody, meaning that it must meet or exceed the requirements for all or most uses including domestic, industrial, and agricultural water supply; stock watering; fish migration, rearing, spawning, and harvesting; wildlife habitat; recreation; sport fishing; boating; and aesthetics. Classified as an impaired waterbody, the river became subject to TMDL requirements.

"We are going to try to accomplish the cleanup goals without being prescriptive," Coffin says. "We are not being heavy-handed [or] imposing any requirements ... except that [farmers] not contribute to excessive sediment draining to the river." The Department of Ecology will help irrigation districts upgrade delivery systems, hold workshops to educate farmers about TMDL targets and goals, teach farmers about modern irrigation methods, and sponsor presentations by agriculture experts, researchers, and suppliers who will explain ways to improve irrigation, he says. Individual farmers can decide what changes to make in their irrigation and water management practices to meet that requirement, he says.

"The Clean Water Act calls on [the Department of Ecology] to manage TMDLs with priority measures to point sources, when those point sources are identified as sources of the targeted pollutant, but we aren't doing this one that way because these pollutants are directly linked to agricultural runoff," Coffin says. Because this is a nonpoint source TMDL, he says, municipal and industrial wastewater treatment plant operators "should be relieved to know that they are not [affected] ... because we perceive them as having a fairly minor influence on the condition of the river."

The lower Yakima River TMDL plan is "a very important signal of the changing times, and shows that communities have more of an interest in water than just using it for irrigation," says Phil Shelton, communications director for the Yakima River Watershed Council, a nonprofit organization comprising irrigators, industry representatives, environmentalists, and other stakeholders interested in water issues in the basin. However, he says, "it is just a plan [and] there is nothing to force irrigators to follow it." As such, the success of the TMDL depends on voluntary cooperation of landowners, because irrigation is "a private property issue," he says.

According to Coffin, the Department of Ecology has authority to enforce agriculture-related water quality complaints, and usually refers violators to their appropriate conservation district or Natural Resources Conservation Service (NRCS) office for technical assistance. "We may require a farm plan that follows NRCS specifications," he says. "If the offender is still recalcitrant, we can levy fines. We have in the recent past and we may have to again, but our goal is keeping water clean ... not adding to a farmer's woes."

Using enforcement as the primary tool to implement this TMDL would require addressing discharges from possibly thousands of farmers and hundreds of drains, one at a time, Coffin says. "This would require more resources than are now available, and would take more time than the river can afford," he says. "We'll take regulatory action where necessary, but we're confident that most growers will take the appropriate actions."

According to Shelton, most growers realize that they have a big financial stake in seeing water quality improve, and probably will cooperate with the TMDL limits. If the Department of Ecology is unsuccessful in generating improvements, he says, a federal court could step in and implement drastic measures that could be detrimental to farmers, such as requiring more water to stay in the river to protect beneficial uses, leaving less for irrigation.

—Kellye Kratch, WE&T

NOVEMBER 1997

WATER ENVIRONMENT & TECHNOLOGY

WATER ENVIRONMENT FEDERATION

Study Links DDT Contamination to Irrigation Runoff

The Washington State Department of Ecology (DEC) says that pollution in the lower Yakima River signals "major changes in water management for many farmers in the Yakima River basin."

The DEC made this conclusion in a report that identifies sediment and contamination from the banned pesticide DDT (dichlorodiphenyltrichloroethane). The report details the amount and sources of sediment and DDT released to the river during the irrigation season, and sets limits and a schedule for reducing those pollutants.

DEC said it will work with the Yakima Indian Nation and state, federal, and local agencies to identify the best and most cost-effective way to reduce soil erosion and runoff.

For a copy of the executive summary for the report, *A Suspended Sediment and DDT Total Maximum Daily Load Evaluation Report for the Yakima River*, call Chris Coffin, Yakima River water quality project coordinator, at 1-509-454-7860.

Project Flexibil

LETTING DESIGNERS CHOOSE THE BEST MEANS TO THE COLLECTION SYSTEM END

Automation • Biosolids recycling • Reinventing EPA

CAPITAL PRESS Oct. 3, 1997

Protecting the Yakima River Valley

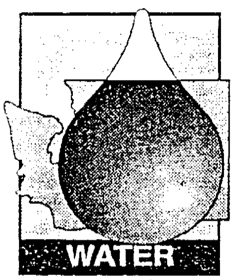
Conservation district and extension officials push harder for alternatives to rill irrigation in the valley

By TERRY DILLMAN
Capital Press Staff Writer

PROSSER, Wash. — Irrigated agriculture is the backbone of the Yakima River Valley economy. But 100 years of farming have taken a toll on the land and the river.

For the past decade, conservation district and extension officials have beaten the drums for change in the way farmers in the valley irrigate their crops. While the drum pattern remains familiar, its pace has quickened significantly.

Water quantity and quality will determine the future of agricultural practices — especially irrigation — along the river, said Bob Stevens, a soil scientist at Washington State University's Irrigated Agriculture Research and Extension Center near Prosser, Wash.



"Water supply and quality is becoming more and more critical, especially in the Yakima River Valley," Stevens said, referring to the Endangered Species Act and its fish listings, as well as the river's appearance on the nation's "most polluted" list.

"We must take steps to keep those fish species from telling us how to farm. And we must use better water and soil management to voluntarily clean up the river."

Growers and irrigation districts face serious challenges. Chief among them is soil erosion and the resulting sediment loads it adds to the river.

Soil disappears in seemingly small increments, said Pat Daly, manager of the Benton Conservation District. But those small increments — carried away in irrigation water — can add up to big losses. A foot or more of soil can erode from thousands of acres each year.

"It takes a few hundred thousand years to build soil," said Stevens. "But it took us just 50 years or so to lose two to three feet of it. It's amazing how much sediment brown water has in it."

He referred to an irrigation drain into the Yakima River near Granger, Wash. In 1995, the flow from the 17,000 acres the drain serves dumped 375 tons of sediment per day into the river. That sediment also carries chemical and fertilizer residues and manure from livestock operations.

To clean up the river and get it off the pollution list, that sediment load must drop to 37 tons per day — an 85 percent reduction. That's exactly what the Washington State Department of Ecology wants by 2017.

The main culprit is rill or furrow irrigation. Those little ditches between crop rows were the only means of getting water when irrigation projects first began to creep through the Yakima Valley. But they're much less efficient than sprinkler or drip irrigation methods.

"Drip irrigation is by far the most efficient," Daly said. "It's a way of spoon-feeding water to the crop. It uses less water and creates less runoff."

Stevens said rill irrigation at best is 40-60 percent efficient. Depending on wind effects, sprinklers are 85-90 percent efficient, while drip systems reach 90-95 percent.

"We have to change," said Stevens. "If we don't clean up the Yakima River voluntarily, the federal government will do it and send farmers the bill." Either way, farmers will pay.

An estimated 40 to 60 percent of the 400,000 irrigated acres in the U.S. Bureau of Reclamation's Yakima River Project is still under rill irrigation. Daly said farmers will pay up to $1,000 per acre to convert to drip irrigation. And it's a management-intensive system.

"It takes a much more educated and well-trained labor force," said Daly. "But almost everything in agriculture demands intensive management these days."

Other solutions include holding/settling ponds and mixing polyacrylamides with the water.

PAMs are special polymers that bind around soil particles and hold them in the ditches or furrows. They also help keep soil pores open for better water infiltration. They can reduce erosion by as much as 90 percent. But they're only a stopgap measure.

For some farmers, the economics simply don't justify switching from rill to sprinkler or drip irrigation systems. The federal government offers an incentive by providing some financial assistance to growers through the Environmental Quality Irrigation Program, which pays up to 70 percent of project costs.

Daly said the program had $917,000 available for farmers in the Lower Yakima Valley this year. "It doesn't go very far," she said. "But it helps them put in that first system, try it out, learn it and find out what it can do."

Stevens said the time to act is now. "Furrow irrigation will continue for a while," he said. "But things will change sooner than you think. The pressures on agriculture will only get more severe."

He pointed to an Oregon law that says no water will leave farm fields beginning in 1998, and to California, where "water is going to the highest bidder."

"It takes a certain amount of water to grow a crop, no matter what it is," said Stevens. "The big difference is in how we use the water. Changing to more efficient systems will use less water in wet years to store up for dry years, leave more clean water in the Yakima River and keep soil on the farm where it's making money for the farmer."

SVID rates increase

Earlier this month, the Sunnyside Valley Irrigation District (SVID) Board of Directors set 1998 assessments for beneficial use lands at $54.50 per acre. This is a $7.25 per acre increase from the 1997 total of $47.25 per acre.

While this is the biggest rate increase for SVID customers in recent years, SVID District Manager Jim Trull feels it is a fair increase which is needed to help address water quality issues. "What we are trying to do is do something that will service [customers] well in future years," he explained.

The increase in cost is associated primarily with water quality planning and implementation.

"Water quality is going to be a big issue," commented Trull. Trull felt it was necessary for the SVID Board of Directors to take a proactive approach towards addressing water quality issues, especially involving the amount of sediment reaching the Lower Yakima River. "We got some significant challenges ahead," he said.

An assessment is the fee paid to an irrigation district to maintain the irrigation system and provide the opportunity to obtain irrigation water. Since an irrigation district is a not-for-profit entity, the assessment funds collected cover the cost of operation and maintenance as well as provide necessary reserve funds for future projects and emergencies.

The annual assessments are set by projecting the cost of operation, maintenance, administration, together with capital projects and necessary reserves for the following year minus reserves from approved grants. The assessment charge for each parcel of land is then computed based on acreage.

SVID Board of Directors are taking a pro-active approach towards water quality in part due to the Endangered Species Act listings and the resultant recovery act programs which could reduce diversions for irrigation purposes. Under the Clean Water Act, the Washington State Department of Ecology has set the total maximum daily loading for the Lower Yakima River with goals to remove 90 percent of the sediment reaching the river within five years. This would include all drains and irrigation facilities which discharge into the river.

In order to address these concerns, SVID had to increase per acreage cost for the up-coming irrigation season.

The following is the breakdown of costs associated with the price increase:

* SVID will hire a total of five additional employees, this will lead to an increase of $3.25 per acre. Three employees will be working on drainage and water quality projects. One employee will be added for building and pump maintenance responsibilities and another employee will be added to work in the shop for metal fabrications which are related primarily to health and safety issues.

* Funding of water quality programs and projects which include increased water quality monitoring, construction of settling basins, and habitat negotiations and restorations increased assessments by approximately $2 per acre.

* The need for such materials and supplies as chemicals, fuels, metals, rock and gravel increased assessment cost an additional $1.25.

* The Bureau of Reclamation has accelerated the storage operation and maintenance program which increased cost $.75 per acre.

For further information on assessment rates for the 1998 irrigation season, customers are encouraged to contact the SVID office at (509) 837-6980

Prosser, WA
(Benton Co.)
Prosser Record-Bulletin
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OCT 29 1997

Top Mid-Columbia stories for Aug. 15. 1997

Yakima irrigators must clean up act

By MIKE LEE
Herald staff writer

Yakima Valley irrigators better start cleaning up their river, the state Department of Ecology directed this week in a detailed report on water pollution.

Though fecal matter from dairy farms is disconcerting, the agency's investigation focused on DDT - a pesticide banned in the early 1970s - and sediment in the river.

It confirmed what earlier studies showed: The lower Yakima River is among the worst polluted stretches of river in the nation. High sediment levels and pesticides have long been endangering fish and threatening drinking water.

But the Ecology Department also called for what are being called major changes in how farmers irrigate land.

The report details how clean the river should be every five years until 2017.

As if that wasn't demanding enough, irrigators fear a handful of Yakima fish will make the federal endangered species list, thus intensifying efforts to keep the river clean - and costing a lot more money.

"We're living in a period of great uncertainty with the Endangered Species Act and the potential listings hanging over our head," said Jim Trull, manager of the Sunnyside Valley Irrigation District.

"There is going to be a real strong focus on water quality like we haven't seen before. ... The irrigated agriculture community is going to have to step forward and make changes in the way we do our business."

A key area of change is rill irrigation, in which water is released at the top of a field to run down through the rows. The big problem in the Yakima Valley is the water returns to the river carrying loads of soil laced with long-lasting DDT.

Not all 340,000 acres of cropland in the Yakima Valley use rill irrigation - but enough farms use it that tens of thousands of tons of top soil are eroded from Valley farms each year, the Ecology Department reports.

"The soil is carried down the drains and ends up in the Yakima River. That's bad for agriculture, and it's bad for the fishery we're trying to restore," said Chris Coffin, Yakima River water quality project coordinator for the Ecology Department.

"There are irrigation practices being used that need to be seriously looked at. The farmer is throwing money down the drain, almost literally."

Years of study leave many convinced of serious problems in the Valley. Now agents like Coffin must convince irrigators it's their job to protect the river.

"I am hopeful that irrigators will be willing to look seriously at their methods of irrigation and consider changing," he said.

That won't always be easy. "Some of the cures will be relatively expensive," Coffin said.

But more efficient watering techniques can sometimes make up the cost of implementing them in just one year, Coffin claimed. Besides, water return systems and other practices likely will allow careful rill irrigation to continue.

Phil Shelton, spokesman for the Yakima River Watershed Council, said improving the river will be done one irrigator at a time. "It's still the decision of the private landowner. He has to be in the position economically" to improve irrigation practices, or at least get grants to help make the change, he said.

Said Shelton, "The positive motivations are out there, but certainly the Endangered Species Act and the Clean Water Act listings are serious business and (irrigators) are well aware of that."

Well before the Ecology Department released its report, the Roza and Sunnyside Valley irrigation districts formed a joint panel to deal with water quality and quantity issues. "We recognize the need to be proactive," Trull said. "Our board has directed us ... not wait for some kind of enforcement action to take place."

Trull said the changes will mean increased rates for water users -though he doesn't think the additional expenses will be too bad. "There's no doubt it's going to cost us more money. ... That's going to be our challenge: to keep the cost from getting out of hand."

Irrigation districts are doing irrigator education campaigns, hiring people to monitor water quality and increasing the number of water samples they take. "We're doing some things we haven't done before, and that's obviously an additional expense," Trull said.

Coffin said the Ecology Department can issue fines for noncompliance - but it's hard to figure out who's at fault and just as hard to find known polluters. "We've got limited resources to track down every one of them."

Whatever happens, it will take quite awhile before the river recovers, Coffin said. "In 20 years, we hope to see very low levels of both DDT and turbidity, and hopefully (it will happen) very much sooner than than."

Trull calls the Ecology Department's sediment reduction goals "ambitious."

"And yet if you don't have the goals, you don't achieve a lot. ... It really will require some fundamental changes in the way we do business."

Clean Water Act may be tough on Yakima, EPA official warns

By DAVID LESTER
Of the Herald-Republic

Compliance with the federal Clean Water Act could have substantial consequences on historic water use in the Yakima River Basin, an Environmental Protection Agency official said Wednesday.

Deputy Regional Director Chuck Findley said improving water quality in the lower Yakima River could mean, among other things, higher instream flows for fish and less water available for irrigation.

The lower stretch of the river below Sunnyside Dam at Parker has been included on a state Department of Ecology list of impaired and threatened waters because of high temperatures, suspended solids, low flows and fecal coliform bacteria.

The listing will require development of what is called a Total Maximum Daily Load plan to reduce pollutants to a level at which water-quality standards are met.

"It means that changes will have to be made to attain water quality standards and have fish," said Findley, a Valley native. "Because we have allowed the situation to deteriorate, the changes will be dramatic."

One possible element in a larger program to improve water quality could be adoption of newer irrigation technologies such as drip irrigation to reduce the amount of runoff.

The lower river has long been a problem because of sediment loads from irrigation runoff and low flows resulting in increased water temperatures.

Also included on the state list of flow-impaired streams, a list that has been approved by EPA, are the tributaries to the Klickitat River, the Walla Walla River and the Wenatchee River.

Findley discussed water issues during an appearance before the Yakima River InterAgency Council, an organization of local, state and federal agencies formed to exchange information on policies and projects affecting the basin.

He said the federal agency has been under the gun to enforce the Clean Water Act as a result of citizen lawsuits in the federal courts challenging EPA's enforcement activities.

A federal judge in Seattle ordered the agency to prepare TMDL plans on 950 sections of water bodies within five years. The agency appealed the decision and now face completion of the task in eight years.

Findley said the initial spate of lawsuits filed under the Clean Water Act was filed in the four Northwest states. Since then, the litigation has expanded to 23 states across the country.

"The courts have been used effectively by citizens to get relief. I don't think that will stop," he said.

Irrigation blamed for poor Yakima River water quality

By TERRY DILLMAN
Capital Press Staff Writer

YAKIMA, Wash. — A Washington State Department of Ecology report on pollution in the lower Yakima River has called for major changes in methods Yakima Valley farmers use to irrigate their land.

The long-term goal is to restore the river's water quality so it meets state water quality standards.

"The lower Yakima River is among the most polluted stretches of river in the nation," said Chris Coffin, Yakima River water quality project coordinator. "The most obvious sign of pollution is the muddy water entering the river at the mouths of irrigation return drains and tributaries."

The agency's investigation focused on ways to reduce the threats to endangered fish and drinking water supplies. Rill or furrow irrigation, used on much of the lower Yakima Valley's 340,000 acres of cropland, is a key target.

During the irrigation season, Coffin said, such practices erode "tens of thousands of tons of topsoil" loaded with pesticide residues, and create unhealthy turbidity levels by choking the river with sediment.

"When that soil ends up in the Yakima River, it's bad for agriculture and for the fishery we're trying to restore in the river."

Sediments and particles can harm the respiratory systems of fish and aquatic insects, settle and clog spawning gravel or suffocate fish eggs and make it difficult for fish to migrate and find food. Farmland sediment also carries residual amounts of DDT and other pesticides.

"DDT was banned in 1972, but it was used so heavily that the soil has a lot of residue," Coffin said. "Tissue samples from bottom fish in the lower Yakima contain some of the highest concentrations of DDT in the nation."

The Clean Water Act requires the department to perform "total maximum daily load" analysis for contaminated waters like the lower Yakima that are on the 303(d), an "endangered species" list for rivers and streams.

TMDLs are estimates of the amounts of specific pollutants that a body of water can safely take in without threatening the water's beneficial uses such as swimming, fishing and irrigation.

The report — based on TMDL studies — blames poor irrigation water management for most of the sediment load. Eroded soils from farms that still use rill or furrow irrigation, especially on steep ground, move into the river via irrigation return drains.

Control of suspended sediment generation and transport during the irrigation season, the study concluded, will result in far-reaching water quality and fish habitat improvements in the Yakima Basin.

"Eliminating or minimizing tail water runoff will reduce or eliminate both sediment transport and pollutants," Coffin said. "We hope that by finding a cure for these two problems, we will find a cure for others."

Recommended actions include switching to drip or sprinkle irrigation; adding on-farm retention ponds, sediment basins or pumpback basins; and more careful management of water flow onto and away from the farm.

A few short-term fixes are also under consideration. One of the most promising is the use of a polymer in irrigation water that binds the soil together and facilitates water absorption for greater efficiency.

"It's a little more labor-intensive, but a lot of farmers are trying it," Coffin said.

More labor usually means higher production costs, and most of the recommended remedies carry hefty price tags.

"Irrigation is a business," said Phil Shelton, spokesman for the Yakima Valley Watershed Council. "Farmers must be able to justify any changes economically."

The key is active involvement and participation in the process and cooperation among individuals and groups who often squabble over river use. According to Shelton, the Roza and Sunnyside Valley irrigation districts already have formed a joint panel to deal with water quality and quantity issues. Among other things, they're conducting irrigation education campaigns and hiring people to monitor water quality.

Such changes likely will mean higher rates for water users. But inaction could cost even more. Just a few Yakima fish on the endangered species list would intensify efforts to clean up the river and keep it clean.

Actions initiated under the Clean Water Act or Endangered Species Act give little or no choice to private landowners, regardless of the associated costs, officials said.

Under the Clean Water Act, the Department of Ecology already answers water quality complaints and follows up on them. They can require growers to set up a farm plan according to NRCS specifications and can levy fines for failure to comply. Voluntarily working to meet water quality goals can stave off what Coffin called additional "prescriptive measures."

Whatever methods are used, the river's recovery is a long-term project. The sediment reduction goals are on a 20-year timeline in five-year increments.

"Even if we cure the ills of irrigation drainage, it will take that long just to flush all the sediment out of the river," said Coffin.

He said he's confident the valley's farmers can meet the challenge. In 1994 — a very low water year — some growers were unable to get water, while others were very careful with what they did get.

TMDL analyses during the irrigation season showed sediment reductions close to the target levels set for the first five-year phase of this new project.

"If they can do it in a low water year, they can do it now," Coffin added.

Shelton said the focus on water quality will only grow stronger. And water quality begins with on-farm practices.

"Topsoil is money," Coffin said. "Topsoil is the farmers' livelihood. It doesn't grow like a crop....To waste it by washing it away is flushing away their future."

Water management changes signaled by report

2373

Sunnyside, WA
(Yakima Co.)
Daily Sun News
(Cir. D. 4,330)

AUG 15 1997

A long-awaited report on pollution in the lower Yakima River has been released by the Washington State Department of Ecology, signaling major changes in water management for many farmers in the Yakima River basin.

The report identifies sediments and the associated pesticides and DDT released to the river during the irrigation season, and sets limits and a schedule for reducing these pollutants. The goal is to restore the quality of the lower Yakima River water so that it meets state water quality standards.

"The most obvious sign of pollution in the lower Yakima is the muddy water entering the river at the mouths of the irrigation return drains and tributaries," said Chris Coffin, Yakima River water quality project coordinator.

see "Water management" page 2

❑ Water management

continued from page 1

"Our sampling indicates tens of thousands of tons of top soil are eroded from Valley farms during the irrigation season. The soil is carried down the drain and ends up in the Yakima River. That's bad for agriculture and it's bad for the fish that we're trying to restore in the Yakima.

"Sediment from farmland also carries with it residual amounts of the banned pesticide DDT. Tissue samples of bottom fish in the lower Yakima have among the highest concentrations of DDT in the nation," Coffin said.

The new report is named "A Suspended Sediment and DDT Total Maximum Daily Load Evaluation Report for the Yakima River."

Total maximum daily loads are estimates of the amount of the specific pollutants that a body of water can safely take without threatening the beneficial uses of the water such as stock water, irrigation, fishing, swimming and aesthetic enjoyment.

Sediments and "suspended solids" harm the respiratory systems of fish and aquatic insects.

Ecology, Yakama Indian Nation and several other state, federal and local agencies now will work together with growers to identify the best and most cost-efficient ways to reduce soil erosion and runoff from farms.

According to the report, most of the sediment is eroded from farmland by poor irrigation water management and is carried back to the river through irrigation return drains.

2373

Editorials

River pollution still chronic woe

While attention often is focused on quantity of water in the Yakima River Basin — whether it be droughts or floods and how to deal with them — we were graphically reminded once again this week that water quality is also of paramount importance.

A state Department of Ecology report tells us something we've always known: The Yakima River is polluted to unacceptable levels, with a main culprit being soil erosion. Fortunately, the report also offers a blueprint for doing something about the problem: an ambitious, 20-year goal for meeting federally mandated water-quality standards.

FOCUS 97

Quality of life

Our hope is that this plan will be an action one. Water quality reports of one type or another have been routinely produced over the years, and pollution is a problem that still eludes satisfactory resolution.

The latest report concludes that major improvements in irrigation water-management practices will be required to meet standards in the federal Clean Water Act. Meeting the state goals, in some cases, will require as much as a 93 percent reduction in the amount of sediment entering the river from the larger drains.

With the sediments comes persistent pollution from the banned pesticide DDT, the report said, with fish samples having among the highest concentrations of DDT anywhere in the nation. The pesticide is still being detected 25 years after the federal Environmental Protection Agency banned the product because of adverse effects on birds. Here's a classic example of the fact that you don't get rid of a problem just because you ban it.

However, it would be unfair to imply that nothing has been done about Yakima River pollution problems in years past. The Natural Resources Conservation Service has been working with farmers for years on a voluntary basis to modify irrigation techniques to reduce runoff. Some of those techniques include installing drip irrigation in place of furrow irrigation to reduce runoff.

Despite improvements through voluntary actions by farmers using state and federal assistance programs, sediments and DDT remain the most significant pollutants in the Yakima River Basin. Obviously, more help is needed to take the search for a solution to a new level. To that end, state and federal officials will be working with the local agricultural community and irrigation districts on educational and technological programs, both on and off the farm.

Much has been done to address the pollution problems in the Yakima River, but even more remains to be done. The Yakima River is the lifeblood of this Valley. While this latest report is helpful, the future integrity of the river is best achieved and protected by not only a new awareness, but a new commitment that we can, and must, do better by it.

Safer water

Ecology plan sets goal for compliance with federal standards

By DAVID LESTER
Of the Herald-Republic

A state Ecology Department report on the causes of pollution in the lower Yakima River sets an ambitious, 20-year goal for meeting federally mandated water-quality standards.

The report, which irrigators and soil-conservation agencies have been awaiting, concludes that major improvements in irrigation water-management practices will be required to meet standards in the federal Clean Water Act.

Meeting the state goals, in some cases, will require as much as a 93 percent reduction in the amount of sediment entering the river from the larger drains.

So significant is the erosion of soil from irrigated agriculture that five major drains between Yakima and Prosser contributed 251 tons of sediments to the Yakima River on a daily basis during the 1995 irrigation season.

In fact, the report said, the Moxee drain contributes more sediment to the Yakima River than does the Naches River, even though water volumes in the Naches River are 14 times that of the Moxee drain.

Other major drains are the Granger, Sulpher Creek and the Spring and Snipes creeks.

With the sediments comes persistent pollution from the banned pesticide DDT, the report said, with fish samples having among the highest concentrations of DDT anywhere in the nation.

The pesticide is still being detected 25 years after the federal Environmental Protection Agency banned the product because of adverse effects on birds.

Despite improvements that have been achieved through voluntary actions by farmers using state and federal assistance programs, sediments and the presence of DDT remain the most significant pollutants in the Yakima River Basin, the report said.

These pollutants have landed several reaches of the Yakima River on the state's list of rivers that fail to meet numerous state and federal water-quality criteria. Because of that listing, Ecology is required under the Clean Water Act to establish what is called a Total Maximum Daily Load analysis for the river.

The TMDL is the maximum amount of specific pollutants that can be present in a river without threatening other uses such as fishing, swimming, irrigation, aesthetic enjoyment and stock water.

Chris Coffin, Ecology project coordinator, said the agency will be looking to local citi-

Water/ Complex problem

■ Continued from 1C

methods.

The complexity of the problem, Coffin said, is enormous.

"We are going to start having some workshops to get farmers and growers together to talk to them," he said. "We will look for funds to either fund technical assistance for farmers or funds to go directly to on-farm improvements."

"We are looking for ideas of how this can be implemented and a schedule in which we have to show improvement," he added.

Coffin said the agency hopes to build on work already under way by Valley conservation districts, with assistance from the Natural Resources Conservation Service and irrigation districts in the Lower Valley.

Chris Johnson, an NRCS nutrient management specialist, said the agency has been working with farmers for years on a voluntary basis to modify irrigation techniques to reduce runoff. Some of those techniques include installing drip irrigation in place of furrow irrigation to reduce runoff. The agency also is working with dairy farmers on their waste-application practices to reduce the amount of nitrates in drains and rivers.

Johnson said the agency's activities have made a difference in the amount of sediments entering drains.

"There is a lot of water going through them and a lot of sediment. We are making headway on contaminants," Johnson said. "Obviously, it's not enough to say the water is to the standard that TMDL wants us to."

Johnson said the NRCS offers a program under which farmers can obtain federal financial assistance for water-management improvements. Farmers must submit bids to participate with the maximum federal participation being $50,000 over a five-year period.

Jim Trull, manager of the Sunnyside Valley Irrigation District, said water quality is a priority for the recently created Board of Joint Control involving SVID and the neighboring Roza Irrigation District.

"Our board believes it is better to move cooperatively to solve the problem than wait until there is rigorous enforcement. It is in our best interests to be good stewards of the water resources," he said.

Both districts drain irrigation water into the Granger drain. Trull said the erosion problems are the result of the more-severe slopes in the area and the fine soil textures that result in greater erosion.

In response, the two districts are installing basins in drains to allow the sediment to settle and are monitoring water samples to pinpoint the sources of pollution.

"There is a whole array of things we can do. We are trying to develop that water-quality program as soon as possible so our contributions will mesh with the goals of the TMDL program. We know it is coming," Trull said.

Editorials

Steelhead listing poses new challenge

Now that Washington state has experienced its first endangered-species listing of a wild fish, the situation can be viewed as both a wake-up call and a chance to learn from history.

The National Marine Fisheries Service has listed as endangered the steelhead run in the upper Columbia River. The agency also listed as threatened the steelhead run in the Snake River, which flows through southeast Washington from east of the Tri-Cities to the Idaho border. Yakima River steelhead, for now, are not included. The basin run is considered to be part of the middle Columbia River stocks and a decision on listing them is being delayed for at least six months. There has been a state-imposed ban on steelhead fishing in the Yakima River for several years.

At a news conference with several other state officials, Gov. Gary Locke said the listings could hurt various industries, including Eastern Washington hydroelectric-power producers, farmers, loggers and developers. However, the governor and other state officials also provided some needed focus on the issue by calling for a coordinated state effort to come up with a plan to protect the runs. A comprehensive state management plan will do much to head off further, more restrictive federal actions in the future.

The endangered designation means a severely depressed run is at risk of becoming extinct if nothing is done to protect it. A listing of threatened means runs are likely to become endangered in the foreseeable future. In either case, the situation calls for action and cooperation. A replay of the standoff between competing interests during the spotted owl controversy over forests and logging simply will not be in the best interests of dealing with the steelhead runs.

And needed action is under way. Locke said his staff already was working with Oregon Gov. John Kitzhaber, Idaho Gov. Phil Batt and California Gov. Pete Wilson in a new effort to restore wild steelhead runs. The four states have begun to develop steelhead-restoration plans modeled on Oregon's recovery plan for coastal salmon. State officials rightly point out that it is imperative that affected states get together and write their own steelhead-recovery plan rather than wait for the federal government to do it for them. It is an effort that should be conducted watershed by watershed, rather than have the federal government and the courts respond every time a particular activity is believed to pose a threat to the runs.

The Yakima Basin already has a leg up on such planning, as part of an overall water-management plan being drafted by the Yakima River Watershed Council. The council is a broadly representative group that is looking at all water needs in the basin, including fisheries, as part of the long-range Yakima River Basin Enhancement Project.

Such efforts will be critical to balancing the need to address Endangered Species Act concerns with the myriad of other competing water uses in any river basin. However, the question is not if such balance can be achieved, but how it can be done.

Local

Yakima Herald-Republic a daily part of your life

Saturday, May 11, 1996 — 1C

Contriving a cleanup plan

New state study provides information to deal with Yakima River pollution

By CRAIG TROIANELLO
Of the Herald-Republic

Researchers say a new two-year study provides the groundwork needed to help clean up the lower Yakima River, which is so contaminated that health authorities warn against eating more than one serving of Lower Valley bottom fish per week.

For years studies have shown unacceptably high levels of the banned farm chemical DDT, other pesticides and fertilizers entering the river with irrigation returns. The question was where and how to stop it.

After analyzing hundreds of water samples taken between Ellensburg and the Tri-Cities, state Department of Ecology officials believe they at last have the baseline data needed to craft cleanup plans.

Armed with the data, the agency can set specific targets for cleaning up discharges entering the river.

"We filled in gaps that allowed us to set very specific standards," said Ray Hennekey, an Ecology Department spokesman in Yakima. "Our goal is to bring the river back to meeting state water quality standards."

To reach that goal, however, some farmers may have to change their irrigation practices and water and crop management plans, said Mary Getchell, an Ecology Department spokeswoman in Olympia.

No specific recommendations have been developed, but among the possibilities are more drip irrigation systems, which reduce the volume of waste water leaving farms.

Rather than tell farmers how to run their operations, the Ecology Department wants to work with local soil conservation districts, the Yakima River Watershed Council, Washington State University's Cooperative Extension Service and other agencies that have partnerships with farmers, Hennekey said.

"We don't have any specifics. We know what is available and are collecting more data all the time. We don't want to prescribe what kind of technology they (farmers) should use ... they know their business better than we do," Hennekey said.

State Rep. Barbara Lisk, whose 15th District includes Lower Valley farmers and the Yakima River, said she would reserve comment until she sees the Ecology Department proposals.

"If they come in with good suggestions, I'm sure everyone will be interested," she said. "I just hope they look at costs and what is practical."

Lisk found it promising that Ecology Department officials want to work with soil conservation districts and others generally accepted by the farming community.

"If that's what they are aiming at, that's very encouraging," she said.

"There are no easy answers," said Sen. Irv Newhouse, also of the 15th District.

"Farmers are generally environmentalists and most of them do a good job," he said.

In the last several years, about 10 percent of the Valley's hop fields have installed drip irrigation lines, he noted.

Ecology Department sampling in 1994 and 1995 measured the volume of sediment being carried into the river. Attached to the sediment was DDT, other pesticides and oxygen-robbing nutrients from fertilizer, manure and failed septic systems.

Water carried by returns from Moxee and Granger area farms showed some of the highest readings.

At the Granger drain, one sample recorded a DDT level of 0.357 micrograms per liter. Ecology Department water specialist Joe Joy called that "a huge hit," noting even a reading of 0.001 micrograms can pose a health hazard for aquatic life.

"If we get a hit like that in a routine sample it causes us alarm for what is happening when we are not there," he said.

While DDT has been banned for more than two decades, it is slow to decay and often attaches itself to soil carried back to the river via irrigation returns. In especially low years, as much as 80 percent of the water flowing in the lower Yakima River comes from irrigation return systems.

In 1993, the U.S. Geological Survey reported DDT concentrations in fish between Yakima and Benton City were among the highest in the nation. The study prompted local health authorities to warn against eating more than one meal of bottom fish per week and to entirely avoid ingesting fish skin or drippings, where the chemical concentrates.

According to the USGS, eating 5 ounces of a whitefish or largescale sucker from the lower Yakima River each week over a lifetime of 70 years corresponds to an increase in cancer risk of about 130 per 1 million people.

That compares to similar servings of rainbow trout captured in the relatively clean waters of the Teanaway River, which the USGS said poses a one in 1 million lifetime chance of contracting cancer.

Hennekey said the Granger reading is an anomaly but added, "We have a long way to go."

RIVER MEETING MAY 14

GRANGER — A public meeting to inform and involve people interested in improving water quality in the lower Yakima River will be held from 7 to 9 p.m. Tuesday at Roosevelt Elementary School in Granger.

The meeting is sponsored by Washington State University, the South Yakima Conservation District, the state Department of Ecology and others.

Ecology Department officials will outline the findings of a new report detailing river pollution, such as how much pollution is reaching the Yakima River, and recommendations on what to do about it.

Editorials

5-16-96
Yakima Herald

Quality, supplies key water issues

Can it finally be that after so many years of being one of the most studied rivers in the state — studies which invariably came to the conclusion the lower stretches of the Yakima River are among the most polluted in the state — we are moving to an action plan to do something about it?

Let's hope so.

As we move slowly, but surely, into a comprehensive Yakima River Basin Enhancement Project to conserve and supplement current water supplies, certainly water quality should be a critical element.

But as is the case with the overall enhancement project, the action phase should be carefully implemented through the cooperative efforts of both water quality people and water users.

After analyzing hundreds of water samples taken between Ellensburg and the Tri-Cities during the latest two-year study, state Department of Ecology officials believe they at last have the baseline data needed to draft cleanup plans. We won't even get into why it has taken so long, since for years researchers have known the lower Yakima River was collecting too much of the banned pesticide DDT and other contaminants.

Armed with the new data, Ecology is now in a position to set specific cleanup goals and targets. The transition to those targets will include working out plans with a large number of interested agencies and growers, such as soil conservation districts, the Yakima River Watershed Council and Washington State University's Cooperative Extension Service.

It is an extremely complicated issue to be sure. While return flows — that water that crosses the farm or orchard and is then returned to the river — is obviously a major source of pollution, any switch to irrigation methods that cut down on the return flow creates new problems. In low-water years, up to 80 percent of the usable water depends on return flows. Cut that amount through new drip irrigation techniques, for example, and you exacerbate a low-water problem.

That, of course, is one reason all those agencies — the watershed council in particular — who are involved in the enhancement project must be plugged in to the water-quality effort, too. Water quality must be closely tied to water supplies, with the latter increased through conservation and added storage capacity.

It's going to take a while to clean up the river and realize adequate water supplies in the basin. But we're at least finally headed in the right direction on all fronts.

Ag and Business News

PROSSER RECORD-BULLETI
SEPTEMBER 27, 1995, PAGE

Muddy waters concern local residents

BY KELLY ADAMS

Self employed Prosser resident Dale Cherry is concerned about what he sees going in to the Yakima River at the irrigation return drain up the river in Granger.

He may be right to be concerned.

According to a Department of Ecology Report published this month, "...the Yakima River is seriously threatened by pollution. High suspended solids, turbidity, DDT, and other pesticides, high temperatures, and other kinds of pollution have been documented for several decades in the lower Yakima."

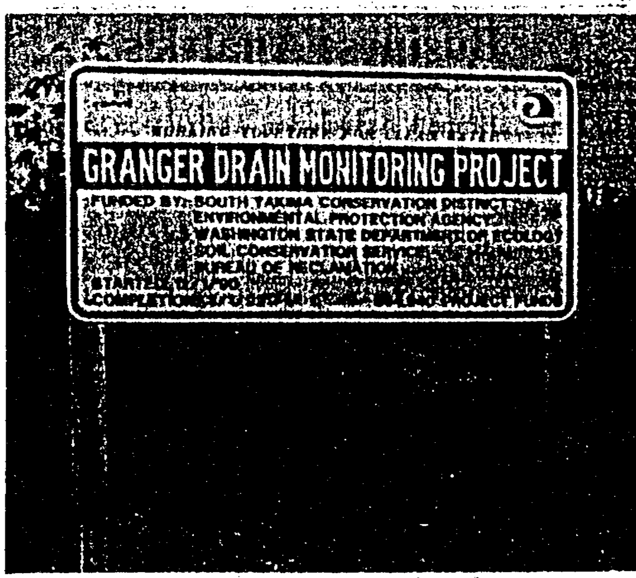
Bob Stevens is a soil scientist at the Washington State University Irrigated Agriculture Research and Extension Center (IAREC) and a member of the Yakima River Watershed Council. He said the Granger Drain is one of many return flows that put water back into the Yakima River after it has been used for furrow field irrigation. Stevens said the reason the water looks muddy is because it contains clay and silt that has been eroded off of the fields.

"We do get a little bit of animal waste," he added. This usually occurs when manure is used to fertilize fields.

At the drainage site, there is muddy water entering the fairly clear water in the river. A definite distinction is visible between the water being pumped in and the river.

The Ecology report goes on to say the Washington State Department of Ecology is beginning a project to restore the water quality in the lower Yakima River.

"It shouldn't be that muddy," said Ray Hennekey, coordinator for the lower Yakima River water quality project for Ecology. He said standards have been set for water quality called Total Maximum Daily Load (TMDL). These are estimates of the amount of pollutants a body



This sign marks the site in Granger where agricultural run off is being monitored by the Department of Ecology for the amount of pollution it contributes to the Yakima River. (Photo by Kelly Adams)

of water can safely take before the beneficial use is affected.

The Yakima River is classified as a Class A waterbody. The Ecology report said: "Class A waters must meet or exceed the requirements for all or substantially all uses. Class A uses include industrial and agricultural water supply; stock watering; salmonoids and other fish migration, rearing and spawning and harvesting; wildlife habitat; primary contact recreation; sport fishing; boating and esthetic enjoyment." The report continues by saying because of pollution the Yakima River is currently not meeting those standards.

Cherry said he first noticed a problem when he went to Granger to float down the river. The mud...

water made him reluctant to use the water and start to wonder about the river's lost potential. He said if the area was cleaned up, "recreational use would just soar." Cherry is also concerned that pollution is being put into the water at Granger and affecting the river down in Prosser.

Stevens said while this may be the case, there are many agricultural drains between Granger and Prosser.

There are three areas where the standards are currently being exceeded in the river, according to Hennekey. They are: pesticide levels, turbidity, and temperature. Stevens said there is a small amount of pesticides which bind to the dirt particles. DDT was banned 20...

both the mud at the bottom of the river and the soil on farmland.

Turbidity is a term used to describe the clarity of the water. Murky water is often caused by a high volume of suspended solids which are soil particles and other materials that are suspended in the water. In the Yakima River, those suspended solids are made up mostly of eroded soil. Turbidity can be harmful because the dark particles absorb sunlight which leads to higher water temperature. The higher water temperature prevents the migration of salmon and steelhead.

Even though Stevens has been working on the Yakima River project for three years he says, "I would drink the Yakima River Water anyway," Stevens continued by saying pollutants get into the water before the Granger site. Part of the work he is doing includes, "working with farmers to cut down on the amount of erosion."

Ecology is determining the TMDLs which they say will set the stage for controlling the pollution. The report said, "Since the pollutants of concern in the lower Yakima River are primarily from agricultural runoff, pollution control strategies for the Yakima will mostly involve identifying and scheduling best agricultural management practices that can be used to meet clean water goals for the Yakima River."

Ecology will be holding public events to provide information about what is being done in regards to Yakima River Water Quality. They will also provide speakers to address groups about water quality issues as well as helping to organize water quality projects for students and volunteers.

For more information, contact Ray Hennekey at the Ecology Central Regional Office at 106 S. Sixth Street, Yakima, Wash. ...

State designates $11 million for 3 Mid-Columbia water quality projects

By JOHN STANG
Herald staff writer

The state has earmarked slightly more than $11 million in water-quality-related grants and loans to Pasco, Royal City and the Benton County Conservation District this month.

Most of that money is expected to go to Pasco to help upgrade its sewage treatment system.

The rest is for preparing studies for a proposed Royal City sewage facility and to study some agricultural practices in northwestern Benton County.

Overall, the Washington Department of Ecology offered at least $71.3 million in grants and loans to cities, counties and Indian nations this month for projects to protect and improve water quality.

The tribes, cities and counties must decide whether they want to accept the money on terms agreeable both to them and the state.

The state sorted through 209 applicants to award grants to 61 government agencies, and through 42 loan applicants to award 39 loans.

In the Mid-Columbia:

■ Pasco received a $2.5 million grant and has been offered an $8.4 million loan. The terms on the loan have not been settled, said Bob Alberts, Pasco's public works director.

So far, Pasco has received $15.3 million in state loans at 3.5 percent interest to upgrade the sewage treatment plant and sewage systems. The $8.4 million would bump the loan total to $23.7 million, in addition to the $2.5 million grant.

Pasco is trying to knock down the interest rates to 1 to 1.5 percent, arguing the city's low-median income and large sewer rate increases in recent years qualifies for the discounted rate.

The difference between the 3.5 percent rate and a 1 to 1.5 percent rate could be $10 a month in a resident's sewer bill.

Overall, the city is tackling an estimated $32 million worth of sewage system and sewage plant improvements, expected to be completed in 1997.

The city is seeking more grants to pay for that project, Alberts said.

■ The Benton County Conservation District has been offered a $91,000 loan to study the relations between farming practices and water quality either along Spring Creek or Snipes Creek. Both are north of Interstate 82 and west of Benton City.

The actual site is still being determined, said district manager Pat Daly. The site will be set when the loan's contract is nailed down within the next couple of weeks, Daly said.

The $122,000 project is expected to begin in October and to last 18 months. The district will provide the remaining project costs with labor and equipment.

■ Royal City has accepted a $174,000 loan to pay for designing a new sewage treatment plant. The town already has a $75,000 state loan to study the area's ground water and geology.

Those studies will determine the design and scope of the new plant, which has a preliminary price tag of $2 million to $6 million, said John Lasen, Royal City's public works director.

The town has gradually increased its sewage rates in recent years in anticipation of this upgrade, he said. The project is expected to take three years.

FOR IMMEDIATE RELEASE
CONTACT: Ray Hennekey, (509) 454-7832
Mary Getchell, (206) 407-6157
April 6, 1995
95-46

WHAT'S THE POLLUTION IN THE YAKIMA RIVER, WHERE IS IT COMING FROM AND WHAT TO DO ABOUT IT?

YAKIMA, WA--Starting next week, the Washington State Department of Ecology will begin sampling lower Yakima River water quality, to begin answering questions about the source of pollutants that put the river on the state's "impaired waters" list. Ecology will also begin answering questions about what to do to prevent the pollution and improve the river's water quality. Ecology plans to take samples at 12 sites in the Yakima River bi-weekly from April to early October.

"This is a very important effort. The sampling will provide vital information that will help us better control the pollution that is going into the river," said Mike Llewelyn, Ecology's water quality program manager.

From April 10 through October, Ecology will be collecting samples from the Yakima River and selected tributaries and irrigation return drains. Sampling will start at the City of Yakima and end just upstream of Richland, where the Yakima meets the Columbia River.

Samples will be analyzed for the following pollutants:

· suspended sediments (particles in the water)
· turbidity (water clarity)
· pesticides
· dissolved oxygen
· pH (measure of acidity or alkalinity in water)
· nutrient levels and fecal coliform (bacteria in animal and human waste) temperature

All of these pollutants affect water supplies, fish and wildlife habitat, recreation and other important uses of the Yakima River. These pollutants have been found in excess of state water quality standards in previous state, federal and private studies. The standards provide a guideline establishing whether the water is safe for swimming, boating and fishing

The results of the sampling will be compiled in a Total Maximum Daily Load Report. Total Maximum Daily Loads are the total amount of pollutants that a water body can take up from all sources and still meet state water quality standards. The report, which is expected to be completed in April 1996, will include information from the sampling about what and how much pollution is going into the lower Yakima River. It will also identify where the pollution is coming from and give recommendations about how to best control the pollution.

"We have evidence that the Yakima River has been polluted for decades. The results of the Total Maximum Daily Load process may mean that new technology, new management practices or other controls may have to be used to reduce the amount of pollution that is currently going into the river." said Llewelyn. "Protecting and improving the health of the river is critical because it is an important source of water for fish and wildlife, irrigated agriculture, fishing, boating, and other business and recreational uses."

- 30 -

NOTE: Opportunities to coordinate print photographs or broadcast taping of the sample collections can be coordinated by contacting Ray Hennekey (509) 454-7832 or Mary Getchell, (206) 407-6157.

Pollution solutions?

Yakima Herald-Republic 4/11/95

Yakima River study seeks ways to limit pollutants

By CRAIG TROIANELLO
Of the Herald-Republic

Nationwide, there are few rivers as heavily altered by irrigation as the Yakima River.

Not only are copious volumes of water siphoned from the river to feed farms, but farm runoff also is returned to the river.

Carried along with the returning water are soils, pesticides and other pollutants. And on Monday, state Department of Ecology researchers fanned out across portions of the river, kicking off a new study aimed at eventually finding new ways to clean water returning to the river.

Study after study clearly has established the river is polluted. Waters that start crystalline in the Cascade Mountains degenerate in the Lower Yakima Valley to a murky condition that falls far below state and federal standards.

"There is a lot of information out there. But it is fragmented," said Ray Hennekey, an Ecology Department spokesman.

"With this study we will have a bigger picture than we've ever had," Hennekey said.

A study released in 1993 by the U.S. Geological Survey showed concentrations of DDT in fish between Yakima and Benton City to be among the highest in the nation. The study prompted the Yakima Health District to issue warnings to limit the intake of Yakima River bottom fish to one meal per week and to avoid eating fish skin or drippings.

While DDT has been banned for more than 20 years, the pesticide takes long periods of time to decay. On farms, the chemical attaches

■ See RIVER, Page 2A

FAR LEFT: Department of Ecology employee Joe Joy measures the depth and flow rate of a drainage ditch in Granger. Some drainage ditches are being sampled because they could be significant sources of pollution in the Yakima River. NEAR LEFT: Barbara Patterson, an Ecology water-quality specialist, performs on-site testing with portable equipment.

(Staff photos by Gordon King)

Date 5/12/95
Paper Record-Bulleti
Topic Water Quality

Prosser, WA
(Benton County)
Record-Bulletin
(Cir. W.)

APR 12 1995

Yakima River pollution researched

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From April 10 through October, Ecology will be collecting samples from the Yakima River and selected tributaries and irrigation return drains. Sampling will start at the City of Yakima and end just upstream of Richland, where the Yakima meets the Columbia River.

Samples will be analyzed for pollutants, including suspended sediments (particles in the water), turbidity (water clarity), pesticides, dissolved oxygen, pH (measure of acidity or alkalinity in water), and nutrient levels and fecal coliform (bacteria in animal and human waste) temperature.

All of these pollutants affect water supplies, fish and wildlife habitat, recreation and other important uses of the Yakima River. These pollutants have been found in excess of state water quality standards in previous state, federal and private studies. The standards provide a guideline establishing whether the water is safe for swimming, boating, and fishing.

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River pollution is well-studied

Yakima Herald-Republic 4/12/95

If one single gallon of Yakima River water remains unstudied on its way to the Pacific Ocean, it is not because various agencies have not tried.

That is the problem the Yakima River Basin Citizens Committee hopes to begin to solve Saturday at a day-long meeting in the Yakima County Courthouse...

There are, the committee learned, in excess of 20 separate studies currently being undertaken in the Yakima River Basin by various local, state and federal agencies dealing with water-related problems.

—News item, Yakima Herald-Republic, April 17, 1975.

Nationwide, there are few rivers as heavily altered by irrigation as the Yakima River.

Carried along with the returning water are soils, pesticides and other pollutants. And on Monday, state Department of Ecology researchers fanned out across portions of the river, kicking off a new study aimed at eventually finding new ways to clean water returning to the river.

—News item, Yakima Herald-Republic, April 11, 1995.

Would we be judged skeptical if we said maybe researchers involved in this latest study of pollution in the Yakima River should just study the studies that have accumulated over the years? After all, we've known for years that the Yakima River is polluted. The question is, what do we do about it?

Ecology spokesmen say this study will be different, that the department acknowledges the many studies, but that the information is fragmented.

The Ecology Department wants to develop the most detailed data yet on what's entering the river, and results will be used to formulate recommendations on how to minimize pollutants.

Some groups, such as soil conservation districts, have long been active in programs to reduce soil runoff into the Yakima River. Working with farmers, dairy operators and others, the districts have helped implement drip irrigation and other systems that reduce waste and lower the rate of contaminants reaching the river.

The conservation districts have an action plan. Let's hope the Ecology Department does, too. Let this newest awareness result in something more than just another study that joins the accumulation of studies over these many years.

4-12-95
Tri-City Herald

State to examine sources of Yakima River pollution

By DOUG CAMPBELL
Herald Valley bureau

YAKIMA — It's no secret the Yakima River is filthy. For years researchers have known about pesticides, soils and other contaminants flowing through the river's dingy waters.

Now a state agency is working to pinpoint the sources of pollutants as a first step toward improving the river's water quality.

The state Department of Ecology this week kicked off a six-month study of the lower Yakima River.

Through October, water samples will be drawn every two weeks at 12 locations along the river's main stem and tributaries between Richland and Yakima.

"There are pollutants in the river and we're sampling to find out how much," said Mary Getchell, ecology spokeswoman.

"For several years this has been a water body that has not met water-quality standards. The actual results of this study will tell us how much (pollution) the river system can take."

Specifically, the Yakima River is on the state's list of "impaired water bodies" — a condition mandating a test known as a "total maximum daily load report."

Similar studies of the Chehalis and Puyallup river systems prompted different recommendations for each community, Getchell explained.

In Chehalis — which was found to be high in pollutants — industries and municipalities were prohibited from discharging certain pollutants into the river during certain times of the year.

But in Puyallup, researchers reported the river had ample capacity for handling more pollutants, allowing the city to consider more residential and industrial development.

By next spring, ecology officials hope to have a draft report of similar recommendations for communities along the lower Yakima River. The $362,000 study will identify where the pollution is coming from and offer suggestions about how to best control the pollution.

The Yakima River already is on the state's list of water systems failing to meet standards of the Clean Water Act. Farms use the river to alternately draw and discharge water. Run off from residential areas and effluent from industries also impact the water quality, fish and wildlife.

Among the most common pollutants known in the river are suspended sediments, pesticides, nitrates and dissolved oxygen, Getchell said.

2020 Vision

Seeing clearly into the future is difficult, but one thing is fairly certain. When summer comes, youngsters will find the nearest water hole. In summer, water is a kid's natural element... for swimming, for fishing, for skipping stones, or just squishing mud between the toes. But parents, especially moms, want that water to be clean water... the mud is just a fact of life.

This summer, next year, and in 2020, the network of surface and ground waters comprising the Yakima River Watershed must be clean, clear, and fresh if the youngsters of the future are to enjoy a better quality of life. Clean water literally is the life blood of the community. The human body is about 65 percent water. Water drives our economy. Water lights our way. Water "greens" our forests. And kids can't go fishin' if there are no fish.

Since all living things are connected to our one watershed network, it's plain to see we are connected to each other and have a responsibility to protect the quality of the community's water.... So who is looking out for the youngsters? Well, mom and dad of course, but also the Washington Department of Ecology, The Environmental Protection Agency, the Yakama Indian Nation, conservation districts, cities, counties, and other public and private entities.

What's more, growers, through their Irrigation Districts, are making serious effort to clean-up their irrigation return flows to the Yakima River. Lower reaches of the River have been designated as not meeting State water quality standards, and the Dept of Ecology has initiated a process called TMDL (total maximum daily load) to improve water quality over the next ten years.

The Watershed Council provides the open forum where the various water interests of the Basin can focus their collective vision and identify solutions to assure the supply of clean water into the 21st century. Sorry about the mud, mom.

Connect With The Yakima River Watershed Council

402 E. Yakima Avenue, Suite 510 (509) 576-9042

Yakima, Washington 9[illegible]01 Fax (509) 576-8666

APPENDIX 18

LOWER YAKIMA RIVER SUSPENDED SEDIMENT TMDL

Yakima River TSS & DDT TMDL Data Files

This CD contains the most essential water quality data used to evaluate the Yakima River TSS and DDT problem as discussed in the TMDL document. "A Suspended Sediment and DDT Total Maximum Daily Load Evaluation Report for the Yakima River". The data are in the original ACCESS Database and EXCEL file formats. The following is a brief description of the files and what they contain.

Data.mdb	ACCESS database Contains all the Ecology data collected in 1995 from the TMDL surveys. Included are USBR discharge and Yakama Indian Nation cooperative data. Tables and Queries are self-explanatory.
Rawdata.xls	EXCEL workbook Contains the 1994 Ecology data collected in the lower and upper Yakima basins in preparation for the 1995 sampling effort.
QAR.xls	EXCEL workbook Quality Assurance field replicate data for the 1994 surveys.
QAPairs.wk1	Lotus spreadsheet Quality Assurance field replicate data for the 1995 surveys.
GS-doe.xls	EXCEL workbook USGS and Ecology TSS methods data and comparisons.
Trbtssbr.xls	EXCEL workbook USBR and Ecology turbidimeter comparisons.
Yin94dat.xls	EXCEL workbook Yakama Indian Nation water quality data collected in 1994 by YIN Environmental Programs staff.
Flow.zip	Winzip Instantaneous discharge measurements taken at water quality monitoring sites in the lower Yakima basin in 1995.
xsection.xls	EXCEL workbook USGS field data from their discharge sites on the main stem Yakima River used to create discharge to velocity relationships.

Sedddat-n.xls	EXCEL workbook USGS historical TSS data for main stem Yakima River sites.
stps.xls	EXCEL workbook Ecology discharge monitoring report data for point sources discharging to theYakima River.
usbr.xls	EXCEL workbook USBR discharge data for the 1994 and 1995 irrigation seasons.
Q_and_TS.xls	EXCEL workbook 1995 TSS loading calculations.
SMPTOX3.exe	Model executable SMPTOX3 model used in the Yakima River evaluation. Model files (30 runs) have an ST3 extension.

Yakima River TSS & DDT TMDL Files
Compiled 9/2/98
Washington Department of Ecology
Environmental Investigations and Laboratory Services Program
Watershed Assessments Section
Project Leader: Joe Joy
phone: (360)407-6486
email: jjoy461@ecy.wa.gov

Abridged items from this section include:

- **Yakima River Basin Water Quality Plan, Vols. I-IV; Yakima Valley Conference of Governments, 1995.**