March 1990

YAKIMA/KLICKITAT PRODUCTION PRELIMINARY DESIGN REPORT APPENDIX B: WATER SUPPLY ANALYSIS

DOE/BP-00245-3

BONNEVILLE POWER ADMINISTRATION

This report was funded by the Bonneville Power Administration (BPA), U.S. Department of Energy, as part of BPA's program to protect, mitigate, and enhance fish and wildlife affected by the development and operation of hydroelectric facilities on the Columbia River and its tributaries. The views of this report are the author's and do r necessarily represent the views of BPA.

This document should be cited as follows:

Bureau of Reclamation Pacific Northwest Region, Tom Clune, COTR, Bonneville Power Administration, Division of Fish and Wildlife, 242 electronic pages (BPA Report DOE/BP-00245-3)

This report and other BPA Fish and Wildlife Publications are available on the Internet at:

http://www.efw.bpa.gov/cgi-bin/efw/FW/publications.cgi

For other information on electronic documents or other printed media, contact or write to:

Bonneville Power Administration
Environment, Fish and Wildlife Division
P.O. Box 3621
905 N.E. 11th Avenue
Portland, OR 97208-3621

Please include title, author, and DOE/BP number in the request.

This report was funded by the Bonneville Power Administration (BPA), U.S. Department of Energy, as part of BPA's program to protect, mitigate, and enhance fish and wildlife affected by the development and operation of hydroelectric facilities on the Columbia River and its tributaries. The views in this report are the author's and do not necessarily represent the views of BPA.

For copies of this report, write to:

Bonneville Power Administration
Division of Fish and Wildlife - PJ
P.O. Box 3621
Portland, OR 97208

YAKIMA/KLICKITAT PRODUCTION PRELIMINARY DESIGN REPORT

APPENDIX B:

WATER SUPPLY ANALYSIS

By
Bureau of Reclamation
Pacific Northwest Region
Boise, Idaho

Prepared for:

Tom Clune, COTR
Bonneville Power Administration
Division of Fish and Wildlife
P. O. Box 3621
Portland, Oregon 97208-3621

March 1990

ACKNOWLEDGEMENTS

Tom Clune of the Bonneville Power Administration served as that agency's Technical Representative for the study and provided valuable advice and assistance. Fred Crase of the Bureau of Reclamation served as Activity Manager for the study and prepared this report. Other Bureau of Reclamation personnel who played key roles in gathering and analyzing data include Chuck Keller and Ray Johnson (stream description); Onni Perala, Ron Morris, Roger Larson, Steve Fanciullo, and Fred Nacke (hydrology); Dave Zimmer and Wallace Wipper (water quality); George Cawthon (reports); and Gary King (ground water). Evelyn Dunbar and Johnette Franke provided editorial and typing assistance.

Special thanks go to the biologists of the Yakima Indian Nation's Fisheries Resource Management Office for providing information from other ongoing studies being conducted by the office. Bruce Watson and David Lind, Lead Subbasin Planners for the Yakima and Klickitat basins, respectively, were especially helpful, and so were Bill Sharp, Joel Hubbel, Dave Fast, and Tom Scribner. Special thanks also go to the members of the Water Supply Analysis Task Team for reviewing data and providing overall direction to the study--Task Team members included John Easterbrooks (Washington Department of Fisheries), Bob Tuck (Yakima Indian Nation), and Walt Larrick (Yakima Basin Irrigation Districts).

Don Anglin and Brian Cates of the U.S. Fish and Wildlife Service's Vancouver Fisheries Assistance Office conducted the Klickitat River Instream Flow Incremental Methodology studies and Dell Simmons of that office oversaw the studies on the Yakima River tributaries on passage flow requirements.

SUMMARY

From May 1988 to January 1990 the Bureau of Reclamation, under an interagency agreement with the Bonneville Power Administration, conducted the water supply analysis required by Task II of the Northwest Power Planning Council's (Council) approval of predesign work on the Yakima/Klickitat Production Project. The purposes of the analysis were to (1) document the adequacy of water supplies (quantity and quality) for the proposed artificial production facilities, and for anadromous fish spawning, incubation, rearing, and migration in the Yakima and Klickitat Rivers and their tributaries; (2) determine the availability and quality of existing anadromous fish habitat in both basins; (3) document existing constraints to achieving anadromous fish production potentials in both basins; and (4) develop a listing of streams in both basins where existing water supplies, access, and habitat are adequate for anadromous fish production; where water supplies, access, and habitat would be adequate if improvements were made and agreements reached with existing water users; and where existing water supplies, access, and habitat are inadequate or unattainable in the near term (<10 years). The results of the water supply analysis will be reviewed by project managers and a technical work group, and recommendations will be made to the Council for any changes needed in the location and/or design of the proposed production project facilities.

FACILITY WATER SUPPLIES

Yakima Basin

The results of the analysis of water supplies (quantity and quality) for the artificial production facilities are summarized in table A. In the Yakima basin, surface water quantities are adequate to meet the projected needs of the proposed facilities at the Prosser, Wapato Canal, Cle Elum, and Oak Flats sites. The proposed facilities at the Wapato Canal and Oak Flats sites would obtain all or part of their surface water supply from water diverted for irrigation by the Wapato Irrigation Project and the Naches-Selah Irrigation District, respectively; thus, fish facility operations and water needs should be closely coordinated with these entities.

The adequacy of surface water quantities to meet the projected needs of the proposed facilities at the Buckskin site uncertain. Flow data for Buckskin and Nelson Springs indicates that their combined flow during winter and spring may be about 8 cubic feet per second (cfs) whereas the projected need of the fish facilities during this period is up to 9 cfs. Further monitoring of the flows at this site should be conducted from November through April to determine if surface flows during these months are adequate to meet facility needs.

The quality of the surface water is probably adequate for the proposed fish culture uses at the Wapato Canal, Cle Elum, and Oak Flats sites, but appears to be questionable at the Prosser and Buckskin sites. A few water quality parameters from surface water samples at the Wapato Canal, Cle Elum,

Table A.--Summary of the Adequacy of Water Quantity and Quality for the Proposed Yakima/Klickitat Production Project Facilities.

Facility Site and Water Supply	Adequacy of Water Quantity	Adequacy of Water Quality
Prosser		
Surface water	Adequate	Questionable--Several parameters do not meet Alaska aquaculture criteria. Further evaluation of data is needed.
Ground water	Adequate	Probably adequate--A few parameters do not meet Alaska aquaculture criteria. Further evaluation of data is needed.
Wapato Canal	Adequate--However, early March diversions need to be coordinated with the Wapato Irrigation Project.	Probably adequate--A few parameters do not meet Alaska aquaculture criteria. Further evaluation of data is needed.
Cle Elum		
Surface water	Adequate	Probably adequate--A few parameters do not meet Alaska aquaculture criteria. Further evaluation of data is needed.
Ground water	Probably adequate--However, additional wells will be needed.	Probably adequate--A few parameters do not meet Alaska aquaculture criteria. Further evaluation of data is needed.
Oak Flats		
Surface water	Probably adequate--Need to coordinate water diversions with Naches-Selah Irrigation District.	Probably adequate--A few parameters do not meet Alaska aquaculture criteria. Further evaluation of data is needed.
Ground water	Inadequate--150 gpm maximum	Probably adequate--A few parameters do not meet Alaska aquaculture criteria. Further evaluation of data is needed.
Buckskin		
Surface water	Marginally adequate--additional data needed	Questionable--Several parameters do not meet Alaska aquaculture criteria. Further evaluation of data is needed.
Ground water	Inadequate	N/A
Cascade Springs		
River water	Adequate	Probably adequate--A few parameters do not meet Alaska aquaculture criteria. Further evaluation of data is needed.
Spring water	Marginally adequate--Some minor reprogramming of facility requirements may be needed.	Probably adequate--A few parameters do not meet Alaska aquaculture criteria. Further evaluation of data is needed.

and Oak Flats sites do not meet the salmonid aquaculture criteria established by the Alaska Department of Fish and Game. Water temperatures at the sites, for example, occasionally exceed the Alaska aquaculture criteria. It may be possible to program hatchery use of surface water to avoid these occasional warm water temperatures, but additional data are needed at the Wapato Canal and Oak Flats sites to more clearly define the surface water temperature regime. Facility use of surface and ground waters at Cle Elum is such that avoidance of the occasional warm surface water temperatures should not be a problem.

In addition to water temperature, some of the chemical constituents in the surface waters at the Wapato Canal, Cle Elum, and Oak Flats sites do not meet the Alaska aquaculture criteria. High levels of aluminum and manganese, and low levels of dissolved sodium were characteristic of the water at all sites sampled in the basin, and appear to represent natural background levels. Further investigation is needed to determine if the observed levels of these and a few other parameters that do not meet the Alaska aquaculture criteria (e.g., chloride) would present a problem to fish culture at any of the sites.

The Alaska aquaculture criteria are quite stringent and are based in part on the very clean and unpolluted nature of most waters in that state. Other criteria for fish culture exist that are somewhat less exacting than the Alaska criteria (e.g., Fish and Wildlife Service criteria for fish hatcheries). A next step in evaluating the water supply for fish culture would be to compare the water quality data against other criteria. If some constituents still do not meet the less stringent criteria, then experts in fish culture and fish toxicology should be consulted to assess whether the observed levels would constrain fish culture.

Several water quality parameters at the Prosser and Buckskin sites do not meet the Alaska aquaculture criteria. Surface waters at both sites have high levels of aluminum, nitrates, and chlorides, and warm water temperatures are common from spring through early fall. Nitrates, chlorides, and warm water temperatures are often indicators of impacts from irrigation return flows. In addition, surface waters at Prosser contain high levels of carbon dioxide and zinc, and detectable levels of several pesticides. Further evaluation of the quality of surface waters at these two sites is needed to determine if any of the observed levels of chemical constituents pose a serious constraint to fish culture.

Ground-water quantities are adequate to meet the projected needs of the proposed facilities at Prosser (>1.8 cfs), appear to be marginally adequate at Cle Elum, but are inadequate at the Oak Flats and Buckskin sites. The production test well drilled at Cle Elum is artesian with an estimated flow of 1 cfs and an estimated pumping capacity of 2-3 cfs. Because the well is artesian, the effect of pumping could be felt throughout the site area and any additional wells must be widely spaced to avoid interference. An additional 2-3 wells may be possible at the Cle Elum site bringing the total ground-water supply at the site 6-8 cfs. This supply would be at, or slightly less, than the projected July-September demand of 8-9 cfs. Additional pump testing is needed of the test well at Cle Elum, and perhaps the development of Two production test wells at the Oak Flats site produced a total yield of less than 0.5 cfs, much less than the projected demand of 2 cfs. No suitable ground-water aquifer was penetrated during well drilling at the Buckskin site. Wells at both locations were drilled to bedrock. There is a possibility that drilling into the upper part of the basalt bedrock may locate an aquifer with adequate water for the proposed facilities. Any test drilling should be limited to an additional depth of 150-200 feet because this is where an aquifer with suitable water temperature would most likely be found.

The quality of the ground-water at the Prosser, Cle Elum, and Oak Flats sites is probably adequate for fish culture; however, a few water quality parameters from ground-water samples at all three sites do not meet the Alaska aquaculture criteria. Further evaluation is needed (similar to that proposed for surface waters) to assure that the quality of the ground water is adequate for the proposed artificial production uses.

Klickitat Basin

There appears to be adequate streamflow and spring water quantities at the Cascade Springs site to meet the projected fish facility needs. However, flow data for the two springs at the site averaged 37.5 cfs in 1989 which is slightly less than the projected spring water need of 40 cfs for March and April. It should be possible to program the spring water requirements of the proposed facilities to conform with the available supply without adversely affecting hatchery production goals.

The quality of the river and spring water at the site is probably adequate; however, a few water quality parameters in each source did not meet the Alaska aquaculture criteria. High levels of aluminum, manganese, copper, and mercury in the river water are of possible concern, as are high levels of aluminum in one of the springs (Kidder). Further investigation of the possible effects of the observed concentrations of these constituents on fish culture is needed.

STREAM DESCRIPTION

Yakima Basin

The results of the analysis of stream water supplies, access, and habitat for the natural production of anadromous fish in the Yakima River basin are summarized in table B. Most of the main stem Yakima River is presently suitable for the natural production of anadromous fish. However, there are a few constraining factors. Flows in the 11.2-mile segment between Prosser Diversion Dam and the Chandler Powerplant are often not adequate for adult passage and juvenile rearing, especially during the summer months, and occasionally during the other seasons of the year. Water quality is a major constraint to anadromous fish production in this segment during summer. Water quality may also be a problem during summer in the area from the powerplant outlet to the mouth of the Yakima River, but flows and water quality in the

Table B.--Summary of Constraints to Anadromous Fish Production, Natural Production Potential, and Suitability for Inclusion in Hatchery Planning for the Yakima River and Selected Tributaries.

Stream Reach or Tributary	Constraints to Anadromous Fish Production 1/	Stocks Affected 2/	Natural Production Potential 3/ (1,000 smolts)	Suitable for Hatch. & Planning
Yakima River				
Columbia River to Prosser Dam	*Flow *Water quality	FC,SuC,SpC,Co,STHD FC,SuC,SpC,Co,STHD	FC- 990 SpC - 45	Yes--possible acclimation site
Prosser Dam to Sunnyside Dam	Flow water quality	FC,SuC,SpC,Co,STHD FC,SuC,SpC,Co,STHD	FC - 2.525 SuC - 190 SpC - 55 Co - STHD - 120	Yes--possible acclimation site
Sunnyside Dam to Wilson creek	Flow	SuC,SpC,Co,STHD	SuC - 1,320 310 Co - 100 STHD - 80	Yes-possible acclimation site
Wilson Creek to Cle Elum River	Flow	SpC,STHD	SpC - 1,150 STHD - 135	Yes--possible acclfnatfm site
Cle Elum River to Keechelus Dam	Flow	Spc,STHD	y&l-- 595 65	Yes-possfble acclimation sfte
Yakima Rfver Tributaries				
Corral (Canyon) Creek	● A&l1tpassage (1) *Juvenile passage (1) Water quality	co, STHD Co, STHD co. STHD	CO- n/d STHD - n/d	Yes--with improvements
Spring/Snipes Creek	*Flow *Pesticides *Water quality False attraction	Co, STHD Co, STHD co. STHD FC, SuC, SpC	Co - <1 STHD - <1	No--needs bawler on Snipes Creek. Constraints can be reduced only over the long term.
Sulphur Creek	*Water quality *Flow False attraction	co, STHD co. STHD SpC	Co - 0 STHD - 0	No--needs barrier. Constraints can be reduced only over the loy term
Satus Creek	Adult Passage (2) 4/ Juvenile passage (3) 4/ *Flow Rfparian	SpC, Co, STHD SpC, Co, STHD SpC, Co SpC, Co, STHD	SpC- 40 Co - n/d STHD - 70	b-designated for wild STHD productfon; flow constraints related to SpC and Co can be reduced only over the long term
Toppenish/Simcoe Creeks (includes drains)	*Adult passage (5) ● Jwenfle passage (9) *Culverts Flow Riparian Water quality	FC. Co, STHD FC, Co, STHD Co, STHD co, STHD Co, STHD FC. Co, STHD	FC - 520 Co - 505 STHD - 50	Yes--with improvements; possible acclimation site
Ahtanum Creek	● Mu1t passage (2) 4/ *Juvenile passage (7+) Flow Riparian	SpC, Co, STHD SpC, Co, STHD SpC, Co SpC, Co, STHD	SpC - 50 Co - 50 STHD - 15	Yes-ufth improvements; possible acclimation site
Wide Hollow Creek	● Mu1t passage (3) ● &venfle passage (4) *Water quality Rfparian	Co, STHD Co, STHD Co, STHD Co, STHD	Co - 19 STHD - 3	Yes-4th improvements; possible acclimation site. Centennial Salmon Stream
Wenas Creek	*Flow *Water quality *Adult passage (9) *Juvenile passage (?) Riparian	SpC, Co, STHD SpC, Co, STHD SpC, Co, STHD SpC, Co, STHD SpC, Co, STHD	SpC - 0 Co - 0 STHD - 1	No--major constrafnts can be reduced only over the long term
Umtanum Creek	Low natural flow Adult passage (1)	STHD STHD	STHD - <1	No--Limited habitat potential
Yilsm Creek System	● Adult passage (?) Sweveflepassa9e (over Riparian	SpC, STHD SpC, STHD SpC, STHD	SpC - 10 STHD - 1	Yes--lower 7.8 miles; need barrier at RM 7.8. Upper part can be improved only over the long term.

1/ An asterisk (*) indicates an existing major constraint to anadromous fish production. Number in parenthesis indicates number of constraints. Constraints without an asterisk tend to reduce production rather than prevent or seriously impact it.
2/ FC = fall chinook, SuC = summer chinook, SpC = spring chinook, Co = coho, STHD = steelhead
3/ n/d = no data
4/ Included in the Phase 2 Fish Passage Facilities Program

Table B--Continued

Stream Reach Of Tributary	Constraints to Anadromous Fish Production[1/]	Stocks Affected[2/]	Natural Production Potential[3/] (1,000 smolts)	Suitable for Hatchery Planning
Manastash Creek	*Adult passage (4) *Juvenile passage (8) *Flows Riparian	SpC, STHD SpC, STHD SpC, STHD SpC, STHD	SpC - 75 STHD - 25	Yes--with improvements; possible acclimation site
Taneum Creek	*Flow water quality Riparian False attraction	SpC, STHD SpC, STHD SpC, STHD SpC, STHD	SpC - 125 STHD - 20	Yes-with improvements; possible acclimation site. Need barrier on drain
Swauk Creek	*Flow *Water quality ● venile passage (2) Adult passage (2) (partial block)	SpC, STHD SpC, STHD SpC, STHD SpC, STHD	SpC - 0 STHD - 5	No--flow and water quality constraints can be reduced only over the long term
Teanaway River	*Juvenile passage (17)[4/] ● Flw Adult passage (?)[4/] (partial block)	SpC, STHD SpC SpC, STHD	SpC - 245 STHD - 55	Yes--STHD in short term with improvements; possible acclimation site. SpC flow constraints can be reduced only over the long term
Cle Elum River	Juvenile passage (1)	SpC, STHD STHD -	SpC - 155 45	Yes--with improvements; possible acclimation site
Little Creek	*Juvenile passage (2) *Flow	STHD	STHD - 2	Yes--with improvements; possible acclimation site
Big Creek	*Adult passage (1) *Juvenile passage (2) *Flow	SpC, STHD SpC, STHD SpC	SpC - 9 STHD - 4	Yes-with improvements; possible acclimation site
Cabin Creek	● Wult passage (1) Riparian	SpC, STHD SpC, STHD	SpC - bo STHD - 9	Yes--with improvements; possible acclimation site
Naches River				
Yakima River to Tieton River	Flow Juvenile passage[4/]	SuC, SpC, Co, STHD SuC, SpC, Co, STHD	SuC - 1,130 SpC - 80 Co - 75 STHD - 45	Yes--possible acclimation site
Tieton River to Bumping River	Juvenile passage[4/]	SpC, Co, STHD	SpC - 555 Co - 140 STHD - 65	Yes--possible acclimtion site
Naches River				
Cowiche Creek	*Adult passage (3) *Juvenile passage (5) Flw Riparian	SpC, Co, STHD SpC, Co, STHD SpC, Co SpC, Co, STHD	SpC - <1 Co - 55 STHD- 10	Yes--with improvements; possible acclimation site
Tieton River	*Flow Adult passage (1)[4/] Juvenile passage (1)[4/]	SpC, Co, STHD SpC, Co, STHD SpC, Co, STHD	SpC- 65 Co - 250 STHD - 20	No-flw problems can be reduced only over the long term
Rattlesnake Creek	Low natural flw	SpC, Co, STHD	SpC - 45 Co - 100 STHD - 25	Yes--possible acclimation site
Nile Creek	Low natural flow	Co, STHD	Co - 14 STHD - 2	Yes-possible acclimation site
Bumping River	None	--	SpC - 90 Co - 165 STHD - 30	Yes--possible acclimtion site
Little Naches River (above Falls)	Lw natural flw (above Middle Fork)	SpC, Co	SpC - 75 co - 100 STHD - 20	Yes--possible acclimation site
American River	Adult passage (1) (partial block)	SpC, Co, STHD	SpC - 425 CO- 125 STHD - 25	Yes--for Co and STHD; designated for wild SpC production

1/ An asterisk (*) indicates an existing major constraint to anadromous fish production. Number in parenthesis indicates number of constrain Constraints without an asterisk only tend to reduce production rather than prevent or seriously impact it.
2/ FC = fall chinook, SuC = summer chinook, SpC = sprig chinook, Co = coho, STHD = steelhead
3/ n/d = no data
4/ Included in the Phase 2 Fish Passage Facilities Program

35.8-mile segment are adequate the rest of the year for fall chinook spawning and incubation, migration of all stocks to upstream areas, and some overwintering of salmon and steelhead.

The quality of the habitat in the lower 33 miles of the reach from Prosser Diversion Dam to Sunnyside Diversion Dam is naturally poor and the anadromous fish production potential of this segment is very limited. However, habitat in the remaining 57 miles of this reach is suitable for spawning and incubation of fall chinook, passage of other stocks to upstream areas, overwintering of some salmon and steelhead, and spawning and rearing of some steelhead. Low flows below Sunnyside Diversion Dam can be a problem to adult passage during summer, and an occasional problem to the spring smolt outmigration in dry years. The quality of the river water deteriorates significantly as it flows through this reach but does not reach problem levels except in the lowest part of the reach during summer.

Flows, water quality, and habitat in the Yakima River from Sunnyside Diversion Dam to Keechelus Dam are suitable for spawning and rearing of summer chinook (below Roza Diversion Dam), spring chinook, coho, and steelhead. The only remaining problems to anadromous fish production in this 67-mile reach of the river, after the Phase I and Phase II fish passage facilities are completed, are flows that often can be too high during summer for optimal juvenile rearing (due to storage releases for irrigation) and flows below Roza Diversion Dam can occasionally be low enough to constrain adult passage.

Tributaries of the Yakima River (excluding the Naches River and its tributaries) do not at present have the balance of adequate flows, access, and habitat to fully achieve the potential for the natural production of anadromous fish. Many of the tributaries presently support some natural production which varies from quite substantial to very limited. All of the tributaries listed as having a near-term production potential need some improvements to fully achieve that potential. Tributaries with production potential, and where the needed improvements appear technically feasible within the next 10 years, include Corral (Canyon) Creek, Satus Creek, Toppenish/Simcoe Creeks, Ahtanum Creek, Wide Hollow Creek, Umtanum Creek, Wilson Creek (lower 7.8 miles), Manastash Creek, Taneum Creek, Swauk Creek, Teanaway River, Cle Elum River, Little Creek, Big Creek, and Cabin Creek. Satus Creek, Umtanum Creek, and Swauk Creek are not considered suitable for the production project's outplanting program for various reasons (table B), but the remaining tributaries would be suitable with the needed improvements.

Yakima River tributaries that would not be suitable for the natural production of anadromous fish, because it does not appear technically feasible to significantly reduce existing constraints within the next 10 years, include Snipes Creek, Sulfur Creek, Wenas Creek, and the Wilson Creek system (above RM 7.8).

The main stem Naches River generally provides good to excellent spawning and rearing habitat for summer chinook (below the Tieton River confluence), spring chinook, coho, and steelhead. The major limiting area on the Naches River (assuming completion of the Phase I and Phase II passage programs) is the 7.4-mile segment between Wapatox Diversion Dam and the powerplant wasteway. Flows in this bypass reach are often too low for adult passage and juvenile rearing during fall and winter. Water quality in the Naches River is generally good to excellent except for occasional warm water temperatures downstream of Wapatox Diversion Dam.

Naches River tributaries with presently adequate flows, access, and habitat for the natural production of anadromous fish include Rattlesnake Creek, Nile Creek, Bumping River, and Little Naches River. Two of the remaining tributaries (Cowiche Creek and American River) would be adequate with improvements; only the Tieton River has significant constraints (flow) that do not appear technically feasible to resolve within the next 10 years. Even with the flow problems, the Tieton River will have some natural production potential when the Phase II passage facilities are completed.

Many tributaries of the Yakima and Naches Rivers contain good to excellent habitat for anadromous fish in the upper reaches, but diversions in the lower reaches limit or preclude anadromous fish use of these tributaries. Many of these tributaries could be made accessible to steelhead, and some made accessible to spring chinook or coho, if adult and juvenile passage facilities were provided at the diversions. It is estimated that an additional 19 adult passage facilities, about 38 juvenile passage facilities, and 4 adult fish barriers are needed beyond those included in the Phase I and Phase II fish passage facilities programs. The Northwest Power Planning Council's Fish and Wildlife Program should be amended to include the construction of these.

Klickitat Basin

The main stem Klickitat River provides suitable habitat for spawning and rearing by fall chinook, spring chinook, coho, and steelhead (table C); however, adult passage and water quality problems are presently limiting natural production by anadromous fish. The two major passage problems on the main stem are Lyle Falls (RM 2.2) and Castile Falls (RM 64.2); a Washington Department of Fish (WDF) hatchery weir at RM 42.4 could also be an impediment to adult passage at times. Although adult passage improvements have been constructed at Lyle and Castile Falls, passage conditions are still difficult at Lyle Falls, and Castile Falls remains a near total barrier to anadromous fish. State-of-the-art passage improvements should be constructed at Lyle and Castile Falls and the WDF hatchery weir to improve natural production in the main stem of the Klickitat River for anadromous fish.

Water quality is a problem in the Klickitat River downstream from the Big Muddy Creek confluence (RM 53.8). Big Muddy Creek and Little Muddy Creek (a tributary of the West Fork) drain glaciers on the east slope of Mount Adams. During the warmest months, sediment from these tributaries colors the Klickitat River downstream to the Columbia River. This sediment load is considered serious enough by fishery biologists that it was designated in the Klickitat Subbasin Plan as a constraint to anadromous fish production downstream of the Big Muddy Creek confluence. Resolution of the sediment problem will be technically difficult and should be pursued over the long-term.

Anadromous fish passage up a number of Klickitat River tributaries is blocked by natural cascades and falls where they steeply descend into the deep

Table C.--Summary of Constraints to Anadromous Fish Production, Natural Production Potential, and Suitability for Inclusion in Hatchery Planning for the Klickitat River and Selected Tributaries.

Stream Reach or Tributary	Constraints to Anadromous Fish Production[1/]	Stocks Affected[2/]	Natural Production Potential (1,000 smolts)	Suitable for Hatchery Planning
Klickitat River				
Columbia River to Lyle Falls	Adult passage Spawning habitat Rearing habitat Water quality	FC, SpC, Co, STHD FC FC, SpC, STHD FC, SpC, Co, STHD	SpC - 25 FC - 115 STHD - 9	No--Limited habitat potential
Lyle Falls to WDF Hatchery	Adult passage Water quality	FC, SpC, STHD FC, SpC, Co, STHD	SpC - 25 FC - 1,765 STHD - 135	Yes--Improvements would increase production potential
WDF Hatchery to Castile Falls	Adult passage Water quality	SpC, Co, STHD SpC, Co, STHD	415 El-- 80	Yes--Improvements would increase production potential
Castile Falls to Headwaters	*Adult passage	SpC, Co, STHD	W - 255 Co - 190 STHD - 25	Yes--With improvements
Tributaries				
Synder Creek	*Adult passage *Water quality	Co, STHD Co, STHD	STHD - <1	No--Passage, water quality problems
Swale Creek	*Flow	Co, STHD	Co - 4 STHD 1	No--Flow problems
Little Klickitat River System	*Adult passage *Flow *Water quality	SpC, Co, STHD SpC, Co, STHD SpC, Co, STHD	SpC - 60 Co - 80 STHD - 15	Yes--Below falls at RM 6.1
Summit Creek	*Adult passage	Co, STHD	CO- 8 STHD - 2	Yes--But has limited habitat potential (2.0 miles)
White Creek	Adult passage Riparian Culverts	STHD STHD STHD	STHD - 3	Yes--With improvements
Outlet Creek	*Adult passage	Co, STHD	Co - <1 STHD - <1	No--Limited habitat potential
Elk Creek	*Adult passage *Flow	Co, STHD Co, STHD	Co - <1 STHD - <1	No--Natural barrier, flow problems
Trout Creek System	Adult passage Flow Culverts	Co, STHD Co, STHD co. STHD	Co - 8 STHD - 2	Yes--Improvements would increase production potential
Deer Creek	*Adult passage Flow	Co, STHD Co, STHD	Co - <1 STHD - <1	No--Natural barrier
Bacon Creek	*Adult passage	to, STHD	Co - <1 STHD - <1	No--Natural barrier, limited habitat potential
Dairy Creek	*Adult passage	Co, STHD	co. <1 STHD - <1	No--Natural barrier, limited habitat potential
Big Muddy Creek System	*Water quality	Co, STHD	Co - <1 STHD - <1	No--Limited habitat potential
Cunningham Creek	*Adult passage	Co, STHD	Co - <1 STHD - <1	No--Natural barrier, limited habitat potential
Surveyors Creek	*Adult passage Culverts	Co, STHD Co, STHD	CO- 16 STHD - 2	Yes--With improvements
Soda Springs Creek	*Adult passage	Co, STHD	Co - <1 STHD - <1	No--Natural barrier
West Fork System	● llbrltpmqe Water quality	Spc, Co, STHD SpC, Co, STHD	SpC - 85 Co - 45 STHD - 15	Yes--With improvements
Chaparral Creek	*Flow	Co, STHD	Co - <1 STHD - <1	No--Limited habitat potential
McCreedy Creek	*Adult passage Culverts	co, STHD co, STHD	Co - <1 STHD - <1	No--Natural barrier, limited habitat potential
Piscoe Creek	Flow Culverts	Co, STHD Co, STHD	Co - 9 STHD - 2	Yes--Improvements would increase production potential
Diamond Fork	Culverts	SpC, Co, STHD	SpC - 40 Co - 25 STHD - 5	Yes--Improvements would increase production potential

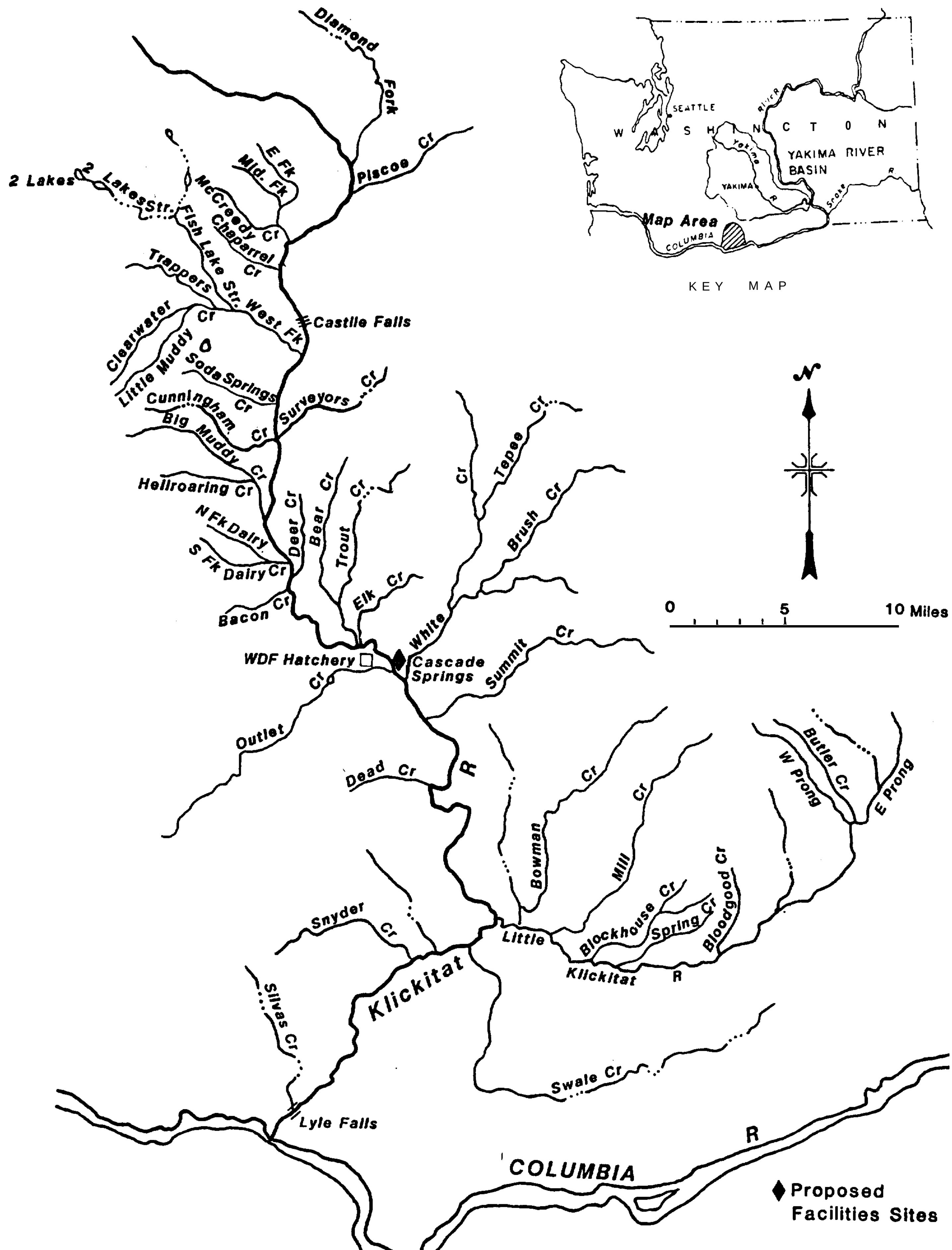
1/ An asterisk (*) indicates an existing major constraint to anadromous fish production. Constraints without an asterisk only tend to reduce production rather than prevent or seriously impact it.
2/ FC = fall chinook, SpC = spring chinook, Co = coho, STHD = steelhead

canyon cut by the Klickitat River. Only eight tributaries were found to be potentially suitable for the natural production of anadromous fish and two of these, the Diamond Fork and Piscoe Creek, are upstream of Castile Falls. The other six tributaries considered potentially suitable for natural production include the Little Klickitat System (below RM 6.1), Summit Creek (lower 2.0 miles), White Creek, the Trout Creek system, Surveyors Creek, and the West Fork system. Passage improvements are needed on White Creek, the Trout Creek system, Surveyors Creek, and the West Fork system before they would be fully usable for natural production. Of special note, summer water temperatures in the West Fork system are very cold (38-43 °F) and these cold temperatures may preclude significant rearing of juvenile anadromous fish in that system.

The improvement project that would provide for the largest increase in natural anadromous fish production in the Klickitat basin would be construction of adequate adult passage facilities at Lyle and Castile Falls.

Future water supply analysis studies for other hatchery projects should begin earlier in the hatchery planning process, i.e., during the development of the hatchery master plan, so that identified problems can be evaluated and solved during predesign studies, rather than during the final design phase.

YAKIMA RIVER BASIN



KLICKITAT RIVER BASIN

TABLE OF CONTENTS

Table of Contents

Table of Contents

TABLES

Table of Contents

TABLES

MAPS AND FIGURES

Table of Contents

Table of Contents

Table of Contents

INTRODUCTION

BACKGROUND

On October 15, 1987, the Northwest Power Planning Council (Council) approved the master plan for the Yakima/Klickitat Production Project as a reasonable basis upon which the Bonneville Power Administration (Bonneville) may proceed to fund predesign work on the production project. The Council approved the predesign work on the condition that it include several tasks needed to provide information for consideration by the Council before it approves construction of the project. Task II of the Council's conditional approval was to conduct a technical analysis of water supplies available for fish production in the Yakima and Klickitat River Basins. The Council stipulated that the analysis should address water supplies (both quantity and quality) for spawning, incubation, rearing, and migration in the natural environment in both river basins, as well as water supplies for the artificial production facilities.

On May 23, 1988, the Bureau of Reclamation (Reclamation) entered into a cooperative interagency agreement with Bonneville to conduct the water supply analysis required by Task II of the Council's approval of predesign work on the production project. The agreement specified that the analysis would: (1) document the adequacy of water supplies (quantity and quality) for the proposed artificial production facilities, and for anadromous fish spawning, incubation, rearing, and migration in the Yakima and Klickitat Rivers and their tributaries; (2) determine the availability and quality of existing anadromous fish habitat in both basins; (3) document existing constraints to achieving anadromous fish production potentials in both basins; and (4) develop a listing of streams in both basins where existing water supplies, access, and habitat are adequate for anadromous fish production; where water supplies, access, and habitat would be adequate if improvements were made and agreements reached with existing water users; and where existing water supplies, access, and habitat are inadequate or unattainable in the near term (<10 years).

The Council originally anticipated that the water supply analysis would rely largely on existing data; however, a review of existing information revealed that very little specific data existed on many tributaries in regard to flows, diversions, other constraints to fish access, and habitat quality. Information was also lacking on ground-water availability and quality at the proposed facility locations. Accordingly, from May 1988 to October 1989, Reclamation conducted field studies to gather some of the needed data and obtained the remainder from other ongoing efforts in both basins by cooperating entities (see Acknowledgments section for cooperating entities).

This report compiles and analyzes information on the availability and adequacy of water supplies and fish habitat in the Yakima and Klickitat River Basins to meet the goals and objectives of the Yakima/Klickitat Production Project. This report is divided into several sections including a Summary which is placed at the front of the report. This introductory chapter is followed by two technical chapters. The first technical section analyzes the adequacy and quality of surface and ground-water supplies to meet the water needs of the proposed production facilities. The second technical section compiles and analyzes information on flows, water quality, habitat quality, impediments to anadromous fish access to potential habitat, and other constraints to anadromous fish production in the Yakima and Klickitat Rivers and their tributaries. Following the technical chapters are the Conclusions and Recommendations and Literature Cited sections. Technical appendixes to this report are included at the rear of this volume.

Much of the information presented in this report summarizes more detailed information which can be found in separate supporting documents prepared during the study. These supporting documents include (1) a Technic?). Data Appendix, (2) a report on ground-water exploration activities [20],1/ (3) a geophysics survey report of the Oak Flats Site [1], (4) a geophysics survey report of the Newman, Cle Elum, and Buckskin sites [2], and (5) a report on instream flow studies in the Klickitat basin [3].

YAKIMA RIVER BASIN

General Description

The Yakima River basin is located in south-central Washington (see Yakima River Basin map) and drains an area of about 6,000 square miles or about 4 million acres. The basin centers around the city of Yakima and includes most of Yakima, Kittitas, and Benton Counties. The Yakima Indian Reservation is located in the southwest corner of the basin just south of the city of Yakima.

Topography in the basin is characterized by a series of long, rather hilly ridges extending eastward from the Cascade Mountain Range and encircling flat valley areas. Elevations in the basin range from about 10,000 feet in the Cascade Mountains to about 350 feet at the confluence of the Yakima and Columbia Rivers.

The Yakima River and its tributaries drain the area. The Yakima River heads near the crest of the Cascade Range above Keechelus Lake at about elevation 6900 feet and flows over 200 miles generally southeastward to its confluence with the Columbia River near Richland. Major tributaries include the Kachess, Cle Elum, and Teanaway Rivers in the northern part of the basin and the Naches River, which itself has three major tributaries--the Bumping, Little Naches, and Tieton Rivers. Ahtanum, Toppenish, and Satus Creeks join the Yakima River in the lower portion of the basin. Natural runoff for the basin above Sunnyside Diversion Dam (Parker gauge) averaged about 3.4 million acre-feet annually over the period 1926 through 1987. Natural runoff usually peaks in May and June and drops to its lowest point in August. However, peak floods have occurred in December and January.

1/ A number in brackets [] refers to the number of the reference in the Literature Cited section.

Vegetation in the basin is a complex blend of forest, range, and cropland. Over one-third of the land in the Yakima basin is covered with forests. Rangeland lies between the cultivated areas, which are generally located in the lower fertile valleys, and the forest land which is limited to higher elevations where the precipitation is greatest. The cropland is confined to valley areas with fertile soils and adequate precipitation, or the provision of irrigation water, for the growing of crops. About 77 percent of the cropland, which accounts for about 16 percent of the total basin area, is irrigated.

The climate of the Yakima basin ranges from cool and moist in the higher mountains to warm and dry in the low valleys; annual precipitation near the Cascade crest ranges between 80 and 140 inches, whereas the lower elevations in the eastern part of the basin receive 10 inches or less. Summer temperatures average 55 °F in the mountains and 82 °F in the valleys. Average maximum winter temperatures range from 25 to 40 °F and average minimums from 15 to 25 °F. Minimum temperatures of -20 to -25 °F have been recorded in most areas. The growing season for the cropland areas varies from 140 to 180 days.

Irrigated agriculture is the economic base of the Yakima River basin. In 1982, about 400,000 irrigated acres produced a gross crop value estimated at near $500 million. Primary crops include apples, cherries, peaches, pears, prunes, sugar beets, grapes, mint, grain, corn, hops, and alfalfa. Livestock production and forestry are also important contributors to the basin's economic base. The major industries in the basin are related primarily to the processing of agricultural and forest products; however, the Department of Energy's Hanford nuclear facilities are located in the southeastern part of the Yakima basin.

The water supply for the Yakima River and irrigated croplands comes from natural flows, storage, and return flows [4]. The six Federal reservoirs in the basin which help regulate this supply have a total storage capacity of 1,070,000 acre-feet. Other principal water supply features include several diversion dams, two hydroelectric generating plants, canals, laterals, and pumping plants. About three-fourths of the present storage capacity of the Yakima basin is in the upper Yakima drainage (Keechelus, Kachess, and Cle Elum Lakes). One-fourth of the storage capacity is in the upper Naches drainage (Bumping, Clear, and Rimrock Lakes). Upper Yakima reservoirs meet water needs in the valley above the confluence of the Yakima and Naches Rivers and are the main suppliers of storage water to the large irrigation districts in the lower valley. The upper Naches reservoirs provide water to irrigation development in the lower Naches Valley and make a lesser contribution to water supplies in the lower Yakima Valley. Return flows from irrigation developments in the upper valley provide a major portion of the water in the lower Yakima River.

Anadromous Fish Resources

Anadromous fish stocks currently using the Yakima River basin include spring and fall chinook salmon, coho salmon, and steelhead trout [7,10]. The estimated spawning escapement of these stocks for the period 1980-89 is shown in table 1-1; runs of summer chinook and sockeye salmon are now extinct in the basin.

Table 1-1--Estimated Spawning Escapement of Anadromous Fish in the Yakima River Basin, Washington, 1980-89

Year	Spring Chinook	Fall Chinook[1/]	Coho	Steelhead	Total
1980	1,120	50(E)[2/]	35(E)	<500(E)	<1,705
1981	1,120	50(E)	35(E)	<500(E)	<1,705
1982	1,250	85‘	35(E)	<500(E)	<1,870
1983	1,240	380	35	<500(E)	<2,155
1984	2,035	1,330	35(E)	360	3,760
1985	3,615	285	35	690	4,625
1986	6,820	1,215	230	1,380	9,645
1987	3,220	545	90	1,840	5,695
1988	2,510	220	45	2,460	5,235
1989	3,490	670	230	1,070	5,460

1/ Above Prosser Diversion Dam only. An estimated 1,500 fall chinook annually spawn in the Yakima River below Prosser Diversion Dam.
2/ (E) = estimate only; no count or redd data available

Spring chinook salmon spawn and rear in the Yakima River and its tributaries above Sunnyside Dam and in the Naches River and its tributaries. In the Naches drainage, spawning can occur as early as mid-July but most commonly occurs in August. In the upper Yakima River drainage, spawning most commonly occurs during mid- to late September. The eggs remain buried in gravel throughout winter and the fry emerge in early March. Juvenile fish remain in the river throughout summer and the following winter. During spring runoff, they migrate to the ocean, with peak numbers being noted passing Prosser Dam from mid-April to mid-May.

It is generally believed that two substocks of spring chinook occur in the Yakima basin--a Naches substock and an upper Yakima substock. The Naches substock spawns earlier than the upper Yakima substock (early to late August versus mid- to late September in the upper Yakima) and has a greater percentage of returning 5-year-old spawners (40 percent versus 5 percent). Spawning adults in the Naches system are therefore generally larger and lay more eggs per spawner than those in the upper Yakima system.

Fall chinook salmon spawn in the Yakima River downstream from Sunnyside Dam to the confluence with the Columbia River and in Marion Drain. The upriver bright fall chinook is the native stock of the basin. Spawning occurs from mid-October through November, and the eggs remain in the gravels throughout the winter. Fry emerge from the gravels in late April and early May and begin drifting downstream. The fry continue to move downstream to the Pacific Ocean, arriving at the Columbia River estuary in late July and August.

Natural runs of summer chinook and coho salmon are now essentially extinct in the Yakima basin. A small remnant run of coho was noted passing Prosser Dam in 1983-89, but these were probably survivors of hatchery coho planted in the river to provide fish for the ocean and Columbia River fisheries. Suitable habitat occurs in the basin for both stocks--summer chinook could utilize the Yakima River between Roza and Sunnyside Dams and the lower Naches River for spawning; coho could utilize the upper Yakima River and its tributaries and the upper Naches River and its tributaries for spawning and rearing.

Sockeye salmon occurred historically in the accessible natural lakes in the basin such as Cle Elum, Kachess, Keechelus, and Bumping before their outlets were dammed. Sockeye spawn in lakes and their tributaries and rear in lakes; thus, the run disappeared shortly after the lake outlets were blocked. The principal migration period of adults was the summer months. The land-locked form of sockeye salmon, the kokanee salmon, is presently found in most Yakima basin reservoirs and provides an especially important fishery in Rimrock Lake.

Steelhead trout are a type of rainbow trout that spawn in freshwater but spend some time rearing in the ocean like salmon. Yakima basin steelhead are summer run stock which spawn and rear in the Yakima and Naches Rivers and their tributaries above Sunnyside Dam and in upper Satus and Toppenish Creeks on the Yakima Indian Reservation. Spawning occurs in April and May, and the fry emerge from the gravels in June and July. The juvenile fish rear in the basin for 1 or 2 years and migrate downstream to the ocean in late April and May.

The Yakima River steelhead stock is native to the basin, but some limited interbreeding with introduced hatchery fish has probably occurred. Steelhead, unlike salmon, may spawn more than once, returning to the ocean after each spawning. However, very few Yakima River steelhead are able to survive the difficult trip to the ocean and back for a second spawning.

Table l-2 shows species and life stages of anadromous fish present in the Yakima River basin in each month. In the Yakima River system, adult spring chinook salmon move upstream from mid-April to mid-August, and adult coho salmon move upstream from early September to early November. Adult fall chinook move upstream from mid-October through mid-December. Adult steelhead trout move upstream from early September to early December and again from early March to early June; occasional upstream movement occurs during the other months of the year. Steelhead, chinook, and coho smolts move downstream between early March and late June. With the exception of fall chinook, which begin their downstream movement as soon as the fry emerge in spring, juvenile rearing of these species occurs in the Yakima River basin throughout the year.

KLICKITAT RIVER BASIN

General Description

The Klickitat River basin is located on the east slope of the Cascade Range in south-central Washington, has an area of about 1,350 square miles in Klickitat and Yakima Counties, and drains into the Columbia River at river mile (RM) 180.4. The basin trends north-south toward the Columbia River and is bounded by Mount Adams on the west, the Goat Rocks to the north, and the Simcoe Mountains on the east. Basin topography ranges from rolling hills and plateaus in the south to rugged mountains in the northwest.

Table 1-2--Anadromous Fish Migration and Life Stages Present in the Yakima River Basin

↑ = upstream migration (adults)
o = egg incubation
* = spawning
↓ = downstream migration (juveniles)
x = juvenile rearing

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Fish Stock (area)
oooo	oooo	oooo ↓↓↓	oooo ↓↓↓↓	o ↓↓↓↓	↓↓↓↓				↑ * o	↑↑↑↑ **** oooo	↑↑ * oooo	Fall Chinook (below Sunnyside Diversion Dam)
oooo xxxx	oooo xxxx	oo xxxx ↓↓↓	↑↑ xxxx ↓↓↓↓	↑↑↑↑ xxxx ↓↓↓↓	↑↑↑↑ xxxx ↓↓↓↓	↑↑↑↑ * o xxxx	↑↑ **** oooo xxxx	**** oooo xxxx	oooo xxxx	oooo xxxx	oooo xxxx	Spring Chinook (above Sunnyside Diversion Dam)
↑ ↑ xxxx	↑ ↑ xxxx	↑↑↑↑ xxxx ↓↓↓	↑↑↑↑ **** oooo xxxx ↓↓↓↓	↑↑↑↑ **** oooo xxxx ↓↓↓↓	↑ ↑ oooo xxxx ↓↓↓↓	↑ ↑ oooo xxxx	↑ ↑ xxxx	↑↑↑ xxxx	↑↑↑↑ xxxx	↑↑↑↑ xxxx	↑ ↑ xxxx	Steelhead Trout (Satus and Toppenish Creeks and above Sunnyside Diversion Dam)
oooo xxxx	oooo xxxx	o xxxx ↓↓↓	xxxx ↓↓↓↓	xxxx ↓↓↓↓	xxxx ↓↓↓	xxxx	xxxx	↑↑↑ *** ooo xxxx	↑↑↑↑ **** oooo xxxx	↑ **** oooo xxxx	**** oooo xxxx	Coho Salmon (upper Yakima and Naches Rivers)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

There is significant variation in climate within the basin; this is related to elevation and proximity to the Cascade Crest. About three-fourths of the Klickitat basin is forested, and forestry and agriculture dominate the basin economy.

The Klickitat River heads at an elevation of about 4400 feet near Goat Rocks in Yakima County and runs generally southward for 95.7 miles, dropping to a mean elevation of 74 feet at the Bonneville pool of the Columbia River. Major tributaries include Diamond Fork (RM 76.8), West Fork (RM 63.1), Big Muddy Creek (RM 53.8), Outlet Creek (RM 39.7), and Little Klickitat River (RM 19.8). (See Klickitat River Basin map.)

The most significant constraints to anadromous fish production in the Klickitat basin are (1) natural barriers to potential production areas and (2) high turbidity in the main stem caused by sediment inflow from two tributaries that drain glaciers on nearby Mt. Adams. The Klickitat River has cut a canyon in the Columbia River basalt which is the most extensive geologic formation in the subbasin. Two barriers to fish migration on the main stem, Lyle (RM 2.2) and Castile Falls (RM 64.2), are located in highly resistant formations of basalt. Passage up a number of tributaries is blocked or limited in their lower reaches by their steep descent into the deep canyon cut by the main stem.

Big Muddy and Little Muddy Creeks drain glaciers on the east slope of Mount Adams. During the warmest months, the sediment from these tributaries colors the Klickitat River from the West Fork downstream 63.1 miles to the Columbia River. This sediment load is considered serious enough to be designated in the Klickitat Subbasin Plan [5] as a constraint to anadromous fish production downstream of the Big Muddy Creek confluence (RM 53.8).

Except for some irrigated lands near Glenwood and Goldendale, irrigation diversions are not a major problem to existing and potential anadromous fish production in the basin. No major storage reservoirs exist in the basin.

Anadromous Fish Resources

Anadromous fish stocks presently occurring in the Klickitat River basin include spring and fall chinook salmon, coho salmon, and steelhead trout [5]. The estimated natural spawning escapement for these stocks for the period 1980-87 is shown in table l-3.

Spring chinook salmon spawn and rear in the main stem Klickitat River from the Washington Department of Fisheries (WDF) hatchery (RM 42.7) to Castile Falls (RM 64.0). Some spawning and rearing also probably occur downstream of the hatchery, but no redd counts have been conducted during the spring chinook spawning season. The WDF hatchery was completed in 1952 and raises spring and fall chinook, coho, and steelhead for release into the Klickitat River. Spring chinook adults migrate into the Klickitat basin from April through July and spawn from August through October. Little information exists on the freshwater life history of naturally-produced spring chinook in the basin, but it is probably similar to that of the upper Yakima River spring chinook.

The WDF hatchery raises most (90 percent) of the present Klickitat basin spring chinook production. The original broodstock for the hatchery was from native Klickitat spring chinook, but releases from other hatchery broodstocks have occurred over the years. As a result of the genetic effects of hatchery production and the introduction of other broodstock, a "wild" population of spring chinook no longer exists in the basin. However, state and tribal biologists are optimistic that a viable population of natural spring chinook, based largely on the Klickitat broodstock, can be established in the basin through a combination of habitat and fisheries management improvements.

Fall chinook are not native to the Klickitat basin. Although suitable habitat for fall chinook exists downstream of the WDF Hatchery, it is believed that Lyle Falls was impassable to chinook during the low water conditions of late summer and early fall. Annual releases of fall chinook from the WDF Hatchery, along with improved passage conditions at Lyle Falls and straying from upriver bright stock, has resulted in the establishment of a natural spawning population of fall chinook in the lower Klickitat River. Most of the releases since 1952 were of tule chinook from Bonneville Pool Hatchery, but releases since 1987 have been of upriver bright stock.

Table l-3. Estimated Natural Spawning Escapement of Anadromous Fish in the Klickitat River Basin, Washington, 1980-87

Year	Spring Chinook	Fall Chinook	Coho	Steelhead	Total
1980	23	770	0	2,236	3,029
1981	81	558	0	5,972	6,611
1982	41	556	0	2,319	2,916
1983	18	348	0	1,335	1,701
1984	- 1/	230	0	3,049	3,279+
1985	23	188	0	1,364	1,575
1986	- 1/	415	0	-- 1/	415+
1987	299	2,377	0	1/	2,676+

1/ No data

Coho salmon are also not native to the Klickitat basin, probably for the same reason that fall chinook were not present. Hatchery releases of coho from the WDF Hatchery were started in 1952, and both early and late run coho have been raised at the hatchery. Current runs of coho are almost totally sustained by hatchery releases; however, juvenile coho have recently been found rearing in some tributaries by Yakima Indian Nation (YIN) biologists conducting electroshocking surveys [6].

Two substocks of steelhead may occur in the Klickitat basin. Summer run steelhead are most prevalent but some evidence exists that a small population of winter run steelhead may exist in the lower Klickitat River and a few lower Klickitat tributaries, i.e., Swale Creek and the Little Klickitat River. Summer steelhead are native to the basin; they spawn and probably rear in the main stem Klickitat River and accessible tributaries upstream to Castile Falls. Summer steelhead migrate into the Klickitat basin from April through December and spawn the following spring. Little is known about juvenile life history of Klickitat basin summer steelhead.

Annual plantings of Skamania hatchery summer steelhead smolts have been made in the Klickitat River each year since about 1960. The Skamania stock was derived in the late 1950's from wild steelhead of the Washougal and Klickitat Rivers. It is estimated that the current runs of summer steelhead in the basin are comprised of about 70 percent hatchery and 30 percent naturally-produced steelhead. Hatchery steelhead have undoubtedly made a genetic contribution to the natural spawning population. However, hatchery steelhead have been selectively harvested since 1986 and continued selective harvest of hatchery fish will eventually reduce the potential for further adverse genetic effects.

METHODS

A "Water Supply Analysis Task Team" was established early in the study to oversee the scope and direction of the water supply analysis data collection effort. The task team was comprised of fish biologists representing Reclamation, the YIN, WDF, and Yakima basin irrigation districts who were familiar with the Yakima and Klickitat basins (see Acknowledgments section). The task team met periodically throughout the study to review existing and new information, and to decide on changes in the data collection program to best meet the needs of the production project.

The water supply analysis study was divided into six work tasks: (1) stream hydrology, (2) stream description, (3) facility water supplies, (4) fish habitat, (5) water quality, and (6) analysis and report preparation. A brief description of the methodologies used to gather and analyze data for each of the work tasks is presented below.

Stream Hydrology

Existing flow data collected over the years by Reclamation, U.S. Geological Survey (USGS), Bureau of Indian Affairs (BIA), and others was reviewed to determine the adequacy of the information for meeting the objectives of the water supply analysis. In general, the existing data was judged adequate for the main stem Yakima and Klickitat Rivers and some of the major tributaries, but was extremely limited or entirely lacking in both basins for the numerous mid-to small-size tributaries of interest to the production project as possible outplanting sites.

Because a large number of tributaries needed to be investigated (more than 70 streams were eventually studied), a variety of methods were used to gather flow data. These methods ranged from the installation of continuous stream gauge recorders to periodic or occasional measurements at flow weirs to simple estimates by experienced hydrologists, depending on the task team's perceived importance of the stream as a potential outplanting site. Changes in the data collection program were made throughout the study as initial information from the various work tasks was reviewed and analyzed by the task team.

The flow data gathered under this study was entered into computer files at Reclamation's Yakima Project office for summary and analysis. Much of the existing data was already located on computers in Reclamation's Yakima and Boise offices, or USGS's Reston, Virginia office. Summary and analysis of streamflows was largely based on actual historic and recent data; however, analysis of flows in the main stem Yakima and Naches Rivers and their regulated tributaries used a computer program to simulate operation of the Yakima River storage system. This program imposes the current level of water use upon historical flows to simulate river flows over the historical period given the present level of development. Every effort is made to adjust the simulation to provide results that closely approach present physical conditions.

Nonetheless, a computer simulation cannot exactly duplicate existing conditions, so there will be some differences. One difference between the computer simulation and actual operation is that the simulation uses monthly average flows and end-of-the-month reservoir contents, whereas actual operations depend on daily or even hourly values. Another important difference is that the simulation is based on a 62-year pattern of precipitation and runoff (1925-1987, data for 1978-1987 is preliminary) and is based primarily on hindsight, while actual operations are based on forecasts of water supply that can change from month to month.

Stream Description

The goal of this work task was to identify flow and fish passage constraints to anadromous fish use of streams for spawning and rearing. Reclamation biologists and hydrologists conducted field surveys during the summers of 1988 and 1989 and estimated and/or measured flow and water quality characteristics; described the number, location, and physical aspects of diversions; identified major flow and fish passage impediments; and noted other flow and fish passage constraints. Photographs were taken as needed to document flows, diversions, constraints, and impediments. The analysis presented in this report summarizes the results of these field surveys--more detailed descriptions of various streams are on file at Reclamation's Yakima Project office. YIN biologists provided information on some streams that they gathered in conjunction with other activities; more detailed information on these streams is on file at the YIN's Fisheries Resource Management office.

Facility Water Supplies

Existing surface and ground water information was reviewed to determine its acceptability for analyzing the adequacy of water supplies for the production facilities. This review found that information on surface waters was generally available and adequate, but that information on ground-water supplies at the proposed facility sites was almost totally lacking. To obtain the needed information on ground-water supplies, a ground-water exploration program was developed at each of the proposed facility sites. The programs involved geophysical surveys, the drilling of production test wells and observations holes, pump testing the test wells, and analyzing the pump test and bore-hole data to develop an estimate of the ground-water production potential. Test well drilling and analysis were completed for the following proposed facility sites: Prosser, Cle Elum, Oak Flat Δ1, Oak Flat Δ2, and Buckskin.

Fish Habitat

The ultimate goal of this work task was to estimate the natural production potential of anadromous fish habitat based upon habitat quantity and quality in the Yakima and Klickitat River basins. Information on habitat quantities was developed from several sources including instream flow incremental methodology (IFIM) studies of the Yakima and Klickitat Rivers and their tributaries [3,8,9], the results of the stream description surveys, and information developed as part of the Northwest Power Planning Council's subbasin planning effort [5,7].

Information on habitat quality was obtained from existing sources, such as the subbasin planning effort, ongoing studies by YIN biologists, and the professional judgment of task team members. In addition, habitat quality information was gathered by Reclamation personnel during the stream description field surveys of Yakima and Klickitat basin streams. During the field surveys, data on riparian cover and shading, bank stability, pool-riffle ratios, pool and substrate quality, stream habitat diversity, and other factors were noted on standard field forms (Appendix A). This information was later analyzed to develop an overall quality rating for a given stream or stream reach. The completed data forms are on file at Reclamation's Yakima Project office. Although habitat suitability for natural coho salmon production is discussed throughout the report, coho are not native to the Klickitat system and the establishment of a natural population is not planned as a part of the production project. Also, no plantings of coho would be made above Roza Diversion Dam in the Yakima River basin from the production project.

Estimates of the natural production potential of the anadromous fish habitat in both subbasins were made using the standard smolt density carrying capacity estimates used in subbasin planning as modified for the Yakima and Klickitat Subbasin Plans [5,7]. Other methods of estimating production potential are possible, such as the IFIM-based method used by Reclamation for the Yakima River Basin Water Enhancement Project studies [4]. However, it was decided to use the standard smolt density method so that production estimates would be comparable to those used in the Yakima and Klickitat Subbasin Plans.

The methods used for estimating smolt capacity, estimates of current production, and estimates of potential production under various habitat improvement alternatives were developed in detail in the Yakima and Klickitat Subbasin Plans, and in the Refined Goalds Report for the production project [19], and are not repeated in this report. Estimates of the existing natural production potential of the various streams and stream reaches in the Yakima and Klickitat basin are shown in tables B and C of the summary section of this report to provide information on the relative production potential of the various streams and stream reaches.

Water Quality

Water quality analyses were conducted to (1) evaluate the suitability of potential hatchery water supplies for salmonid aquaculture, and (2) determine the suitability of Yakima and Klickitat River reaches and tributaries for salmonid rearing, passage, and harvest. Existing data collected by the USGS and Reclamation were retrieved from the Environmental Protection Agency (EPA) data storage system (STORET) and supplemented by new data where additional information was necessary. Water quality analyses conducted by the USGS and Reclamation are performed using EPA approved methodologies.

Data gathering for potential hatchery facility water supplies was designed around water quality criteria developed by the Alaska Department of Fish and Game for salmonid aquaculture [11] (table 1-4). Data describing the quality of surface and ground-water supplies were collected specifically for this analysis because no other detailed information was available. An initial survey of ground-water supplies was conducted by sampling local springs; site specific data were collected following development of test wells at the proposed facility sites.

Suitability of river reaches and tributary streams for salmonid rearing, passage, and harvest were evaluated using Washington State standards for Class B streams, a Department of the Interior summary of criteria for protection of freshwater aquatic life, and general temperature guidelines proposed by Bell [12]. The criteria used in the analyses are shown in table 1-5. Existing USGS and Reclamation data were retrieved from STORET files and supplemented with new data from key reaches and tributaries not represented in the historic data base. Comparison of data with appropriate water quality criteria was conducted using the STORET "Standards" retrieval procedures.

Analysis and Report Preparation

Activities under this work task largely involved study management, the synthesis of information from the above work tasks, and the preparation of this report. In addition, monthly progress reports were prepared and distributed to the Bonneville Project Manager, task team members, and others. Two preliminary reports were prepared at the end of the 1988 field season summarizing the results of the stream description field work up to that point [13,14]. No special methodologies were associated with this work task.

Table 1-4.--Alaska Department of Fish and Game Water Quality Standards for Salmonid Aquaculture[1/]

Water Qualities	Standards[2/]
Alkalinity	Undetermined
Aluminum	<0.01 mg/L
Ammonia (un-ionized)	<0.0125 mg/L
Arsenic	<0.05 mg/L
Barium	<5.0 mg/L
Cadmium	0.0005 mg/L (100 mg/L alkalinity)
	<0.005 mg/L (> 100 mg/L alkalinity)
Carbon dioxide	<1.0 mg/L
Chloride	<4.0 mg/L
Chlorine	CO.003 mg/L
Chromium	<0.03 mg/L
Copper	<0.006 mg/L (100 mg/L alkalinity)
	<0.03 mg/L (≥ 100 mg/L alkalinity)
Dissolved oxygen	>7.0 mg/L
Fluorine	<0.5 mg/L
Hydrogen sulfide	CO.003 mg/L
Iron	CO.1 mg/L
Lead	co.02 mg/L
Magnesium	<15.00mg/L
Manganese	<0.01 mg/L
Mercury	<0.0002 mg/L
Nickel	<0.01 mg/L
Nitrate	<1.0 mg/L
Nitrite	<0.1 mg/L
Nitrogen	<110.00 percent total gas pressure
	(<103.00 percent nitrogen gas)
Petroleum (oil)	<0.001 mg/L
pH	<6.50-8.0
Potassium	<5.0 mg/L (range of 2-7 mg/L)
Salinity	<5.0 parts per thousand
Selenium	<0.01 mg/L
Silver	<0.0003 mg/L (fresh water)
	<0.003 mg/L (salt water)
Zinc	CO.005 mg/L
Sodium	<75.0 mg/L but > 15 mg/L
Sulfate	<50.0 mg/L
Temperature	0" - 15 °C (32 - 59 °F)
Total dissolved solids	x400.0 mg/L
Total settleable solids	<80.0 mg/L (25 JTU)

1/ Synergistic and antagonistic chemical reactions must be considered when evaluating a water source against these criteria.

2/ mg/L = milligrams per liter.

Table 1-5.--Water Quality Criteria Used to Evaluate the Suitability of Stream Water for Anadromous Fish Production

Parameter	Criteria[1/]	Source
Water temperature	<65 °F, 65-70 °F only for short periods, >70 °F unsuitable	Bell
pH	6.5 - 8.5	WDOE (Class B)
Dissolved oxygen	>6.5 mg/L	WDOE (Class B)
Turbidity	50 FTU[2/]	WDOE (Class B)
Copper	6.5 µg/L	DOI
Cadmium	<2.0 µg/L (detection limit):'	--
Chromium	2,200 µg/L	DO1
Mercury	<0.2 µg/L (detection limit)[3/]	--
Lead	34 µg/L	DOI
Selenium	5 µg/L	DOI
Zinc	180 µg/L	DOI

1/ Trace metal criteria based on an estimated hardness of 50 milligrams per liter; FTU = Formazin Turbidity Units; mg/L = milligrams per liter; µg/L = micrograms per liter.
2/ Used to categorize turbid streams--not a water quality standard.
3/ Lowest levels that could be detected by the laboratory--detection limit exceeds criteria.

FACILITY WATER SUPPLIES

YAKIMA RIVER BASIN

Prosser

Surface Water

The proposed hatchery facilities at Prosser would require up to 13 cubic feet per second (cfs) of surface water from late March through early June, 4 cfs during September and October, 6 cfs during November, and 5 cfs in December (table 2-l). Use of surface water for this facility, and for all of the other proposed facilities, would be nonconsumptive, i.e., the water would be treated and returned to the river a short distance downstream of the diversion point.

There is adequate streamflow at the Prosser site to meet the surface water needs of the hatchery facilities. Simulated monthly mean flows past Prosser Diversion Dam for the period 1926-87 are shown in figure 2-l and Appendix B. Flows ranqe from an average high of about 3,610 cfs in May to an average low of 50 cfs in August. Reclamation maintains minimum flows of 50 cfs (July 10 - September 1 and November 30 - March 1) and 200 cfs (March 1 - July 10 and September 1 - November 30) past Prosser Diversion Dam according to an agreement with the U.S. Fish and Wildlife Service. Therefore, during the proposed neriod of hatchery use a minimum flow of 200 cfs would be present in the river. Flows would generally be greater than 200 cfs during March through May, but can be as low as 200 cfs during this period due to diversions at Prosser Diversion Dam for irrigation and power production.

Water quality data for surface waters at the Prosser site do not meet several of the Alaska aquaculture criteria. Water temperature is one of the most important parameters for fish culture and temperature data for the Chandler Canal for the period 1970-81 are shown in figure 2-2. Water temperatures exceeded 15 °C in all years of record. Closer examination of the data showed that 9 of 9 (100 percent) water temperatures taken in June equaled or exceeded 15 °C (59 °F), as did 4 of 7 (57 percent) temperatures taken in May, 1 of 9 (11 percent) taken in April, and 1 of 3 (33 percent) taken in October (Technical Data Appendix). Samples of Chandler Canal water taken on August 23, 1988, did not meet the aquaculture criteria for aluminum, chloride, manganese, dissolved nitrates, and pH (Appendix C).

To further explore the possible water quality problems associated with surface waters at the Prosser site, the Alaska aquaculture criteria were compared with the extensive water data quality from Kiona. The quality of the Yakima River at Kiona should be similar to the quality of the river at Prosser. Criteria that were not met in a substantial percentage of the samples at Kiona were aluminum (100 percent), carbon dioxide (95 percent), chloride (74 percent), manganese (97 percent), dissolved nitrates (54 percent), pH (36 percent), zinc (82 percent), dissolved sodium (49 percent), and water temperature (43 percent) (Appendix C). In addition, detectable levels of several pesticides have been measured in the river water at Kiona, but no pesticide standards are included in the aquaculture criteria. Experts in fish culture need to thoroughly review the water quality data for surface waters at Prosser and Kiona, and determine if any of the criteria variances pose a serious constraint to the proposed hatchery operations at this site.

Ground Water

In addition to the above surface water requirements, the proposed facilities at Prosser would use up to 1 cfs of ground water from March through June and from September through December (table 2-l). Two ground-water exploration wells, one 6-inch observation well and a 12-inch production test well, were drilled at the Prosser site during the summer of 1989 to determine the availability of ground-water supplies to meet this need.

Table 2-l.--Estimated Water Supply Needs for Proposed Production Project Facilities (cfs)

	Month											
Facility	J	F	M	A	M	J	J	A	S	0	N	D
Prosser												
Surface water	--	--	13	13	13	13	--	--	4	4	6	5
Ground water	--	--	1	1	1	--	--	--	1	1	1	1
Wapato Canal												
Surface water	--	--	55	55	55	26	--	--	--	--	--	--
Cle Elum												
Surface water	16	18	18	2	4	4	8	8	9	16	16	16
Ground water	--	--	--	--	2	4	8	8	9	--	--	--
Oak Flats												
Surface water	38	40	36	36	15	18	18	22	32	40	38	38
Ground water	--	--	--	--	--	2	2	2	2	--	--	--
Buckskin												
Surface water	9	7	8	1	7	7	7		9	9	9	9
Ground water	l	l	l	l	l	l	l	- ‘	1	1	1	1
Klickitat												
River water	39	39	38	38	--	--	--	--	--	--	--	39
Spring water	37	37	40	40	37	37	37	37	37	37	37	37

Pump tests of the production test well were conducted on October 17-18, 1989. Pumping began at about 1.8 cfs (820 gpm) and this flow was continued throughout the 26-hour test. Pumpinq drawdown stabilized at 7.75 feet below the static water level, about 18 feet below the land surface, after 19 hours of pumping. Installation of a permanent pump with the suction level set at about 75 feet below the land surface would allow for about 65 feet of drawdown; therefore, the well could yield a greater flow than was pumped during the test.

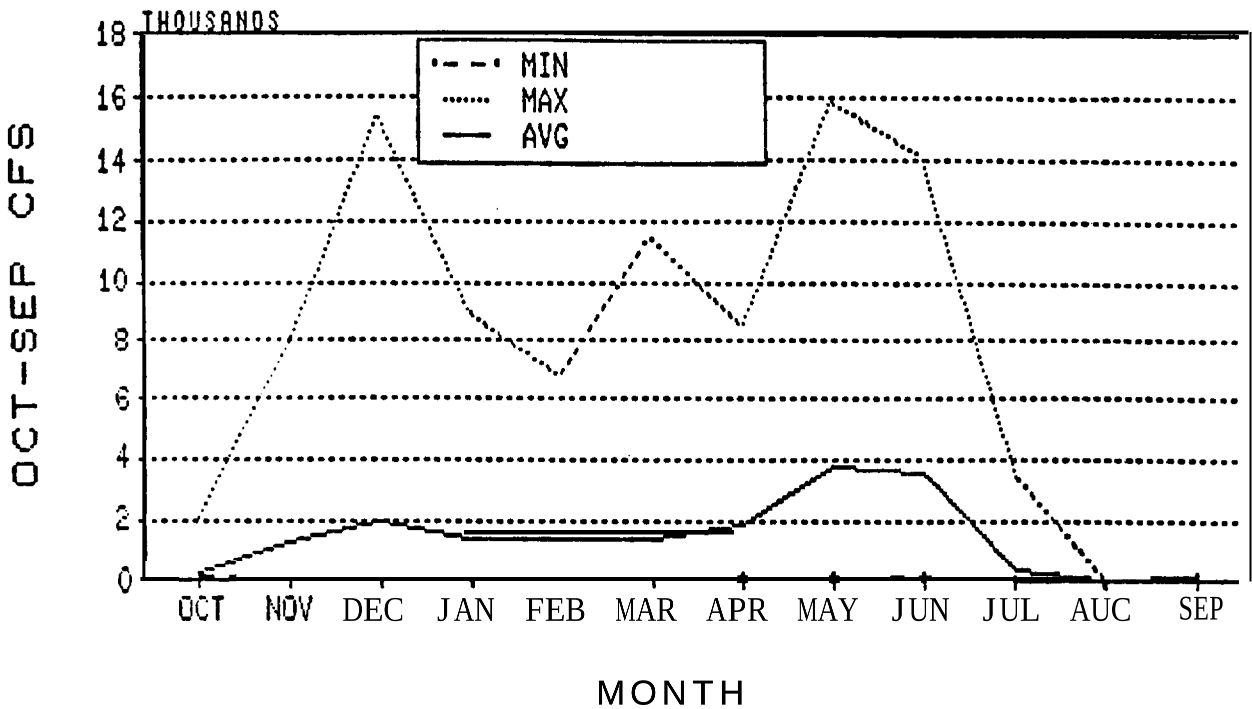


Figure 2-1.--Simulated Maximum, Average, and Minimum Monthly Mean Flows(CFS) for the Yakima River Below Prosser Diversion Dam, 1926-1987

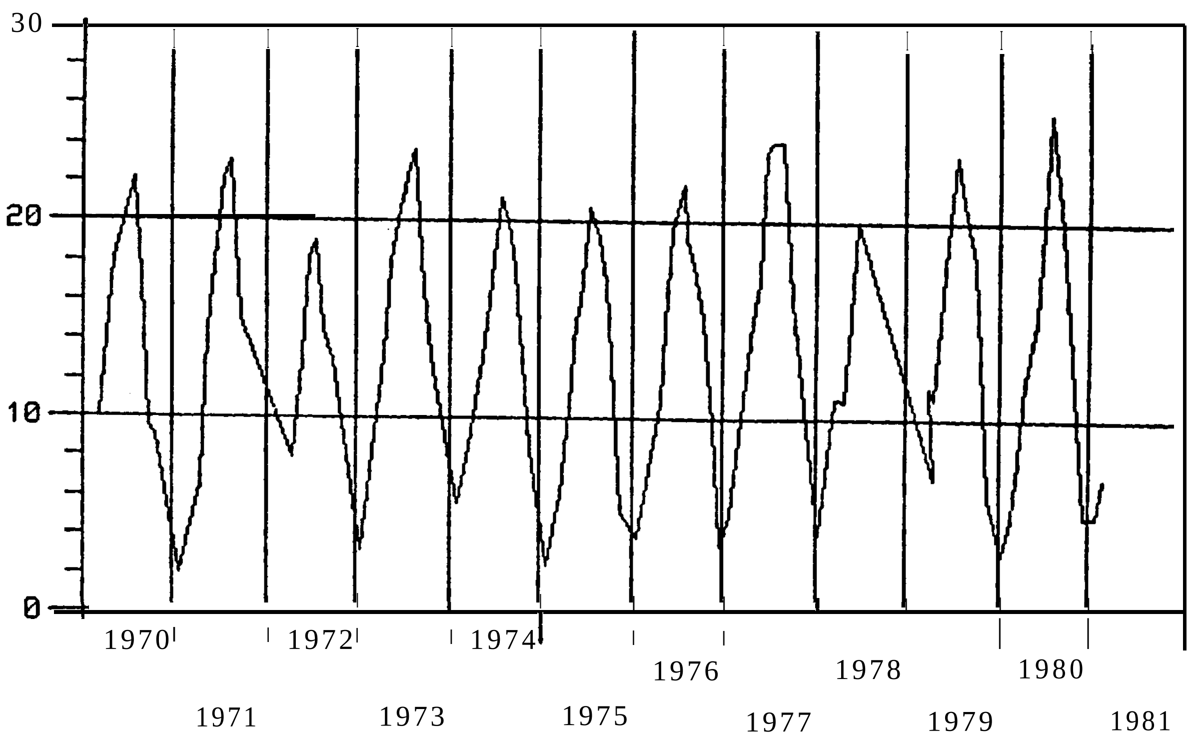


Figure 2-2 .--Annual Water Temperatures ("C) for the Chandler Canal, 1970-1978

The temperature of the ground water throughout the test remained at 58 °F. The aquifer appears to have a slight artesian head which suggests that the source of recharge is probably some distance from the well site. Therefore, it is unlikely that the temperature will change much with prolonged pumping.

Ground-water quality at the Prosser site is similar in some respects to the quality of the river water. Parameters (from measurements taken on December 20, 1989) that did not meet the Alaska aquaculture criteria include aluminum, carbon dioxide, chloride, chromium, dissolved oxygen, iron, magnesium, manganese, nitrates, and nitrogen gas (Appendix C). High levels of carbon dioxide and nitrogen gas, and low levels of dissolved oxygen are common in ground-water and can be corrected in design of the hatchery facilities. Further evaluation is needed to determine if any of the mineral concentrations pose a problem to the use of the groundwater for fish culture.

Wapato Canal

The proposed hatchery facility at the Wapato Canal site would require up to 55 cfs of flow in the canal from March through early June (table 2-l); augmentation with ground water would not be needed. Monthly average canal flows for the period 1980-89 show that diversions into the canal usually begin in mid-March and that these diversions average about 208 cfs for the month (figure 2-3 and Appendix B). Diversions for April, May, and June are even larger; thus adequate water supplies are available to meet hatchery facility needs during these months. However, an agreement needs to be reached with the Wapato Irrigation Project to begin diversions on March 1 to meet the early water supply needs of the proposed facility.

The only available water quality information applicable to the Wapato Canal is a detailed analysis conducted by Reclamation near Sunnyside Diversion Dam on August 2, 1988. Water quality parameters that did not meet the Alaska aquaculture criteria included aluminum, carbon dioxide, manganese, dissolved sodium (too low), and water temperature. Despite these variances from the Alaska aquaculture criteria, overall water quality at the sample site appeared to be good. High levels of aluminum and manganese and low levels of dissolved sodium are common throughout the basin and appear to be natural background levels. If necessary, carbon dioxide problems could be corrected in hatchery design. Still, fish culture experts need to determine if the high levels of aluminum and manganese, and the low levels of dissolved sodium, are a significant problem to fish culture at this and other sites in the basin. Water temperature should not be a problem during the proposed period of use, but a recording thermograph should be placed in the canal to determine the temperature regime of the water at this location.

Cle Elum

Surface Water

The proposed hatchery facilities at the Cle Elum site would require up to 18 cfs of surface water in February and March, 2 cfs during April, 4 cfs in May and June, up to 8 cfs during July and August, 9 cfs in September, and up to 16 cfs from October through January (table 2-1). There is adequate streamflow at the site to meet these surface water needs. Simulated monthly mean streamflows for the Yakima River at Cle Elum for the period 1926-87 range from an average high of about 3,115 cfs in June to an average low of about 460 cfs in October (figure 2-4 and Appendix B). The lowest monthly mean flow that would have occurred over the period of record is 300 cfs in October 1986. The lowest flows at this site generally occur in October and November and would generally range about 300-350 cfs in dry years.

Water temperature data for the Yakima River at the Cle Elum site for the period 1974-87 are shown in figure 2-5. Water temperatures at or above 15 °C occurred every year but one for the period of record. Most of these high temperatures occurred during July and August (Technical Data Appendix), however, 6 of 16 (38 percent) temperatures taken in September equaled or exceeded 15 °C as well as 1 of 13 (8 percent) temperatures taken in June. It should be possible to program facility use of surface and ground waters to avoid high water temperatures.

Other water quality parameters that do not meet the Alaska aquaculture criteria include aluminum, chloride, dissolved oxygen, manganese, sodium (too low), and total dissolved solids (Appendix C). Some of the variances are relatively uncommon, e.g., dissolved oxygen - 3 percent of samples and total dissolved solids - 2 percent of samples. The other variances appear to represent natural background levels but possible effects on fish culture need to be evaluated.

Ground Water

The proposed facilities at Cle Elum would also use 2 cfs of ground water in May, 4 cfs in June, 8 cfs in July and August, and 9 cfs in September (table 2-1). A 6-inch observation well and a 14-inch production test well were drilled at the site during the summer of 1989 to determine if adequate ground water was available to meet this need. A pump test was started on the production test well on December 5, 1989, but had to be canceled because of excessive sand in the water, later determined to be caused by improper placement of the well screen. However, pumping at about 2 cfs for several minutes showed a water level drawdown of about 31 feet below the top of the casing. The water level had not stabilized when pumping was stopped but placement of a pump suction at about 90 feet would allow for about 85 feet of drawdown. Therefore, it appears probable that the well may yield 2 cfs or more for prolonged pumping periods. In addition, the production test well was not drilled to bedrock, so more aquifer may be available below the existing screened section of the well. Any additional aquifer that could be utilized would increase the yield of the well.

The production test well is a flowing artesian well with an estimated flow of about 400 gpm (1 cfs). The temperature of the ground water is 47 °F.

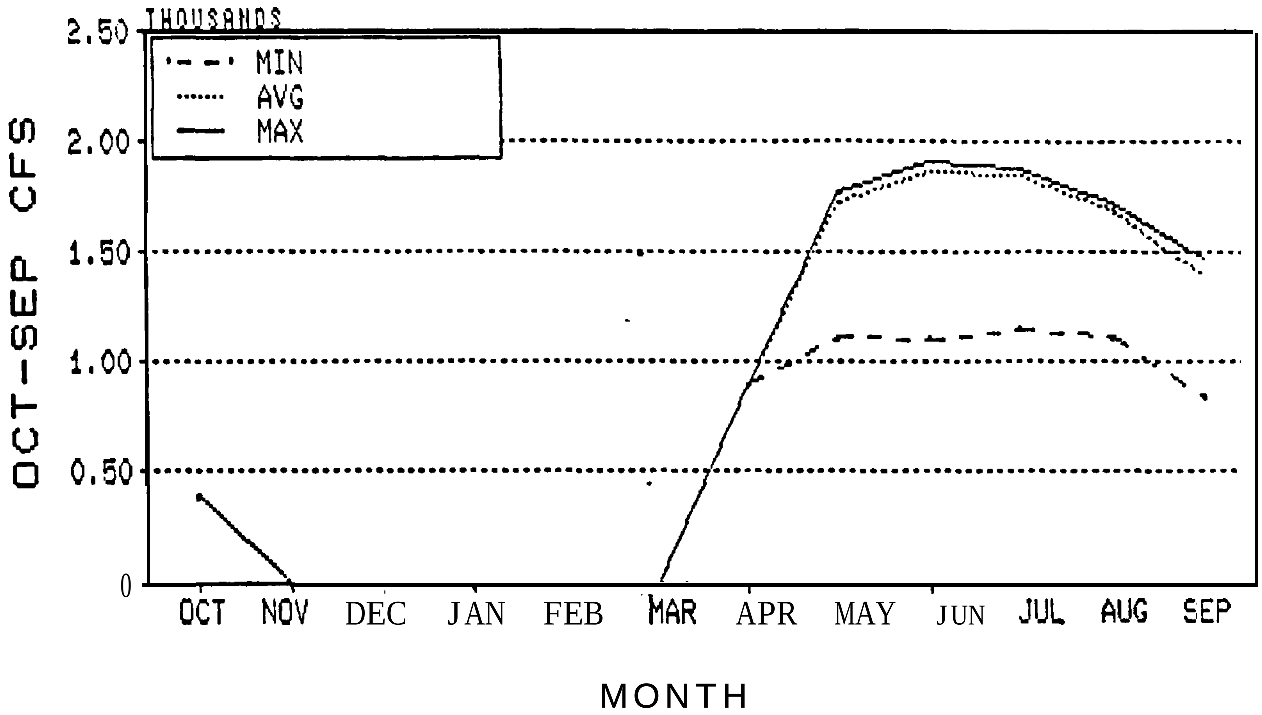


Figure 2-3. --Simulated Maximum, Average, and Minimum Monthly Mean Flows (CFS) for the Wapato Canal, 1980-1989

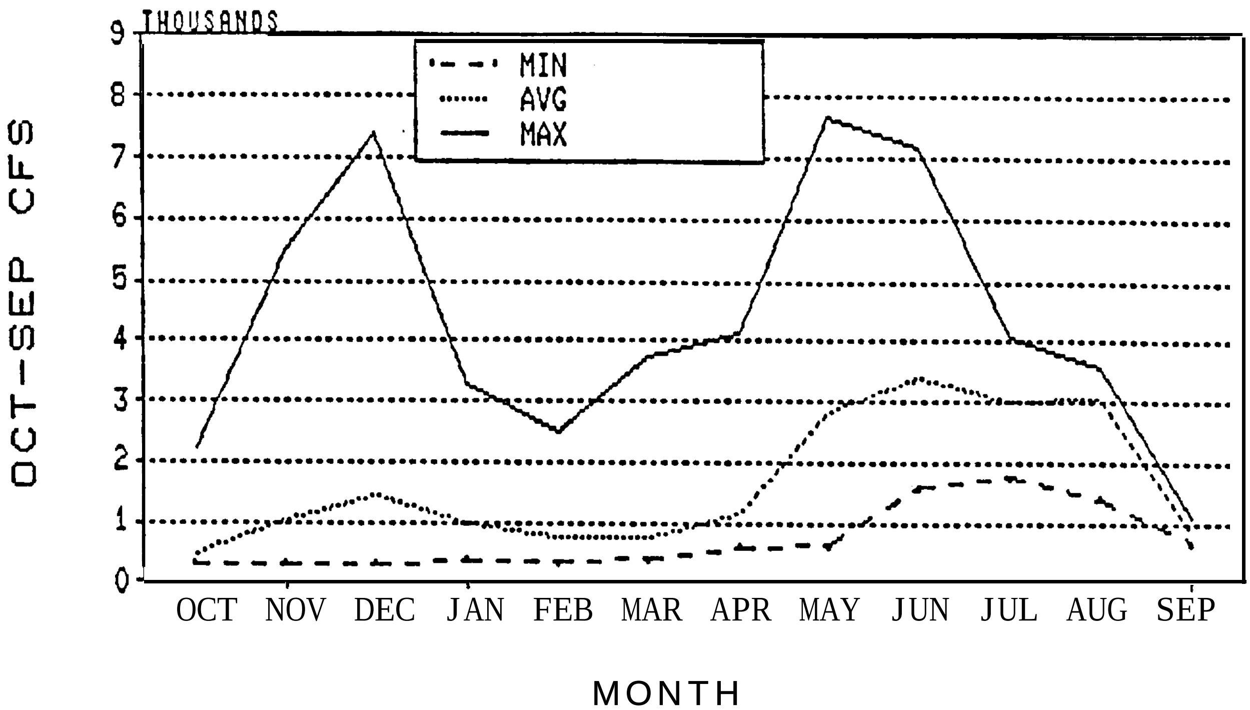


Figure 2-4 Simulated Maximum, Average, and Minimum Monthly Mean Flows (CFS) for the Yakima River at Cle Elum, 1926-1987

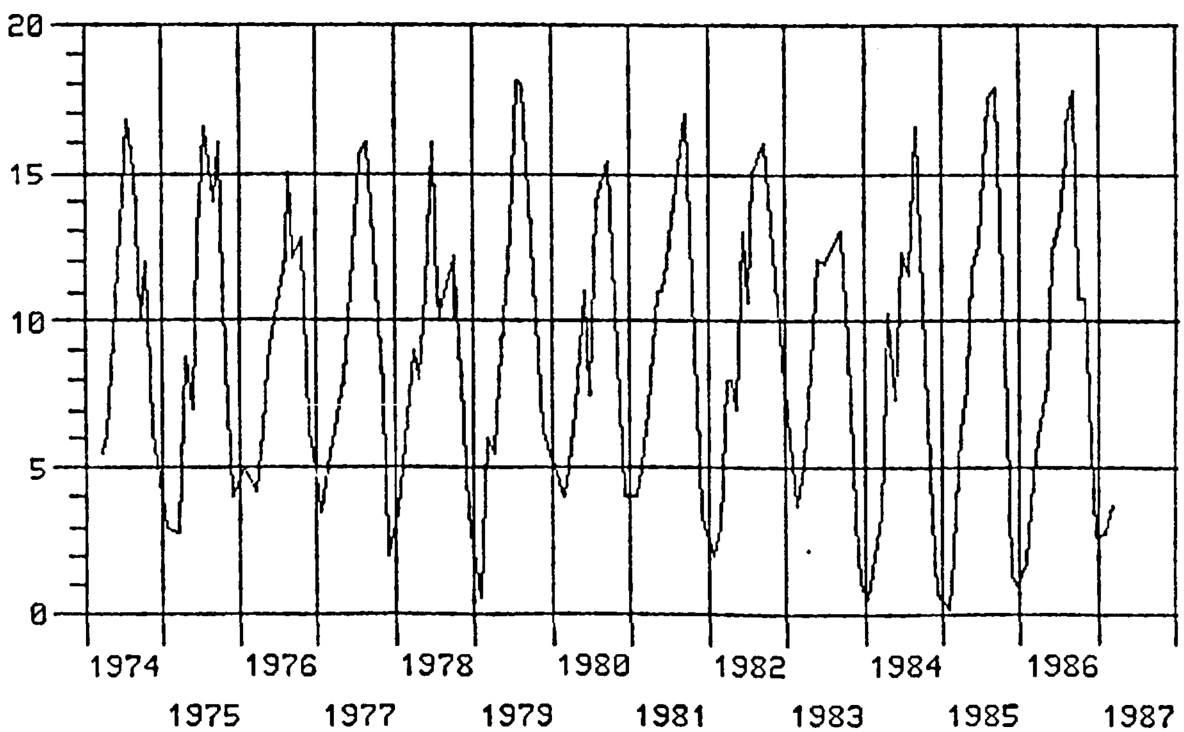


Figure 2-5. --Annual Water Temperatures ("C) for the Yakima River at Cle Elum, 1974-1987

Because the well is artesian, the effect of pumping will probably be felt throughout the area of proposed hatchery site. Any additional wells drilled at the site must be widely spaced to avoid interference among the wells. It is possible that an additional two or three wells could be drilled at the site bringing the total ground-water supply at the site to around 6-8 cfs. This supply would be at, or slightly less than, the projected July-September demand of 8-9 cfs.

Chemical constituents measured in the ground water at the site on December 19, 1989, that did not meet the Alaska aquaculture criteria include aluminum, carbon dioxide, chloride, dissolved oxygen, magnesium, manganese, nitrogen gas, and dissolved sodium (too low). The observed levels of aluminum, chloride, and manganese are of the most concern and need to be evaluated for possible effects on fish culture.

Oak Flats

Surface Water

The surface water requirements of the proposed hatchery facilities at the Oak Flats site would be up to 36 cfs in March and April, up to 15 cfs during May, up to 18 cfs in June and July, up to 22 cfs in August, 32 cfs in September, up to 40 cfs in October, 38 cfs from November through January, and up to 40 cfs in February (table 2-l). Flows in the Naches River at the Oak Flat site are adequate to meet these needs. Simulated monthly mean flows at Oak Flats for the period 1926-87 range from an average high of about 2,945 cfs in May, to an average low of about 265 cfs in October (figure 2-6 and Appendix B). Low river flows of less than 50 cfs can occur during July of extremely dry years (3 years of the 62-year period of record). In addition, flows of 50-75 cfs can occur at Oak Flats during October of these very dry years. The Naches-Selah Irrigation District is considering moving its diversion to the Oak Flats site and the above flows assume that the Naches-Selah diversion (about 175 cfs) has already been taken from the river. It may be advantageous for the handling of waste products from the hatchery to reach an agreement with the Naches-Selah Irrigation District to use some water from the Naches-Selah Canal to meet some of the hatchery needs and then to return the water to the canal.

Water quality at the Oak Flat site is generally good. However, water temperature data taken during 1989 (figure 2-7) shows that daily average temperatures equaled the 15 °C aquaculture criteria in August and that daily maximums often exceeded the criteria during July and August. Other water quality parameters that did not meet the Alaska aquaculture criteria were aluminum, manganese, and dissolved sodium (too low) (Appendix C).

Ground Water

The projected ground-water needs of the proposed facilities at Oak Flats would be 2 cfs from June through September (table 2-l). Four ground-water exploration wells were drilled at two locations at the Oak Flats site during the summer of 1989 to determine the ground-water potential of the site. One site was located on the west end of the site (Oak Flats #1) and the second was located near the center of the site (Oak Flats #2). One 6-inch observation well and one 16-inch production test were completed at each location.

Pump tests were started on the production test wells during December 6-7, 1989. During development pumping of the production test well at Oak Flats #1, it became apparent that the well would only yield about 75 gpm or less with about 15 feet of drawdown below static water level. Any greater pumping caused the pump to break suction. Development pumping at Oak Flats #2 showed that the well would only yield about 100 gpm with a 15-foot drawdown. The pump used in the tests was too large for pumping the small volumes of water found in these wells. Additional pumping with a much smaller pump will be needed to determine the firm yield of the wells under prolonged pumping.

Both of the drilling locations at Oak Flats were selected on the basis of a resistivity survey. The survey showed that the locations contained an island of coarse gravel surrounded by fine sediment. Samples taken during drilling showed that both locations had good aquifer potential. Apparently there is an aquifer, but little water at both sites. It appears that the recharge water moving into the aquifers is limited because of the surrounding fine sediment. Therefore, pumping results in the water being removed from storage rather than being supplied by recharge. It is doubtful that the two production test wells would yield more than a total of about 150 gpm during prolonged pumping. In fact, prolonged pumping may completely deplete the water supply in storage. The wells need to be pump tested further to establish the long-term pumping yield of the aquifer.

There is a possibility that drilling into the upper part of the basalt bedrock may locate an aquifer with greater yield than those found in the sediments. Any test drilling should be limited to an additional depth of 150-200 feet, because this is where an aquifer with suitable water temperature would most likely be found.

Water quality parameters measured in the two wells at the Oak Flats site on December 19, 1989 that did not meet the Alaska aquaculture criteria include aluminum, chromium, dissolved oxygen, iron (Oak Flats #2), manganese (Oak Flats #2), nitrogen gas, zinc (Oak Flats #2), and dissolved sodium (Oak Flats #1) (Appendix C). These wells have not been pump tested for any length of time and the levels of chromium and zinc noted may be residues from the well drilling activity. Water quality measurements should be retaken once the wells have been adequately pump tested. Any parameters that still do not meet the Alaska aquaculture criteria should be evaluated by fish culture experts to determine if the ground water is suitable for the proposed uses.

Buckskin

Surface Water

The proposed facilities at the Buckskin site would need 7 cfs of surface (spring) water in February, 8 cfs during March, 1 cfs in April, up to 7 cfs from May through July, and 9 cfs during August through January (table 2-1). Water supplies at the site appear to be marginally adequate to meet this need.

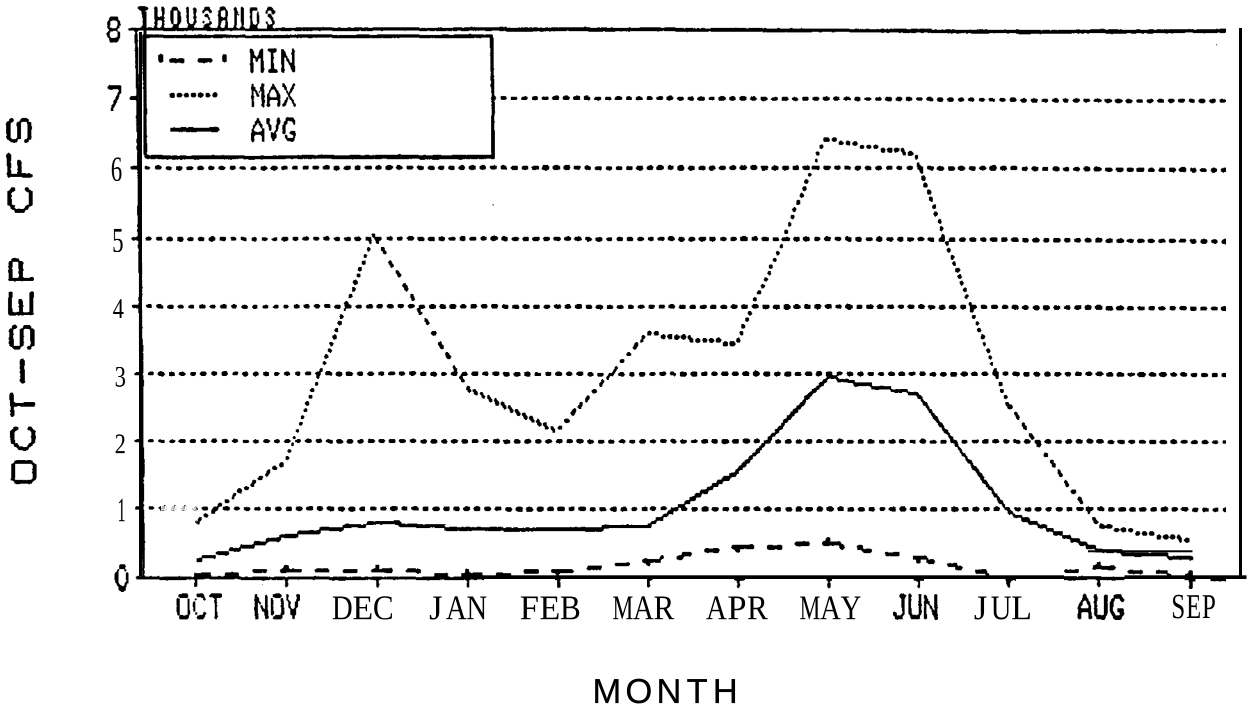


Figure 2-6.--Simulated Maximum, Average, and Minimum Monthly Mean Flows (CFS) for the Naches River at Oak Flats, 1926-1987

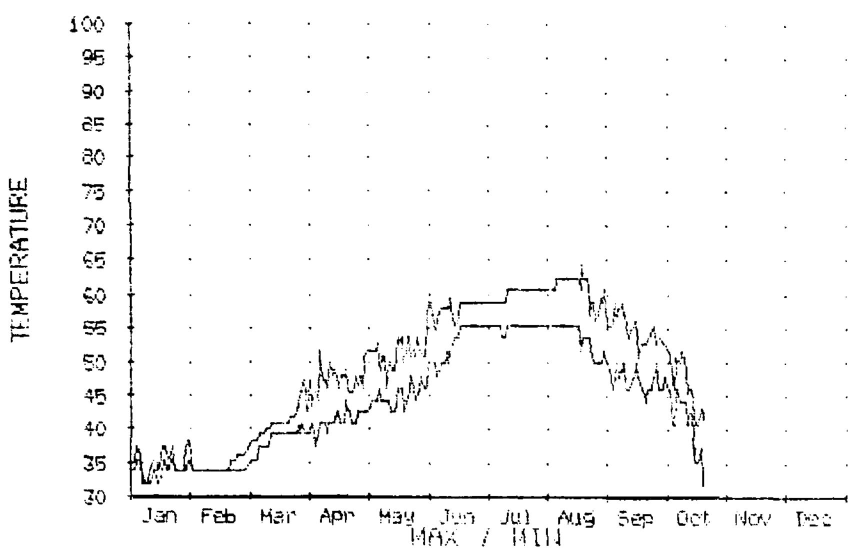


Figure 2-7.--Daily Maximum and Minimum Water Temperatures ("F) for the Naches River at Oak Flats, 1989

Below the two springs, flow data for Buckskin Creek, taken from March 19 to October 17, 1989, show a low flow of 9 cfs in March and a high flow of 26 cfs in September (figure 2-8 and Appendix B). This relatively wide fluctuation in flow from the springs is believed to be caused by ground-water return flow from nearby irrigated lands which is greatest during the summer. Flow data for Buckskin Spring (figure 2-9) and Nelson Spring (figure 2-10) indicate that the combined flow of the springs on March 19 and April 24, 1989, was only about 8 cfs. Buckskin Spring appears to generally have more flow than Nelson Spring (Appendix B), although changes in the amount of irrigation returns can sometimes cause flow in Nelson to exceed that in Buckskin. Further monitoring of the flows at this site should be conducted, especially from November through April, to determine if supplies during these months are adequate to meet fish facility needs.

Summer water temperatures at the site exceed 15 °C (59 °F) in both springs and in the creek below the springs (figures 2-11, 2-12, 2-13, and Appendix B). Temperatures rose higher than 59 °F (15 °C) in mid-June 1989 and lasted through September. The highest measured temperature was 63 °F in Buckskin Spring on July 6, 1989, but maximum-minimum thermometers placed in the springs recorded maximum temperatures as high as 79 °F. These warm temperatures are likely associated with the irrigation return flows that enter the springs and creek.

Water quality samples of Buckskin Spring, Nelson Spring, and a small (0.75 cfs) spring below the present hatchery outlet were collected on August 1, 1988, and April 11, 1989. Water quality parameters that did not meet the Alaska aquaculture criteria in all these springs included aluminum, carbon dioxide, chloride, hydrogen sulfide, nitrate, and temperature (Appendix C). In addition, Buckskin Spring and the small spring near the hatchery contain low levels of dissolved oxygen and supersaturated levels of nitrogen gas. High levels of carbon dioxide and hydrogen sulfide and low levels of dissolved oxygen are commonly found in spring water. These can be corrected before' hatchery use. High levels of chloride and nitrate and warm water temperatures are typical indicators of irrigation return flows. Experts in fish culture need to determine if any of the above Alaska aquaculture criteria variances pose a serious constraint to the proposed hatchery operations at this site.

Ground Water

In addition to the above spring water, the proposed facilities at Buckskin would use up to 1 cfs of ground water from September through July (table 2-1). To explore the potential for ground water at the site, one 6-inch observation well was drilled at the site during the fall of 1989. The well was drilled to bedrock at a depth of 45 feet and no ground water was found except for a minor amount that was encountered between 3-10 feet. It is possible that drilling into the basalt bedrock may locate an aquifer that can yield the desired flow of ground water. Any test drilling should be limited to an additional depth of 100-200 feet because this is where an aquifer with suitable water temperatures would most likely be found. In addition, an adequate aquifer in the sediments may occur on the private land northwest and farther away from the basalt outcrop just north of the drilling site.

KLICKITAT RIVER BASIN (CASCADE SPRINGS)

The proposed hatchery facilities for the Klickitat basin would be located at Cascade Springs a short distance downstream of the WDF hatchery at RM 42.4. The proposed facilities would require up to 39 cfs of river water from December through February, and 38 cfs during March and April (table 2-l). In addition, the facilities would use up to 37 cfs of spring water from May through February and 40 cfs of spring water during March and April.

There appears to be adequate streamflows and spring water at the site to meet the above needs, but some minor reprogramming of spring water needs may be required. Monthly mean streamflows at the site for the the period 1910-71 ranged from an average high of about 1,850 cfs in May to an average low of about 440 cfs in September (figure 2-14 and Appendix B). The lowest daily flow of record (236 cfs) occurred during November. Flow data for the two springs at the site, Cascade Springs and Kidder Springs, averaged a total of 37.5 cfs (22.5 cfs for Cascade and 15 cfs for Kidder) [15], which is 2.5 cfs less than the 40 cfs of spring water required for March and April. It should be possible to reprogram the spring water requirements of the hatchery facilities to conform with the available supply without adversely affecting hatchery production goals.

The temperature of the river water at the site is generally good; the highest temperature recorded during the summer of 1989 was 56 °F (figure 2-15). This is close enough to the upper limit of the Alaska aquaculture criteria (59 °F) that additional monitoring is warranted to determine if river water temperatures exceed 59 °F during especially warm or especially low water years. Several other water quality parameters measured from samples of river water collected at the site did not meet the Alaska aquaculture criteria. These included aluminum, carbon dioxide, manganese, mercury, dissolved sodium, and suspended sediment (Appendix C).

The water quality of Cascade and Kidder Springs is relatively good. The temperature of the spring water in both springs is about 45 °F (Appendix C). The only water quality parameters that did not meet the Alaska aquaculture criteria were carbon dioxide and dissolved sodium (too low in both springs), and aluminum (Kidder).

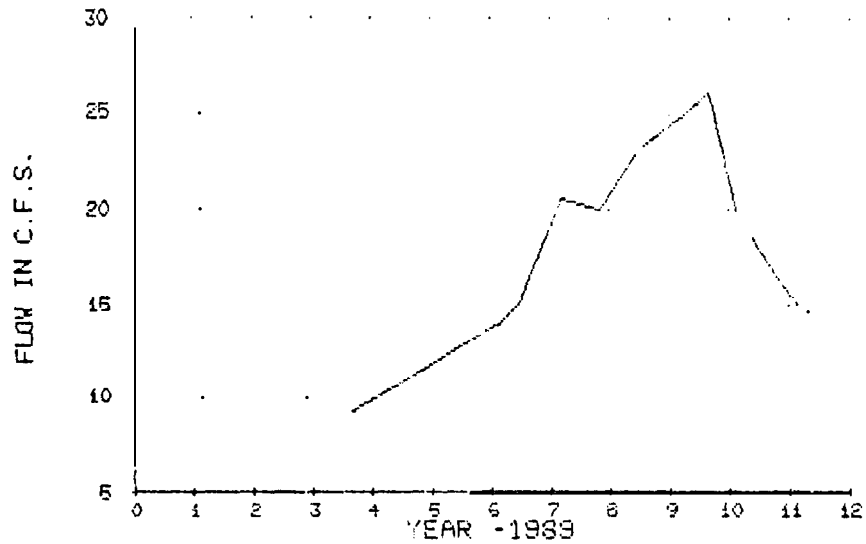


Figure 2-8.--Monthly Flows (CFS) for Buckskin Creek Below the Confluence of Buckskin and Nelson Springs, 1989

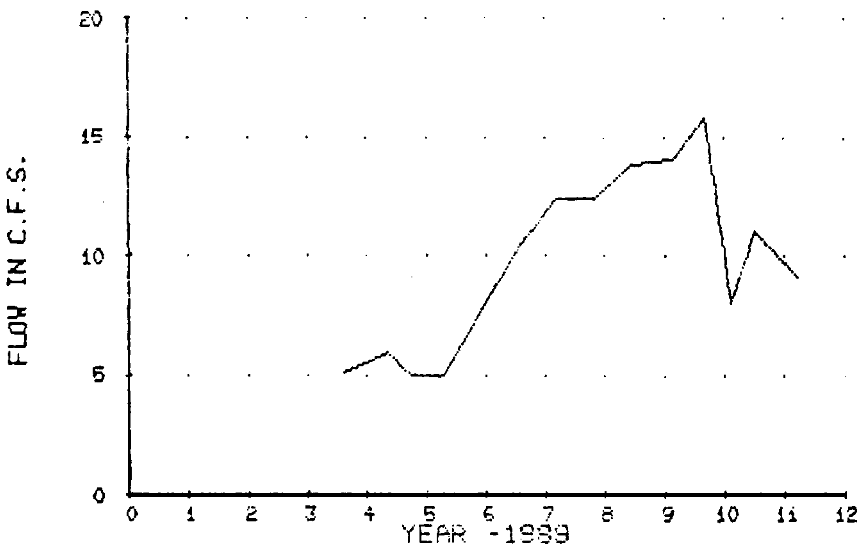


Figure 2-9.--Monthly Flows (CFS) at Buckskin Spring, 1989

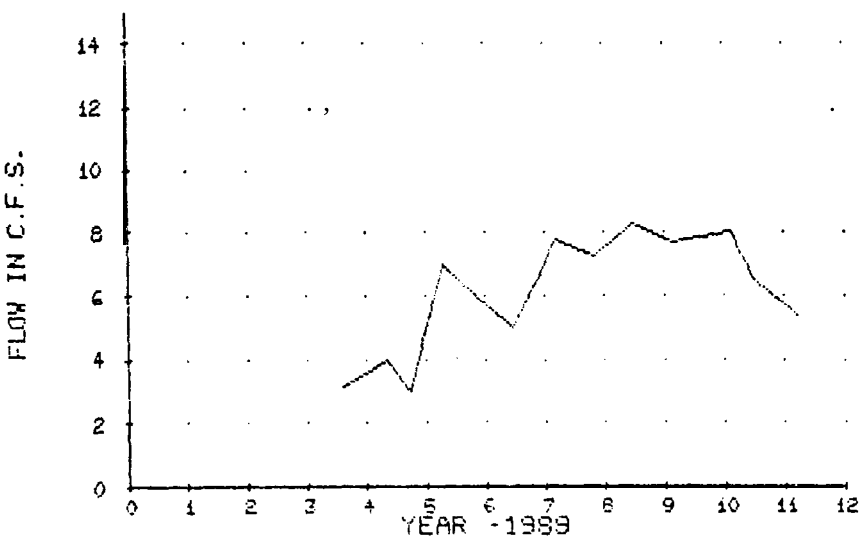


Figure 2-10.--Monthly Flows (CFS) at Nelson Spring, 1989

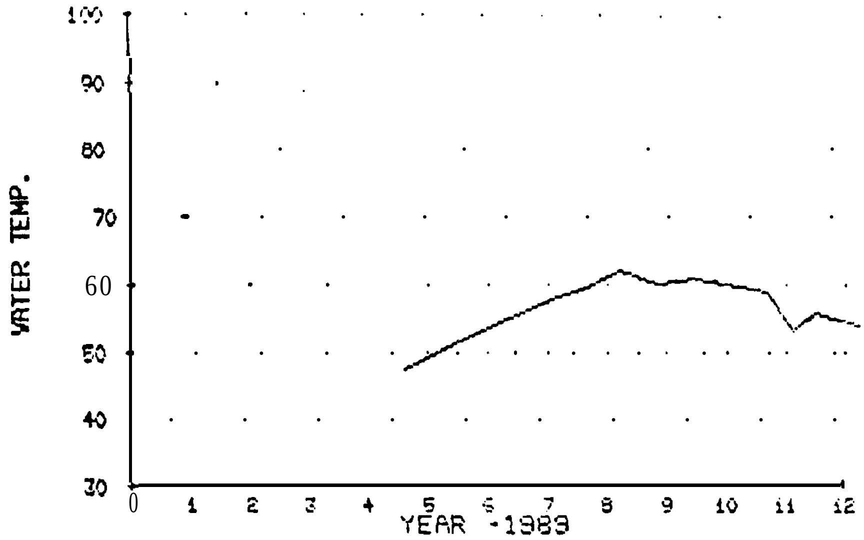


Figure 2-11.--Monthly Water Temperatures ('F) for Buckskin Creek Below the Confluence of Buckskin and Nelson Springs, 1989

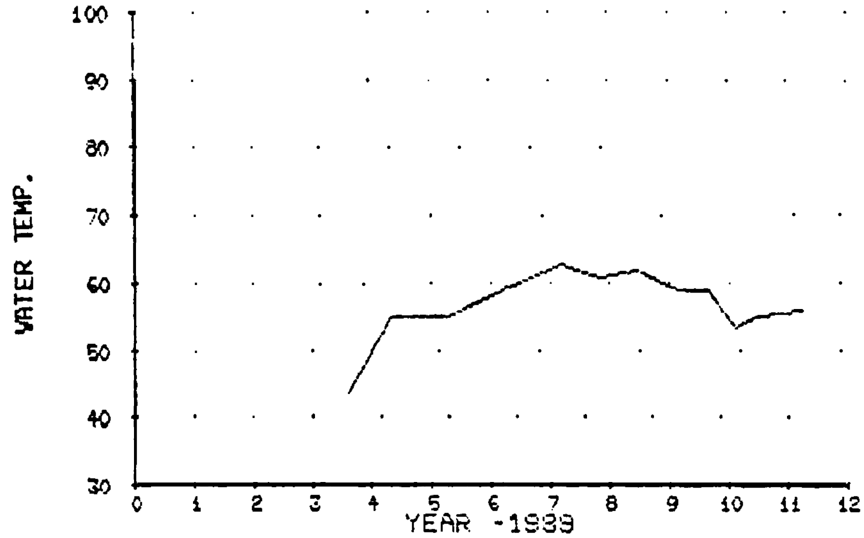


Figure 2-12.--Monthly Water Temperatures ('F) for Buckskin Spring, 1989

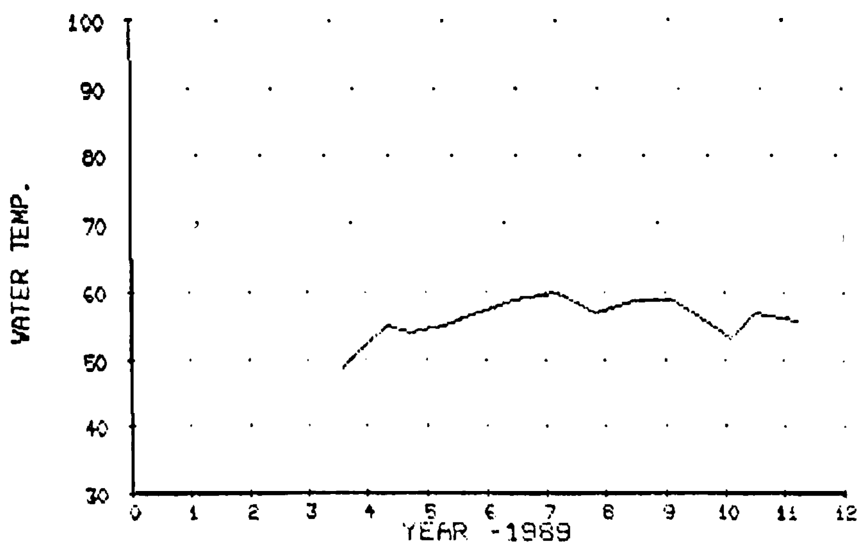


Figure 2-13.--Monthly Water Temperatures (°F) for' Nelson Spring, 1989

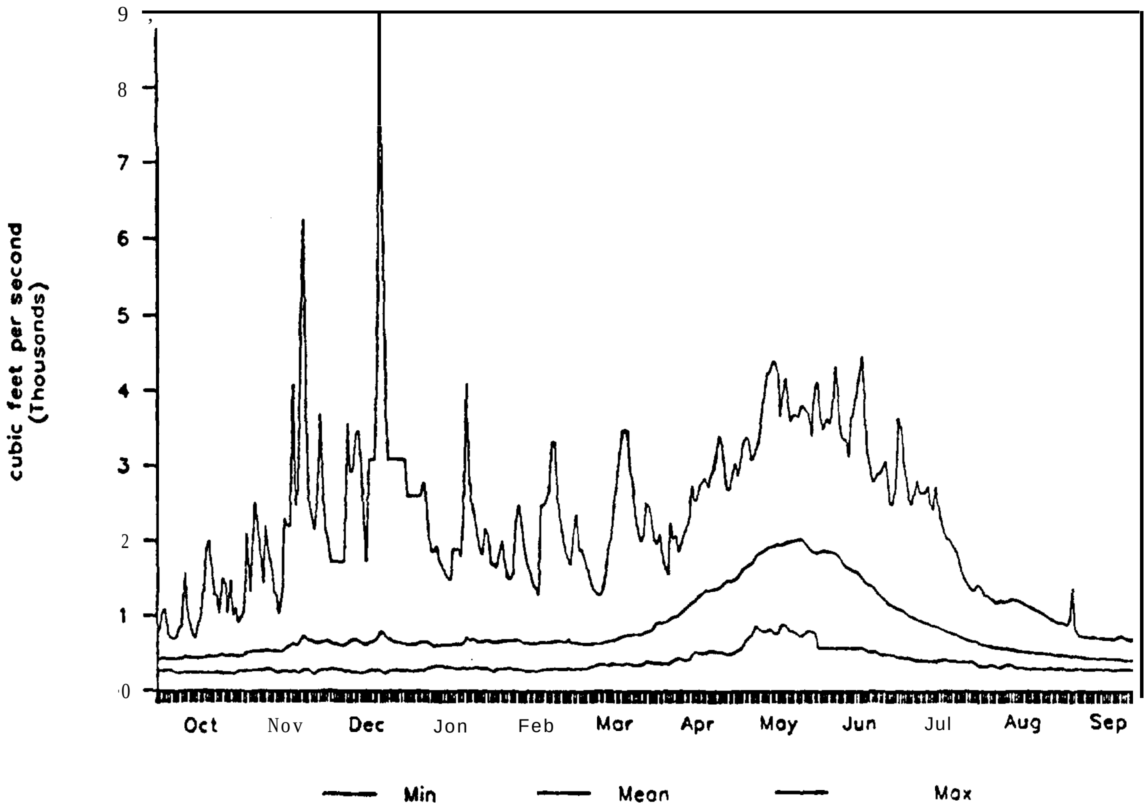


Figure 2-14.--Maximum, Average, and Minimum Mean Daily Flows (CFS) of the Klickitat River Near the WDF Hatchery, 1910-1971

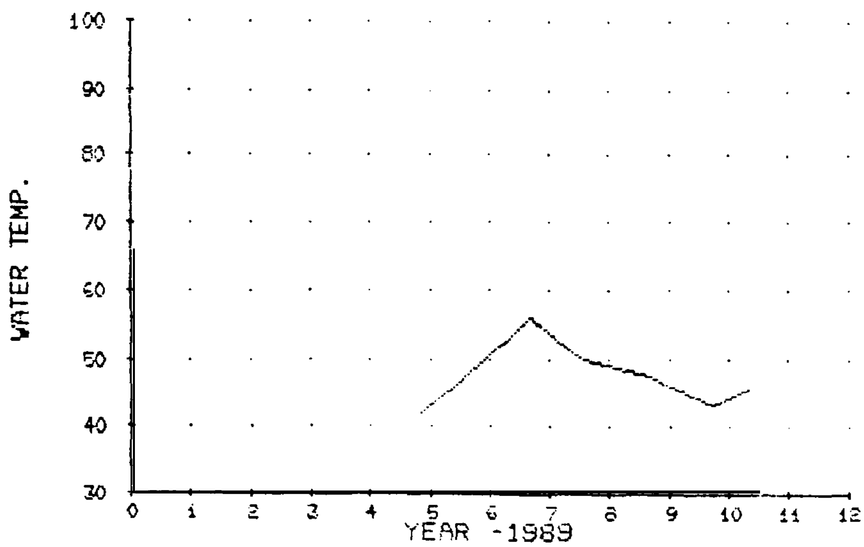


Figure 2-15. --Monthly Water Temperatures ("F) for the Klickitat River Near the WDF Hatchery, 1989

STREAM DESCRIPTION

YAKIMA BASIN

Yakima River

Columbia River (RM 0.0) to Prosser Diversion Dam (RM 47.0)

The Yakima River enters the Columbia River from the north (right bank) at RM 335.2 of the Columbia. The condition of riparian cover throughout this lowest reach of the Yakima River is only fair to poor. Spawning gravel is abundant, although deposited sediment in the gravel is a concern. The lower portion of the reach, below the Chandler Powerplant discharge at RM 35.8, contains good riffle and pool habitat except for the lowest 2 miles which are inundated by McNary Pool. Anadromous fish use of the reach includes fall chinook spawning and incubation, passage of all stocks to and from upstream areas, and overwintering of some spring chinook and steelhead.

Simulated flows in the lower 35.8 mile segment of the reach are generally good, with monthly mean flows for the period 1926-87 ranging from an average high of 5,520 cfs in May to an average low of 1,400 cfs in August at Kiona (RM 34.9) (figure 3-1). The lowest monthly mean flow (713 cfs) occurred in April 1977.

Water quality is the major constraint to anadromous fish production in the lower segment of this reach. High water temperatures prevent salmonid passage and rearing during mid- and late summer in most years. At Kiona, 108 of 416 (26 percent) temperature samples taken during the period January 1953-July 1989 exceeded 65 °F and 53 (18 percent) exceeded 70 °F (21 °C) (Appendix D). Temperatures over 65 °F can occur as early as late June and they generally last through early September. Temperatures above 70 °F are common in July and August and readings in the high seventies and low eighties are not uncommon (Technical Data Appendix).

Ideal water temperatures for salmon and steelhead spawning and rearing in the natural environment are 54-61 °F with daily peaks not exceeding 65 °F. Salmon and steelhead can generally survive water temperatures of 65-70 °F for short periods of time with limited ill effects but temperatures above 70 °F are unsuitable for anadromous fish production. Surviving stocks of anadromous fish in the Yakima basin use this reach when the high water temperatures are not present. Adult spring chinook pass through the reach in early spring and adult fall chinook spawn in late fall (after water temperatures have cooled). The fall chinook juveniles emerge and emigrate during spring. Adult steelhead pass through this reach from late fall to early spring. Some juvenile spring chinook and steelhead also rear in this reach but only during winter.

Other water quality parameters in samples from Kiona do not meet acceptable criteria for salmonid spawning and rearing; 19 of 38 copper determinations exceeded the aquatic life criteria (table 1-5) of 6.5 µg/L and 17 of 96 mercury determinations exceeded the laboratory detection limit of 0.1 µg/L. (Aquatic life criteria for mercury is less than 0.1 µg/L.) Because of the intermittent use of the reach by salmonids, these water quality variances probably do not significantly affect anadromous fish production. Water samples from Kiona also contain relatively high levels of suspended sediment, nitrogen, phosphorus, coliform bacteria, and various pesticides (Technical Data Appendix). Even with the above problems, hatchery supplementation of natural spawning fall chinook populations would still be feasible downstream of the Chandler Powerplant discharge.

Flow and water quality constraints between Prosser Diversion Dam and the powerplant discharge are more important. (Flows and water quality below Prosser Dam during spring and fall were discussed previously in the section on water supplies for the proposed hatchery facilities at Prosser.) Much of the summer flow of the Yakima River is diverted at Prosser Diversion Dam to provide irrigation water to the Kennewick Irrigation District and for power production, and fall and winter flows are diverted for power production. Recent studies have suggested that the 50-200 cfs minimum flows maintained by Reclamation below Prosser Dam are not adequate for adult passage and juvenile rearing [9,10]. The studies recommend minimum flows of 450 cfs below Prosser for acceptable anadromous fish passage conditions and flows of 800-1,000 cfs are desirable for anadromous fish spawning and rearing. The present minimum flows of 50 or 200 cfs can occur during any month of the year but are most common from July through October.

Water quality during the summer months in the 11.2-mile segment from the diversion dam to the powerplant outlet is the poorest in the Yakima basin with high water temperatures, high suspended sediment concentrations, and low dissolved oxygen levels in some of the deeper areas [7]. Ammonia concentrations may reach toxic levels in some years and pesticide concentrations are the highest in the subbasin. Flows and water quality in this segment could be improved by measures such as subordinating power production at the Chandler Powerplant to instream flows and identifying and controlling upstream point and nonpoint sources of water pollution. However, until such measures are implemented, anadromous fish spawning and rearing in this segment will remain extremely limited.

Prosser Diversion Dam to Sunnyside Diversion Dam (RI1 103.8)

The river in the lower 33 miles of this reach is a deep, slow-moving, meandering stream with a silt/algae bottom and very few riffles, providing poor habitat for anadromous fish spawning or rearing. From about the Toppenish Creek confluence (RM 80.4) upstream, however, riffles and pools become more common and gravels comprise a larger portion of the substrate. Although instream cover is scarce in this reach, the riparian corridor is either quite brushy (below Toppenish Creek) or has a reasonably dense stand of trees (above Toppenish Creek) and would be classed as fair to good.

Anadromous fish use of this reach is primarily for upstream and downstream passage but fall chinook spawn in the area near the Toppenish Creek confluence and some steelhead spawning and rearing probably occur between Satus Creek (RM 69.6) and Sunnyside Dam. Some limited overwintering of salmon and steelhead also probably occurs in this reach. Recent studies have shown high smolt mortalities between headwater areas and Prosser Diversion Dam

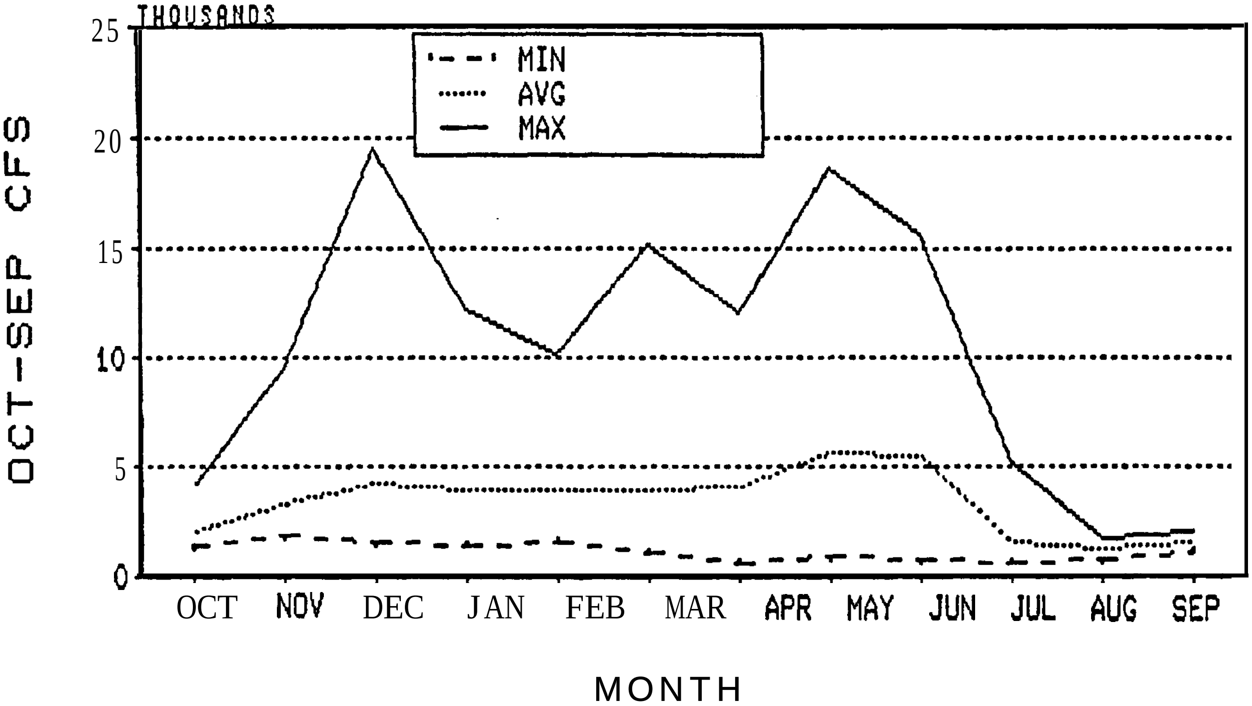


Figure 3-1.--Simulated Maximum, Average, and Minimum Monthly Mean Flows (CFS) of the Yakima River at Kiona, 1926-1987

during low flows; most of these mortalities appear to occur in the Prosser to Sunnyside reach. The cause(s) of this high mortality needs to be determined and corrective measures taken.

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 Diversion Dam is diverted once the storage system begins releases to meet water needs. Simulated monthly mean flows for the period 19'26-87, just below Sunnyside Diversion Dam, range from an average high of 4,335 cfs in May to an average low of 200 cfs in August and September (figure 3-2). Reclamation informally maintains a minimum flow of 200 cfs past Sunnyside Diversion Dam but adult migration is difficult at this flow. Problems also occasionally occur with smolt outmigrations during the spring of dry years; flows as low as 200 cfs can occur in April and May of low water years and these flows are too low to provide rapid downstream transport of the smolts to the Columbia River.

Flows improve downstream of Sunnyside Diversion Dam as irrigation return flows enter the river but these return flows are of generally poor quality. Simulated monthly mean flows just upstream of Prosser Diversion Dam for the period 1926-77 range from an average high of about 5,110 cfs in May to an average low of about 1,155 cfs in September (figure 3-3).

Water quality deteriorates downstream of Sunnyside Diversion Dam because more and more of the river flow is comprised of agricultural return flows and because the river water warms as it meanders slowly through the lower 33-mile segment from Toppenish Creek to Prosser Diversion Dam. This deterioration is reflected in the water temperature data for Granger (RM 82.8) and Mabton (RM 55.0); only 8 of 72 (11 percent) water temperature samples at Granger taken during the period March 1974-September 1981 were above 65 °F and none were above 70 °F, whereas 18 of 74 (24 percent) samples taken at Mabton during the period January 1971-September 1981 were above 65 °F and 5 (7 percent) were above 70 °F (Appendix D). These high temperatures occurred between late June and early September at both locations (Technical Data Appendix).

Flows and water quality could be improved in this reach by the provision of additional flow past Sunnyside Diversion Dan. This would require the creation of additional water supplies (most likely by a combination of water conservation and new storage) and by identification and control of upstream point and nonpoint sources of water pollution. Until these measures are implemented anadromous fish use of this area will remain limited to passage of upstream stocks, fall chinook spawning, and incubation upstream of the Toppenish Creek confluence, and a limited amount of spring chinook and steelhead rearing in the segment between the Satus Creek confluence and Sunnyside Diversion Dam.

<u>Sunnyside Diversion Dam to Wilson Creek (RM 147.0)</u>

Most of this reach lies within the Yakima Canyon. The river in the canyon is relatively fast-flowing with few gravel bars and little spawning habitat above Pomona. Large pools are also lacking. The lower portion of this reach, from Sunnyside Diversion Dam to Pomona, is more braided and contains a good series of riffles and pools. Riparian vegetation in this reach is generally good throughout the reach except for an 8-mile stretch from about RM 114 to RM 122 which has been impacted from construction of Interstate Highway 82 and grazing. The primary importance of this reach for anadromous fish is as overwintering habitat for spring chinook and steelhead; however, spawning and rearing of spring chinook and steelhead is also significant. This reach also has the potential for summer chinook and some coho spawning and rearing.

Flows in this reach below the Naches River confluence (RM 116.3) are generally good except for low winter flows in dry years that can adversely affect overwinter survival of spring chinook and steelhead. Simulated monthly mean flows above Sunnyside Diversion Dam for the period 1926-77 range from an average high of about 5,570 cfs in May to an average low of about 1,125 cfs in October (figure 3-4). The lowest simulated monthly mean flow was 633 cfs and this would occur in October during six dry water years.

Flows upstream of the Naches confluence can often be too high for optimal rearing during the irrigation season and are often too low downstream of Roza Diversion Dam (RM 127.9) during the fall and winter for adult passage and juvenile rearing. Flows are diverted at Roza Diversion Dam for irrigation (early fall) and power production (fall and winter). Simulated monthly mean flows in this reach above the Naches confluence for the period 1926-87 range from average highs of about 2,540 and 4,330 cfs in May below Roza Dam and at Umtanum (RM 140), respectively, to average lows of about 360 cfs (September) below Roza and 970 cfs (October) at Umtanum (figures 3-5 and 3-6). Reclamation informally provides minimum flows of 300 cfs below Roza Dam; however, flows of about 400 cfs are needed for good adult passage conditions and flows of about 750-900 cfs are needed for optimal rearing in the reach below the diversion dam. Flows below Roza Dam could be improved for anadromous fish passage and rearing by subordination of power production at Roza powerplant to instream flows; however, this would require the provision of replacement power to the Roza Irrigation District, at equivalent cost, for irrigation pumping needs.

Water quality in this reach is generally good to excellent with three exceptions. First, Roza Diversion Dam acts as a settling pond and when Roza pool is drained large volumes of sediment are released and washed downstream. Second, the wakes from power boats in pools just above Roza Diversion Dam are causing some bank erosion and, therefore, some turbidity and sedimentation problems. And last, one of two copper determinations taken near Umtanum exceeded the aquatic life criteria (Appendix D).

Wilson Creek to Cle Elum River (RM 185.6)

This reach has a generally good pool to riffle ratio and is braided in some sections. The upper portion of this reach flows through Thorpe Canyon which is similar in habitat to the Yakima Canyon area. The riparian corridor in the 19-mile stretch between Wilson Creek and Taneum Creek (RM 166.1) is only fair and bank sloughing is common, but otherwise, the riparian vegetation in this reach is good to excellent. Spring chinook use this reach primarily for juvenile rearing, and the reach has the potential for steelhead and coho rearing as well.

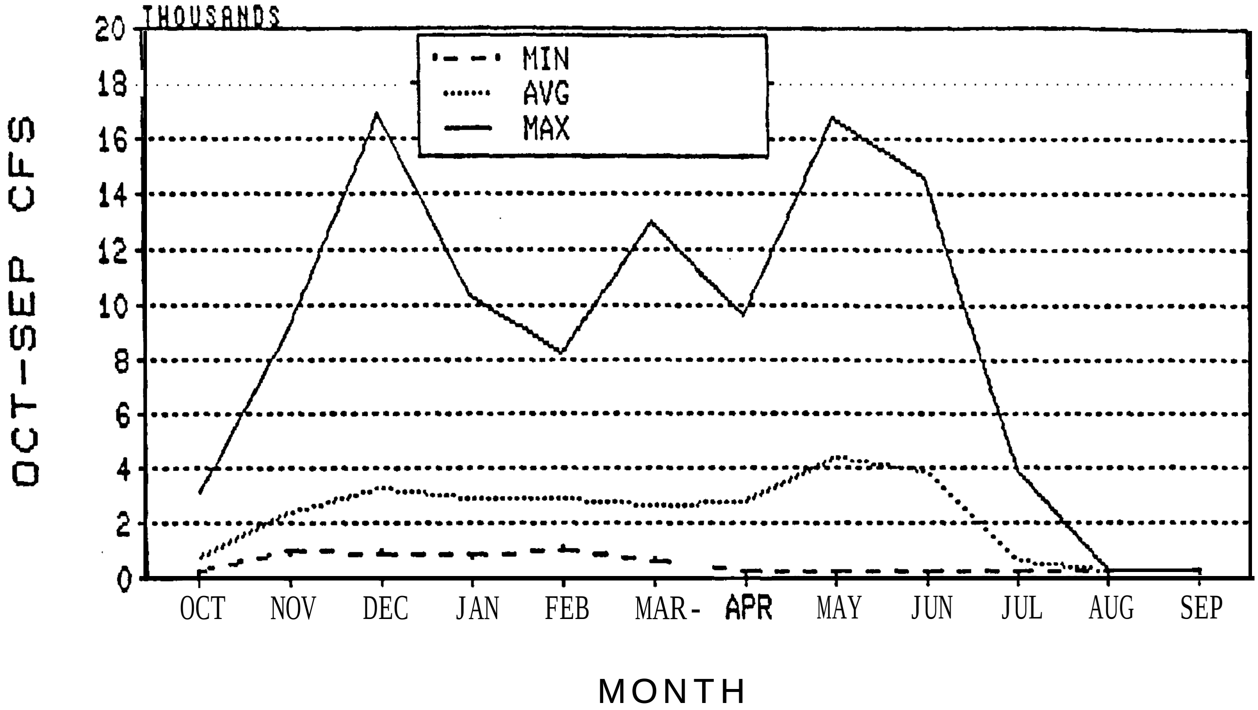


Figure 3-2. --Simulated Maximum, Average, and Minimum Monthly Mean Flows (CFS) of the Yakima River below Sunnyside Diversion Dam, 1926-1987

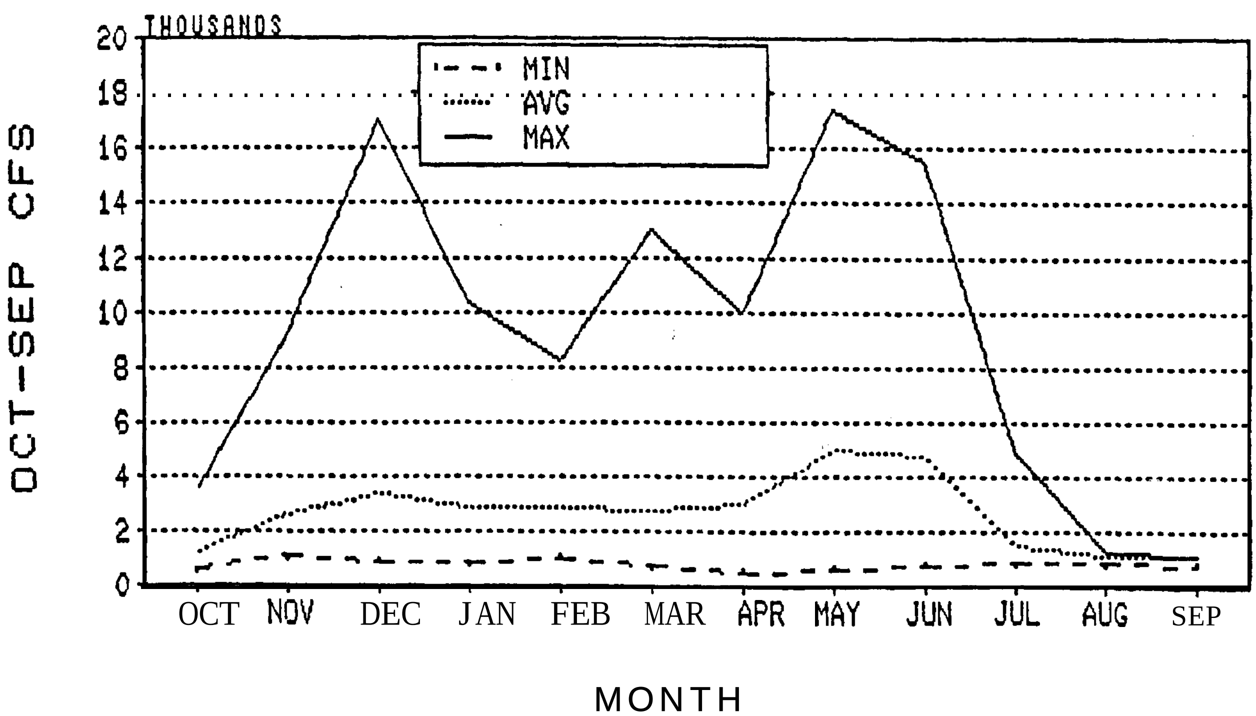


Figure 3-3. --Simulated Maximum, Average, and Minimum Monthly Mean Flows (CFS) of the Yakima River above Prosser Diversion Dam, 1926-1977

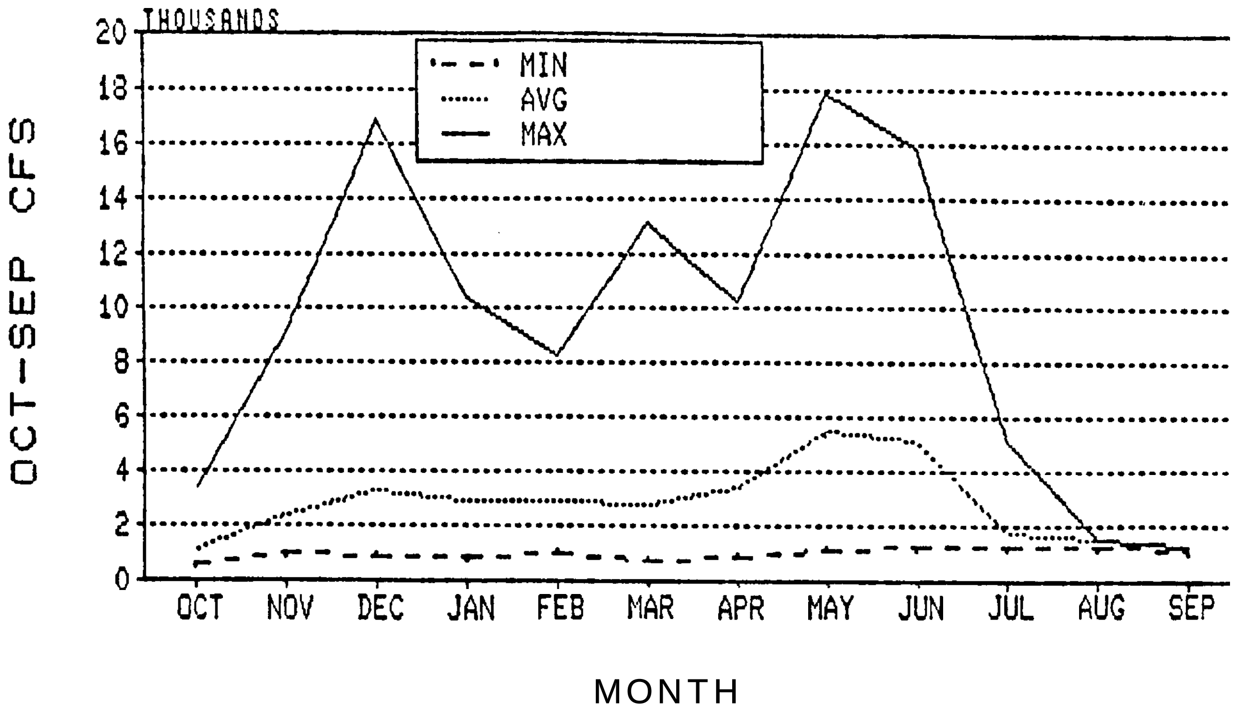


Figure 3-4. --Simulated Maximum, Average, and Minimum Monthly Mean Flows (CFS) of the Yakima River at Sunnyside Diversion Dam, 1926-1977

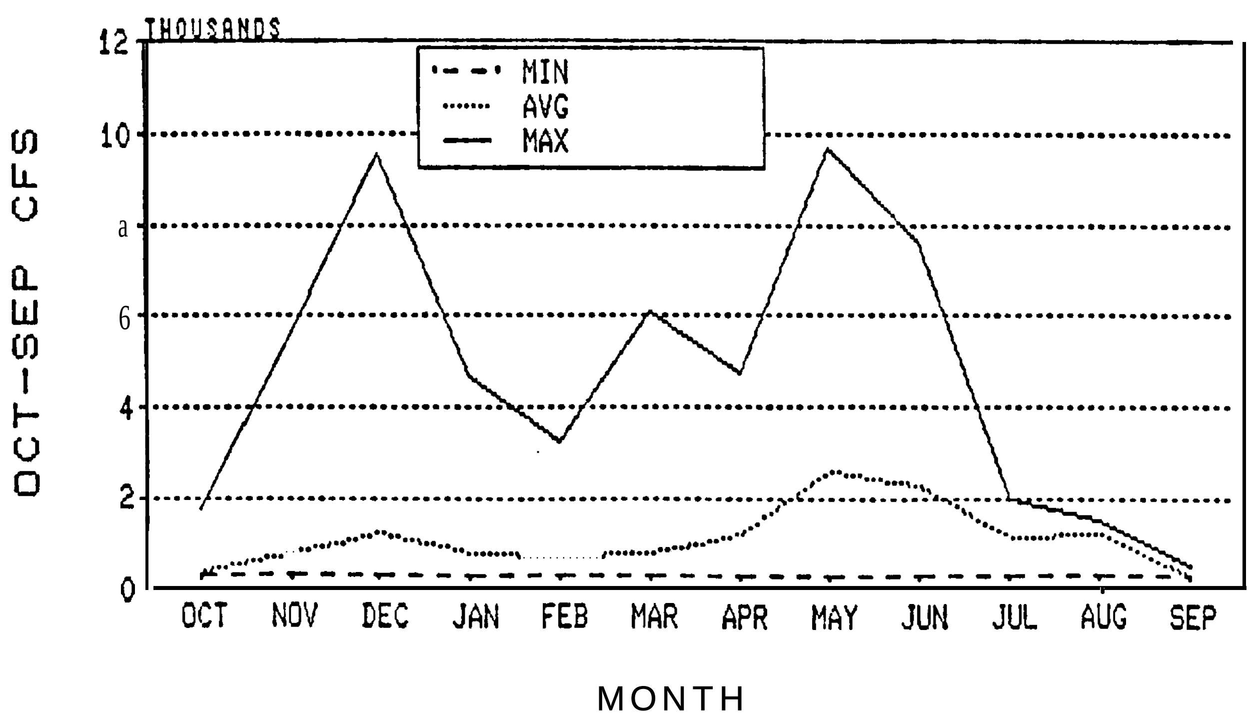


Figure 3-5. --Simulated Maximum, Average, and Minimum Monthly Mean Flows (CFS) of the Yakima River Below Roza Diversion Dam, 1926-1987

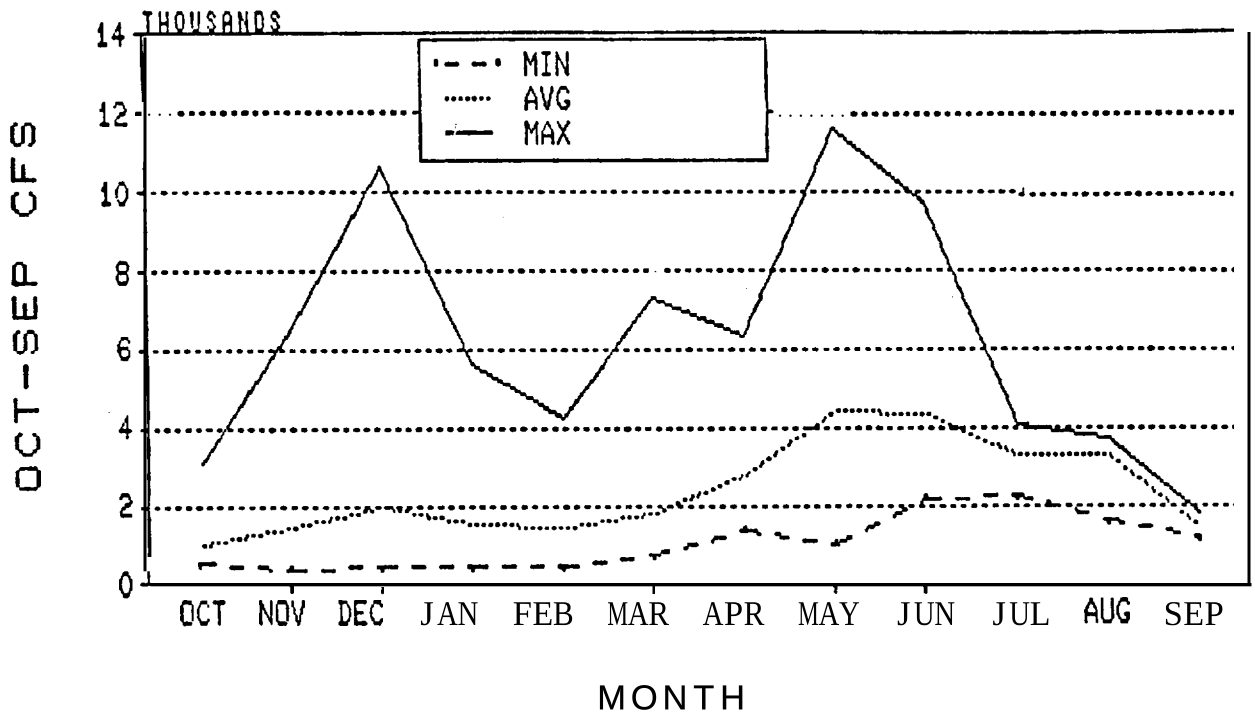


Figure 3-6.--Simulated Maximum, Average, and Minimum Monthly Mean Flows (CFS) of the Yakima River at Umtanum, 1926-1987

Flows in this reach are also commonly too high for optimal rearing during the irrigation season and too low during flip-flop operations and during winters following dry years. (Flows and water quality below the confluence of the Cle Elum River were discussed previously in the section on water supplies for the proposed hatchery facilities at Cle Elum.) Low flows of 300-350 cfs can occur below the Cle Elum River confluence during the fall of dry years.

Water quality in this reach is generally good to excellent; the only aquatic life criterion variance noted from water quality samples taken below the Cle Elum River confluence during the period March 1974-March 1987 was that one of two copper determinations exceeded the standard of 6.5 µg/L (Appendix D).

Cle Elum River to Keechelus Dam (RM 214.5)

This reach contains the best spring chinook spawning habitat in the upper Yakima River and could also be excellent spawning and rearing habitat for steelhead and coho. The reach has many excellent gravel bars and large pools, and cover such as large organic debris (LOD) is especially abundant. The riparian corridor is excellent except for a few clusters of summer homes where the banks have been riprapped and the vegetation removed. The area above Easton Diversion Dam (RM 202.5) has only recently been made accessible to anadromous fish by replacement of the nonfunctional ladder at the dam; a new screen and bypass system on the Kittitas Reclamation District (KRD) Canal has also been recently constructed.

Flows below Easton Diversion Dam are generally adequate for spring chinook spawning and incubation, especially in recent years, but are often too low for optimal rearing in winter-early spring. Simulated monthly mean flows below Easton Dam for the period 1926-87 range from an average high of about 935 cfs in May to an average low of about 185 cfs in October (figure 3-7). Reclamation provides minimum spring chinook spawning flows of 200 cfs below Easton Diversion Dam during September and minimum incubation flows of 150 cfs during winter in conformance with the Quackenbush Decision [16]. Winter flows between Keechelus Dam and Easton Dam are more of a problem because releases from Keechelus have historically been stopped after the irrigation season to allow filling of the reservoir. Simulated monthly mean flows in this segment of the reach range from an average high of about 735 cfs in August to an average low of about 65 cfs in March (figure 3-8). However, low flows of about 3 cfs, largely from seepage, are common from October through April below Keechelus Dam. An agreement between irrigation interests and the YIN was recently concluded in conjunction with the ladder and screen construction at Easton Dam to provide spawning flows of 60 cfs and incubation flows of 30 cfs in the reach above Easton.

Water quality throughout the Cle Elum River to Keechelus Dam reach is excellent; five monthly water samples were collected and analyzed during the summer of 1989 and all of the water quality measurements met the aquatic life criteria (Technical Data Appendix).

Yakima River Tributaries

Corral Canyon Creek (5 Miles)

Corral Canyon Creek enters the Yakima River from the east (left bank) at RM 33.5. There is an unscreened diversion that diverts most of the creek into the Kiona Canal near its mouth. This diversion is impassable during the irrigation season but if the check boards were removed at the end of the season, Corral Creek would be accessible to steelhead. This creek has good summer flows (about 25 cfs) and good riparian conditions, and it could produce steelhead (and possibly coho) if the diversion near its mouth were screened, or if an undershot bypass were constructed to separate the creek from the canal. Water quality may be a problem since most of the summer flow is comprised of irrigation return flows.

Spring/Snipes Creek (16 Miles)

Spring/Snipes Creek enters the Yakima River from the east (left bank) at RM 41.8. Spring and Snipes Creeks are downstream of the historic spring chinook production area in the basin. These creeks, which join 1/4 mile from the Yakima confluence, are used as an irrigation wasteway conduit in the summer and constitute a false attraction hazard to migrating spring chinook adults. Discharge in Snipes Creek drops precipitously in the fall and winter, and spawning gravel is scarce in both creeks. Nonetheless, Spring Creek has some minor potential for steelhead and coho spawning and rearing as small numbers of both species spawn and rear there now. High summer water temperatures, high levels of suspended sediment, and pesticide concentrations in irrigation returns are also of concern (Appendix D). A barrier is needed on Snipes Creek to prevent the loss of adult spring chinook to the false attraction hazard.

Sulphur Creek

Sulphur Creek enters the Yakima River from the east (left bank) at RM 61.0. This channel is a combined wasteway for the Sunnyside and Roza Canals and is used for drainage by several county drainage districts and the city of Sunnyside sewage treatment plant. Like Spring and Snipes Creeks water quality (Appendix D) and seasonal low flows are the major problems for anadromous fish production in this tributary. In the spring, waste water from the Sunnyside and Roza Canals can provide a significant attraction flow to migrating spring chinook and a barrier is also needed at the mouth of this creek to prevent losses from these false attraction flows.

Satus Creek System (131 Miles Including Forks)

Satus Creek enters the Yakima River from the west (right bank) at RM 69.6. The principal tributaries to Satus include Mule Dry Creek (18 miles), Dry Creek (39 miles), Logy Creek (14 miles to falls), and Kusshi Creek (11 miles). Only Logy Creek has sufficient fall flows for salmon spawning. Spring chinook were reported to be abundant in Logy Creek before 1910 and there have been reports of spawning chinook in Logy and Satus Creeks in recent years. Although the Satus system is not now (nor was it historically) a major spring chinook producer, it is currently the primary producer of steelhead in the Yakima basin.

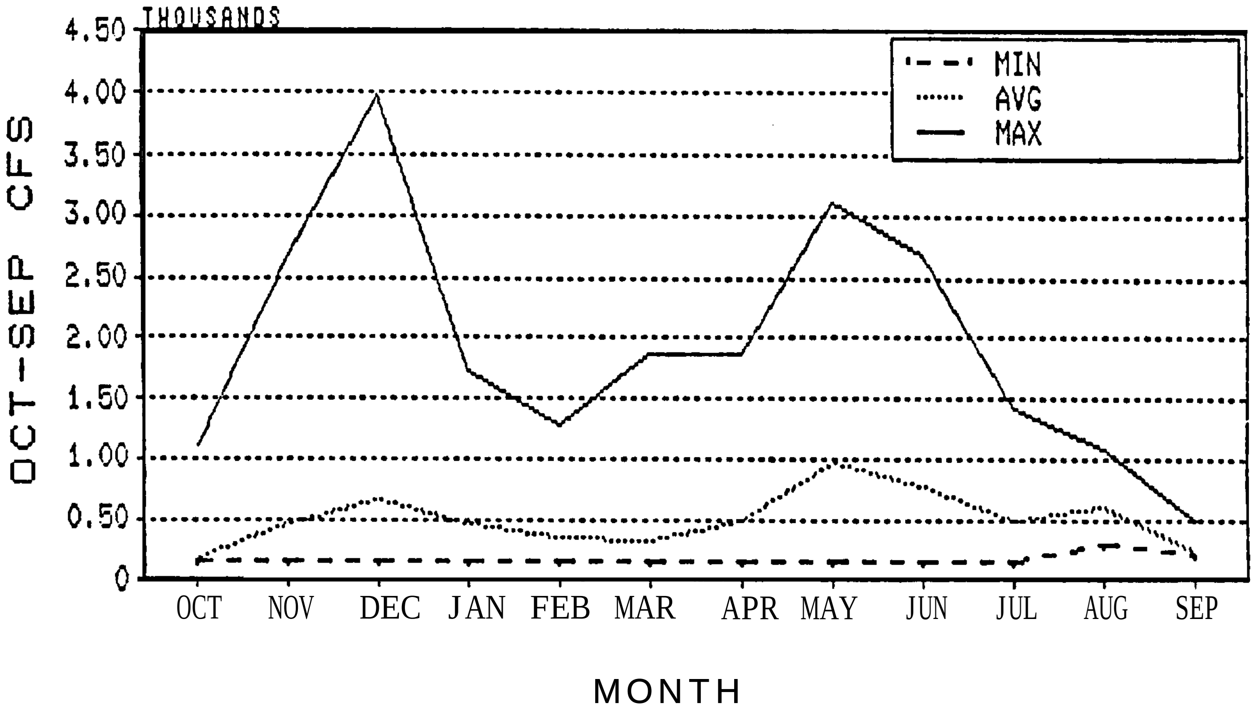


Figure 3-7. --Simulated Maximum, Average, and Minimum Monthly Mean Flows (CFS) of the Yakima River Below Easton Diversion Dam, 1926-1987

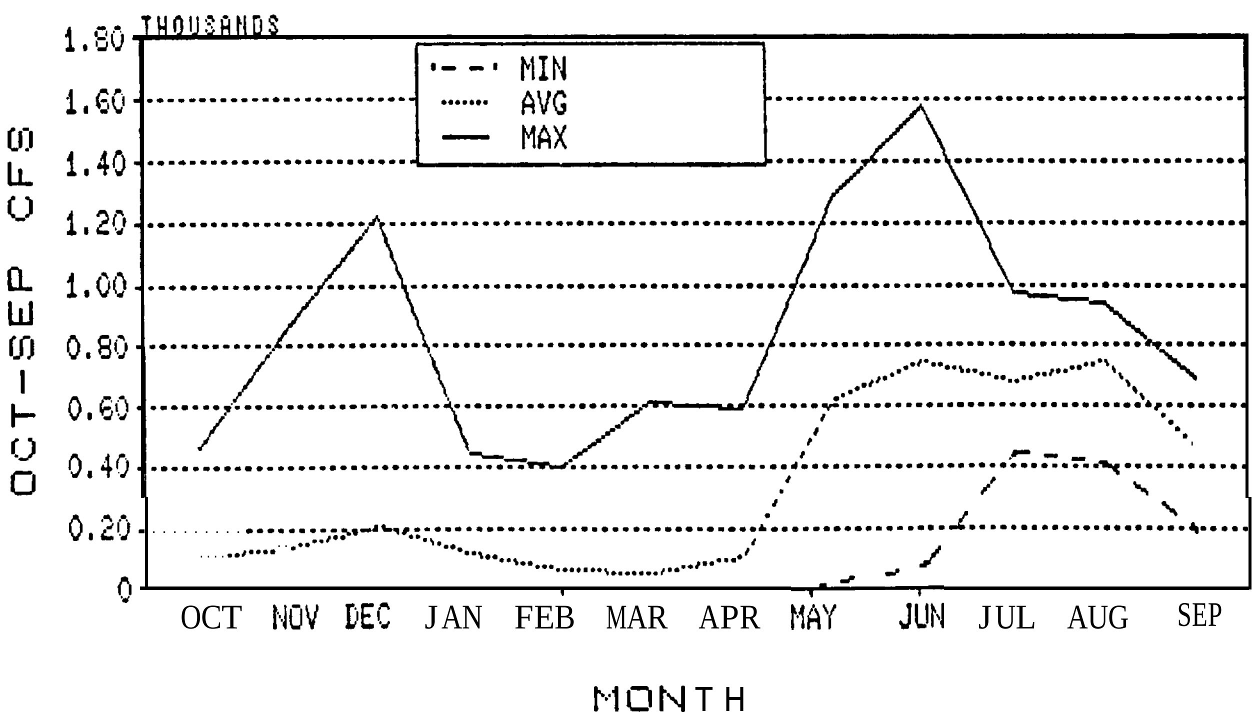


Figure 3-8. --Simulated Maximum, Average, and Minimum Monthly Mean Flows (CFS) of the Yakima River Below Keechelus Dam, 1926-1987

The lower 6 miles of Satus Creek provide poor habitat for anadromous fish because it is slow-moving with a mud-sand streambed and only a few isolated riffles. The remainder of the system, however, contains considerable spawning and rearing habitat. Gradient is slight (0.2-0.3 percent) in the lower' 37 miles Of Satus Creek thereafter becoming steeper (1-2 percent) upstream. There is a large (30-40 feet high) impassable falls on Satus Creek near RM 34 about 4 miles upstream of the Highway 97 bridge.

There are three unscreened diversions on Satus Creek: (1) the laddered Wapato Irrigation Project (WIP) diversion at about RM 10 (unused for a number of years), (2) the large, unladdered Shattuck diversion complex near RM 12, and (3) the small, gravel berm Holwegner diversion near RM 28. The Shattuck diversion, even though recently reconstructed, is a barrier to spring chinook spawners and would probably delay steelhead spawners as well. Moreover, this structure diverts a substantial amount of the summer flow from Satus Creek and is an entrainment hazard to outmigrating smolts.

Monthly mean flows in lower Satus Creek near the mouth (RM 2.6) for the period 1933-85 ranged from an average high of about 370 cfs in February to an average low of about 55 cfs in October (figure 3-9). The lowest monthly mean flow of record was 23 cfs in October 1934. Monthly mean flows are an average for the month and should be viewed with caution because daily flows can vary considerably; for example, a flow of only about 5 cfs was measured in lower Satus Creek on October 12, 1989 (Technical Date Appendix). Monthly mean flows in upper Satus Creek (RM 19.7) for the period 1932-85 ranged from an average high of about 350 cfs in February to an average low of about 17 cfs in September (figure 3-10). The lowest monthly mean flow of record was 4.9 cfs which occurred in August 1932.

Water quality in Satus Creek is generally good except for warm water temperatures and occasional low levels of dissolved oxygen. All of the other water quality parameters measured during the period April 1981-August 1984 met the aquatic life criteria. Water temperatures above 65 °F were common at RM 2.6 from June through August, and temperatures above 70 °F occurred at times (Technical Data Appendix). In 1989, temperatures above 65 °F occurred during July and August, but temperatures above 70 °F were not noted (figure 3-11).

Logy Creek enters Satus Creek near RM 20.0 and is a major tributary providing one-half or more of the flow of Satus Creek downstream of their confluence. Flows near the mouth of Logy Creek ranged from 11.5 to 15.0 cfs during the summer of 1989 (Technical Data Appendix), and water temperatures were excellent ranging from 38 to 58 °F. One possible problem was noted in Logy Creek; maximum-minimum thermometers placed in the stream near a meadow at RM 1.0 recorded maximum water temperatures ranging from 79-82 °F. These maximum temperatures are too warm for salmonid rearing. Additional monitoring of Logy Creek water temperatures is needed to determine if the above maximum temperatures represent the creek as a whole or are the result of a localized condition.

With the exception of Logy Creek, all of the Satus tributaries would be more productive if summer flows were higher. Mule Dry Creek, Dry Creek, Kusshi Creek, and Wilson Charley Creek normally dry up in one or more reaches each year. There are good sites for small impoundments to provide additional water for instream flows at a number of places in the Satus drainage.

Fairly large areas of the Satus drainage have suffered riparian damage, primarily from overgrazing. Much of this damage consists of bank sloughing, however, many impacted areas still support fair numbers of large trees which often provide adequate shading. These riparian areas have been prioritized by productive potential and need for restoration in the Yakima Subbasin Plan [7] as follows (in descending order of importance): Satus Creek from Dry Creek (RM 18.7) to High Bridge (RM 30.1), Dry Creek from the mouth to a point about 3 miles above Elbow Road crossing (RM 27), Logy Creek from the mouth to the first crossing above Sheep Camp (RM 2.5), the entire Mule Dry Creek drainage (18 miles), and lower Satus Creek from Mule Dry Creek (RM 8.5) to the mouth.

Toppenish/Simcoe System (140 Miles Including Forks)

Toppenish Creek enters the Yakima River from the west (right bank) at RM 80.4. Toppenish Creek is 70 miles long, Simcoe Creek is 18.9 miles long, the North and South Forks of Toppenish Creek are about 18 and 6 miles long, respectively, and the North and South Forks of Simcoe Creek are 13.9 and 12.8 miles long, respectively. The system is thus quite large and, with improvements, has the potential to be a major producer of steelhead and perhaps of coho as well. It is not now, nor apparently has it ever been, a significant producer of spring chinook, but a limited amount of fall chinook spawning may occur in the lower few miles.

The lower 32.7 miles of Toppenish Creek, up to the confluence with Simcoe Creek, has a low gradient, is extremely braided, and receives significant amounts of irrigation return water. Riparian degradation is patchy but significant where it occurs. The substrate is heavily sedimented, primarily because of the silty input from Mud Lake Drain (RM 31.5), a ditch which drains irrigated range that was historically a swamp. Much of the sedimentation problem in lower Toppenish Creek could be eliminated by the construction of a small impoundment on Mud Lake Drain which would function as a sediment trap and could also provide valuable waterfowl and wildlife habitat. Except for several culverts, which may slow upstream migration to some degree during low water, and the unscreened Durham diversion at RM 1.0, there are no significant passage problems in this reach of Toppenish Creek. The WIP diverts water from the creek at RM 3.6, but this diversion has recently been fitted with a state-of-the-art screen and ladder system.

Monthly mean flows near the mouth of Toppenish Creek (RM 1.7) for the period 1933-85 ranged from an average high of about 250 cfs in March to an average low of about 60 cfs in November (figure 3-12). The lowest monthly mean flow of record was 5 cfs in August 1976. Low monthly mean flows of less than 20 cfs, largely due to upstream diversions, can occur from July through September of dry years. Flows of 30-125 cfs are common during this period in 'average to wet years (Technical Data Appendix). Warm water temperatures are the most significant water quality problem in lower Toppenish Creek; 5 of 37 (14 percent) water temperatures collected at RM 1.7 during the period March 1981-August 1984 exceeded 65 °F, but none exceeded 70 °F (Appendix D). However, temperatures near the confluence of Simcoe Creek (RM 32.7) are lower; none of the measurements taken just downstream of the Simcoe Creek confluence during the summer of 1989 exceeded 65 °F (figure 3-13).

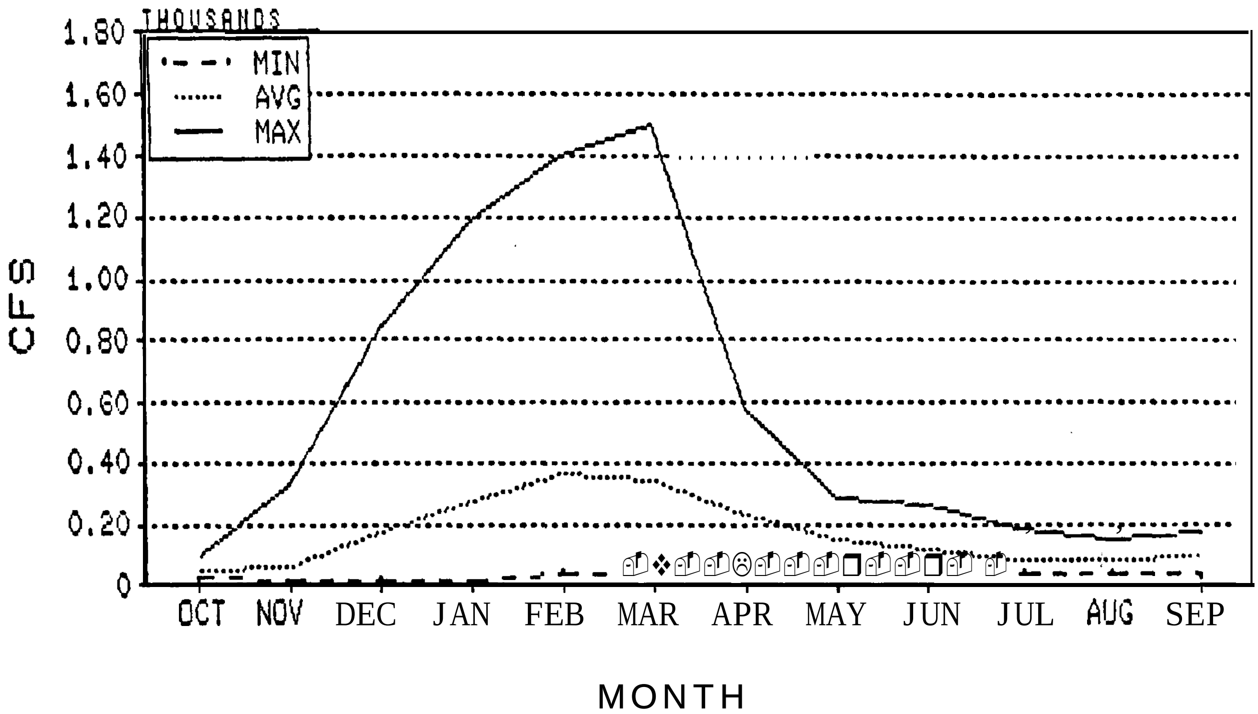


Figure 3-9. --Maximum, Average, and Minimum Monthly Mean Flows (CFS) of Satus Creek Near Highway 22 Bridge (RM 2.6), 1933-1985

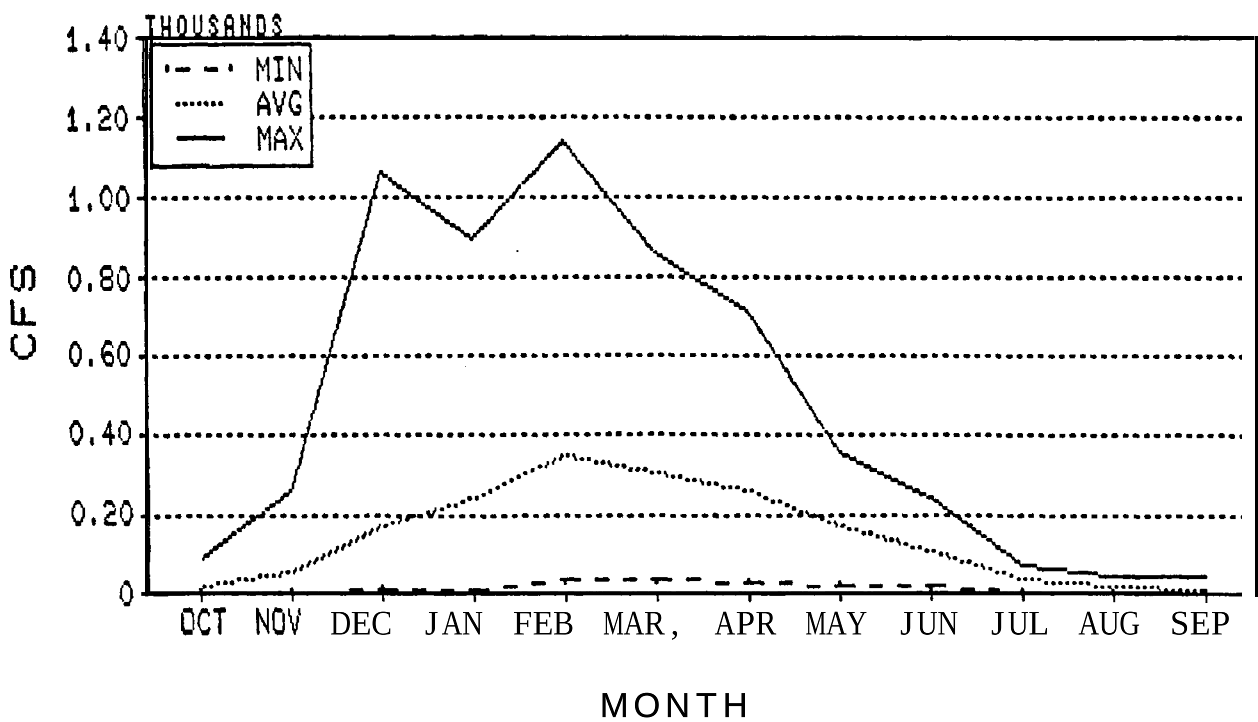


Figure 3-10. --Maximum, Average, and Minimum Monthly Mean Flows (CFS) of Upper Satus Creek (RM 19.7), 1932-1985

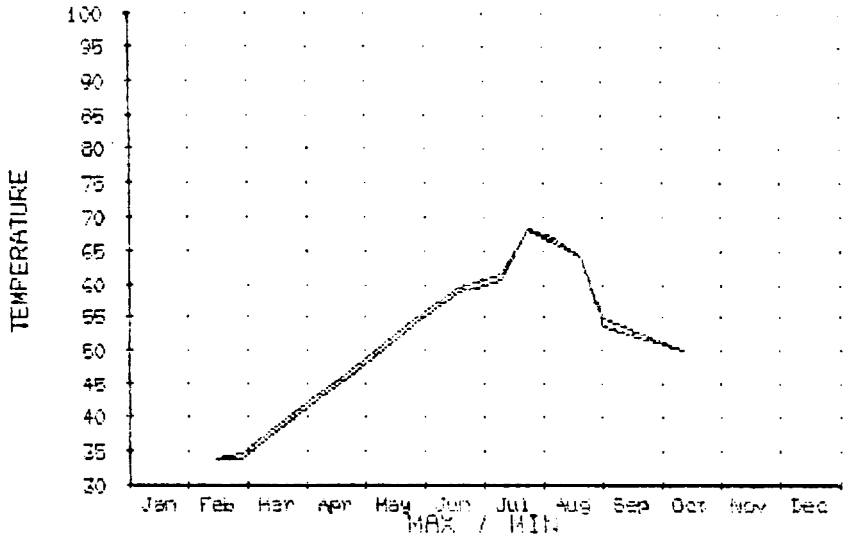


Figure 3-11.--Maximum and Minimum Water Temperatures ('F) of Lower Satus Creek Near Highway 22 Bridge (RM 2.6), 1989

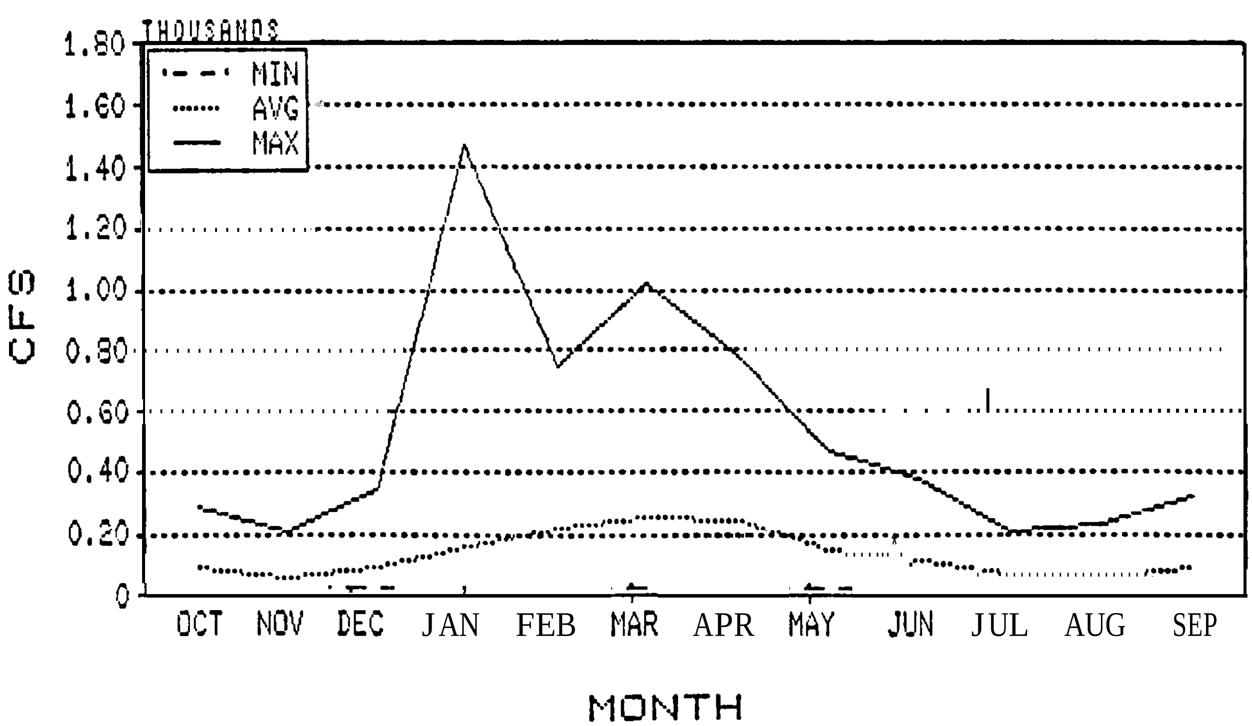


Figure 3-12.--Maximum, Average, and Minimum Monthly Mean Flows (CFS) of Lower Toppenish Creek (RM 1.7), 1933-1985

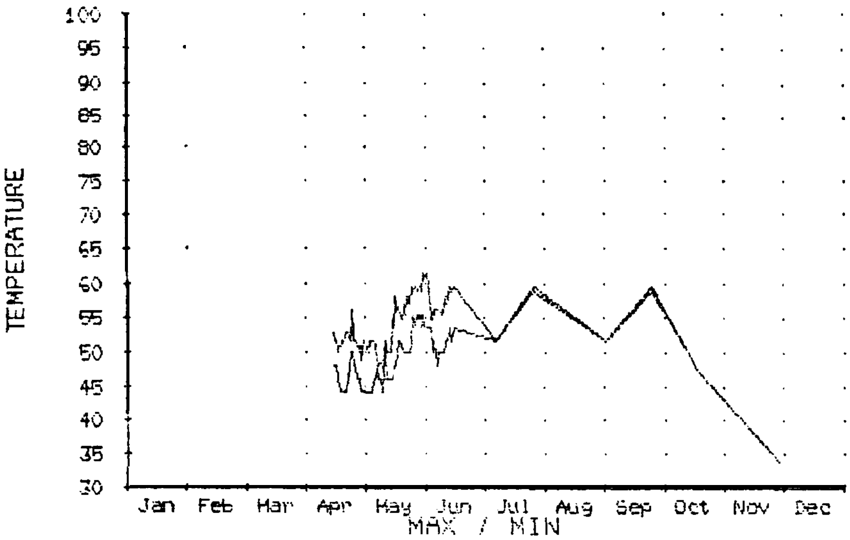


Figure 3-13. --Maximum and Minimum Water Temperatures ('F) of Toppenish Creek Just Below Simcoe Creek Confluence (RM 32.7), 1989

Wanity Slough, an 18-mile long collector drain for the WIP, empties into Toppenish Creek at RM 6.5. In addition to receiving irrigation returns, Wanity Slough diverts Yakima River water at a point just above Sunnyside Diversion Dam, and its discharge is not allowed to fall below 50 cfs to protect resident trout. If three gravity diversions were screened, Wanity Slough, one of its feeder drains, and the 11-mile long Lateral Drain Four could possibly be used for spawning and rearing by fall chinook and as off-channel winter refuges for migrant spring chinook and steelhead presmolts. The potential for establishing fall chinook populations in these drains appears good, as fall chinook have already been established in Marion Drain, another WIP collector.

In the next 12 miles of Toppenish Creek, from Simcoe Creek up to the WIP diversion for the Toppenish Lateral Canal (RM 44.2), the stream is diverted into many small channels for irrigation. These channels have adequate spawning gravel, but periodically go dry. The riparian corridor for a distance of 10 miles or more below the diversion has been impacted by a combination of overgrazing and channelization. This reach will constitute no more than a migration corridor for the foreseeable future. The WIP Dam is passable to adult steelhead at high flows because of a rock gabion backwater below it, and is equipped with new rotary screens. After mid-May, this diversion removes a substantial amount of the total flow from the creek. By June, Toppenish Creek dries up for a distance of 4 to 5 miles below the diversion because the bed was channelized following a flood in the late 1970's, and the new streambed is too permeable to prevent small flows from becoming subsurface. Also, in some years there is no spill over the dam.

The drying up of Toppenish Creek below the WIP diversion may not be as serious as it appears. Flows are adequate to pass the smolt outmigration in late February through late April, although fry and fingerlings dispersing downstream in the summer and early fall would be stranded in the dry streambed below the bypass, or would be crowded together in the creek just upstream of the dam. However, there is a remedy. The Toppenish Lateral Canal, a semi-natural ditch which supports a resident trout population, splits into two branches several miles below the diversion. One branch is a cul-de-sac, but the other ultimately drains into Simcoe Creek below the Agency Creek confluence. If screens were installed at the canal bifurcation to divert fry from the cul-de-sac, there would be a migration corridor on Toppenish Creek at all times. If the rotary screens at the diversion were lifted just before Toppenish Creek went dry below the dam, fry could move down the canal into a portion of Simcoe Creek that remains free flowing year-round, and ultimately back into Toppenish Creek.

The gabion backwater intended to provide upstream passage at the WIP Diversion Dam has suffered some structural damage since it was installed in 1986, and the gabions are more permeable than was anticipated. Consequently, the structure does not "back up" water as planned. There is now some doubt as to its ability to pass adults except at the highest flows. In its present condition, fall-run steelhead would probably not be able to pass the diversion until late November or early December; spring-run steelhead would, in many years, have to attempt passage before April. This structure should be replaced with a more permanent facility.

The remaining 25 miles of Toppenish Creek above the Toppenish Lateral Canal diversion, as well as the North and South forks of Toppenish Creek, maintain adequate flows for anadromous fish production year-round. Monthly mean flows above the Toppenish Canal (RM 44.3) for the period 1910-85 ranged from an average high of about 230 cfs in April to an average low of about 15 cfs in September (figure 3-14). The lowest monthly mean flow of record was 4.9 cfs in December 1927, but flows of less than 10 cfs are uncommon (9 of 76 years) (Technical Data Appendix).

Water quality in upper Toppenish Creek is excellent; all of the measurements collected from near Cook Road during the period March 1974-April 1974 met the aquatic life criteria (Technical Data Appendix). Spawning gravel is abundant and the riparian corridor is excellent except for a "patchy" section in the 11-mile reach from the Toppenish Lateral Canal to the confluence with the North Fork. The major problem for these upper reaches appears to be a fair number of culverts which are either perched or blocked. About 30 percent of the culverts in the upper Toppenish drainage (forks plus main stem) may impede passage.

Simcoe Creek, which enters Toppenish Creek at RM 32.7, has numerous problems but considerable potential. Simcoe Creek is nearly dry during the summer for the 4.5 miles upstream from Agency Creek (RM 9.5) to the WIP diversion at RM 14.0. Monthly mean flows in the creek below the WIP diversion (RM 13.9) for the periods 1909-23 and 1981-85 ranged from an average high of about 80 cfs in March to an average low of about 1 cfs in September (figure 3-15). Monthly mean flows averaged less than 5 cfs from July through November. The lowest monthly mean flow of record was 0.15 cfs which occurred during October 1921 (Technical Data Appendix). Discharge in the North Fork of Simcoe Creek is usually about twice that in the South Fork, but both usually carry less than 10 cfs from July through mid-October. Water quality in Simcoe Creek is generally good except for occasional warm water temperatures during summer; 2 of 37 (5 percent) water temperatures taken near the power station during the period March 1981-August 1984 exceeded 65 °F, but none exceeded 70 °F (Appendix D).

The WIP diversion on Simcoe Creek at RM 14 is unscreened and erosion below the diversion dam spillway has created a high "jump" which is a barrier to upstream passage at all but the highest flows. In addition, two diversions (the Hubbard and Hoptowit Ditches) in the first half-mile of the North Fork divert most of the water in the creek during the irrigation season and neither is screened. There is also one small unscreened diversion on the South Fork and a couple of small unscreened ditches on the North Fork. Although occasional dense stands of streamside trees provide a fair amount of shading and keep temperatures down, the riparian corridor along Simcoe Creek and its forks is heavily grazed and bank sloughing is significant.

Even with all its problems, the Simcoe system still produces some steelhead (YIN biologists counted 26 redds in a l-day survey of lower Simcoe Creek in April 1988). If all the diversions described above were screened, and if a ladder or gabion backwater were installed below the WIP diversion to facilitate upstream migration, the Simcoe Creek system could be a substantial steelhead producer. Steelhead production could be further enhanced if passage improvements were combined with a riparian restoration project and the construction of several small impoundments at the headwaters of the forks and the headwaters of Wahtum Creek to augment late summer instream flows.

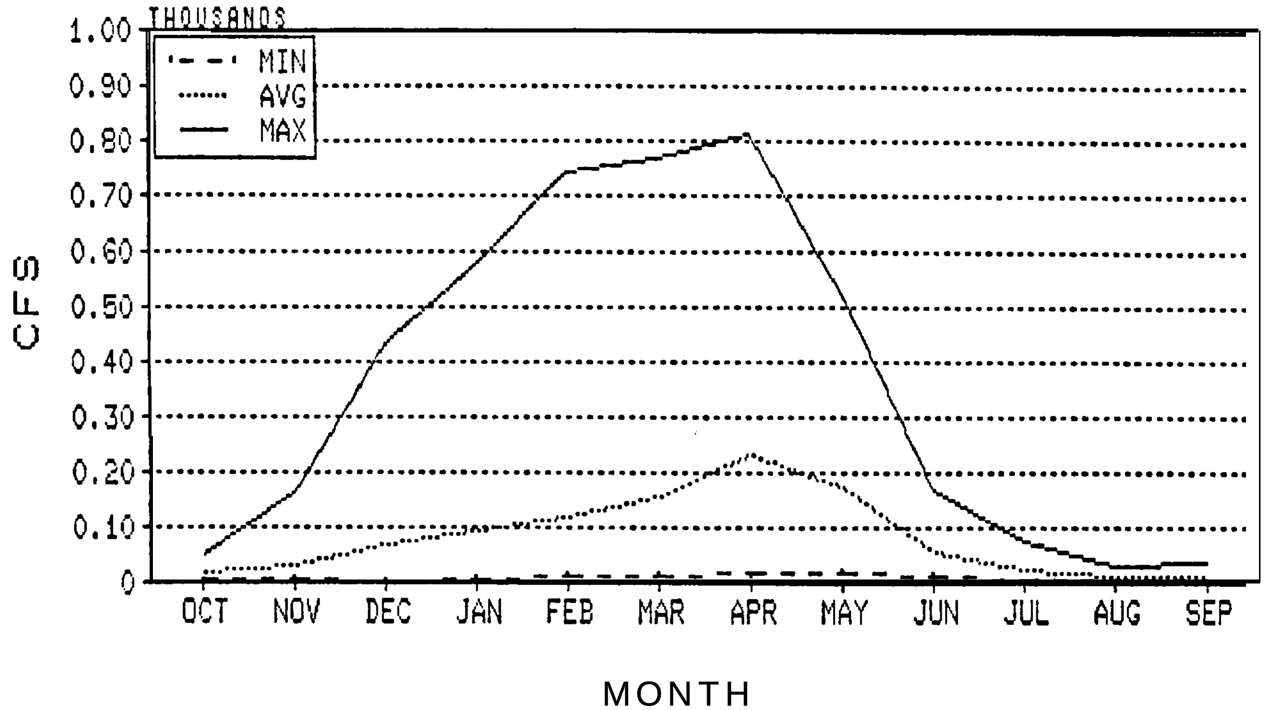


Figure 3-14.--Maximum, Average, and Minimum Monthly Mean Flows (CFS) of Toppenish Creek Above Toppenish Canal (RM 44.3), 1910-1985

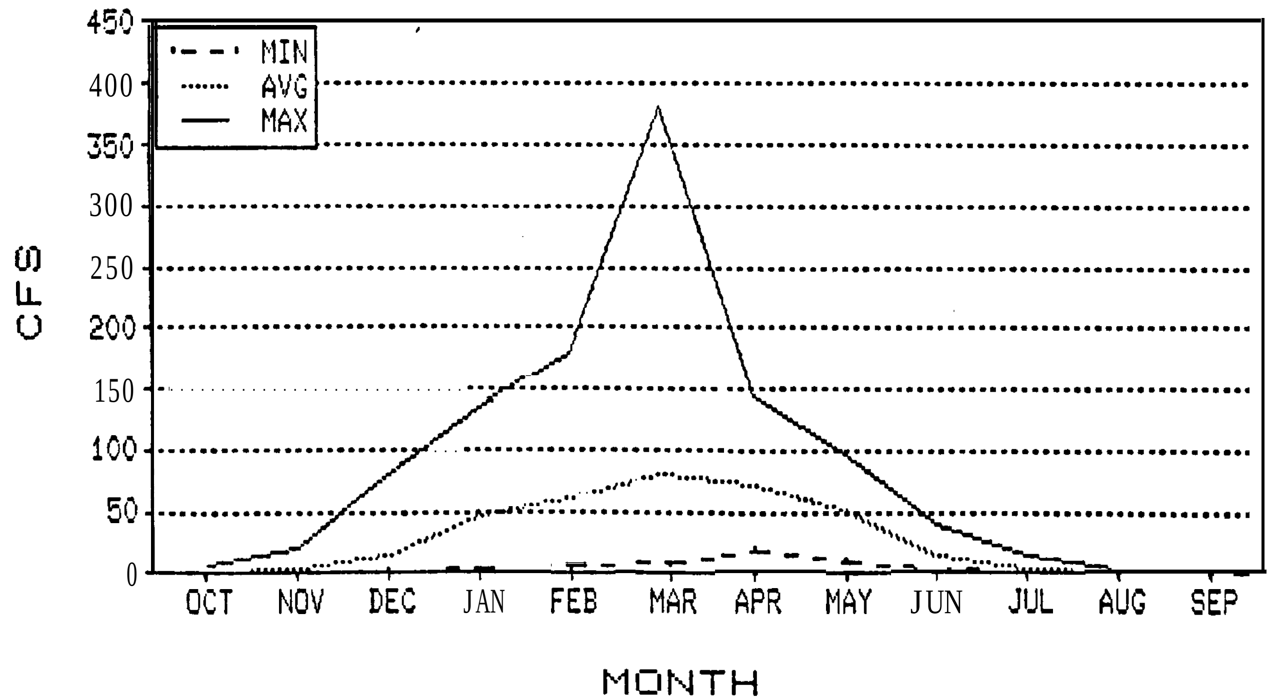


Figure 3-15.--Maximum, Average, and Minimum Monthly Mean Flows (CFS) of Simcoe Creek Below the Wapato Irrigation Project Diversion (RM 13.9), 1909-1923 and 1981-1985

Ahtanum Creek (61 Miles Including Forks)

Ahtanum Creek enters the Yakima River from the west (right bank) at RM 106.9. The gradient in the lower 8-9 miles of the creek is slight to moderate, and bank sloughing from overgrazing has caused the deposition of sand and mud. Good riparian vegetation is patchily distributed. Concrete dams divert water into side channels named Hatton Creek (RM 18.2) and Bachelor Creek (RM 18.9), which serve as irrigation conduits for the Ahtanum Irrigation District. Numerous pumps and small gravity ditches (1 cfs) divert water from these "creeks" during the irrigation season (April 15-July 10), and as water is shifted back and forth among the three channels, one or more of the three streambeds is frequently dry.

Monthly mean flows near the mouth of Ahtanum Creek (RM 0.6) for the period 1951-85 ranged from an average high of about 185 cfs in May to an average low of about 17 cfs in August (figure 3-16). Although low monthly mean flows of 7-10 cfs have occurred from July through October mean flows of 15-25 cfs are much more common (Technical Data Appendix). Still, a flow of only 2.4 cfs was measured near the mouth of Ahtanum Creek on September 1, 1989, showing that daily flows can vary significantly depending on the diversion pattern upstream.

Water quality in lower Ahtanum Creek is generally fair except for warm water temperatures; 8 of 73 (11 percent) water temperatures taken at RM 0.6 from March 1974-September 1981 exceeded 65 °F and 3 (4 percent) exceeded 70 °F (Appendix D). Further, temperature data collected during the summer of 1989 showed that daily maximums of 65-70 °F were common in July, and likely in August as well (figure 3-17). These temperatures would not preclude anadromous fish rearing but many juveniles may move downstream into the Yakima River for the summer months where water temperatures are more favorable.

Two large WIP diversions are located on Ahtanum Creek near Ahtanum village (RM 9.8) and Tampico area (RM 19.6). The upper facility diverts the entire stream from early mid-July through mid-October, and the streambed is dry downstream for a distance of 7 to 8 miles (to about RM 12), at which point ground water and irrigation returns recharge the stream. Discharge is usually substantial below the WIP diversions from mid-October through June. Until 1988, when a temporary rock backwater was constructed, the lower WIP diversion constituted a total passage barrier to spawning adults. Both of these diversions need permanent, state-of-the-art passage facilities and both are included in the Phase II passage facilities program [18]. There are two more small (2-4 cfs) unscreened diversions on Ahtanum Creek, one at about RM 22.9 (the Lesh Ditch), and one at RM 21.1.

Flows above the upper WIP diversion are excellent for anadromous fish production. Monthly mean flows at RM 20.8 for the period 1931-85 ranged from an average high of about 245 cfs in May to an average low of about 27 cfs in October (figure 3-18). The lowest monthly mean flow of record was 12.0 cfs which occurred in August 1977 (Technical Data Appendix). Water quality is also good in this upper portion of Ahtanum Creek with only 1 of 37 (3 percent) water temperature measurements taken during the period March 1981-August 1984 exceeding 65 °F and none exceeding 70 °F (Appendix D).

The North and South Forks join to form Ahtanum Creek at RM 23.1. The North Fork is about 23 miles long and the South Fork about 15 miles. There are two diversions on the North Fork, the moderate-sized (13 cfs) John Cox Diversion at RM 3.0, and the small (2 cfs) Shaw-Knox Ditch at RM 2.0. The South Fork has one small (2 cfs) diversion located about RM 3.0.

Water quantity, water quality, riparian conditions, and substrate are good to excellent in the 25-30 miles of tributary stream above Tampico. Flows in the North Fork ranged from 13.5-14.9 cfs during the summer of 1989 whereas flows in the South Fork ranged from 4.6-5.4 cfs (Technical Data Appendix). Water temperatures in both forks during the summer of 1989 were excellent for anadromous fish rearing ranging from 49-63 °F. Except for passage and flow problems associated with the downstream diversions, Ahtanum Creek would probably be a major steelhead producer under present conditions.

Wide Hollow Creek (22 Miles)

Wide Hollow Creek enters the Yakima River from the west (right bank) at RM 107.4. This stream flows through the city of Yakima and its surrounding orchards, and suffers from many of the problems typical of urban (leaking septic tanks, miscellaneous storm sewer pollution) and agricultural (elevated pesticide concentrations) streams. In addition, a mill dam constructed in 1869 at RM 0.6 totally blocked upstream migration until it was made passable with Alaska steep pass laddering in October 1989 by the WDF. Coho salmon were subsequently observed spawning in the creek upstream of the dam in November 1989. Wide Hollow Creek was recently selected by the State of Washington as a Centennial Salmon Stream and will be targeted for fish habitat improvements by the WDF and local citizen groups.

Wide Hollow Creek provides a surprising amount of good habitat. Summer instream flows are good, ranging from 30-50 cfs in the lower 4 miles to 1-3 cfs near RM 14.0, and summer water temperatures are in the mid-1950's. Except for several small reaches near the mouth (RM 0.2-0.6 and RM 1.3-2.5), where there has been some bank sloughing, the riparian corridor is in excellent condition; clumps of willows provide patches of heavy shading interspersed with sunny areas with abundant overhanging grasses and undercut banks. Pools and runs are fairly deep (2 feet or more) and are more frequent than riffles. Within areas of heavy residential development, the stream tends to be deeply incised, and shaded by dense foliage on the tops of steep banks. A number of debris jams occur in such areas, one of which (RM 3.5) constituted a migration barrier until it was removed by the WDF in March 1989. The overall impression of the stream is that it would provide good coho and steelhead rearing habitat in many reaches, but spawning gravel may be in short supply. Small-scale adult and/or juvenile passage facilities are needed on four diversions (RM 1.3, 2.1, 4.7, and 8.2) to make 10-11 miles of the creek fully available to salmon and steelhead.

The major problem to anadromous fish production in Wide Hollow Creek is water quality. The Washington Department of Ecology surveyed the creek in July 1987 and found high evening water temperatures, suboptimal oxygen concentrations, and high fecal coliform concentrations in some reaches [7] (Technical Data Appendix). These problems could be solved by a riparian habitat restoration program and more vigorous enforcement of existing laws regarding point and nonpoint sources of pollution.

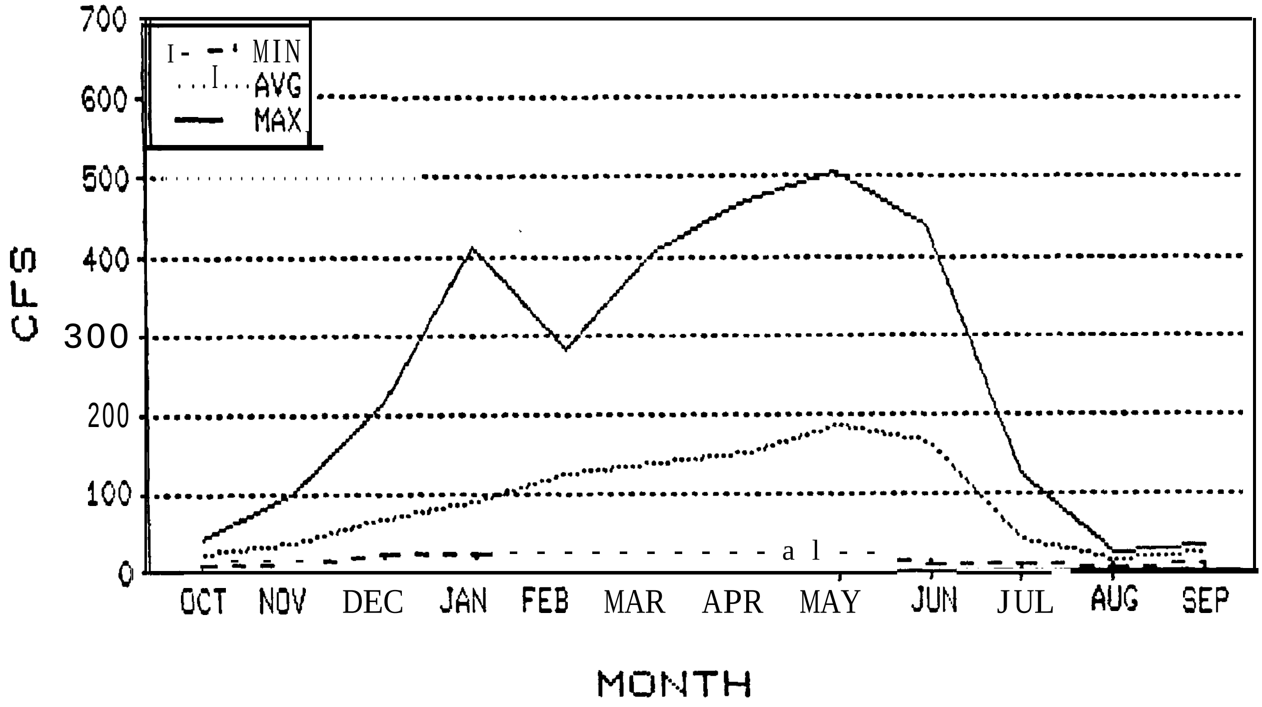


Figure 3-16. --Maximum, Average, and Minimum Monthly Mean Flows (CFS) of Lower Ahtanum Creek (RM 0.6), 1951-1985

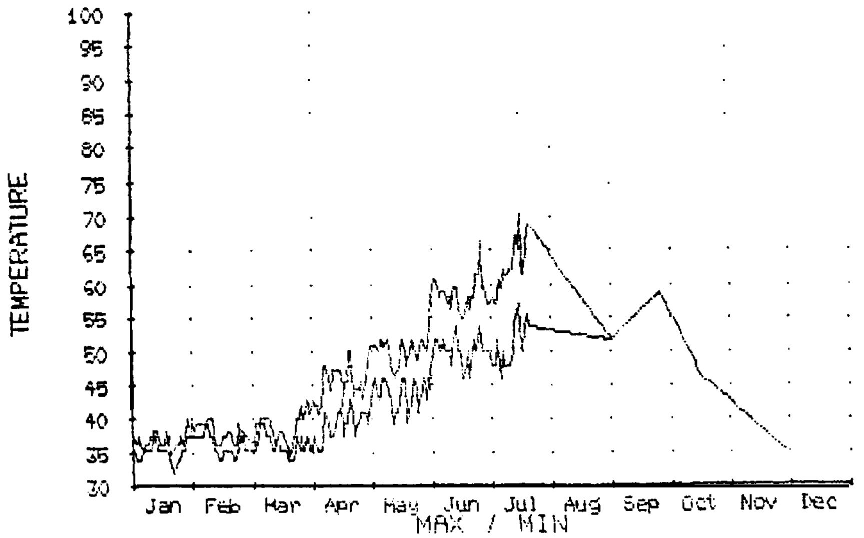


Figure 3-17. --Maximum and Minimum Water Temperatures (°F) of Lower Ahtanum Creek (RM 0.6), 1989

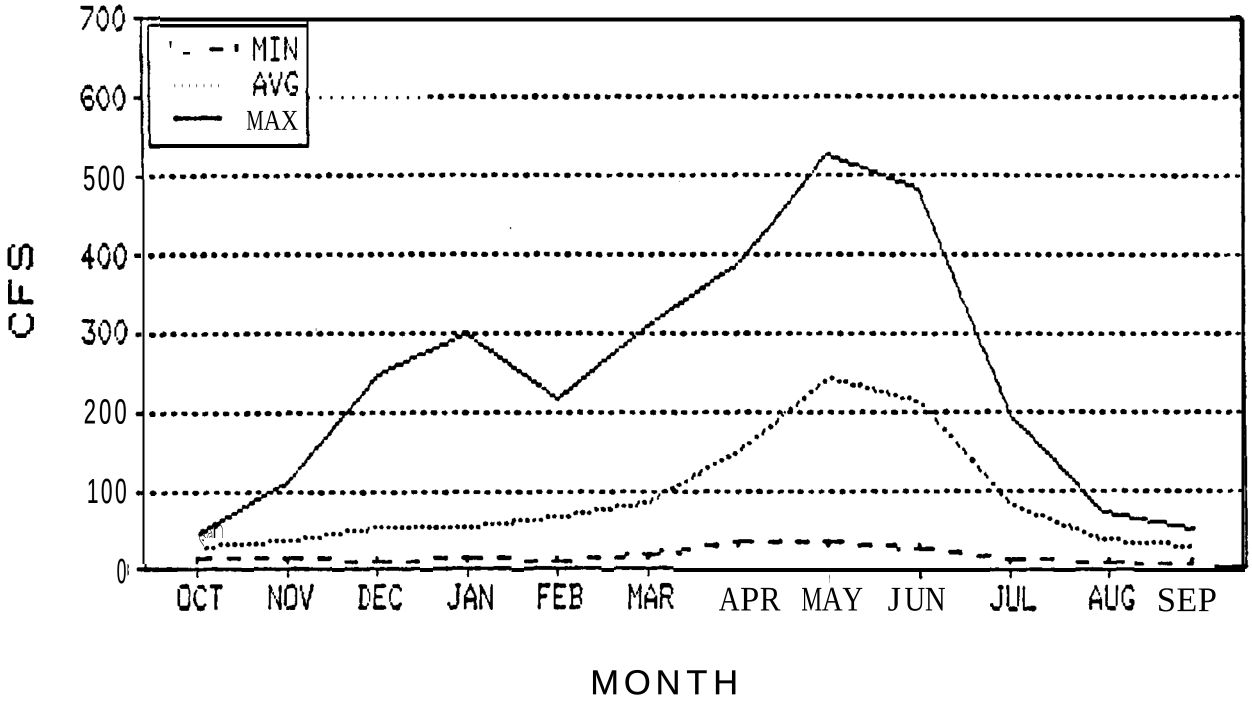


Figure 3-18.--Maximum, Average, and Minimum Monthly Mean Flows (CFS) of Upper Ahtanum Creek (RM 20.8), 1931-1985

Wenas Creek (14 Miles to Wenas Dam)

Wenas Creek enters the Yakima River from the west (right bank) at RM 122.4. This creek suffers from heavy irrigation diversions, which usually dry up the lower 9 miles of the creek, and from severe riparian damage, which results in summer water temperatures above 80 °F in the reaches that have some water. Because the small size of the watershed limits the potential for storing additional water to augment instream flows and because Wenas Creek is already over appropriated for irriqation, it has virtually no potential for production of anadromous salmonids in the near term.

Umtanum Creek (16 Miles, 8 Miles Below Falls)

Umtanum Creek enters the Yakima River from the west (right bank) at RM 139.8, and flows through rugged and arid terrain in the 8 miles below an impassable falls. In this reach there is no development and the adjacent range land is only lightly used. Accordingly, the deciduous and brushy riparian habitat is nearly pristine. The stream channel is stable with only occasional signs of high seasonal runoff (none recent). In August 1988 stream temperatures were acceptable, ranging from 55 to 61 °F. Rearing habitat for coho and steelhead was judged excellent, spawning gravel was present in all areas surveyed, and was abundant in some areas. No irrigation diversions were observed. A good run of coho is reported to have used this stream prior to the construction of Pomona Dam in the late 1300's.

The primary limiting factor for this stream is the small amount of available habitat. Flows of barely 1 cfs were estimated in the lower and middle part of the accessible reaches in August 1988, and in the section between RM 0.5 and 0.8 flows were intermittent. The only physical impediment to anadromous salmonids is a wire basket-gabion at RM 4.9 that stabilizes a road crossing (Old Durr Road). At high flows this structure would be passable to some migrants, but at lower flows it constitutes a total barrier.

The riparian zone is overgrazed upstream of the falls and the stream dries up above RM 10. A small impoundment in this area, or perhaps a riparian improvement project, might generate enough additional summer flow to increase productivity in the creek below the falls.

Wilson Creek System

Wilson Creek enters the Yakima River from the east (left bank) at RM 147.0. Naneum and Coleman Creeks have been channelized and diverted into lower Wilson Creek and no longer have natural mouths. All streams in this system are heavily diverted on the valley floor and have been channelized into an intricate drainage/irrigation system. There are over 200 unscreened diversions on this system. The riparian zone of the valley portions of these streams is heavily impacted by grazing and other agricultural activities. Although Wilson, Naneum, and Coleman Creeks flow through timbered canyons with good year-round flows in their upper reaches, the major problem with these streams is access to and from the headwater areas. The probability of rectifying passage problems of such magnitude in the short-term future is remote. Therefore, the upper Wilson/Naneum system appears to have little potential for anadromous fish production at the present time.

One surprising aspect of the Wilson system discovered during stream surveys was that the lower 7.8 miles of the system appear to offer good habitat for anadromous salmonid rearing. Nearly all reaches in lower Wilson Creek offer artificially dredged, ditch-type habitat with sand or silt substrate and grassy banks with deciduous trees. However, the gradient is slight and water is l-3 feet deep or deeper. The depth, as well as some overhanging or floating vegetation, provides some instream cover. Stream channels and banks are very stable and mid-September 1988 water temperatures were in the fifties. A diversion at RM 7.8 (Bull Ditch Diversion) needs a barrier to prevent upstream movement into the heavily diverted upper portion of the system.

The lower portions of several tributaries to lower Wilson Creek, i.e., Naneum Creek, Cherry Creek, Coleman Creek, and Wipple Wasteway also contain good flows. Like lower Wilson Creek, most of the lower reaches in these tributaries are artificially dredged, ditch-type habitat with grassy banks and silt or sand substrate. But unlike lower Wilson Creek, much of the flow in these streams contains heavy sediment loads from returning agricultural wastewater. Habitat value for salmon and steelhead rearing in these streams appears limited at the present time or at least not nearly as good as in lower Wilson Creek.

Manastash Creek (40 Miles Including Forks)

Manastash Creek enters the Yakima River from the west (right bank) at RM 154.5. The creek branches at RM 8.5 into the 12-mile-long North Fork and the 20-mile-long South Fork. The lower 5 miles of the main stem flow through fields and pastures. Eight diversions downstream from RM 5.7 presently restrict anadromous fish production in this stream. Many miles of excellent spawning and rearing habitat remain relatively undisturbed above the diversions but are presently inaccessible because of both upstream and downstream passage problems. Despite the diversions, some positive habitat features still remain in the lower portion of the stream and spring chinook redds have been observed near the mouth several times in the past 5 years.

Vegetation and streambank cover are favorable to salmonid production in nearly all areas of the main stem. The North and South Forks flow through forested lands where the riparian corridor is nearly pristine. Current logging activity is restricted to the highest parts of the drainage and does not appear to have impacted the stream significantly. Except for a l-mile stretch of grazed riparian habitat between RM 2.0 and 3.0, agricultural activity along the main stem consists primarily of crop production, with little effect on streamside vegetation. Trees and brush are dense along the lower several miles of the main stem and in the lower 1.5 miles, often form a complete canopy over the stream. The riparian corridor remains in good condition even along reaches that are seasonally dewatered. Both the streambanks and channel of the creek and its forks appear to very stable. Instream habitat is diverse ranging from high gradient riffles to pools. Spawning habitat ranges from reaches with adequate "patch gravel" to reaches in which gravel bars are numerous.

Flows in Manastash Creek above the diversions are adequate for anadromous fish production ranging from a high of 96 cfs in June 1989 to a low of 7.8 cfs in September 1989 near the Lazy F Ranch (figure 3-13). Water temperatures were excellent, ranging from 45 to 50 °F during the same period (Technical Data Appendix).

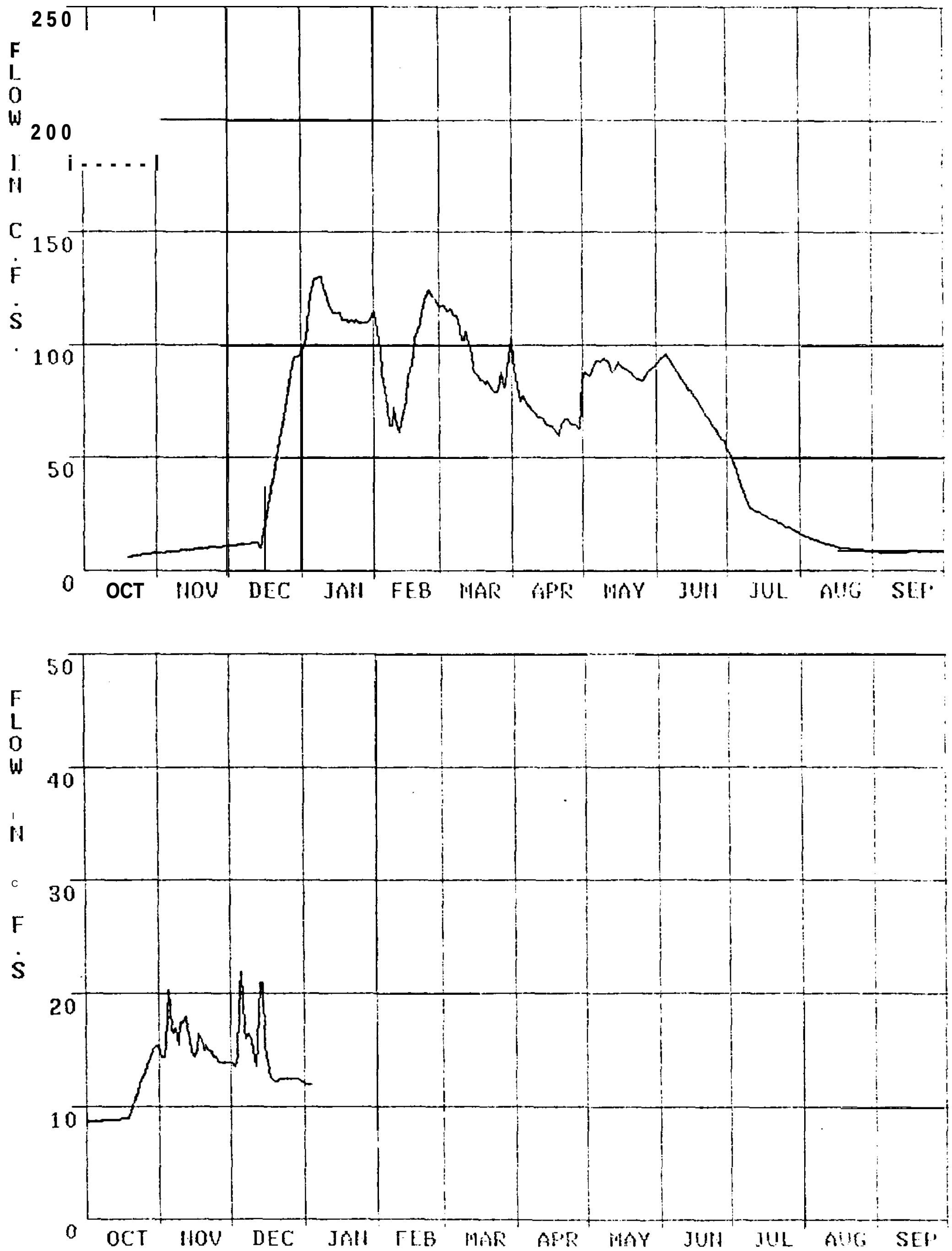


Figure 3-19.--Daily Flows (CFS) of Manastash Creek Near the Lazy F Ranch, December 1988-January 1990

Three factors currently limit Manastash production: adult migration barriers, unscreened ditches, and low streamflows. Four diversion dams on the main stem are partial or total barriers to migrating adults. The upper Anderson diversion (RM 3.0) is concrete with large riprap at the base. With a head of 8 feet this dam is a total barrier at all flows. The Reed diversion (RM 5.1) is formed by a broad concrete sill across the stream that backs up about 5 feet of water. The structure may be passable at high flows, especially by steelhead but, nevertheless, a fishway or other passage structure is needed if upper reaches are to be fully accessible to steelhead and salmon.

Steelhead and coho can probably negotiate the lower Anderson diversion (RM 1.3) and the Keach-Jenkins diversion (RM 5.6) at higher flows, however, both structures should be rebuilt to provide unrestricted passage. None of the ditches diverting from Manastash Creek are screened.

Manastash Creek was totally dry between RM 1.5 and 3.0, and between RM 3.3 and 4.9 in August 1988. All other flowing reaches downstream of the uppermost diversion (the Manastash Ditch, RM 5.7) carried a less-than-natural discharge. Daily flows can vary significantly near the mouth depending on the amount of diversion upstream; flows varied between 3.6 and 22.9 cfs during the summer of 1989 but a period of no flow was noted during the fall of 1988 (Technical Data Appendix). Even with the periods of very low flows, water temperatures near the mouth during the summer of 1989 were adequate for salmonid rearing (figure 3-20).

Three branches of the Kittitas Reclamation District (KRD) delivery system intersect the main stem at RM 5.5, 3.3, and 1.4. These points of intersection provide the basis for a possible solution to the instream flow problem. The streambed is presently used at two locations to deliver KRD water; water enters at RM 3.3 and is removed at RM 3.0 and enters again at RM 1.5 to be removed at RM 1.4. Except for these "conduit reaches" the stream is often dry during summer between RM 4.9 and 1.4. A potential solution to the flow problem would be to augment streamflows from the South Branch Canal at the uppermost KRD crossing. Alternatively, a small impoundment could be built near the headwaters of the North or South Fork. Some streambed rehabilitation may be needed with either alternative.

Taneum Creek (34 Miles Including Forks)

Taneum Creek enters the Yakima River from the west (right bank) at RM 166.1. There are four diversions on the main stem at RM 1.6, 2.4, 3.2, and 3.4. The KRD South Branch Canal drops water into the creek at RM 2.6 most of which is removed at the Taneum Ditch diversion at RM 2.4. The North and South Forks of the Taneum branch from the main stem at RM 12.7 and are 12 and 9 miles long, respectively. Taneum Creek has substantial potential for producing steelhead and coho and, to a lesser degree, spring chinook. The stream supported good runs of coho prior to the construction of Taneum Ditch in 1910. A vestigial run of steelhead may still exist in the Taneum and spring chinook juveniles are known to rear in the lower reaches.

The riparian corridor on the main stem is generally in good condition, with deciduous vegetation in the lower valley and progressively more coniferous cover upstream. Except for cropland in the valley, which has little impact on streamside vegetation, the drainage is largely undeveloped. Riparian conditions on the North and South Forks are excellent and instream cover in the form of LOD and boulders is abundant. Logging occurs at the highest elevations of the drainage but so far has not appreciably affected the stream. The stream channel is stable in most places but dry gravel bars in a number of locations indicate that seasonal runoff may occasionally be high. Stream gradient is moderately steep in the lower reaches and the substrate is composed primarily of rubble. Patches of good spawning gravel are abundant and are more than adequate to satisfy spawning needs. The gradient tends to limit pool frequency making the habitat relatively more suitable for steelhead than for coho.

Flows in Taneum Creek above the diversions are adequate for salmonid rearing with daily average flows during the period December 1988-January 1990 ranging from a high of 106 cfs in May 1989 to a low of 5.1 cfs in September 1989 (figure 3-21) (Technical Data Appendix). Water temperatures were excellent above the diversions during the summer of 1989 ranging between 44 and 55 °F.

The installation of juvenile screen/bypass systems and adult passage facilities at all of the Taneum diversions was completed in 1989 as part of Phase I of the Yakima basin fish passage facilities program. However, a wastewater return below the Bruton diversion could represent a false attraction flow and may need a barrier.

The largest remaining constraint to anadromous fish production in the Taneum system, particularly in regard to spring chinook, is low summer and fall flows in the lower 3.3 miles of the main stem. Flows near the mouth varied from 1.5 to 7.5 cfs during the summer of 1989, but a period of no flow was noted in February 1989. Because of the low flows, summer water temperatures near the mouth may also be a problem. A recording thermograph placed near the mouth of the stream during the summer of 1989 recorded several daily maximum temperatures above 65 °F and a few exceeded 70 °F (figure 3-22).

Low flows in the lower main stem could be augmented by flows from the KRD Canal at RM 2.6 or a small impoundment could be built near the headwaters of the north or south fork. Either provision, along with protection of riparian vegetation, would reduce the warm water problem.

Swauk Creek (24 Miles)

Swauk Creek enters the Yakima River from the north (left bank) at RM 169.9. It has two sizable tributaries, Williams Creek at RM 11.0 and Iron Creek at RM 17.3.

Although the drainage area is fairly large (100 square miles), precipitation is minimal and summer streamflows are naturally very low. The lower 2-3 miles are in an arid canyon where the gradient is steep and the streambed consists of large rock and boulders. This reach is dry in summer and flows are very low or intermittent as far upstream as RM 5.0. The stream enters a forested zone at RM 8.0 and above this point flows are marginally adequate during the summer. The riparian corridor is generally good above RM 3.0 and the streambed appears stable throughout. The substrate above RM 3.0 consists mostly of coarse rubble, with a patchy distribution of gravel suitable for steelhead or coho spawning. Water temperatures in the perennial reaches were in the upper fifties in August 1988, but reached the midsixties in the intermittent reaches and pools.

There are only two active irrigation diversions on the creek. Both are near RM 7.0, are relatively small and do not appear to impact downstream flows significantly. They do, however, need to be screened. In addition, there are several small pumps used for domestic purposes along the creek. Also, a large amount of recreational gold mining (suction dredging) and a smaller amount of professional placer mining occurs above Liberty (RM 11.0). The affect of this activity on potential anadromous fish populations might be significant but could be regulated by existing Hydraulics Project application procedures.

Swauk Creek was a substantial producer of steelhead and coho in historic times. The stream is too steep, narrow, and shallow for spring chinook production, and there are no records that it ever supported a run of chinook. Spawning coho were observed in the creek as late as the early 1960's, and a vestigial run of steelhead may still exist. At the present time, naturally occurring low summer flows throughout the system and the absence of flows in the lower 3-5 miles in the fall limit steelhead production, and totally preclude coho production. A small (3,000-5,000 acre-foot) impoundment near the headwaters could rectify this situation.

<u>Teanaway River (61 Miles Including Forks)</u>

The Teanaway River enters the Yakima River from the north (left bank) at RM 176.1. The Teanaway is the second largest Yakima tributary with a drainage area of about 200 square miles. There are 11.7 miles of main stem and three forks--the North Fork (19 miles), the Middle Fork (15 miles), and the West Fork (15 miles). The WDF has identified 17 diversions on the Teanaway system that have juvenile screening facilities. Nearly all of these structures have temporary gravel berms which wash out during high water; none have permanent diversion structures. The WDF previously maintained these screens but has not done so since 1983. All of the presently active diversions have been identified as Phase II passage improvement projects [18].

The first 10 miles of the Teanaway flow through a broad valley. This section of the valley consists mainly of hay fields and is heavily irrigated. As natural runoff declines during summer and fall, the flows through this reach drop dramatically, and by September and October the lower river is often dry or nearly dry. The riparian zone, however, is in fairly good condition structurally as streamside hay production takes precedence over grazing. The major riparian problems in this lower reach are seasonal lack of overhanging vegetation and LOD. The instream habitat also suffers from the disturbances associated with the annual berming of irrigation intakes.

Simulated monthly mean flows near the mouth of the Teanaway for the period 1926-77 range from an average high of about 870 cfs in May to an average low of about 90 cfs in August (figure 3-23). However, periods of no or very low flow are common near the mouth from July through October. In 1989, flows during the period August 2-October 19 ranged from 10.0 to 19.2 cfs

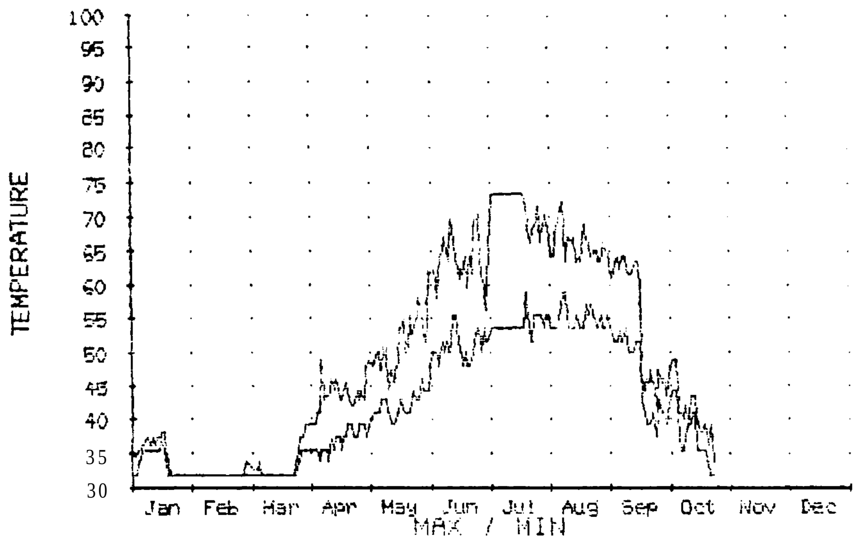


Figure 3-22.--Maximum and Minimum Water Temperatures (°F) of Taneum Creek Near the Mouth, 1989

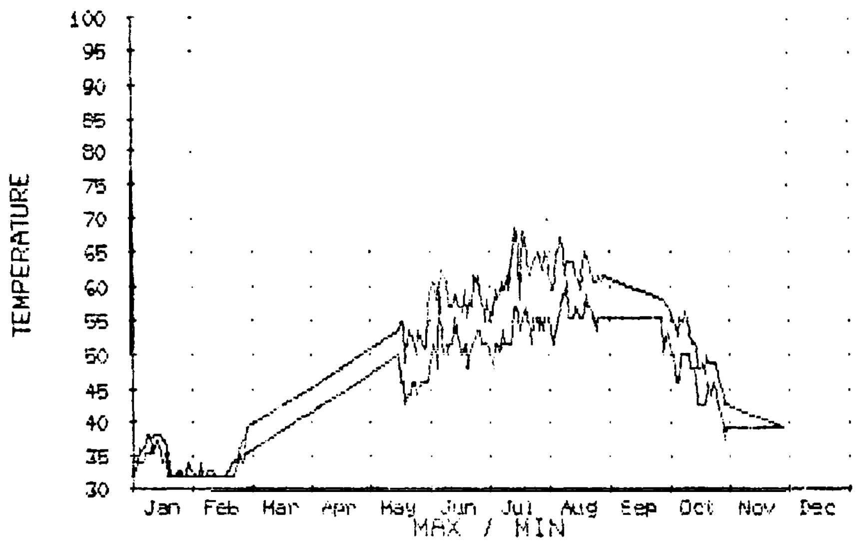


Figure 3-20.--Maximum and Minimum Water Temperatures ('F) of Manastash Creek Near the Mouth, 1989

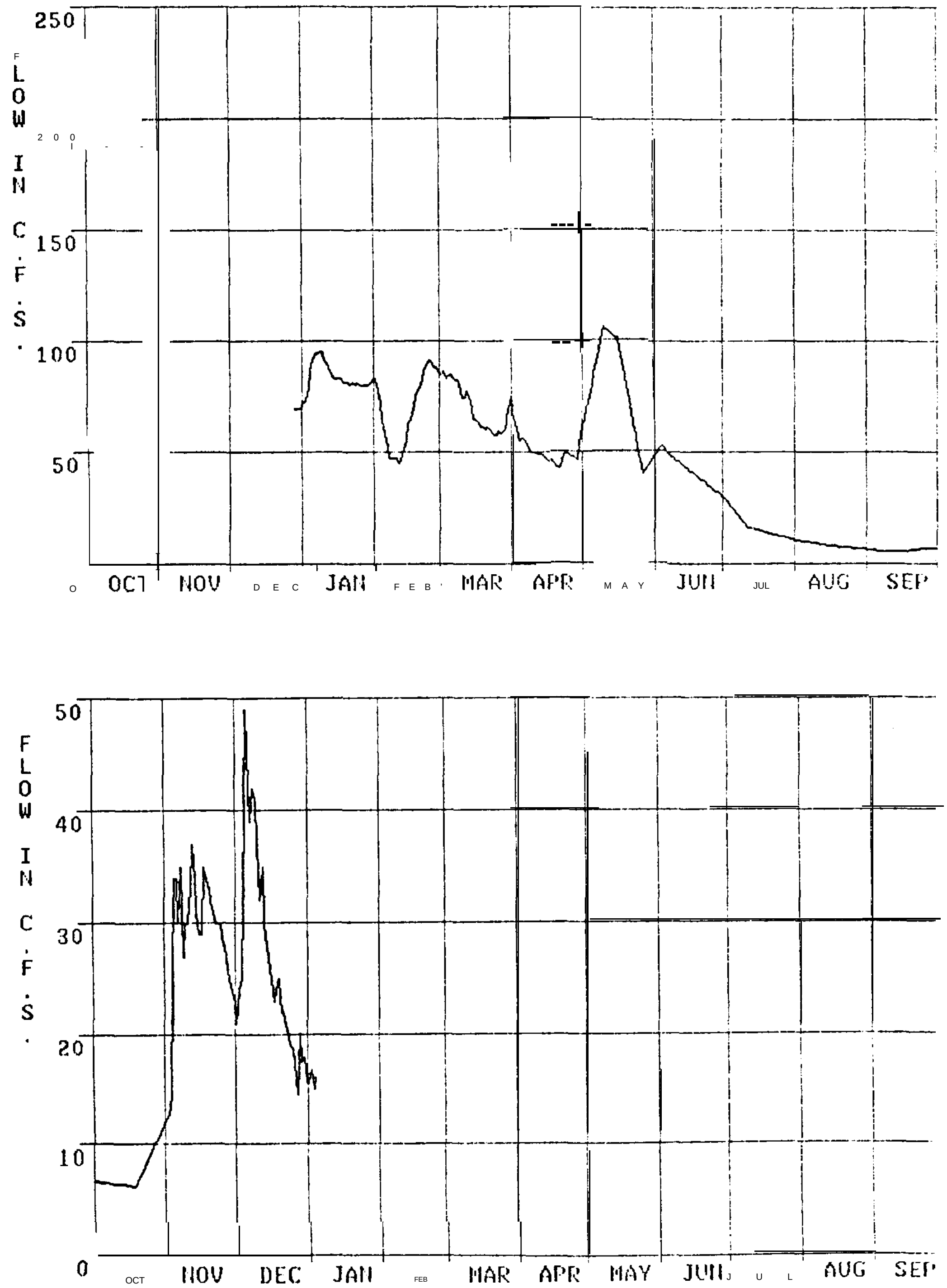


Figure 3-21. --Daily Flows (CFS) of Taneum Creek Near the U.S. Forest Service Guard Station, December 1988-January 1990

(Technical Data Appendix). These low fall flows currently preclude significant spring chinook spawning in the Teanaway system. Even when the lower river does not dry up completely, flows are well below the minimum needed for salmon passage to upstream spawning areas in most years. Steelhead, however, encounter good passage flows in the spring. Some spring chinook may also move through to upstream areas during late spring - early summer.

As the river recedes and is diverted in summer and fall, the flowing water moves farther and farther from the streambank and warms considerably from the lack of shading. A recording thermograph placed near the mouth during the summer of 1989 noted several daily maximum temperatures above 70 °F in July and August, and one daily maximum of 80 °F (figure 3-24). Other than the warm water temperatures, water quality in the lower Teanaway is very good with only an occasional turbidity or dissolved oxygen variance from the aquatic life criteria (Appendix D).

Of the three tributaries, the North Fork carries most (about 80 percent) of the summer flow (Technical Data Appendix). For the period December 15, 1988-January 2, 1990, daily average flows in the North Fork ranged from a high of 434 cfs in April 1989 to a low of 13 cfs September and October 1989 (figure 3-25). Summer flows also appear adequate for salmon and steelhead rearing through perhaps 4-5 miles of the West Fork and 8-9 miles of the Middle Fork. In all three forks the condition of the riparian corridor is generally good, although widespread logging and grazing have had some impact. Water quality in the upper Teanaway system is excellent; none of the temperatures taken during the summer of 1989 in any of the forks exceeded 60 °F and all of the water quality measurements taken during the period February-April 1981 met the aquatic life criteria (Technical Data Appendix).

The Teanaway was historically a substantial producer of spring chinook, steelhead, and coho. Even now, a few spring chinook spawn in the lower river and apparently in the North Fork as well--juvenile spring chinook were found in the North Fork in 1988 by YIN biologists. A vestigial run of steelhead still persists in the system. If a number of significant problems were corrected, its physical diversity and size guarantee that the Teanaway could still be a major producer of anadromous fish. Suitable spawning gravels are present in most reaches of the main stem and the lower portions of the forks, and are abundant in many areas. The upper reaches of the forks, as well as the lower reaches of some smaller tributaries, provide additional habitat for steelhead and coho. There is a good mix of pools, runs, and riffles, and the channels and banks are generally stable, although broad-based channels and dry gravel bars have resulted from high seasonal runoff. Several irrigation ditches provide excellent rearing habitat between the intake and bypass with excellent riparian cover and complete bank and channel stability. The length of these potential "rearing canals" ranges from yards to nearly a half mile and collectively represent a significant component of possible rearing habitat.

In decreasing order of importance the main factors currently limiting production in the Teanaway system are low flows during the summer and fall in the lower main stem, inadequately screened diversions, impaired adult passage at many gravel diversion berms, and a "flashy" runoff pattern which has

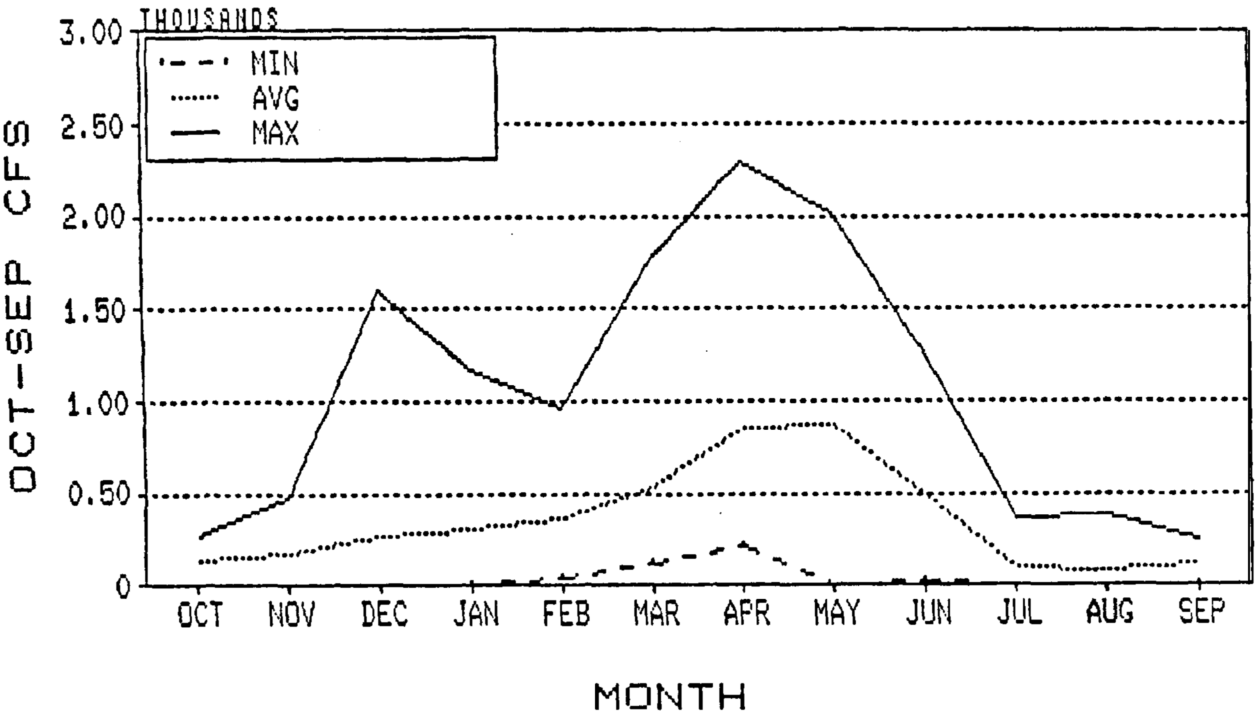


Figure 3-23.--Simulated Maximum, Average, and Minimum Monthly Mean Flows (CFS) of the Teanaway River Near the Mouth, 1926-1977

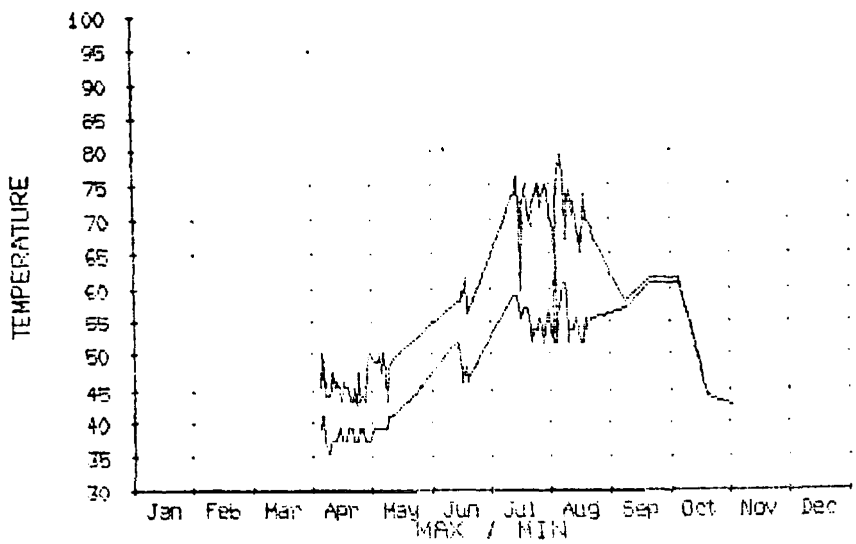


Figure 3-24.--Maximum and Minimum Water Temperatures ("F) of the Teanaway River Near the Mouth, 1989

widened the streambed and generated a fringe of riparian vegetation that cannot provide shade or cover when the stream shrinks in the summer and fall.

A solution to the instream flow problem of the lower Teanaway might involve buying water rights from willing sellers, if Washington water law is changed to accommodate such purchases, and/or constructing small impoundments at the headwaters of the forks. Judging from the use patterns of diversions there are indications that some individuals, particularly in the upper valley, are abandoning farming. Of 17 diversions investigated in August 1988, 8 were not operating when inspected and 4 (two on the main stem and one each on the Middle and West Forks) were presumed inactive. The possibility of buying water rights in the upper Teanaway valley thus merits investigation. Small headwater impoundments would also rectify the instream flow problem, and could contribute additional irrigation water to agricultural operations as well.

Temporary gravel berms restrict passage and would probably do so even with substantially increased flows. These berms are made of coarse streambed material and water usually flows right through them. Negotiable spills are therefore reduced or eliminated. This problem could be eliminated by the construction of permanent concrete facilities with notches or backwaters for adult passage. Projects of this type are currently included in the Phase II passage improvements program.

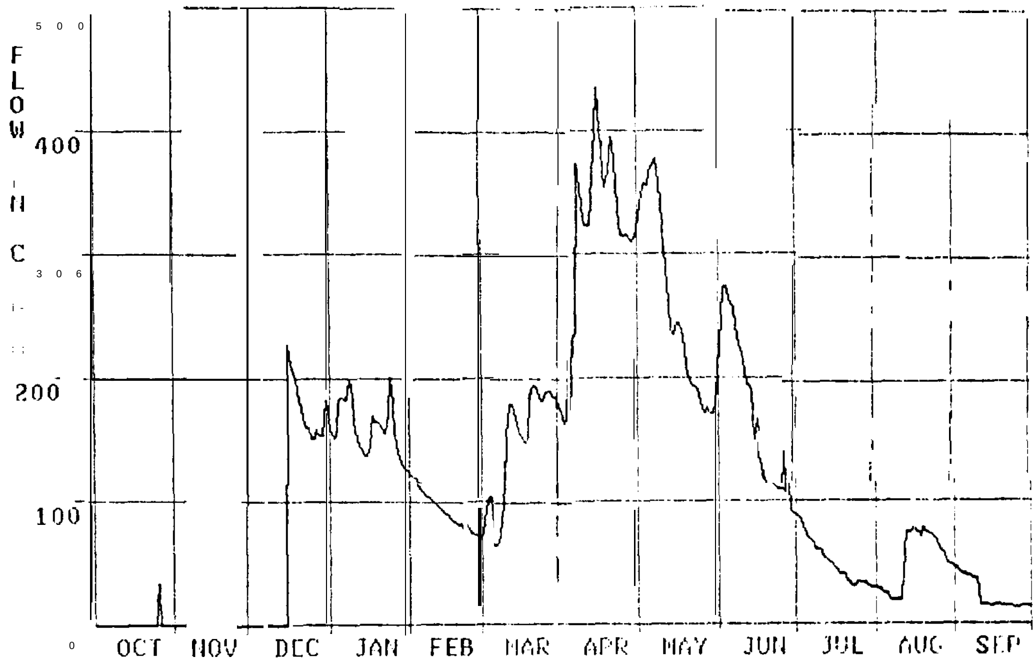
Cle Elum River (7 Miles)

The Cle Elum River enters the Yakima River from the north (left bank) at RM 185.6. Below the impassable barrier of Cle Elum Dam, (RM 8.2), the river runs through forested land, and the riparian corridor is in generally good condition. Although much of the substrate is made up of large rocks, there are adequate gravel bars for spawning. There is one small diversion on the Cle Elum that needs to be screened. Anadromous fish use of the Cle Elum River below the dam is for spawning and rearing by spring chinook and steelhead.

Flows in the Cle Elum River are too high during summer for optimal rearing due to releases for irrigation, but are generally adequate during the rest of the year. Reclamation maintains minimum flows in the river of 150 cfs through winter for incubation of spring chinook redds in conformance with the Quackenbush Decision [16]. Simulated monthly mean flows below the dam for the period 1926-87 range from an average high of about 2,465 cfs in July to an average low of about 180 cfs in October (figure 3-26). The lowest flow that occurs in the river is the 150 cfs minimum flow which is common from October through April. Water quality in the Cle Elum River is generally good but an occasional water temperature (1 of 23) above 65 °F was noted in measurements taken during the period April 1972-September 1987 (Appendix D).

Little Creek (10 Miles)

Little Creek enters the Yakima River from the south (right bank) at RM 194.6. The stream is dry during the summer months below two unscreened diversions at RM 1.6. (The diversions, one on each side of the stream, are located about 50-yards apart.) Above RM 1.6 the creek has year-round flow with excellent potential habitat for steelhead and coho.



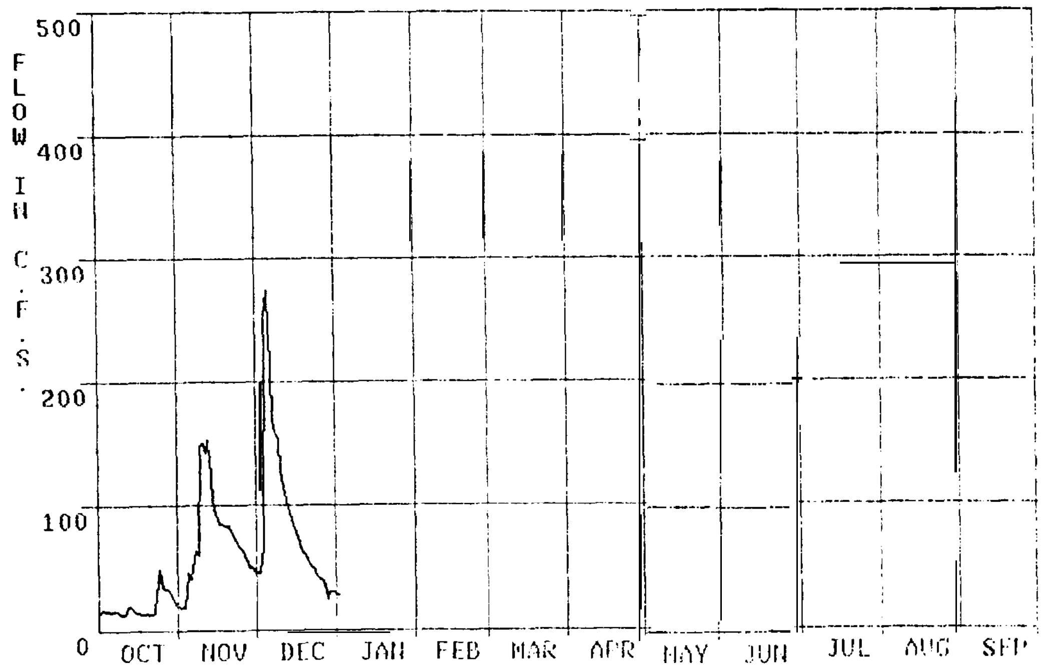


Figure 3-25. --Daily Flows (CFS) of the North Fork Teanaway River Near Dickey Creek Campground (RM 3.5), December 1988-January 1990

Flow upstream of the diversions was estimated at about 5 cfs in July 1989 and habitat was excellent for salmonid production throughout the next 3 miles to about RM 4.5. The stream throughout this reach is very stable. It has moderate gradient, excellent riparian cover and shading, and abundant spawning gravel.

Logging activity above RM 4.5 has removed much of the riparian canopy and has left excessive debris in the stream channel to the extent that upstream migration would likely be impeded at a few locations. Instream habitat is still fairly good and will improve with the regrowth of riparian vegetation. The gradient above RM 4.5 remains moderate and suitable gravels for spawning are still abundant.

Restoration of anadromous fish production in Little Creek would not be technically difficult. The two diversions are located about 0.2 miles or less downstream of the Kittitas Main Canal which could be an alternative source of water supply for the diversions. The diversion berms are temporary structures and would not be a problem for migrants. If flow is restored to the lower stream reach, selective removal of logging debris would improve upstream migration access. Care should be taken to retain beneficial organic debris.

Big Creek (12 Miles)

Big Creek enters the Yakima River from the south (right bank) at RM 195.8. The creek has been heavily channelized in its lower reaches and in the lower-most quarter mile suffers from channel instability and bedload deposition. It has two diversions, a small (2-3 cfs) bermed diversion about 0.7 mile from the mouth, which has a flat screen across the ditch and is easily passable by adults and a larger (5-foot head) impassable diversion dam at RM 2.1 with a permanently closed fishway and two unscreened ditches. A siphon for the Kittitas Main Canal passes under Big Creek at about RM 1.6.

Big Creek has substantial summer flows (3-15 cfs in 1989) above the upper diversion, but below this point, the creek carries no more than 1 cfs, most of which represents leakage (Technical Data Appendix). Flows are recharged somewhat by ground water over the next mile, however, most of this flow is removed at the lower diversion and the stream is nearly dry from this point to the mouth. Water temperatures above the uppermost diversion are excellent for salmonid rearing. The highest temperatures recorded upstream of the diversion by maximum-minimum thermometers during the summer of 1989 were 60-63 °F (Technical Data Appendix). Other water quality parameters are also excellent; five monthly water samples were collected and analyzed during the summer of 1989 and all of the parameters measured met the aquatic life criteria.

Above RM 3.0 Big Creek flows through a steep-walled canyon for about 5 miles to RM 8.0. In the canyon reach Big Creek is a rather large stream (up to 40 feet wide) with a substantial amount of excellent rearing habitat for salmon and steelhead. Riparian cover is excellent, streambanks are stable, and the instream habitat is diverse. Spawning gravel is abundant below RM 3.5 and abundant patch gravel is present in the remainder of this reach.

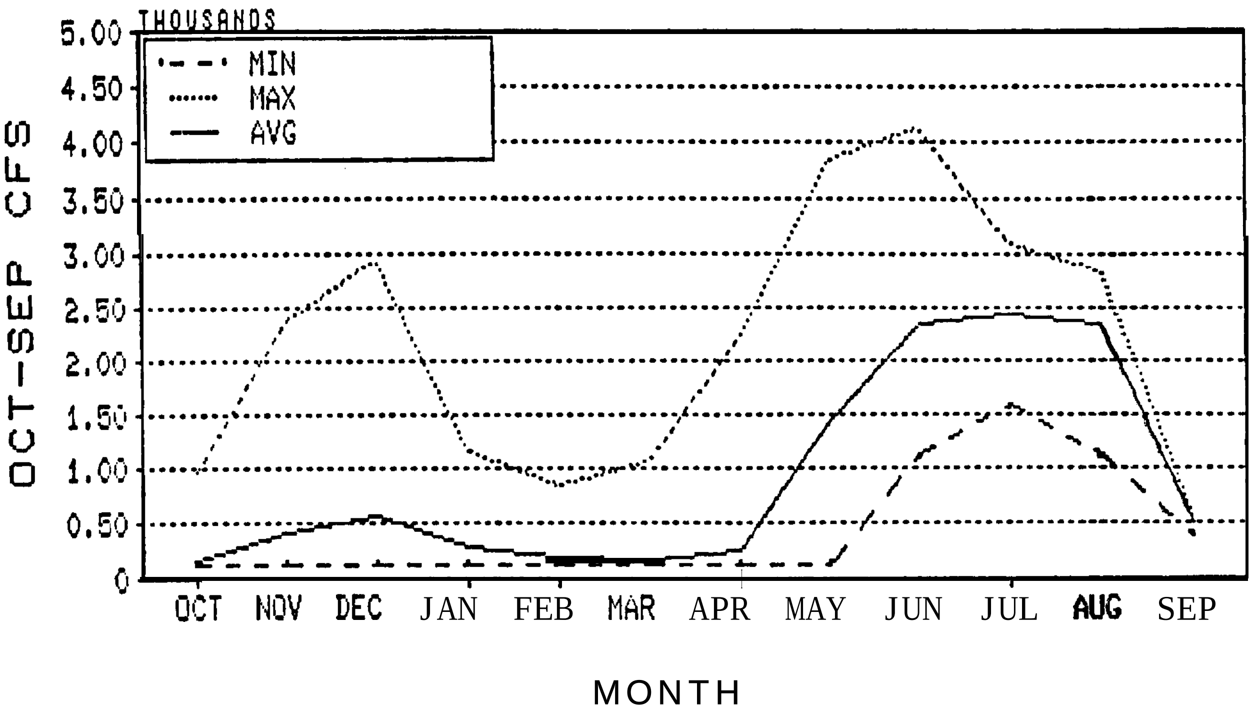


Figure 3-26. --Simulated Maximum, Average, and Minimum Monthly Mean Flows (CFS) of the Cle Elum River Below Cle Elum Dam, 1926-1987

Farther upstream, from RM 8.0 to about RM 11.1, the creek is smaller (up to 30 feet wide) but is still very suitable for production of salmon and steelhead. The stream valley becomes wider in this reach and the gradient moderates. Spawning gravel is abundant and instream habitat conditions are good although the riparian cover has been impacted in places by logging. Jim Creek, a right bank tributary at RM 8.7, provides additional habitat for about 1 mile above its confluence.

Big Creek produced steelhead historically and appears to still have potential for producing steelhead, coho, and to a lesser degree, spring chinook. Currently, spring chinook juveniles rear in the lower reaches in substantial numbers; 20-30 pounds of presmolts were salvaged from several isolated pools in the lower part of the creek in 1986.

The major factors limiting production on Big Creek are the impassable dam and unscreened diversion at RM 2.1 and the lack of instream flow from this point to the mouth. Poor summer/fall flows in the lowest reaches could be rectified by diverting some water from the Kittitas Main Canal at RM 1.6.

Cabin Creek (10 Miles)

Cabin Creek enters the Yakima River from the south (right bank) a short distance above Lake Easton at RM 205.0. It has two significant tributaries, Cole Creek and Log Creek, which enter from the south at RM 2.4 and 5.3, respectively. Unlike most Yakima River tributaries, Cabin Creek has no irrigation diversions. However, it does suffer from other serious constraints to anadromous fish production including an impassable series of cascades and waterfalls between RM 3.1 and 3.8 and from various logging related impacts. The first mile of the creek is moderately braided with a fairly intact riparian corridor and some evidence of channel shifting. The next 2 miles are steep, with major streambank damage and channel shifting due to heavy seasonal runoff. The intensity of runoff has probably been exacerbated by large clear cuts throughout the watershed and "rain-on-snow" flood events. Streambed scouring is evident in the high gradient reaches above and below the mouth of Cole Creek. Riparian conditions from the cascades to about RM 1.0 are poor; late-winter/spring floods have damaged the riparian zone and streambed, which is steep and choked with large boulders and rock. Flows measured near the mouth of Cabin Creek during the summer of 1989 ranged from 138 cfs in June to 6.3 cfs in September (Technical Data Appendix).

Reclamation has previously constructed a simulated period of record for Cabin Creek. This simulated record is based on a series of flow measurements and correlation of these measurements to the period of record of a nearby stream. The result of this simulation is shown in figure 3-27. The simulated monthly mean flows for the period 1926-77 range from an average high of about 270 cfs in May to an average low of 20 cfs in September. According to the simulation, low monthly mean flows of 3 cfs would occur near the mouth in dry years and 2 months of no flow would occur during extreme drought (Technical Data Appendix).

Water temperatures near the mouth of Cabin Creek were excellent during the summer of 1989 ranging from 46 to 61 °F. However, maximum-minimum thermometers placed near the mouth measured maximum temperatures of 68-73 °F.

Other water quality parameters in the stream are excellent; all of the parameters measured during the period December 1986-September 1987 met the aquatic life criteria (Technical Data Appendix).

Above the cascades, instream habitat quality improves markedly. Spawning and rearing habitat for steelhead and coho and, to a lesser extent, for spring chinook is plentiful. Spawning gravel is abundant and generally of excellent quality, and the gradient becomes more gentle. Flows measured above the cascades ranged from 2.4 to 7.1 cfs during August-October 1989 (Technical Data Appendix). Water temperatures were excellent during this period ranging from 43 to 58 °F. However, maximum-minimum thermometers did register temperatures as high as 75 °F. Virtually all of the Cabin Creek drainage (with the exception of Cole Creek) has been logged to the water's edge, so shading and LOD are limited. Above the cascades, however, annual floods have not prevented reforestation. The riparian corridor there is in the early stages of regrowth with short, but dense, growths of deciduous and coniferous trees and brush.

If the cascades were made negotiable for steelhead and salmon, Cabin Creek could become an important producer of anadromous fish. The watershed has undergone little development other than logging, and its rugged terrain and remote location almost guarantee that it will remain undeveloped. Moreover, habitat and water quality will improve with time, as reforestation progresses and some of the impacts of logging are naturally remedied. The cascades could be made passable by blasting or some other passage improvement project. The cascades are confined to a narrow canyon about 0.7 miles long, choked with large boulders and logs, and includes two sections in which water drops 30 to 40 feet in a distance of 75 to 100 yards. Although a considerable amount of blasting or construction would be required, it seems possible that the canyon could be made passable to salmon and steelhead.

Naches River

Yakima River (RM 0.0) to Tieton River (RM 17.5)

The Naches River enters the Yakima River from the west (right bank) at RM 116.3 of the Yakima. This lower reach has excellent potential for summer chinook spawning and rearing and fair to good potential for coho and steelhead spawning and rearing. The reach is moderately braided with many good gravel bars and a good riparian corridor. There is a lack of cover, however, especially LOD below the Naches-Cowiche Diversion Dam (RM 3.6).

Flows in this reach are generally good except for the 7.4-mile portion between Wapatox Diversion Dam (RM 17.1) and the powerplant wasteway (RM 9.7). Instream flows in this powerplant bypass reach are frequently too low for adult passage and optimal juvenile rearing during fall and winter, Simulated monthly mean flows at RM 13.0 for the period 1926-1987 range from an average high of about 3,025 cfs in May to an average low of about 120 cfs in October (figure 3-28). Low flows of 100 cfs are common in this 7.4-mile segment from October through March. Simulated monthly mean flows near the mouth are better ranging from an average high of about 3,280 cfs in May to an average low of about 435 cfs in October (figure 3-29). Low flows of 125-150 cfs can occur near the mouth during October in the driest years, but these occurrences are rare.

Water quality is generally good in this reach, except for occasionally high water temperatures downstream of Wapatox Diversion Dam. Four of 133 (3 percent) water temperature readings taken at RM 0.3 during the period August 1974-March 1987 exceeded 65 °F and one exceeded 70 °F (Appendix D). The only other water quality parameter of possible concern was copper; one of three copper determinations exceeded the aquatic life criteria.

Tieton River to Bumping River (RM 44.6)

This uppermost reach of the Naches contains abundant spawning gravel beds interspersed with deep resting pools. The riparian corridor is excellent and instream cover is abundant. Present anadromous fish use of this reach is for spawning and rearing by spring chinook and steelhead, and it could be used for spawning and rearing coho as well.

Flows in this reach of the Naches River are seldom a problem. Simulated monthly mean flows at Cliffdell (RM 41.0) for the period 1926-1987 range from an average high of about 2,165 cfs in May to an average low of about 235 cfs in October (figure 3-30). Low flows of 70-100 cfs can occur during the fall of low water years, but are relatively uncommon (8 of 62 years). Flows in this reach at the proposed Oak Flats facility site were discussed in the section on facility water supplies.

Water quality in this reach is excellent and none of the water temperatures taken at Cliffdell during the summer of 1989 exceeded 60 °F (figure 3-31).

Naches River Tributaries

Cowiche Creek (33 Miles Including South Fork)

Cowiche Creek enters the Naches River from the south (right bank) at RM 2.7. A survey in July 1988 found that Cowiche Creek has many miles of good to excellent spawning and rearing habitat for steelhead and coho, and possibly some habitat for spring chinook. Instream flows in the main stem and in most reaches of the South Fork are permanent and sufficient to support rearing despite substantial irrigation withdrawals. Riparian vegetation is dense along most reaches, even in areas of residential development or cropland. Stream configuration and cover provide good to excellent rearing habitat in most areas; a moderate gradient is associated with many pools, riffles, and glides; LOD is abundant; and banks are stable in all but a few locations. It appears that there are enough gravel bars for spawning to fully seed the habitat.

Flows near the mouth of Cowiche Creek during the period December 1988 - December 1989 varied from a high of 195.0 cfs in March to a low of 0.6 cfs in late July (see figure 3-32). Daily flows can vary between l-7 cfs during summer depending on the amount of irrigation withdrawal upstream. Summer water temperatures were generally good in 1989 ranging from 49 to 60 °F (Technical Data Appendix). However, 3 of 21 (14 percent) water temperatures taken during the period September 1971-February 1974 exceeded 65 °F and one (5 percent) exceeded 70 °F (Appendix D).

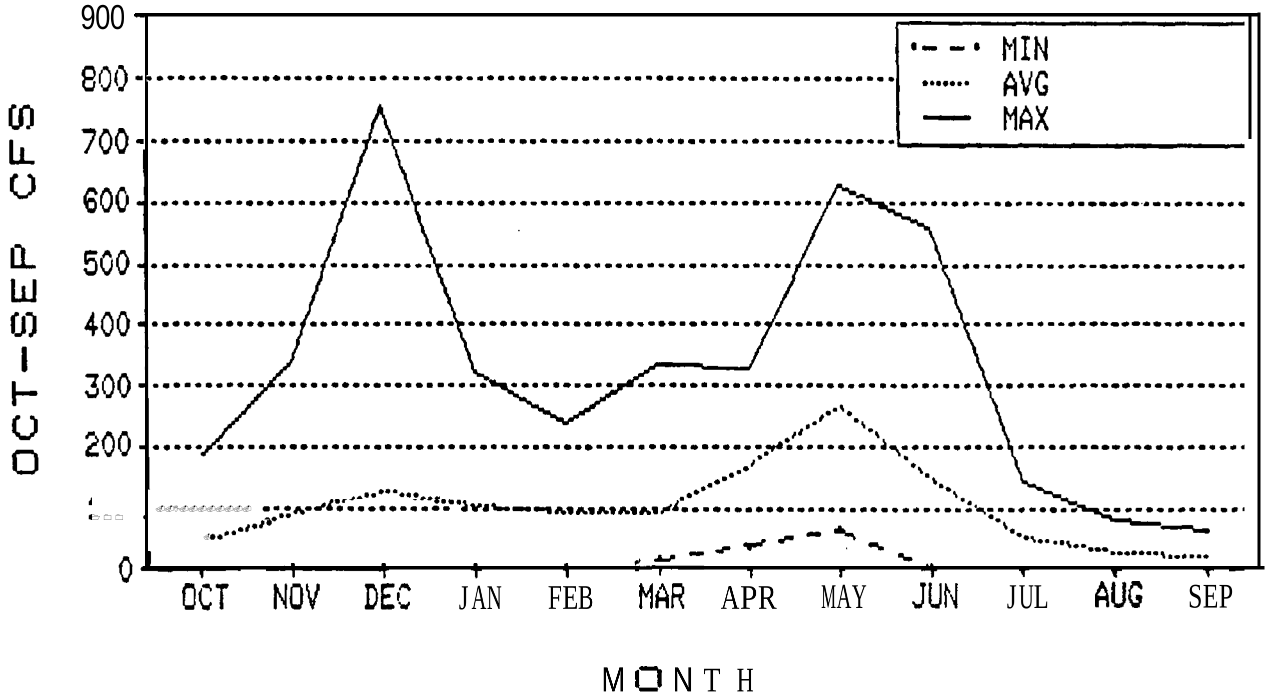


Figure 3-27. --Simulated Maximum, Average, and Minimum Monthly Mean Flows (CFS) of Lower Cabin Creek, 1926-1977

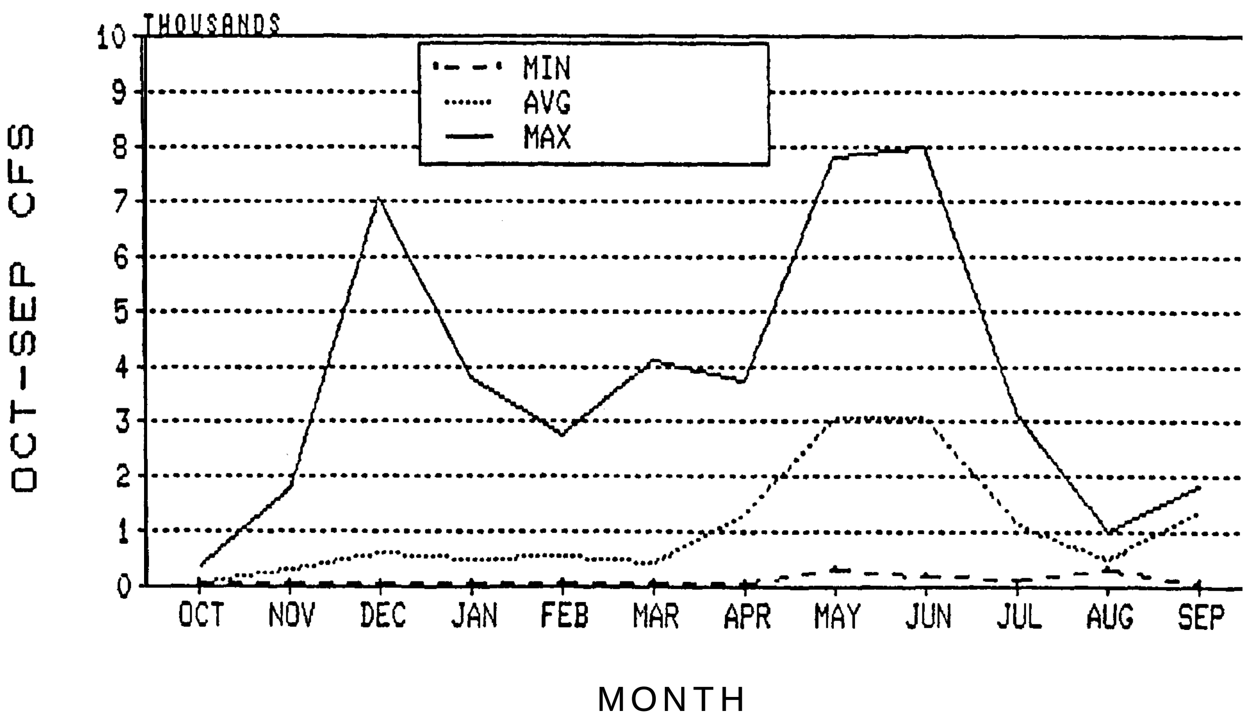


Figure 3-28. --Simulated Maximum, Average, and Minimum Monthly Mean Flows (CFS) of the Naches River Near Naches (RM 13.0), 1926-1987

In decreasing order of importance, the major problems in the Cowiche system consist of migration barriers, low flows in the lower main stem and North Fork, and riparian degradation on the North and South Forks. A wooden plank diversion dam just below the confluence of the North and South Forks (RM 7.5) may be passable, however, three concrete diversion dams on the South Fork (RM 1.3, 3.9, and 4.4) are total barriers at all flows. Except for the city of Yakima diversion at the mouth of the creek, all diversions on the stream are unscreened. A debris jam at a railroad trestle at RM 5.8 on the main stem constituted a migration block until it was removed in May 1989 by members of the Washington Conservation Corps , and there is the potential for jams at several other crossings. Beaver dams are fairly common on the South Fork, and one, just above the confluence of Reynolds Creek (RM 11.8), might constitute a migration barrier.

Flows in the North Fork were too low in July 1988 to provide rearing habitat except in the lower 2 to 3 miles (the North Fork dried up at RM 5.9). Bank sloughing due to degraded riparian vegetation occurred on the South Fork from RM 10.0 to about RM 12.0, and along much of the lower 3 miles of the North Fork. However, the overall impact of this sloughing is small; siltation was minor except in the North Fork where low flows promote settling.

Cowiche Creek could currently be a major producer of steelhead and coho (and perhaps a minor producer of spring chinook) if adult passage facilities were installed at three diversion dams on the South Fork, and if four diversions on the South Fork and the diversion at RM 7.5 were screened. The city of Yakima's irrigation check dam at the mouth of the creek was recently reconstructed (November 1988) with an Alaska steep pass ladder to permit adult passage while still backing up water. Now, lower Cowiche Creek and a number of intersecting canals can be used for rearing and overwintering by spring chinook and steelhead.

Tieton River (21 Miles to Tieton Dam)

The Tieton River enters the Naches from the south (right bank) at RM 17.5. Although the Tieton was historically a major producer of spring chinook and steelhead, current river operations below Tieton Dam (which impounds Rimrock Lake) limit the amount of spawning and rearing by anadromous fish. Simulated monthly mean flows below the dam for the period 1926-87 range from an average high of about 1,490 cfs in September to an average low of about 95 cfs in March (figure 3-33). Low flows of less than 50 cfs are common in winter and early spring to facilitate filling of Rimrock Lake (Technical Data Appendix). The high flows in September are due to large releases to meet irrigation needs because releases from the reservoirs in the upper Yakima River are reduced in early September to facilitate spring chinook spawning and incubation in that area.

Despite these flow problems, some steelhead spawning and steelhead and spring chinook rearing would still be possible in the Tieton River. Water quality is excellent; one slightly low reading of dissolved oxygen was the only parameter from data collected during the period April 1972-September 1973 that did not meet the aquatic life criteria (Appendix D). Some spawning gravel is present and the riparian zone is in fair to good condition. Instream habitat is comprised mostly of large rock because LOD is flushed from the system by the

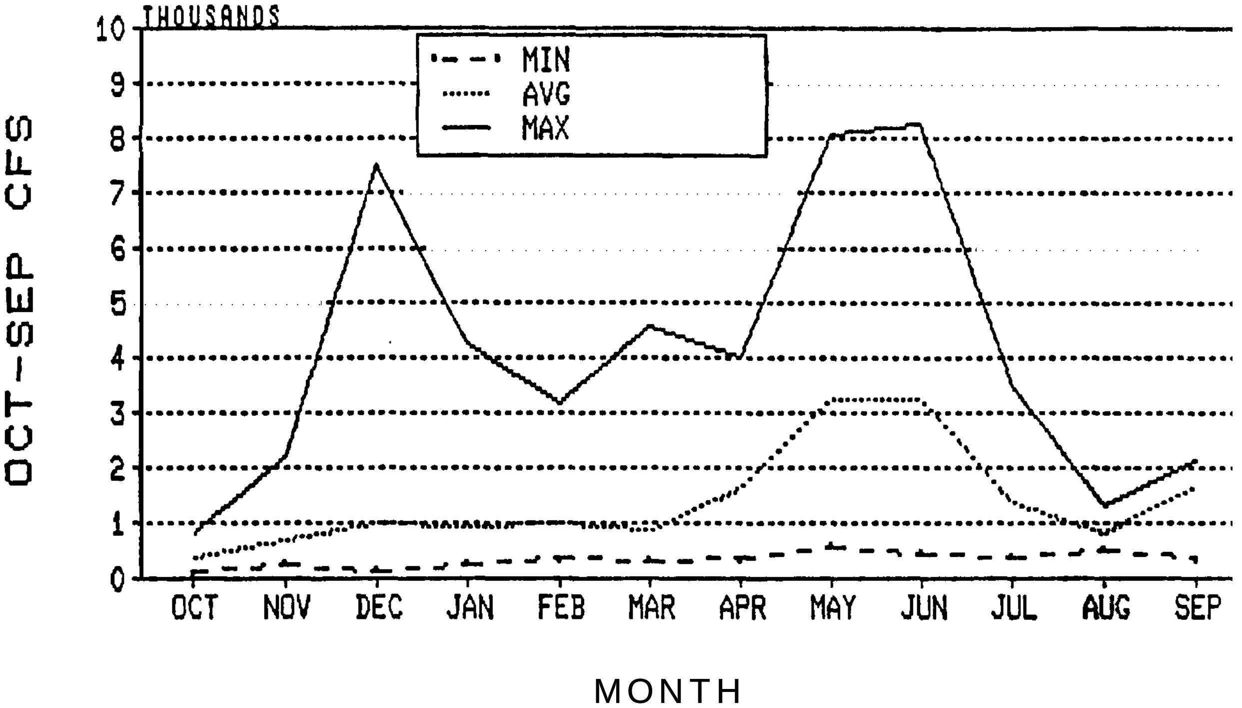


Figure 3-29.--Simulated Maximum, Average, and Minimum Monthly Mean Flows (CFS) of the Naches River Near the Mouth, 1926-1987

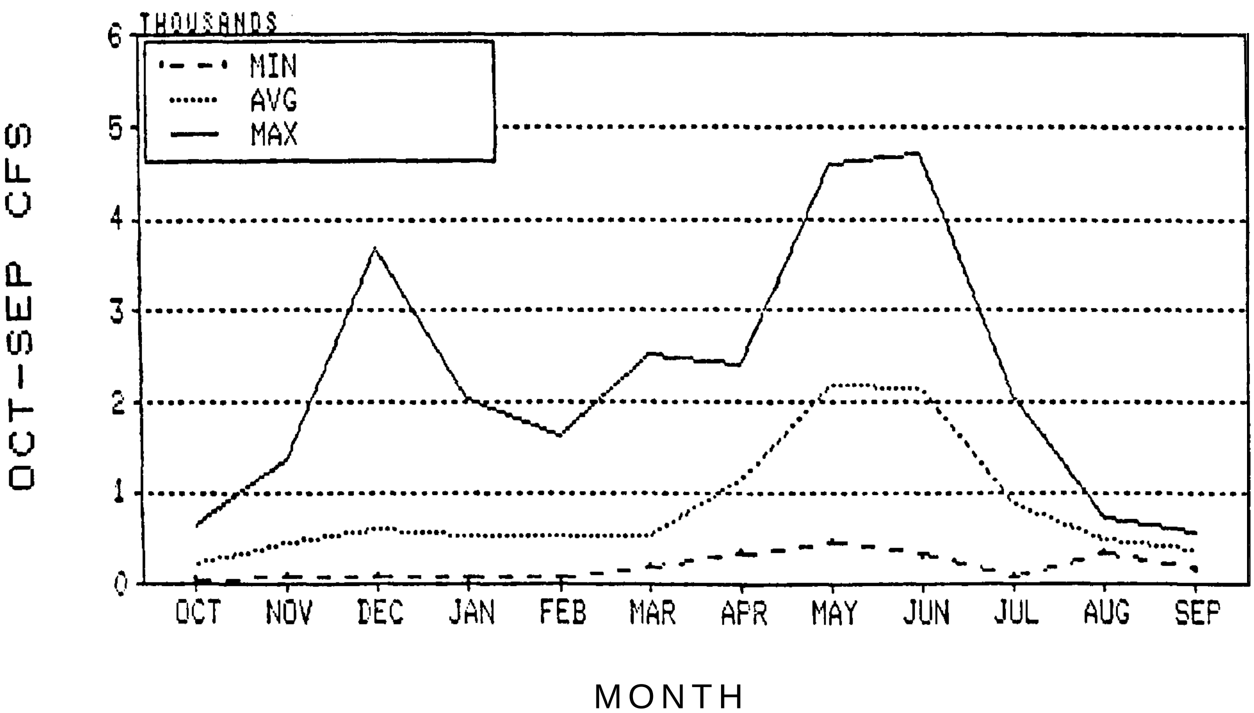


Figure 3-30.--Simulated Maximum, Average, and Minimum Monthly Mean Flows (CFS) of the Naches River Near Cliffdell (RM 41.0), 1926-1987

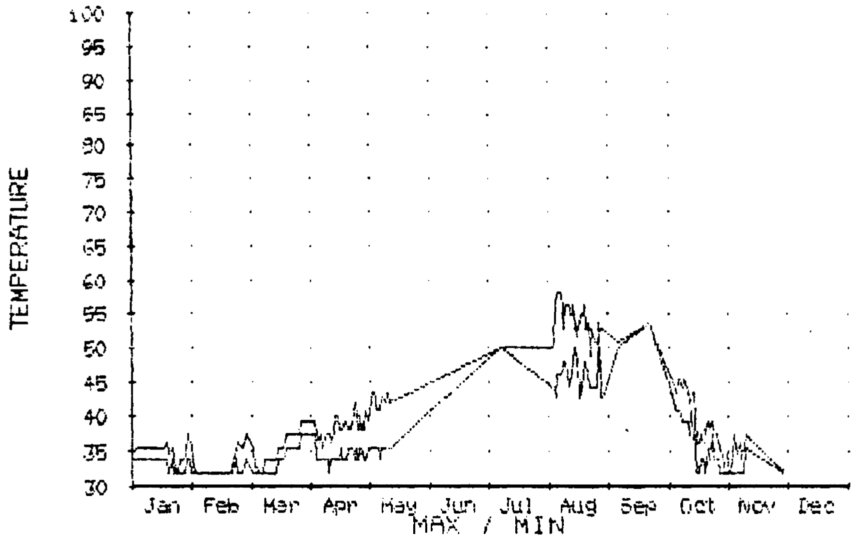
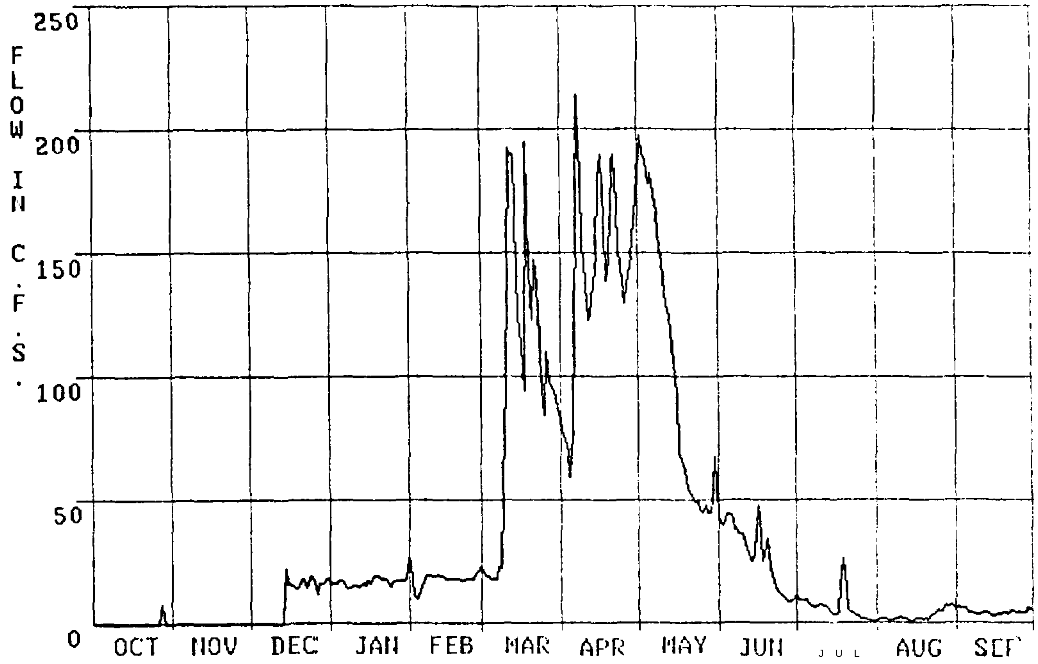


Figure 3-31. --Maximum and Minimum Water Temperatures ("F) of the Naches River Near Cliffdell (RM 41.0), 1989



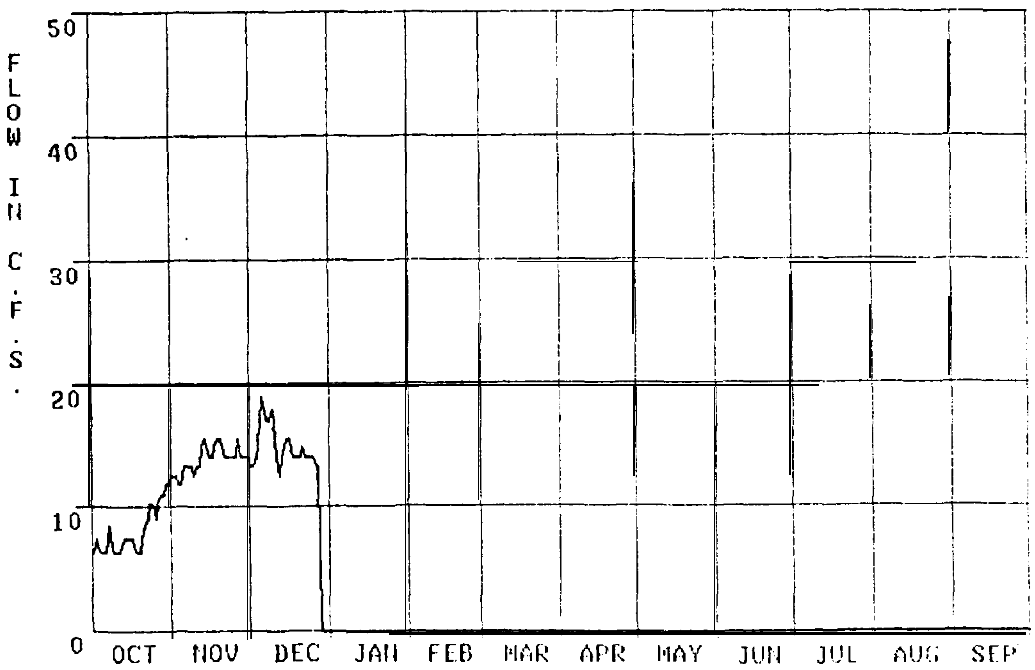


Figure 3-32.--Daily Flows (CFS) of Cowiche Creek Near the Mouth, December 1988-January 1990

high September flows. Still, some juvenile salmon and steelhead could rear in the Tieton during spring and summer, then leave the river during the high September and low winter flows, and overwinter in the lower Naches and Yakima Rivers.

Tieton Dam represents a permanently impassable barrier to anadromous fish and the Yakima-Tieton Diversion Dam at RM 14.5 is a barrier to upstream migration at low flows. The diversion dam is proposed for fish passage facilities improvement under the Phase II fish passage facilities program [18].

Rattlesnake Creek (24 Miles)

Rattlesnake Creek enters the Naches River from the south (right bank) at RM 27.8. Although the streambed shows evidence of scouring from high spring runoff, instream habitat in the creek is generally good. Spawning gravels are abundant but the riparian zone is generally only in fair condition from the occasional scouring by high flows. The upper 7.5 miles of the drainage is probably unusable by anadromous salmonids due to an 8-foot falls at RM 16.5. Some spring chinook spawning presently occurs in Rattlesnake Creek downstream of the North Fork (RM 7.7) and there is potential for steelhead and coho spawning and rearing as well.

Monthly mean flows near the mouth of Rattlesnake Creek for the periods 1966-74 and 1978-85 ranged from an average high of about 395 cfs in May to an average low of about 35 cfs in September (figure 3-34). The lowest monthly mean flow of record was 13.5 cfs which occurred in September and October of 1981 (Technical Data Appendix). Flows during the summer of 1989 ranged from 19.5 to 114.0 cfs and water temperatures were excellent ranging from 40 to 56 °F. Other water quality parameters are also excellent; one slightly low reading of dissolved oxygen was the only parameter from samples collected during the period March 1981-May 1984 that did not meet the aquatic life criteria (Appendix D).

Nile Creek (13 Miles)

Nile Creek enters the Naches River from the south (right bank) at RM 29.4. The creek is small, but fairly long, and carries adequate summer flows (2-7 cfs in 1989) for steelhead and coho rearing throughout most of its length. Instream habitat is good to excellent throughout the stream, streambanks are stable, and spawning gravels are abundant in all reaches. The creek has excellent riparian cover, and water temperatures of 52-61 °F were measured near the mouth during the summer of 1989 (Technical Data Appendix). Also, maximum-minimum thermometers placed in the creek near the mouth recorded maximum temperatures of 67-69 °F during July-September of 1989. Farms along the lower 1.5 miles of the stream are irrigated, but no diversions from the creek were noted.

A few improvements could be made to enhance anadromous fish use of Nile Creek. The culvert outfall at the U.S. Forest Service road crossing at RM 7.1 drops about 18 inches into a pool. Although not a barrier to adult passage, it is an unnecessary impediment to anadromous fish. Baffling the flow within the culvert might also enhance passage. In addition, the creek comes to within a few feet of the Naches River at RM 0.4, then veers away and continues downstream. The Naches River may spill into Nile Creek during high flows, and

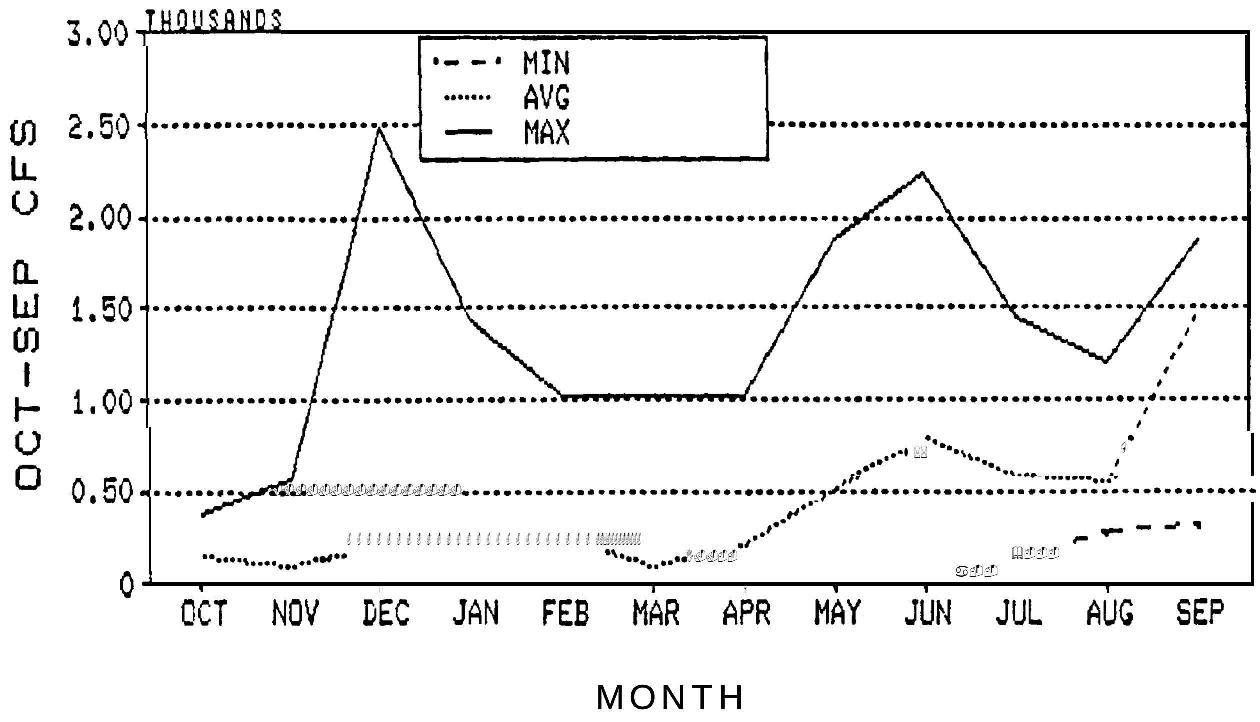


Figure 3-33.--Simulated Maximum, Average, and Minimum Monthly Mean Flows (CFS) of the Tieton River Below Tieton Dam, 1926-1987

the low berm separating the two streams may eventually erode away resulting in the loss of the lower 0.4 mile of Nile Creek. Armoring of the berm should be considered. A beaver pond at the lowermost pond near the mouth would be a barrier at low summer flows, but passage is likely possible during the higher spring flows.

Bumping River (17 Miles)

The Bumping and Little Naches Rivers combine to become the Naches River at RM 44.6 of the Naches. A substantial amount of spring chinook spawning presently occurs in the Bumping, and the potential for steelhead exists as well. This stream has several areas with large rock unsuitable for spring chinook spawning, but steelhead would probably use the small pockets of appropriately sized gravels that are available in these areas. Otherwise, the Bumping affords excellent habitat below the permanent barrier of Bumping Lake Dam.

Simulated monthly mean flows in the Bumping River below the dam for the period 1926-87 range from an average high of about 790 cfs in June to an average low of about 110 cfs in October (figure 3-35). Low flows of 30-50 cfs are common during the fall and winter of dry years (Technical Data Appendix).

Water quality in the Bumping River is generally good to excellent; only 1 of 13 (8 percent) temperature and dissolved oxygen measurements taken during the period May 1972-March 1981 did not meet the aquatic life criteria (Appendix D).

Little Naches River (22 Miles Including North Fork)

The Little Naches River flows from the west and combines with the Bumping River to form the Naches River at RM 44.6 of the Naches. Until recently, the Little Naches was only a minor spring chinook producer, with spawning and rearing occurring only in the lower 4.4 miles (below Salmon Falls). A fishway over Salmon Falls was finished in 1988 along with an extensive instream restoration project in the reach below the falls, which had been degraded by a severe flood in the late 1970's. The fishway opened up about 18 miles of habitat suitable for spring chinook, steelhead, and coho. Spawning gravel is abundant in the Little Naches, the riparian zone is excellent, and LOD and instream cover are plentiful. The major limiting factor for this new system is probably the amount of available rearing habitat during the summer low flow period, particularly in the North and Middle Forks.

Monthly mean flows near the mouth of the Little Naches for the periods 1966-75 and 1981-87 ranged from an average high of about 750 cfs in May to an average low of about 50 cfs in September (figure 3-36). The lowest monthly mean flow of record was 20.2 cfs which occurred in (January 1985 (Technical Data Appendix). Water quality in the Little Naches is excellent; all of the water quality parameters measured near the mouth during the period March 1981-August 1984 met the aquatic life criteria.

American River (24 Miles)

The American River enters the Bumping River from the south (left bank) at RM 3.5. Next to the Easton-Cle Elum reach of the upper Yakima River, this is

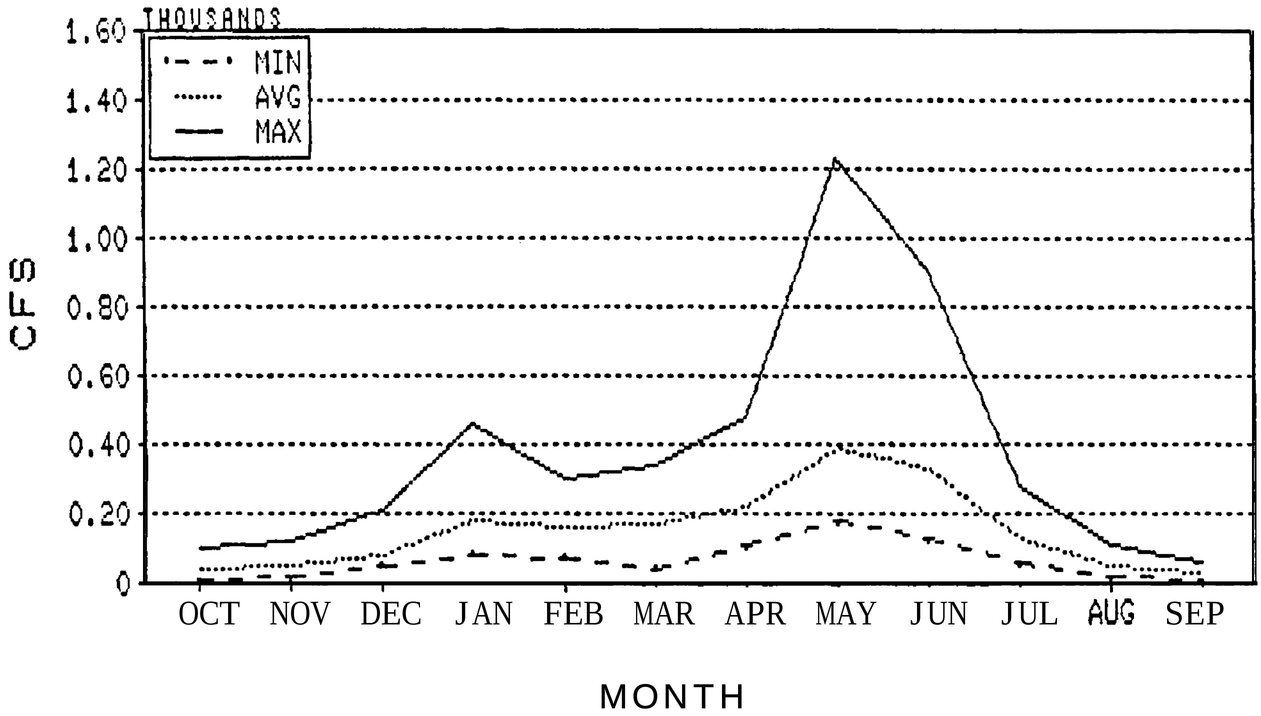


Figure 3-34.--Maximum, Average, and Minimum Monthly Mean Flows (CFS) of Rattlesnake Creek Near the Mouth, 1966-1974 and 1978-1985

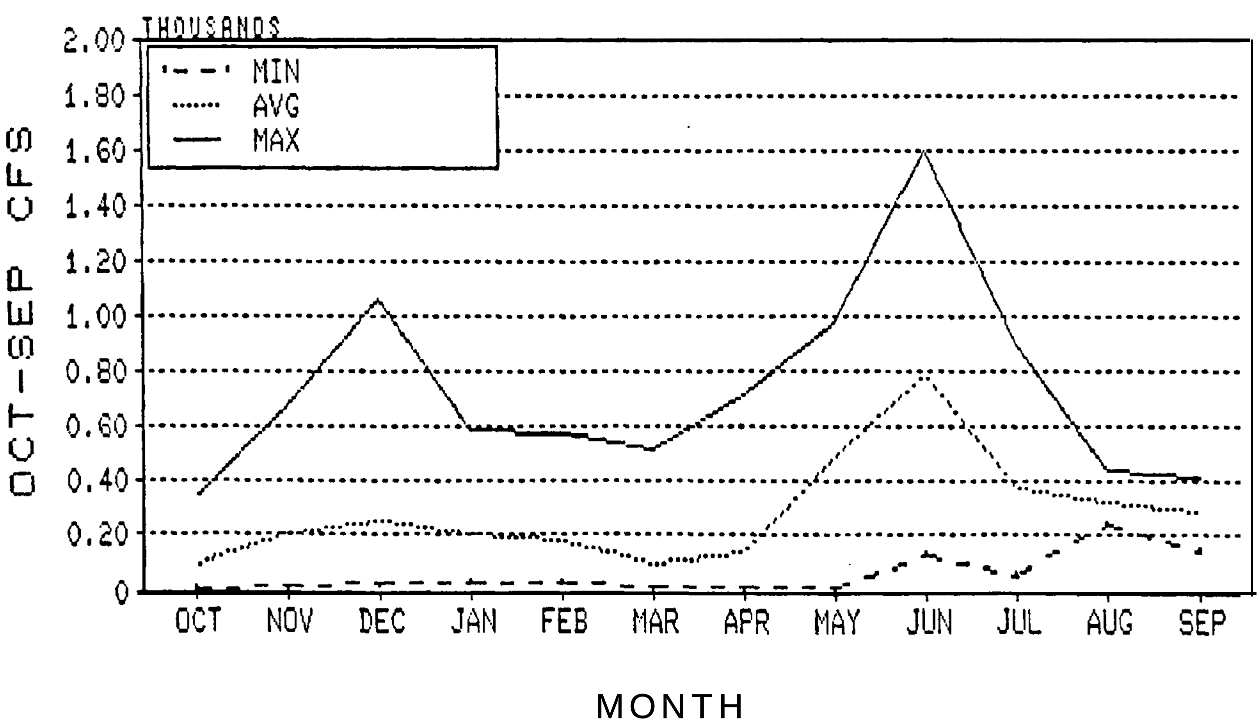


Figure 3-35.--Simulated Maximum, Average, and Minimum Monthly Mean Flows (CFS) of the Bumping River Near Nile, 1926-1987

presently the most productive spring chinook spawning area in the basin. Over its 24 miles the American has a mean gradient of about one percent, although in its lower 5 miles the gradient is about two percent. This steep, lower section is filled with large boulders and choked with fallen trees, and is the only section not affording excellent steelhead, coho, and spring chinook spawning habitat. The middle and upper sections of the stream have abundant spawning gravel, and deep, well protected resting pools average about six per mile. The river enters a narrow gorge near RM 14, above Union Creek, where it drops 100 feet in 400 yards in a series of cascades. During low flows these cascades probably constitute a barrier to upstream passage.

Monthly mean flows near the mouth of the American River for the periods 1909-15 and 1940-85 ranged from an average high of about 675 cfs in June to an average low of about 65 cfs in September (figure 3-37). The lowest monthly mean flow of record was 31 cfs which occurred in January 1979 (Technical Data Appendix). Water quality in the American River is excellent.

KLICKITAT BASIN

Klickitat River

Columbia River (RM 0.0) to Lyle Falls (RM 2.2)

The Klickitat River enters the Columbia River from the north (right bank) at RM 180.4 of the Columbia. The lower 2.2 miles of the Klickitat flow through a steep-walled canyon that has a few resting pools and a minor amount of rearing habitat for spring chinook and steelhead. Some spawning habitat for fall chinook is present in this reach, but is quite limited. The first mile of the reach is inundated by Bonneville Pool. In the upper 1/2-mile of this reach the canyon narrows to only 15-20 feet wide, and a series of five falls, ranging from 4 to 12 feet high, makes upstream passage of salmon and steelhead through this gorge very difficult. The WDF removed rock and constructed two fishways at the falls in 1952 to improve passage conditions. While anadromous fish can make it through Lyle Falls, an intense Indian fishery and still difficult passage conditions make this a key location for escapement of fish to upstream areas. The main value of this lower reach of the Klickitat River to anadromous fish is as a migration corridor in and out of the remainder of the system.

No major storage reservoirs have been constructed in the Klickitat basin and total diversions are relatively small compared to total basin runoff, thus, river flows follow a largely natural runoff pattern in this and the other main stem reaches and are not considered a problem for anadromous fish production. Average monthly flows at RM 7.0 for the period 1909-1987 ranged from a high of about 2,550 cfs in May to a low of about 760 cfs in September (figure 3-38). The lowest daily flow of record is 430 cfs.

Water quality in this reach appears to be suitable for anadromous fish production (Appendix D). Water temperatures are adequate--only 13 of 187 (7 percent) readings taken at RM 7.0 exceeded 65 °F and none exceeded 70 °F.

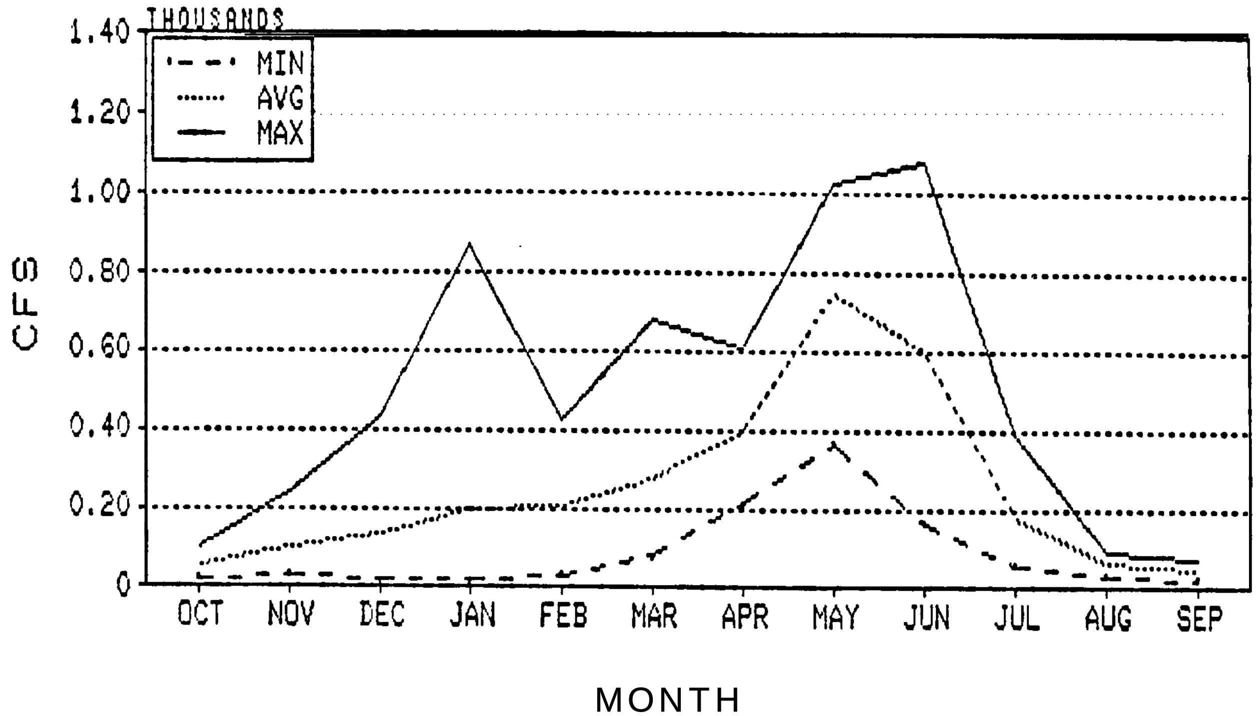


Figure 3-36.--Maximum, Average, and Minimum Monthly Mean Flows (CFS) of the Little Naches River Near the Mouth, 1966-1975 and 1981-1987

The river is fairly turbid in this reach from glacial silt carried into the stream by Big Muddy and Little Muddy Creeks. This silt load is highest during summer and is considered serious enough by fishery biologists that it was identified as a production constraint in the Klickitat Subbasin Plan [5].

Occasional high readings of copper (19 of 41 samples exceeded the aquatic life criteria) and mercury (23 of 66 samples exceeded the detection limit) at RM 7.0 indicate that further monitoring is warranted to locate the source of these metals. One possible source would be Outlet Creek which also shows occasionally high levels of copper and mercury (Appendix D). Another possibility for the high mercury levels would be that mercury may be associated with the high sediment loads in Big Muddy and Little Muddy Creeks (no water quality data is available on these creeks). The occasional high readings of lead (1 of 40 samples exceeded the aquatic life criteria) and zinc (1 of 41 samples exceeded the criteria) would not adversely affect anadromous fish production in this reach.

Lyle Falls to WDF Hatchery (RM 42.4)

Above Lyle Falls the gradient of the Klickitat River becomes more moderate, although in a few places the canyon constricts the stream and causes areas of relatively high velocities. There is a good ratio of pools and riffles in this reach creating an abundance of spawning gravels and resting pools; a substantial amount of rearing habitat exists in the pools and along the margins of the stream. In much of this reach the river flows through a bedrock canyon bordered by rocky benches; the plateaus on the benches are generally cultivated, chiefly in hay, pasture, and orchards. Riparian vegetation in this reach consists of a moderate growth of small pines and firs interspersed with occasional willows and alders. This reach is used by fall chinook for spawning, and by spring chinook and steelhead for spawning and rearing. Winter steelhead are reported to occur in the Klickitat and, if they do, this lower part of the river and its associated tributaries would be the most likely location in which they spawn and rear.

Flows in the upper part of the reach, which were discussed previously in the section on facility water supplies, are adequate for anadromous fish production. Flows and water quality in the lower part of this reach were discussed in the previous section on the Columbia River to Lyle Falls reach.

Sediment from Big Muddy and Little Muddy Creeks is considered by fish biologists to also be a constraint to anadromous production in this reach. The only other water quality parameter, from several samples collected during the summer of 1989 at RM 42.4, that did not meet the aquatic life criteria was mercury (one of two samples exceeded the detection limit) (Appendix D). A possible passage problem in this reach could be associated with the WDF Hatchery weir. In mid- and late summer only a wide thin sheet of water flows over the weir and this could cause delays and injury to fish, primarily spring chinook, attempting to migrate to upstream spawning and rearing areas.

WDF Hatchery to Castile Falls (RM 64.5)

The lower section of this reach, from RM 42.4 to about RM 58.0 is similar to the Lyle Falls-WDF Hatchery reach with abundant resting pools, spawning

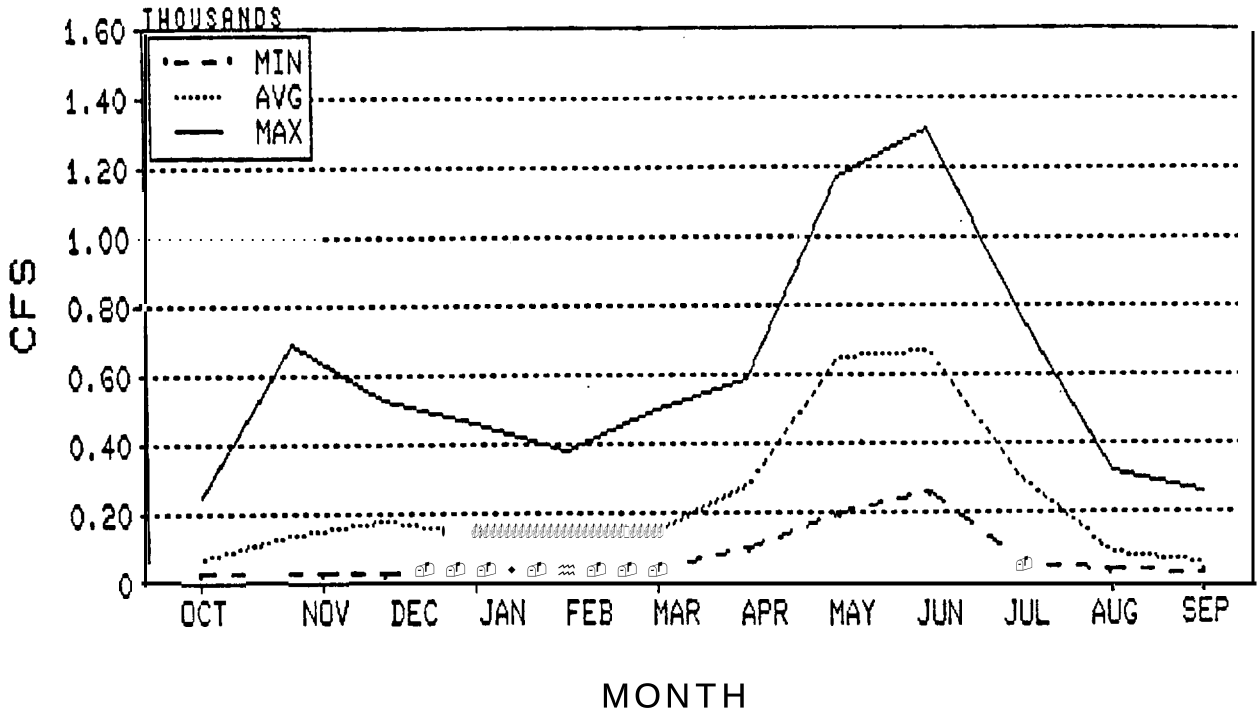


Figure 3-37.--Maximum,. Average, and Minimum Monthly Mean Flows (CFS) of the American River Near the Mouth, 1909-1915 and 1940-1985

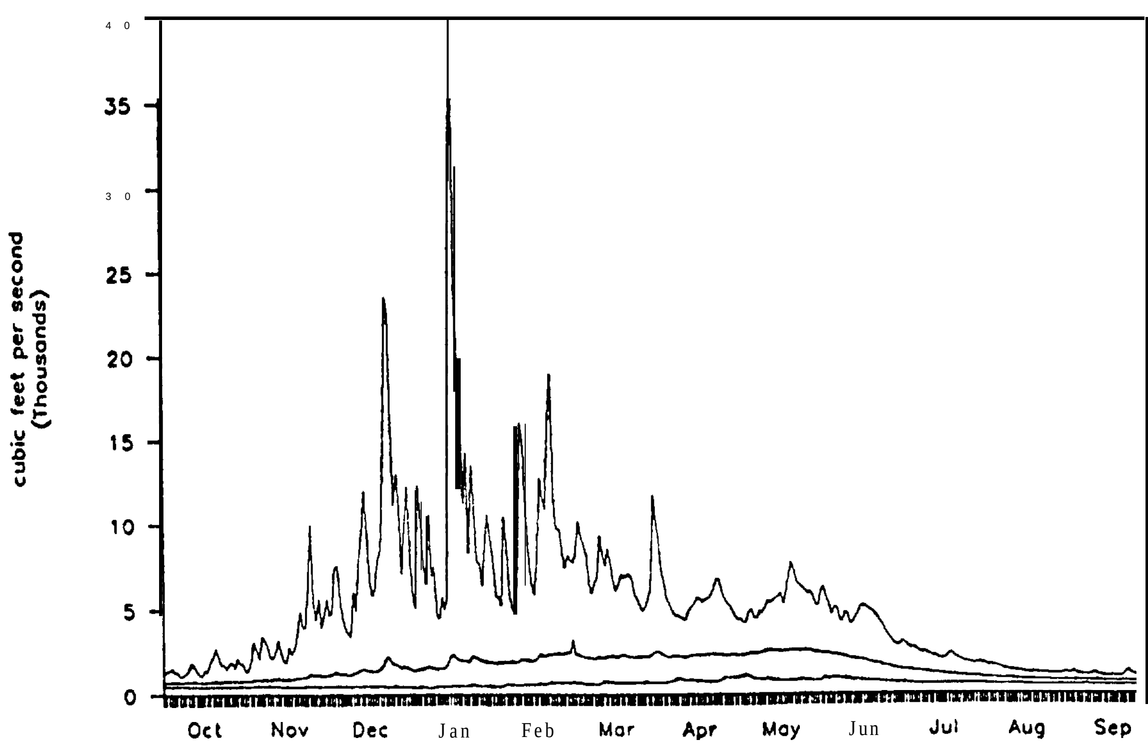


Figure 3-38.-- Maximum, Average, and Minimum Monthly Mean Daily Flows (CFS) of the Klickitat River Near Pitt (RM 7.0), 1909-1987

riffles, and good rearing habitat in the pools and along the stream margins. At about RM 54.0 the river extends for approximately 3 miles through a rugged, precipitous box canyon, and then through a narrow, relatively steep valley to Castile Falls. In the section through the box canyon, the substrate is composed mostly of bedrock and large rubble, and spawning habitat is poor. However, between the box canyon and Castile Falls there are a number of good spawning riffles and resting pools. The WDF constructed two tunnel ladders and an open fishway at Castile Falls in 1960-62, but these fishways have apparently never been effective. Castile Falls is a series of 11 falls within a distance of 1/2-mile and was the historic upper limit of anadromous fish spawning and rearing in the Klickitat River. Anadromous fish use of this reach is by spring chinook and summer steelhead for spawning and rearing; there is potential for coho spawning and rearing as well.

Average monthly flows in this reach are adequate for anadromous fish production with flows at RM 64.7 for the period 1945-77 ranging from an average high of about 965 cfs in May to an average low of about 105 cfs in September (figure 3-39). The lowest monthly flow of record (4.5 cfs) occurred in February. (This may have been due to freezing up of the river banks and/or the gauge.)

Turbidity is still a problem in this reach up to the confluence of Big Muddy Creek at RM 53.8, and some turbidity is apparent up to the confluence of the West Fork at RM 63.1 (from Little Muddy Creek), but above this point the river runs clear in summer and overall water quality is excellent. All of the water quality measurements taken upstream of the Big Muddy Creek confluence during the summer of 1989 met the aquatic life criteria (Technical Data Appendix).

<u>Castile Falls to Headwaters (RM 87.5)</u>

The Klickitat River above Castile Falls has a fairly steep gradient of about 50 feet/mile up to the Diamond Fork (RM 76.8) and 25 feet/mile from there to above McCormick Meadow (RM 87.5). Summer flows below the Diamond Fork confluence are about 100-125 cfs, and are about 75-100 cfs above (Technical Data Appendix). In two areas, Caldwell Prairie (RM 80.2-82.2) and McCormick Meadow (RM 84.5-86.6) the river meanders gently through flat valleys with a series of excellent gravel riffles for spawning and pools for rearing. However, stream banks in these areas lack riparian cover and appear to be eroding.

Some LOD is present throughout this reach and adds to instream habitat diversity and cover. In the portions of the reach with higher gradient, the substrate is predominately coarse rubble with areas of patch gravel; however, the streambanks are stable in these areas and abundant LOD adds to the value of this reach as rearing habitat. The river is formed by three forks coming together shortly above McCormick Meadow (RM 87.5) and this is the assumed upper limit of possible anadromous fish distribution in the Klickitat River. Potential anadromous fish use of this river reach would be for spring chinook, coho, and summer steelhead spawning and rearing if the passage problems at Castile Falls could be rectified.

Klickitat River Tributaries

Snvder Creek

Snyder Creek enters the Klickitat River from the west (right bank) at RM 14.0. The stream flows through and underneath the Champion International Lumber Mill at the town of Klickitat and is enclosed in a concrete flume. There is no passage through the flume and water quality (from mill wastage) is also a likely problem. This stream is presently of no value for production of anadromous fish.

Swale Creek

Swale Creek enters the Klickitat River from the east (left bank) at RM 17.2. This is the first significant tributary on the Klickitat system. Steelhead redds and chinook, coho, and steelhead/rainbow juveniles were observed in Swale Creek by YIN biologists during the spring and summer of 1989 [6]. The stream appears to provide fair to good habitat for steelhead spawning and salmon and steelhead early rearing with stable streambanks, fair to good riparian cover, and a good pool-to-riffle ratio.

Swale Creek is fairly long (about 22.5 miles) and is diverted for irrigation near its source southeast of Goldendale. The creek then enters about 10 miles of canyon before joining the Klickitat River. The major problem related to Swale Creek is flow. Although flows of 15-20 cfs were measured near the mouth in January and February 1989, the stream dries up during mid- to late summer except for some relatively stagnant pools and/or resurfacing flow throughout its length (Technical Data Appendix). Water generally begins flowing again in November and remains flowing until midsummer (early to mid June). It appears that most of the salmon and steelhead juveniles rearing in the creek during spring may have to leave in early summer and rear in the Klickitat River. Some juveniles could return to the creek once flows became adequate in the fall and they could overwinter in the lower reaches.

Little Klickitat River System

The Little Klickitat River enters the main stem from the east (left bank) at RM 19.8. This stream is about 29 miles long, but a 16-foot high falls, impassable to anadromous fish, occurs at RM 6.1. The gradient is moderate in the lower 5 miles but is steeper above; several cascades and low falls which are passable occur below RM 6.1. The stream braids near the confluence with the Klickitat River, but one main channel is apparent and anadromous fish should be able to negotiate the braided area without any major problems. LOD is scarce in this reach but large rocks are common in the channel and provide important cover. The substrate is largely bedrock with only patchy areas of gravel.

Flows in the lower part of the Little Klickitat are adequate for some anadromous fish production. Monthly mean flows near the mouth for the period 1945-82 ranged from an average high of about 415 cfs in February to an average low of about 25 cfs in August (figure 3-40). Low daily flows of 7-10 cfs can occur during the summer (June-September) of dry years (Technical Data Appendix).

Because of the low summer flows, summer water temperatures near the mouth can exceed 65 °F from June through August with occasional temperatures above 70 °F (Appendix D). Small salmonids rearing in the stream may temporarily move into Bowman or Mill Creeks, or into the main Klickitat River, to avoid these warm temperatures.

Two right bank tributaries, Bowman (RM 1.2) and Mill (RM 3.6) Creeks, enter the Little Klickitat from the north below the impassable falls. The lower part of Bowman Creek offers some good rearing habitat for steelhead and coho; the stream has several pools more than 2 feet deep. Spawning habitat may be limited, however. Water temperature was 58 °F in September 1988 and flows were about 2.5 cfs (Technical Data Appendix). Two falls occur on Bowman Creek above the Canyon Creek confluence--a lo-foot-high falls at RM 1.1 may be passable to steelhead, but a 40-foot-high falls at RM 1.3 is an obvious barrier to anadromous fish.

Mill Creek has an area of steep gradient and virtually continuous cascades from RM 0.8 to about RM 1.3. Most of the cascades would be individually passable, but collectively may be a problem to upstream migration. There are several small falls 3-4 feet high where passage improvement measures may be desirable. All of Mill Creek contains excellent stcelhead and coho rearing habitat, with dense, brushy riparian cover and stable banks. Spawning gravel is patchy in the lower section of the creek but becomes more abundant upstream. Flows near the mouth varied from 4.5 cfs in October 1988 to 12.0 cfs in March 1989 (Technical Data Appendix). The water temperature was only 48 °F in October 1988. A pump diversion at RM 3.4 would need improved screens if salmon or steelhead production in Mill Creek is enhanced.

The upper portion of the Little Klickitat, above the impassable falls at RM 6.1, has many problems but would have some habitat potential if the problems were solved. The 4-5 miles of the canyon above the impassable falls at RM 6.1 have not been surveyed, thus, there may be other passage problems on the main stem. One tributary in this area, Blockhouse Creek, is not accessible to anadromous fish due to large falls. However, Spring Creek, which also enters the Little Klickitat in this area, does not have any large falls and contains good to excellent habitat for salmon and steelhead spawning and rearing [17]. It does have an area of cascades near the mouth, however. There is good riparian vegetation along the creek, spawning gravels are adequate, and temperature and summer flows (6 cfs) are suitable for salmonid production. There are two diversions on Spring Creek--one on the upper part of the stream and another at the head of the canyon where the creek descends to join the Little Klickitat.

Flows in the Little Klickitat near Goldendale are presently not adequate for production of anadromous fish. Monthly mean flows near Goldendale for the period 1911-70 ranged from an average high of about 165 cfs in February to an average low of 2 cfs in August and September (figure 3-41). Daily flows of less than l-3 cfs are common from June through January. Summer water temperatures are warm--several temperatures above 70 °F were recorded during the summer of 1988 (Technical Data Appendix). The riparian habitat varies from good to poor to none, depending on the degree of use by livestock.

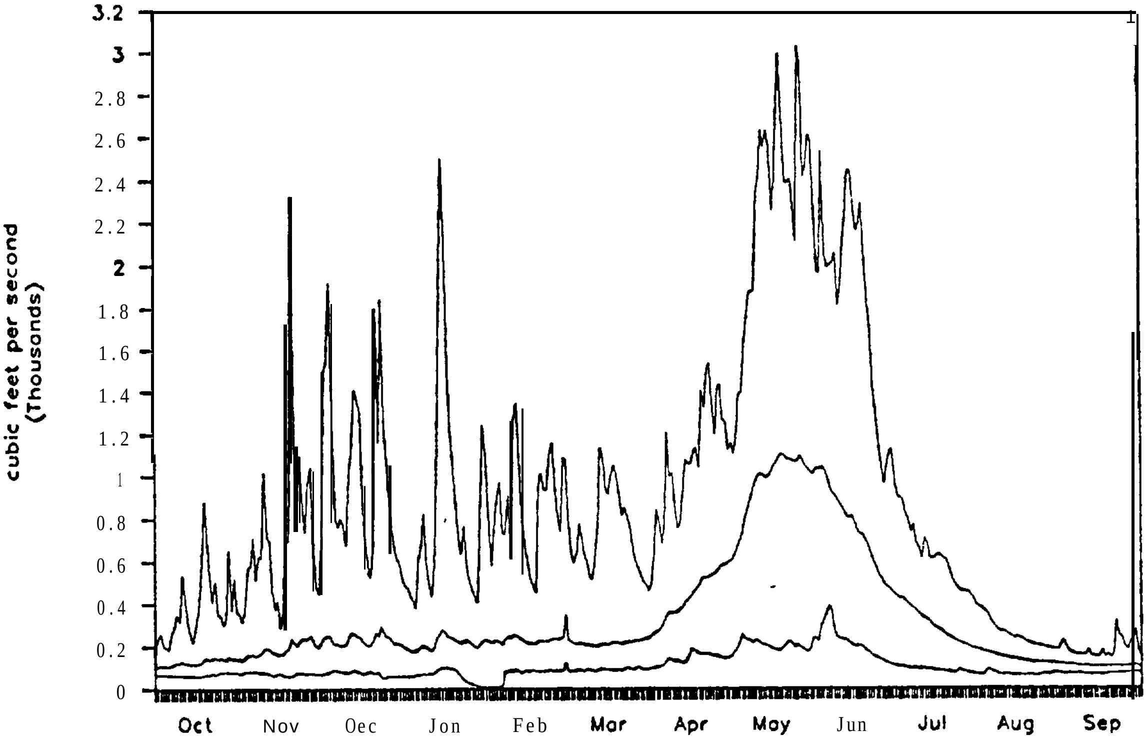


Figure 3-39.-- Maximum, Average, and Minimum Monthly Mean Daily Flows (CFS) of the Klickitat River Above the West Fork (RM 64.7), 1945-1977

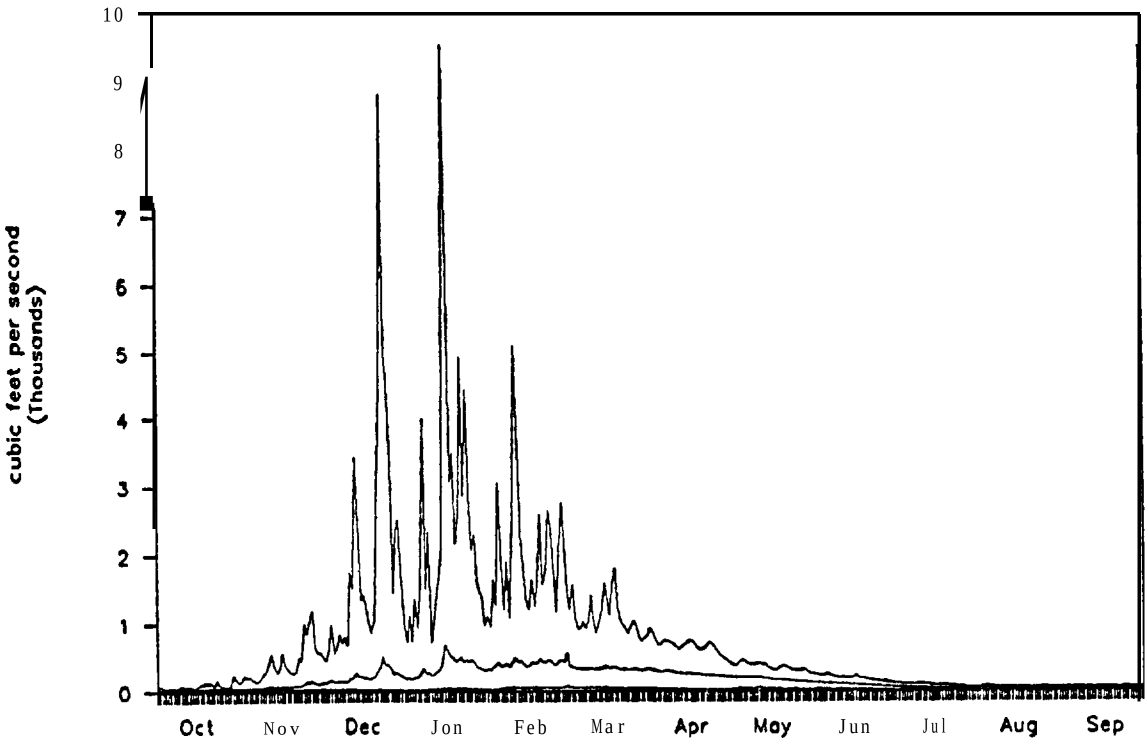


Figure 3-40.-- Maximum, Average, and Minimum Monthly Mean Daily Flows (CFS) of the Little Klickitat River Near Wahkiacus (RM 0.2), 1945-1982

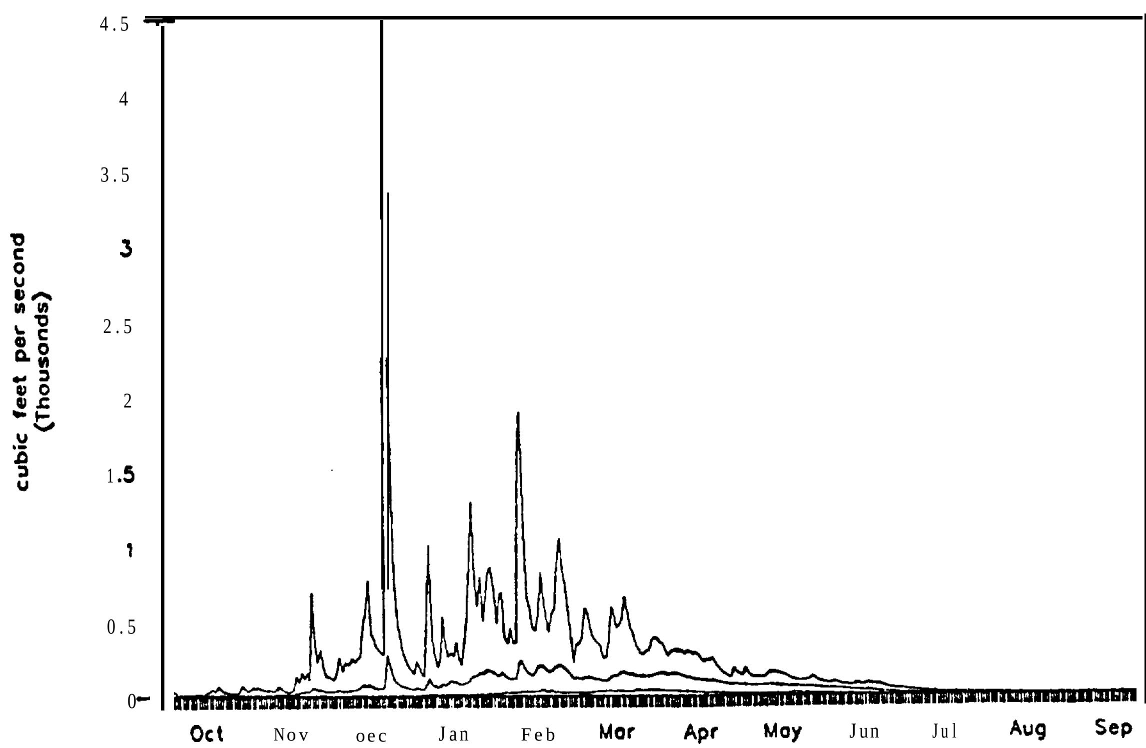


Figure 3-41.-- Maximum, Average, and Minimum Monthly Mean Daily Flows (CFS) of the Little Klickitat River Near Goldendale, 1911-1970

The east and west prongs of the Little Klickitat appear to offer some good salmonid rearing habitat--the riparian vegetation is generally good to excellent, summer water temperatures are in the low fifties and spawning gravels are present, but the naturally small amount of flow (0.75-2.5 cfs) probably limits the amount of potential habitat in these tributaries. Bloodgood Creek enters the Little Klickitat near Goldendale and has adequate flow (3.5 cfs) and suitable temperature for salmonid rearing.

Summit Creek

Summit Creek enters the Klickitat River from the east (left bank) at RM 37.3 and is over 15 miles long. The lower 2 miles of this stream appear to offer good to excellent spawning and rearing habitat for steelhead and coho. However, a 35 foot falls at RM 2.5 blocks anadromous fish passage above this point and cascades for about 0.5 miles below the falls have only minor potential as rearing habitat. Flows in the lower 2 miles of the creek during the summer of 1989 were good ranging from a high of 25.0 cfs in April to a low of 8.0 cfs in September 1988 (Technical Data Appendix). Water temperatures were also good (33-53 °F) in this reach and rearing habitat, cover, and spawning gravels all appear good to excellent for a limited amount of steelhead and coho production. Six monthly water samples were collected from Summit Creek for water quality analysis during the summer of 1989. All of the water quality parameters measured met the aquatic life criteria (Technical Data Appendix). Coho and steelhead/rainbow juveniles were observed in the stream below the falls by YIN biologists during July 1989 [6].

White Creek

White Creek enters the Klickitat River from the east (left bank) at RM 39.6. This stream dries up near the mouth soon after spring runoff, therefore, passage into the system would be possible only for steelhead. Because the substrate near the mouth is comprised mostly of large cobbles and boulders up to 4 feet in diameter, it is estimated that flows of 15 cfs or more would be required for steelhead passage. Flows of this magnitude were observed from January through April of 1989 and passage appeared possible but marginal (Technical Data Appendix). A boulder removal-channel improvement project would be desirable to improve adult passage conditions through this reach. The poor condition of the substrate near the mouth is apparently due to past large floods which scoured the substrate and destroyed the streambanks and associated riparian vegetation.

The mid- and upper reaches of White Creek have been significantly impacted by logging activities. In some areas the vegetation has been affected to the wetted channel of the stream. Local loggers have reported that many springs and seeps that previously fed the creek have dried up in the last few years. Also, a few culverts on the stream could cause passage problems. Because of these conditions, the present habitat in upper White Creek can only be rated as fair. However, it appears that improved logging and riparian management, coupled with a culvert repair/maintenance program, could rehabilitate the stream for some steelhead production. Two major tributaries of White Creek, Brush and Tepee Creeks, show evidence of flash flooding, have a substrate comprised mostly of large boulders, and generally dry up in summer. These small streams do not have any apparent anadromous fish value at the present time.

Outlet Creek

Outlet Creek enters the Klickitat River from the west (right bank) at RM 39.7. This stream and its tributaries, including Bird Creek, drain the agricultural lands in the Glenwood area. A 50-foot-high, impassable falls is located at RM 0.75; thus, this stream has only minor anadromous fish production potential in the steep reach below the falls (8 percent average gradient).

Outlet Creek may be one source of some of the chemical constituents found in the lower Klickitat River; 3 of 7 (43 percent) mercury determinations and 1 of 6 (17 percent) copper determinations made on water samples from the creek during the period December 1973-June 1980 exceeded the aquatic life criteria (Appendix D).

Elk Creek

Elk Creek enters the Klickitat River from the east (left bank) at RM 43.0. This small tributary had a flow of less than 0.5 cfs at its confluence with the Klickitat in July 1989 and likely dries up in late summer. The creek is not accessible to anadromous fish due to a precipitous gradient with numerous cascades and falls near its mouth.

Trout Creek System

Trout Creek enters the Klickitat River from the east (left bank) at RM 43.4. Bear Creek is a major tributary that enters Trout Creek at about RM 1.8. Both of these streams appear to offer some good to excellent spawning and rearing habitat for steelhead and coho; however, naturally low summer flows limit production potential. Flows in Trout Creek upstream of the Bear Creek confluence ranged from 1.0 to 3.6 cfs during the summer of 1989 (Technical Data Appendix). Water temperatures were excellent ranging from 46 to 53 °F.

Logging has occurred in both drainages but impacts have been relatively minor. Still, culvert and riparian enhancement programs are needed to improve the overall productivity of both streams. Beaver dams are common on both creeks but do not appear to block adult passage. Small salmonids were common in both streams, especially in association with the beaver dams in June 1988. Passage conditions on lower Trout Creek near RM 0.75 need to be improved by a boulder removal-channel improvement project but this creek appears to be one of the few tributaries on the Klickitat system where adult passage is not blocked by large falls and cascades.

Deer Creek

Deer Creek enters the Klickitat River from the east (left bank) at RM 46.4. This small creek is similar in size to Elk Creek (0.5 cfs), although marshy riparian vegetation near its confluence with the Klickitat suggests possible perennial flow. Like Elk Creek, Deer Creek is inaccessible to anadromous fish due to a steep gradient containing many cascades and falls near its mouth.

Bacon Creek

Bacon Creek enters the Klickitat River from the west (right bank) at RM 48.2. This stream is only accessible to adult salmon and steelhead for about 100 yards near the mouth. Above this, a series of steep cascades and falls extend upstream for about 200 yards. The largest falls has a vertical drop exceeding 12 feet. The habitat above the cascades appears to be suitable for juvenile rearing with excellent cover, instream habitat quality, and flows of about 4 cfs in August 1988. However, the stream is diverted for irrigation farther upstream. The length of stream suitable as rearing habitat was not determined due to the passage problems near the mouth.

Dairv Creek

Dairy Creek enters the Klickitat River from the west (right bank) at RM 50.9. This small stream is inaccessible near its mouth due a series of cascades and falls in the lower 200 yards of the stream. Habitat above the falls appears suitable for juvenile rearing but the small size of the stream (estimated at 0.75 cfs in August 1988), an irrigation diversion, and the impassable falls greatly limit overall production potential.

Big Muddy Creek System

Big Muddy Creek enters the Klickitat River from the west (right bank)at RM 53.8. This creek originates from two glaciers high on the slopes of Mount Adams and runs extremely turbid with glacial silt during summer. Big Muddy Creek is a major source of the high levels of suspended sediment in the lower Klickitat River that are believed to be a constraint to anadromous fish production. The creek is about 10 miles long and has a steep gradient. A portion of the flow of Big Muddy Creek and its two tributaries, Cougar and Hellroaring Creeks, is diverted to irrigate agricultural land near Glenwood. Due to the turbid nature of this creek, its value to steelhead and salmon production is negligible. If any potential exists in this system it would be in Cougar Creek, which enters the Big Muddy at RM 0.2. However, the small size of this stream (estimated at 1 cfs in June 1988) and an unscreened diversion upstream limit the potential production capacity of this small tributary.

Cunningham Creek

Cunningham Creek enters the Klickitat River from the west (right bank) at RM 58.0. This creek (estimated flow of 6 cfs in August 1988) contains good to excellent rearing habitat for steelhead and coho in its upper reaches. This habitat is not accessible to anadromous fish, however, because the stream gradient is very steep near the mouth with numerous cascades and small falls 6-8 feet high, and one major falls about 40 feet high.

Surveyors Creek

Surveyors Creek enters the Klickitat River from the east (left bank) at RM 58.2. This creek could offer more than 6 miles of excellent spawning and rearing habitat for steelhead and coho. However, large boulders, cascades, and small falls 3-5 feet high at RM 0.5 presently block anadromous fish access to the upper portion of the creek. A boulder removal-channel improvement project may be possible but access to the site by mechanical equipment would be difficult.

Flows near the mouth of Surveyors Creek ranged from about 3.3 to 7.1 cfs during the summer of 1989 (Technical Data Appendix). Water temperature was excellent ranging from 38 to 50 °F during the same period. The channel and streambank are stable throughout the length of the stream; riparian and instream cover are good. There are swampy areas within the stream that should offer good rearing potential. The marshy reaches do not appear to present any passage problems for migrants. Culverts at RM 1.0 and RM 6.4 need to be repaired/maintained if passage conditions near the mouth are improved.

Soda Spring Creek

Soda Springs Creek enters the Klickitat River from the west (right bank) at RM 61.2. Flows in this small creek were more than 1 cfs in July 1989 and the flow appears to be perennial. However, the presence of falls and a steep gradient with numerous cascades near its confluence with the Klickitat make this creek inaccessible to anadromous fish.

West Fork Klickitat River System

The West Fork of the Klickitat River enters the main stem from the west (right bank) at RM 63.1. The West Fork is formed by the confluence of Fish Lake Stream and Little Muddy Creek at RM 4.9. The predominate feature of the West Fork is the presence of suspended glacial sediment from Little Muddy Creek, which like the Big Muddy originates from glaciers on Mount Adams. The suspended sediment, along with a consistently steep gradient, would probably limit the value of the West Fork for either spawning or rearing. The stream channel, however, is quite stable.

Flows in the West Fork for the period 1910-48 ranged from an average high of about 665 cfs in May to an average low of 220 cfs in January (figure 3-42). The lowest daily flow of record was 100 cfs, which occurred during December. A primary function of the West Fork could be as a transportation corridor for steelhead and coho to more favorable spawning and rearing areas in upstream tributaries. The most formidable problem to this is a 12-foot-high falls at RM 4.6 which is presently a barrier to adult migration. There are also some cascades near the mouth that appeared to be passable, but a boulder removal-channel improvement project would make adult passage much easier.

Fish Lake Stream is a major tributary of the West Fork with summer flows of about 90-125 cfs in 1989 (Technical Data Appendix). The lower reaches of this stream have a fairly steep gradient and a coarse substrate. However, gravel patches suitable for salmon (spring chinook and coho) and steelhead spawning were available in all areas observed. The stream channel is very stable and riparian cover is generally good to excellent but only a few pools were noted. A 6-foot-high falls located at RM 2.3 is a partial barrier to adult migration, but may be passable if migration period flows are suitable. A series of three small falls occurs near RM 3.0 that may also be a partial barrier to salmon. From these falls upstream to Fish Lake outlet (RM 7.6), the stream has a moderate gradient; the major limiting factor here may be cold water temperatures, temperatures were only 38-43 °F during the summer of 1989.

Because of a heavy load of glacial silt, Little Muddy Creek would have little value for anadromous fish spawning and rearing. Clearwater Creek (20-25 cfs) enters the Little Muddy at RM 0.8 but three falls (25, 20, and 6-feet high) in the lower 0.4 miles of Clearwater Creek prevents anadromous fish access to excellent habitat upstream in both Clearwater and Trappers Creeks.

Chaparral Creek

Chaparral Creek enters the Klickitat River from the west (right bank) at RM 68.1. This is a very small stream (1 cfs in June 1988) with a limited watershed and offers only minor potential for steelhead and coho spawning and rearing.

McCreedy Creek

McCreedy Creek enters the Klickitat River from the west (right bank) at RM 70.7. This stream is a good sized tributary (estimated flow of 25 cfs in August 1988) but has a mostly steep gradient and is accessible only in the lower reaches. The lower 0.2 mile of McCreedy Creek has a moderate gradient and would provide excellent spawning and rearing habitat for steelhead, coho, and spring chinook. The stream is stable in this area and has excellent spawning gravels and riparian cover. A culvert at RM 0.2 has a steep slope that could present velocity problems to migrating adults. Stream gradient above the culvert becomes increasingly steep, and access would be likely limited to about RM 0.5. No barriers were noted but the steep gradient would limit migration success. The East Fork of McCreedy Creek (RM 0.6) would not be accessible to anadromous fish because of its steep gradient. Also, it is unlikely that adult salmon or steelhead could reach the East Fork because of the steepness of the gradient in McCreedy Creek.

Piscoe Creek

Piscoe Creek enters the Klickitat River from the east (left bank) at RM 75.1. The stream has a good conifer canopy and brushy bank cover and would provide excellent spawning and rearing habitat for steelhead and coho. There has been moderate-to-heavy grazing along the creek but little or no bank damage has occurred except in the meadow area near RM 5.0. A debris buildup near the mouth would not restrict passage and would provide good cover. In addition, two smaller debris jams near RM 0.5 should not be migration problems at high flows. The culvert near the mouth would not be a passage problem.

Streamflow in the lower part of the creek varied from about 2.3 to 4.2 cfs during the summer of 1989 (Technical Data Appendix). However, the creek became dry at Piscoe Meadows near RM 5.0. Water quality of the creek is excellent. Six monthly water samples from the creek were collected and analyzed during the summer of 1989, and all of the parameters measured met the aquatic life criteria (Technical Data Appendix).

Diamond Fork

The Diamond Fork enters the Klickitat River from the north (left bank) at RM 76.8. The lower 6 miles of this stream flows through a canyon and has a

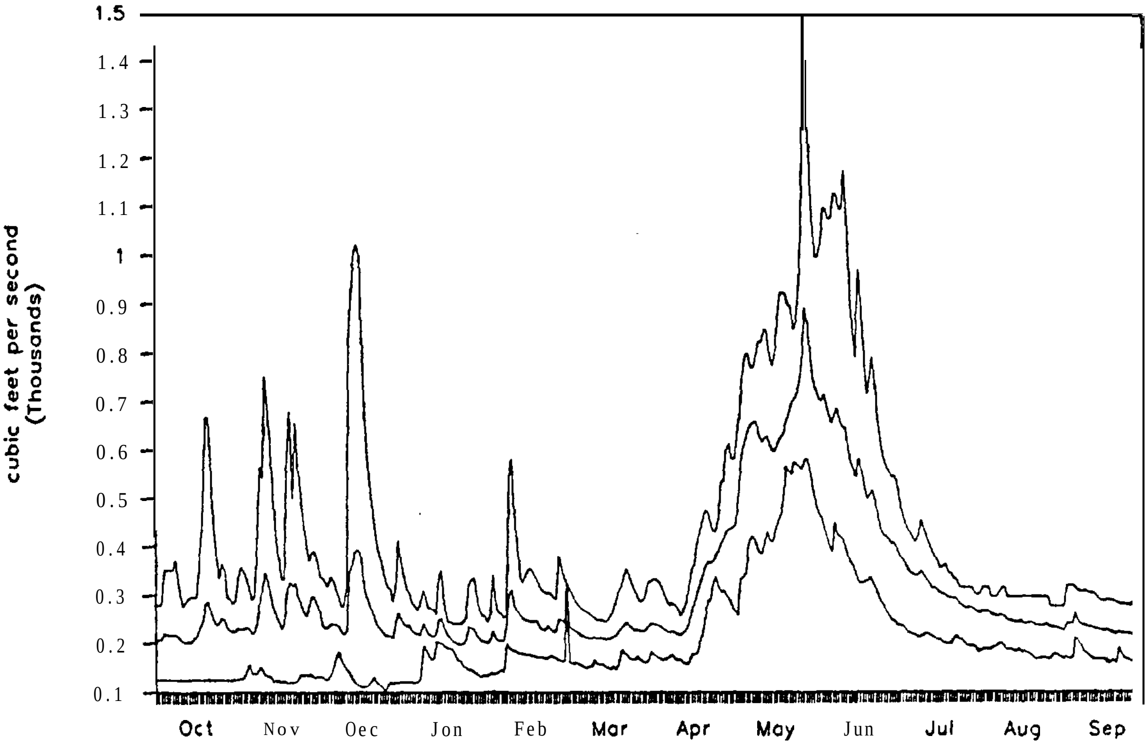


Figure 3-42.-- Maximum, Average, and Minimum Monthly Mean Daily Flows (CFS) of the West Fork Klickitat River Near the Mouth, 1910-1948

steep gradient. The substrate in this reach is predominately boulder and rubble but patchy areas of suitable spawning gravel are available along the stream margins. This section would also provide fair juvenile steelhead and coho rearing habitat, again, mostly along the stream margins. The streambank and channel appear stable but evidence of scouring and damage from past flooding is evident. During 1989, streamflow near the mouth ranged from about 62 cfs in June to about 18 cfs in late September and early November (Technical Data Appendix). Upstream of the canyon, the stream flows through Klickitat Meadow with excellent spawning and rearing habitat for salmonids for about 2 miles before the gradient becomes too steep for access by adults. Water quality in the Diamond Fork is excellent.

One tributary of the Diamond Fork, Maiden Springs Creek at RM 6.1, was surveyed in its lower reach in 1988. This is a small (flow of about 1.5 cfs in August 1988) tributary that would provide only fair habitat for steelhead and coho spawning and rearing. A debris buildup is present at the mouth but could easily be removed. A steep culvert at RM 0.2, on an old road that is no longer used, is a potential adult migration problem.

CONCLUSIONS AND RECOMMENDATIONS

FACILITY WATER SUPPLIES

Surface water quantities are adequate to meet the projected needs of the proposed artificial production facilities at the Prosser, Wapato Canal, Cle Elum, Oak Flats, and Cascade Springs sites. Data for the Buckskin site is incomplete but available data indicates a possible winter-spring surface water supply of 8 cfs or less, compared to a projected need of up to 9 cfs. Further monitoring of the surface water flow at the Buckskin site is needed from November-April to determine if surface flows during this period are adequate to meet facility needs.

The quality of the surface water is probably adequate for the proposed fish culture uses at the Wapato Canal, Cle Elum, Oak Flats, and Cascade Springs sites, but appears to be questionable at the Prosser and Buckskin sites. Some water quality parameters at the sites do not meet the Alaska aquaculture criteria. However, the Alaska aquaculture criteria are quite stringent and other criteria exist that are somewhat less exacting for some parameters. Surface water quality data for all of the proposed sites should be compared against other criteria to narrow the parameters and levels of concern. If some parameters do not meet the less strigent criteria, then fish culture experts need to be consulted to determine whether the observed values pose a significant constrtaint to fish culture at any of the sites.

Ground water (and spring water) quantities are adequate to meet the projected facility needs at the Prosser site, are marginally adequate at the Cle Elum and Cascade Springs sites, but are inadequate at the Oak Flats and Buckskin sites, at least in the shallow sediment aquifers. Further pump testing of the production test well at the Cle Elum site, and perhaps the development of additional wells, is needed to more accurately define the firm long-term pumping yield of the artesian aquifers at the site. Additional exploration into the basalt bedrock at the Oak Flats and Buckskin sites is recommended to determine if a suitable aquifer can be located.

The quality of the ground water (and spring water) is probably adequate for the proposed fish culture uses at the Prosser, Cle Elum, Oak Flats, and Cascade Springs sites. However, a few parameters at each site do not meet the Alaska aquaculture criteria and further evaluation of the data, as noted above for surface water quality, is needed.

STREAM DESCRIPTION

The suitability of the various streams and/or stream reaches in the Yakima and Klickitat River basins for the natural production of anadromous fish is shown in table 4-1. The streams and stream reaches have been placed into three suitability categories: Category I--existing flows, access (assuming completion of the Phase I and Phase II passage facilities programs), and habitat are adequate for the natural production of anadromous fish; Category II--flows, access, and habitat would be adequate with improvements

Table 4-1. Suitability of Yakirna and Klickitat River Basin Streams for the Natural Production of Anadromous Fish

category I (Adequate)	Category II (Adequate with Improvements)	Category III (Unsuitable in Near-term)
	----YAKIMA RIVER AND TRIBUTARIES----	
Yakfma River (mouth to Chandler Powerplant outlet)	Yakfma River (Chandler Power-plant outlet to Prosser Dam)	Yakima River (Prosser Dam to Toppenfsh Creek)
Yakima RI ver (Sunnyside Dam to Naches River)	Yakima River (Toppenish Creek confluence to Sunnyside Dam)	Snipes Creek Sulfur Creek Wenas Creek Wilson Creek system (above RM 7.8)
Yakima River (Roza Dam to Keechelus Dam)	Yakima River (Naches River confluence to Roza Dam)	
	Corral (Canyon) Creek Satus Creek Toppenish/Simcoe Creeks Ahtanum Creek Wide Hollow Creek Umtanum Creek Wilson Creek (lower 7.8 miles) Manastash Creek Taneum Creek Swauk Creek Teanaway River Cle Elum River Lfttle Creek Big Creek Cabin Creek	
	----NACHES RIVER AND TRIBUTARIES----	
Naches River (Wapatox Dam to Bumping-Little Naches Rivers)	Naches River (mouth to Wapatox Dam) Cowfche Creek American River	Tieton River
Rattlesnake Creek Nile Creek Bumping River Little Naches River		
	----KLICKITAT RIVER AND TRIBUTARIES----	
Summit Creek (lower 2.0 miles)	Klickitat River (mouth to headwaters) Little Klickitat system (below RM 6.1) White Creek Trout Creek system Surveyors Creek West Fork system (part) Piscoe Creek Diamond Fork	Snyder Creek Swale Creek Little Klickftat system (above RM 6.1) Summit Creek (above RM 2.01 Outlet Creek Elk Creek Deer Creek Bacon Creek Dairy Creek Big Muddy Creek system Cunningham Creek Soda Springs Creek West Fork system (part) Chaparral Creek McCreedy Creek

that are technically feasible within 10 years; and Category III--flows, access, and/or habitat are inadequate for anadromous fish production and/or technically unattainable within the next 10 years.

Most of the main stem Yakima River is suitable at present for the natural production of anadromous fish. Exceptions to this are the 11.2-mile segment from the Chandler Powerplant outlet to Prosser Diversion Dam, the 23.4-mile segment from the Toppenish Creek confluence to Sunnyside Diversion Dam, and the 11.6-mile segment from the Naches River confluence to Roza Diversion Dam. Flow improvements are needed in all three segments. In addition, the 33-mile segment from Prosser Diversion Dam to Toppenish Creek contains generally poor habitat.

No tributary of the Yakima River (excluding the Naches River and its tributaries) presently has adequate flow, access, and habitat to fully achieve its potential for the natural production of anadromous fish. Many of the tributaries presently support some natural production, and this varies from quite substantial to very limited, but all of the tributaries with near-term production potential need at least some level of improvement to fully achieve that potential.

The main stem Naches River generally provides good to excellent habitat for anadromous fish except for the 7.4-mile segment between Wapatox Diversion Dam and the powerplant outlet, where flow improvements are needed. Most of the Naches River tributaries provide adequate habitat for anadromous fish production. Exceptions to this are Cowiche Creek and the American River, where passage improvements are needed, and the Tieton River where seasonally high flows caused by irrigation releases at Tieton Dam preclude substantial production in the near-term.

Many tributaries of the Yakima and Naches Rivers contain good to excellent habitat for anadromous fish in their upper reaches, but diversions in the lower reaches presently limit or preclude anadromous fish use of these tributaries. Many of these tributaries could be made accessible to steelhead, and some made accessible to spring chinook and coho, if adult and juvenile passage facilities were provided at the diversions. It is estimated that an additional 19 adult passage facilities; about 38 juvenile passage facilities, and 4 adult fish barriers are needed beyond those included in the Phase I and Phase II fish passage facilities programs. The Northwest Power Planning Council's Fish and Wildlife Program should be amended to include the construction of these needed passage facilities.

The main stem Klickitat River provides suitable habitat for the natural production of anadromous fish; however, adult passage and water quality (sediment) problems are presently limiting the amount of natural production. State-of-the-art adult passage facilities should be constructed at Lyle and Castile Falls to improve natural production in the main stem; resolution of the sediment problem is more difficult and needs to be pursued over the long-term.

Passage up most of the tributaries to the Klickitat River is blocked by natural cascades that are part of the steep decent of the tributaries into the deep canyon cut by the main stem. Only eight tributaries were found to be potentially suitable for the natural production of anadromous fish; however, two of these (Piscoe Creek and Diamond Fork) occur upstream of Castile Falls and two more (Little Klickitat system and Summit Creek) have falls that limit the anadromous fish production potential to the lower portion of the stream. In addition, cold summer water temperatures in the West Fork system may limit the production potential in that tributary. Overall, the improvement project that would do the most to increase the natural anadromous fish production potential of the Klickitat basin in the near-term would be the construction of adequate adult fish passage facilities at Lyle and Castile Falls.

LITERATURE CITED

1. Sprenke, K. F., 1989. Completion Report: Geophysics Survey of Oak Flats Site, Yakima/Klickitat Production Project Water Supply Analysis. Contract Order No. 9-PG-10-08980, Bureau of Reclamation, Pacific Northwest Region, Boise, Idaho.

2. Sprenke, K. F., 1989. Geophysics Surveys of the Newman, Cle Elum, and Buckskin Sites, Yakima/Klickitat Production Project Water Supply Anal,ysis. Contract Order No. 9-PG-10-10690, Bureau of Reclamation, Pacific Northwest Region, Boise, Idaho.

3. Anglin, D. R., 1989. Instream Flow Analysis:Klickitat Subbasin. U.S. Fish and Wildlife Service, Fisheries Assistance Office, Vancouver, Washington.

4. Bureau of Reclamation and Washington Department of Ecology, 1985. Phase 2 Status Report, Yakima River Basin Water Enhancement Project, Washington. Pacific Northwest Region, Boise, Idaho.

5. Confederated Tribes and Bands of the Yakima Indian Nation, 1989. Draft Klickitat River Subbasin Salmon and Steelhead Plan. Toppenish, Washington.

6. Sharp, B., 1989. Yakima Indian Nation, Fisheries Resource Management, Toppenish, Washington. Personal communication.

7. Confederated Tribes and Bands of the Yakima Indian Nation, 1989. Draft Yakima River Subbasin Salmon and Steelhead Plan. Toppenish, Washington.

8. Bureau of Reclamation, 1984. Review of Existing IFIM Data, Yakima River Basin. Pacific Northwest Region, Boise, Idaho. Contractors: Paramatrix, Inc., Bellevue, Washington and Hardin - Davis, Albany, Oregon.

9. Bureau of Reclamation, 1984. Initial Flow Recommendations, Yakima River Basin. Pacific Northwest Region, Boise, Idaho. Contractors: Parametrix, Inc., Bellevue, Washington and Hardin - Davis, Albany, Oregon.

10. Bureau of Reclamation, 1984. Finding of No Significant Impact. Fish Passage and Protective Facilities, Yakima River Basin, Washington. Pacific Northwest Region, Boise, Idaho.

11. Alaska Department of Fish and Game, 1983. Fish Cultural Manual. FRED Division, June 1983.

12. Bell, M.C., 1972. Fisheries Handbook of Engineering Requirements and Biological Criteria. Corps of Engineers, North Pacific Division, Portland, Oregon.

13. Bureau of Reclamation, 1989. Preliminary Report on the Stream Description Work Task for the Yakima Subbasin. Pacific Northwest Region, Boise, Idaho. January 1989.

14. Bureau of Reclamation, 1989. Preliminary Report on the Stream Description Work Task for the Klickitat Subbasin. Pacific Northwest Region, Boise, Idaho. April 1989.

15. Kidder, J., 1989. Chinook Engineering. Mukilteo, Washington. Personal communication.

16. Kittitas Reclamation District v. Sunnyside Valley Irrigation District. Federal District Court, Spokane, Washington.

17. Caldwell, B., 1989. Washington Department of Ecology, Olympia, Washington. Personal communication.

18. Bureau of Reclamation, 1989. Yakima River Basin Fish Passage Improvement: Phase II Screens. Preliminary Draft Environmental Assessment. Pacific Northwest Region, Boise, Idaho. December 1989.

19. Confederated Tribes and Bands of the Yakima Indian Nation, Washington Department of Fisheries, and Washington Department of Wildlife, 1989. Report to the Northwest Power Planning Council on Refined Project Goals and Harvest Management Plan for the Yakima/Klickitat Central Outplanting Facility. May 1990.

20. Bureau of Reclamation, 1990. Groundwater Evaluation at Selected Sites, Yakima/Klickitat Production Project Water Supply Analysis, Washington. Pacific Northwest Region, Boise, Idaho. March 1990.

Appendix A

Habitat Quality Survey Form

Appendix A

Habitat Quality Survey Form

Stream ____________________ Location (stream mile or other) __________
Map Reference ____________________ Surveyor ______________ Date ____________

A. Stream Measurements
   Width (nearest 0.5 foot) ____
   Depth (nearest 0.1 foot, deepest part) __________
   Temperature
      Air __________
      Water __________

B. Riparian Cover and Shading
   4 - txcellent (Medium to heavy cover of trees and/or tall shrubs)
   3 - Good (Some trees and/or tall shrubs. Dense low shrubs/forbs)
   2 - Fair (Medium to dense cover of grass, forbs, small shrubs)
   1 - Poor (Cropland, low grass/small forbs)

C. Bank and Channel Stability
   4 - txcellent (<10% erosion)
   3 - Good (10-25% erosion)
   2 - Fair (25-50% erosion)
   1 - Poor (>50% erosion)

D. Bank Rock Content
   4 Excellent (90-100X rock)
   3 - Good (50-90% rock with some interspersion of soil)
   2 - Fair (Mostly soil with some rock interspersion)
   1 - Poor (Soil, little or no rock interspersion)

E. Pool-Riffle Ratio
   4 txcellent (>50% pools)
   3 : Good (25-50% pools)
   2 - Fair (10-25% pools)
   1 - Poor (<10% pools)

F. Pool Quality
   3 Excellent (Pools longer or wider than average stream width)
   2 : Good (Pools about as wide or long as average stream width)
   1 - Fair (Pools shorter or narrower than average stream width)

G. Substrate
   4 - Large rubble (6-12 inches)
   3 - Small rubble (3-6 inches)
   2 - Coarse gravel (0.5-3 inches)
   1 - Fine gravel (<0.5 inch)

H. Stream Habitat Diversity

4 - Excellent (Large rocks, limbs, dead trees abundant and dispersed)
3 - Good (Large rocks, limbs, dead trees fairly common, dispersed)
2 - Fair (Some large rocks, etc., often clumped)
1 - Poor (Limited wood or rock structure)

I. Water Quality

4 - Excellent (Clear, clean looking water)
3 - Good (Slightly murky, looks o.k.)
2 - Fair (Somewhat milky or muddy)
1 - Poor (Milky, murky, or muddy. Looks bad)

J. Remarks

K. Photographs

Appendix B

Hydrological Data for Facility Water Supplies

YAKIMA RIVER DIGITAL MODEL BASE STUDY WITH 500 CLE SEPT 8-APR-88
01973-1982 AVG W/O 1973,1977,1979 6-8-84

YAKIMA R, PROSSER-MABTON CFS UNITS

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AVERAGE
1926	200.	200.	241.	99.	615.	1280.	333.	200.	200.	100.	50.	200.	309.
1927	200.	200.	1117.	59.	364.	a73.	1251.	984.	3539.	100.	50.	200.	741.
1928	200.	3374.	4321.	4377.	802.	1899.	650.	7043.	200.	100.	50.	200.	1944.
1929	200.	200.	50.	50.	50.	200.	200.	200.	200.	100.	50.	200.	142.
1930	200.	200.	50.	53.	335.	223.	1302.	200.	200.	100.	50.	200.	256.
1931	200.	293.	53.	50.	50.	200.	203.	200.	200.	100.	50.	200.	142.
1932	233.	200.	50.	149.	725.	3441.	1829.	1588.	2406.	100.	50.	200.	925.
1933	200.	3093.	2713.	1359.	146.	200.	1124.	2894.	8893.	1438.	50.	200.	1897.
1934	2016.	4695.	15520.	5932.	4450.	6674.	7637.	1024.	200.	100.	50.	200.	4299.
1935	200.	2762.	1163.	3229.	3147.	976.	291.	3675.	3638.	100.	50.	200.	1597.
1936	200.	200.	50.	50.	50.	754.	3893.	5530.	3147.	100.	50.	200.	1184.
1937	200.	200.	50.	53.	50.	280.	376.	274.	3042.	100.	50.	203.	403.
1938	200.	121.	1731.	1413.	459.	2137.	3954.	6348.	3185.	100.	50.	200.	1755.
1939	200.	250.	166.	747.	50.	607.	943.	200.	200.	100.	50.	200.	312.
1940	200.	200.	254.	50.	529.	1315.	613.	200.	200.	100.	50.	200.	325.
1941	200.	200.	330.	50.	123.	777.	436.	200.	200.	100.	50.	200.	240.
1942	200.	263.	1224.	50.	215.	200.	733.	200.	200.	100.	50.	200.	304.
1943	200.	450.	331.	925.	594.	1007.	561%.	776.	3636.	100.	50.	200.	1186.
1944	200.	200.	237.	50.	50.	200.	200.	200.	200.	100.	50.	200.	158.
1945	200.	203.	50.	768.	987.	203.	200.	284.	200.	100.	50.	200.	282.
1946	200.	272.	154.	510.	85.	989.	1913.	4118.	4006.	100.	50.	200.	1052.
1947	200.	200.	3351.	1359.	2421.	2415.	2962.	4566.	200.	100.	50.	200.	1591.
1948	324.	2233.	1167.	363.	722.	200.	445.	8229.	11287.	100.	50.	200.	2102.
1949	200.	292.	57.	50.	404.	2163.	4297.	12156.	5012.	100.	50.	200.	2092.
1950	200.	2551.	2617.	62.	888.	2107.	2111.	6942.	12554.	2319.	50.	200.	2722.
1951	491.	5092.	4363.	2830.	6054.	1869.	5452.	9520.	3582.	100.	50.	200.	3566.
1952	200.	432.	244.	50.	460.	550.	1937.	2715.	441.	100.	50.	200.	619.
1953	203.	233.	50.	1741.	2617.	228.	200.	2354.	2544.	100.	50.	200.	860.
1954	200.	200.	2924.	350.	1066.	748.	1259.	7754.	5953.	2145.	50.	200.	1954.
1955	200.	2631.	1086.	141.	490.	200.	200.	514.	0704.	145.	50.	200.	1207.
1956	535.	5541.	4793.	1394.	506.	2675.	8501.	15934.	9153.	818.	50.	200.	4184.
1957	200.	1475.	5273.	301.	596.	938.	1869.	7352.	200.	100.	50.	200.	1688.
1958	200.	200.	76.	163.	2030.	1067.	1319.	4432.	565.	100.	50.	200.	861.
1959	200.	2605.	4107.	4876.	1957.	1346.	2592.	4044.	4473.	100.	50.	200.	2235.
1960	1011.	7838.	5081.	744.	1155.	1413.	2222.	2821.	2516.	100.	50.	200.	2089.
1961	200.	632.	53.	902.	3520.	2921.	2959.	6530.	6575.	100.	50.	200.	2035.
1962	200.	200.	79.	2042.	1566.	200.	2644.	821.	1822.	100.	50.	200.	818.
1963	200.	1736.	2625.	1384.	5165.	916.	259.	791.	200.	100.	50.	200.	1109.
1964	200.	203.	50.	167.	114.	200.	200.	200.	6440.	590.	50.	200.	710.
1965	200.	710.	3278.	3832.	5316.	2019.	4178.	4420.	2927.	100.	50.	200.	2240.
1966	200.	200.	50.	50.	50.	381.	1470.	1400.	200.	100.	50.	200.	364.
1967	200.	200.	1560.	1383.	1600.	200.	200.	2282.	6752.	100.	50.	200.	1218.
1968	200.	1070.	3314.	4390.	6020.	3057.	200.	486.	367.	100.	50.	200.	1610.
1969	200.	1327.	786.	1515.	258.	1551.	2758.	9478.	4185.	100.	50.	200.	1887.
1970	200.	293.	50.	94.	863.	1063.	200.	1952.	3246.	100.	50.	200.	680.
1971	200.	200.	75.	2066.	3888.	394.	319.	0353.	7133.	1504.	50.	200.	2018.
1972	200.	1347.	1008.	1726.	4304.	11573.	3472.	14350.	12124.	1656.	50.	200.	4341.
1973	200.	1366.	3819.	2417.	452.	200.	200.	200.	200.	100.	50.	200.	790.
1974	200.	536.	882.	5073.	2104.	1613.	3685.	4941.	14090.	3427.	50.	200.	3064.
1975	200.	848.	2197.	3580.	1547.	1452.	21s.	5880.	8825.	100.	50.	200.	2091.

YAKIHA RIVER DIGITAL MODEL BASE STUDY WITH 500 CLE SEPT 8-APR-88
01973-1982 AVG W/O 1973,1977,1979 6-B-04

YAKIMA R, PROSSER-MABTON CFS UNITS

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	HAY	JUN	JUL	AUG	SEP	AVERAGE
1976	200.	3347.	11513.	5068.	2171.	347.	2081.	7364.	3085.	417.	50.	200.	3000.
1917	200.	650.	348.	502.	50.	200.	200.	200.	200.	100.	50.	200.	243.
1978	200.	1238.	7744.	1370.	1596.	3417.	1916.	1472.	2053.	100.	50.	200.	1786.
1919	200.	281.	50.	so.	507.	1339.	200.	1423.	200.	100.	50.	200.	384.
1980	200.	200.	1072.	50.	427.	1616.	2528.	2230.	315.	100.	50.	200.	750.
1981	203.	622.	5152.	33 90.	5257.	1406.	200.	200.	200.	100.	50.	200.	1395.
1982	200.	200.	252.	738.	5547.	2934.	205.	5031.	7360.	100.	50.	200.	1.971.
1983	200.	200.	1094.	4173.	2199.	4919.	1654.	6360.	2476.	100.	50.	200.	1977.
1984	200.	1631.	915.	9056.	2675.	2142.	1020.	2828.	6530.	2152.	50.	200.	2408.
1985	200.	1506.	603.	so.	50.	200.	1831.	2814.	1407.	100.	50.	200.	157.
1986	230.	815.	50.	50.	1465.	5555.	1244.	2002.	200.	100.	50.	200.	995.
1987	200.	464.	50.	50.	171.	2004.	1790.	3349.	200.	100.	50.	200.	725.
TOTAL	489133.21~1276.3669506.2a86522.26~3446.2993209.3209794.6936402.6137402.									673697.	96960.	372747.32330146.	
AVERAGE	254.	1173.	1909.	1502.	1533.	1557.	1726.	3609.	3300.	351.	50.	200.	1428.

Bw

RSCY - NEW RESERVATION CANAL DIVERSION, WA - CANAL FLOW - 1000 AF

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1980	16.08	0.00	0.00	0.00	0.00	8.89	49.17	112.50	112.45	115.08	107.42	85.83	607.42
1981	21.51	0.00	0.00	0.00	3.30	23.32	59.39	104.57	102.40	109.87	103.99	90.15	618.50
1962	20.93	0.00	0.00	0.00	0.00	6.66	56.30	111.38	113.23	114.46	103.45	81.99	608.40
1983	19.36	0.00	0.00	0.00	0.00	6.58	47.91	101.48	112.05	113.92	105.21	79.02	586.33
1984	19.90	0.00	0.00	0.00	0.00	12.30	53.60	103.40	115.50	116.80	105.00	86.50	613.00
1985	22.95	0.00	0.00	0.00	0.00	8.50	58.90	112.79	118.73	115.34	105.47	82.36	625.12
1986	2.43	0.00	0.00	0.00	0.00	9.31	63.68	101.82	114.89	109.73	105.38	80.32	587.56
1987	12.05	0.00	0.00	0.00	0.00	16.46	64.04	112.37	107.07	94.07	06.75	53.53	54b.34
1988	24.91	0.00	0.00	0.00	9.23	29.17	72.70	94.87	110.35	109.04	110.29	72.02	632.65
1989	21.22	0.00	0.00	0.00	0.00	7.03	57.91	105.40	117.96	113.48	101.22	81.21	605.44
AVERAGE	18.13	0.00	0.00	0.00	1.25	12.02	58.30	106.06	112.46	111.18	103.42	79.37	603.08
MAXIMUM	24.91	0.00	0.00	0.00	9.23	29.17	72.70	112.79	118.73	116.80	110.29	90.15	632.65
MINIMUM	2.43	0.00	0.00	0.00	0.00	6.58	47.91	94.01	102.40	94.07	84.75	53.53	546.34

SUMS OF AVERAGES:

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
MON-JUN	309.11	290.97	290.97	290.97	290.97	289.72	216.90	210.52	112.46			
MON-JUL	420.28	402.15	402.15	402.15	402.15	400.90	388.08	329.70	223.64	111.18		
MON-AUG	523.70	505.57	505.57	505.51	505.57	504.32	491.49	433.12	327.06	214.60	103.42	
WON-SEP	603.08	584.94	584.94	584.94	584.94	583.69	570.87	512.49	406.43	293.97	102.79	79.37
OCT-WON	10.13	18.13	18.13	18.13	19.39	32.21	90.59	196.64	309.11	420.28	523.70	603.08

YAKIMA RIVER DIGITAL MODEL BASE STUDY WITH 500 C.L.E SEPT 8-APR-88
01973-1982 AVG W/O 1973,1977,1979 b-8-04

YAKIHA RIVER AT CLE ELUM CFS UNITS

YEAR	OCT	NOV	OEC	JAN	FE0	MAR	APR	MAY	JUN	JUL	AUG	SEP	AVERAGE
1926	405.	333.	554.	511.	594.	878.	709.	1916.	3172.	3147.	2406.	960.	1324.
1321	389.	453.	652.	454.	432.	546.	093.	040.	1603.	2563.	3225.	027.	1081.
1928	354.	2262.	2620.	2315.	417.	931.	934.	5089.	2035.	3444.	3261.	784.	2053.
1929	359.	371.	419.	371.	370.	532.	1377.	1303.	2068.	4052.	3012.	064.	1267.
1930	497.	329.	452.	463.	59').	025.	1312.	1321.	1998.	2720.	2023.	681.	1105.
1931	412.	373.	409.	302.	424.	593.	904.	722.	2360.	3061.	2263.	779.	1062.
1932	495.	351.	479.	47a.	389.	1098.	1239.	1500.	3263.	2970.	3362.	795.	1373.
1933	406.	1693.	2398.	1794.	455.	498.	698.	2771.	5905.	2524.	3089.	024.	1929.
1934	2160.	3450.	7377.	3305.	1405.	3204.	4159.	2552.	2070.	3689.	2961.	914.	3189.
1335	515.	795.	725.	1294.	920.	796.	741.	2541.	3333.	2922.	3291.	750.	1.559.
1936	347.	332.	455.	401.	478.	699.	1443.	4241.	3648.	342b.	3341.	807.	1656.
1937	334.	332.	513.	409.	433.	542.	762.	703.	2510.	3074.	3191.	819.	1144.
1930	365.	753.	1301.	687.	502.	590.	1126.	3741.	2853.	3273.	3245.	881.	1596.
1939	357.	498.	602.	375.	465.	645.	1209.	1386.	2590.	3819.	3364.	962.	1414.
1345	416.	343.	556.	370.	491.	663.	743.	668.	2939.	3630.	3049.	925.	1236.
1941	324.	393.	449.	377.	369.	434.	602.	1138.	1974.	2340.	1408.	1052.	908.
1342	372.	454.	551.	424.	403.	425.	821.	1077.	1701.	3003.	2744.	743.	1068.
1943	413.	443.	599.	595.	475.	663.	1481.	625.	2264.	1933.	3203.	735.	1125.
1344	380.	358.	531.	383.	394.	490.	891.	1915.	2793.	4031.	3050.	1001.	1364.
1945	429.	354.	434.	743.	603.	471.	602.	744.	1069.	3403.	3070.	959.	1161.
1946	460.	487.	447.	529.	305.	603.	977.	1497.	3461.	2297.	3380.	854.	1287.
1947	380.	376.	1836.	1300.	059.	1153.	2231.	4053.	1796.	3351.	3333.	736.	1797.
1948	351.	1233.	846.	456.	453.	545.	710.	4052.	7001.	2422.	2956.	968.	1039.
1949	432.	438.	405.	603.	475.	495.	1639.	6803.	4142.	2560.	3246.	913.	1002.
1950	336.	1347.	2339.	800.	594.	837.	1127.	4159.	7199.	2025.	3068.	743.	2168.
1951	495.	3422.	3253.	1191.	2339.	680.	1728.	5566.	3063.	2925.	3557.	930.	2431.
1952	471.	425.	410.	369.	460.	542.	1070.	2327.	1964.	3294.	3251.	944.	1301.
1953	455.	339.	335.	704.	1006.	563.	820.	1752.	2005.	2091.	3169.	165.	1236.
1954	457.	324.	2535.	1010.	543.	594.	099.	4460.	4740.	3046.	2081.	803.	1868.
1955	484.	2282.	1370.	414.	653.	471.	027.	1357.	6224.	2376.	3474.	842.	1706.
1956	698.	3780.	2373.	551.	411.	460.	1660.	7521.	5206.	2101.	3129.	026.	2407.
1357	460.	1408.	4934.	431.	451.	518.	1141.	4599.	1811.	3744.	3321.	901.	2014.
1358	442.	332.	470.	460.	772.	605.	046.	1414.	1909.	3637.	3160.	065.	1254.
1953	439.	1324.	1801.	2216.	691.	788.	1528.	3790.	4040.	2953.	3336.	074.	1993.
1960	029.	5462.	3407.	593.	513.	654.	1134.	3030.	3011.	3424.	3264.	042.	2106.
1961	430.	511.	426.	753.	1331.	1053.	1420.	4420.	4441.	2901.	3347.	012.	1023.
1962	457.	374.	578.	1290.	072.	454.	1703.	2329.	2643.	3002.	3163.	923.	1488.
1963	390.	741.	1357.	1044.	1402.	734.	808.	1913.	1926.	3693.	3299.	709.	1536.
1934	383.	430.	417.	447.	444.	590.	912.	1171.	4310.	2059.	3181.	053.	1335.
1965	43c.	1041.	2264.	1892.	1673.	997.	2125.	3865.	2996.	3225.	3263.	700.	2055.
1346	341.	362.	379.	372.	351.	443.	999.	1597.	2129.	2980.	3430.	967.	1203.
1967	518.	342.	800.	1238.	1041.	610.	764.	1673.	4443.	2930.	3496.	821.	1564.
1968	354.	775.	2736.	2749.	2512.	1237.	902.	2092.	2396.	3635.	3036.	830.	1940.
1969	465.	753.	073.	853.	439.	555.	1143.	5391.	3011.	3441.	3401.	042.	1044.
1970	369.	355.	359.	395.	442.	615.	713.	1188.	2303.	3303.	3407.	757.	1192.
1971	455.	396.	355.	006.	1432.	640.	906.	4113.	5034.	2922.	3346.	969.	1790.
1972	427.	1468.	1373.	1339.	2106.	3746.	1705.	7657.	6761.	2534.	2732.	046.	2729.
1973	527.	1432.	2570.	1316.	402.	517.	1235.	1879.	2855.	3723.	3059.	1122.	1737.
1974	338.	349.	452.	994.	686.	631.	1002.	1274.	6740.	3342.	2723.	695.	1606.
1915	384.	1111.	2149.	2233.	549.	613.	661.	3591.	5463.	1758.	2052.	834.	1862.

YAKIHA RIVER DIGITAL MODEL BASE STUDY WITH 500 CLE SEPT 8-APR-88

01973-1982 AVG W/O 1973,1977,1979 b-E-84

YAKIMA RIVER AT CLEELUM CFS UNITS

YEAR	OCT	NOV	DEC	JAN	FE6	MAR	APR	MAY	JUN	JUL	AUC	SEP	AVERAGE
1976	552.	2993.	6790.	2398.	819.	638.	1225.	4807.	3347.	2033.	2342.	762.	2404.
1977	556.	1064.	985.	1244.	439.	416.	1173.	4116.	2977.	3395.	2126.	1051.	1639.
1978	503.	453.	2352.	815.	615.	1404.	1221.	1985.	2472.	2751.	3304.	735.	1562.
1979	434.	408.	442.	421.	464.	647.	554.	898.	1954.	3699.	3135.	1068.	1185.
1980	393.	334.	764.	339.	481.	707.	1166.	2308.	2248.	3410.	3087.	940.	1359.
1981	335.	544.	2802.	2310.	2175.	615.	937.	1827.	2399.	3842.	3221.	804.	1839.
1982	413.	341.	429.	549.	1934.	1057.	813.	3124.	4769.	2095.	3349.	849.	1644.
1983	315.	414.	881.	1904.	792.	1665.	1270.	4681.	2806.	2755.	3257.	799.	1814.
19?4	466.	603.	1016.	4343.	839.	1297.	838.	3159.	4603.	2966.	3128.	778.	2013.
1985	394.	1509.	896.	354.	356.	429.	1156.	2901.	2602.	3563.	3581.	1046.	1584.
1986	300.	505.	460.	450.	668.	2213.	1553.	3095.	2142.	3399.	3352.	898.	1591.
1387	421.	551.	556.	361.	432.	620.	1157.	3239.	2693.	3731.	3120.	1123.	1528.
TOTAL	880660.	1760763.	2602500.	1921593.	1334799.	1571664.	2137402.	5381359.	6164342.	5892456.	5949187.	1607263.	37203988.
AVERAGE	458.	947.	1354.	1000.	762.	018.	1149.	2800.	3314.	3066.	3095.	864.	1643.

01973-1982 AVG W/O **1973,1977,1979** **6-8**--84

NACHES R, **TIETON R-CLIFFDELL** 'CFS UNITS

YEAR	**OCT**	**NOV**	DEC	JAN	FEB	**MAR**	**APR**	NAY	**JUN**	**JUL**	**AUG**	SEP	AVERAGE
1926	382.	183.	531.	483.	438.	*986.*	1112.	930.	319.	*0.*	246.	135.	529.
1927	257.	502.	1010.	558.	488.	521.	1333.	2929.	4165.	1268.	411.	463.	1177.
1928	438.	1400.	1220.	1333.	439.	1009.	1086.	3856.	1610.	543.	303.	107.	1116.
1929	253.	232.	197.	93.	107.	348.	539.	2024.	1908.	434.	237.	99.	343.
1930	63.	141.	203.	140.	535.	614.	2045.	1452.	1090.	226.	245.	82.	569.
1931	50.	168.	143.	283.	440.	444.	1148.	2493.	862.	44.	191.	96.	331.
1932	78.	270.	292.	378.	789.	1298.	1124.	3010.	2748.	909.	323.	258.	1005.
1933	97.	1374.	884.	366.	319.	306.	1571.	2484.	4612.	2350.	585.	477.	1302.
1934	620.	1003.	5076.	2844.	1398.	2549.	3200.	1794.	1019.	223.	383.	519.	1725.
1935	403.	1737.	978.	1410.	1247.	687.	1203.	3155.	3010.	885.	321.	372.	1281.
1936	106.	233.	222.	259.	143.	414.	2431.	4232.	2629.	489.	332.	250.	978.
1937	113.	126.	251.	171.	254.	346.	1003.	2805.	3603.	1064.	389.	363.	875.
1938	168.	841.	1040.	1032.	514.	757.	2313.	3802.	2813.	683.	372.	299.	1240.
1939	167.	247.	360.	460.	314.	609.	1769.	2202.	1338.	457.	390.	168.	710.
1940	108.	190.	646.	446.	364.	1046.	1795.	2430.	1084.	208.	371.	224.	760.
1941	137.	236.	490.	349.	340.	730.	1417.	1240.	673.	112.	390.	165.	324.
1942	222.	438.	1092.	349.	309.	367.	1597.	1644.	1566.	429.	398.	198.	720.
1943	94.	353.	732.	594.	483.	703.	3455.	2839.	3444.	1534.	437.	401.	1272.
1944	183.	290.	482.	302.	317.	387.	**758.**	1485.	1069.	218.	365.	193.	304.
1945	102.	172.	281.	712.	834.	359.	773.	2863.	1812.	372.	382.	274.	746.
1946	133.	340.	392.	537.	345.	500.	1812.	4467.	2904.	1317.	424.	403.	1137.
1947	249.	440.	1482.	377.	1070.	1310.	2109.	3171.	1640.	364.	372.	319.	1109.
1948	814.	1193.	820.	608.	552.	503.	1211.	3962.	4082.	1182.	425.	433.	1381.
1949	324.	338.	394.	224.	404.	186.	2390.	5268.	3240.	1295.	492.	482.	1309.
1930	280.	1153.	835.	206.	569.	1012.	1371.	3615.	5346.	2592.	688.	525.	1518.
1951	602.	**1477.**	2133.	1197.	2012.	883.	2746.	4343.	2711.	891.	397.	328.	1639.
1952	346.	473.	514.	331.	507.	453.	1979.	2781.	1834.	733.	346.	249.	880.
1933	96.	132.	160.	1168.	1236.	337.	1131.	2823.	2676.	1632.	490.	457.	1044.
1954	**184.**	363.	978.	**595.**	618.	649.	1353.	4167.	3429.	2532.	798.	359.	1374.
1953	403.	732.	430.	343.	366.	301.	464.	1752.	4147.	1486.	509.	513.	933.
1956	637.	1714.	1375.	650.	440.	616.	3318.	6424.	4694.	2142.	57-l.	502.	**1925.**
1957	323.	534.	1282.	400.	434.	636.	1586.	4259.	**1758.**	307.	412.	166.	1032.
1958	191.	265.	332.	496.	962.	799.	1316.	4609.	1987.	319.	447.	178.	1028.
1959	249.	1470.	1988.	1516.	816.	610.	1830.	2422.	2971.	1064.	398.	499.	1320.
1960	814.	1638.	1248.	507.	696.	918.	1924.	2199.	2514.	720.	**380.**	350.	**1157.**
1961	196.	576.	391.	779.	1421.	1082.	1917.	3422.	4126.	968.	421.	424.	1304.
1962	254.	262.	397.	907.	773.	365.	2043.	1634.	2286.	857.	410.	387.	878.
1963	312.	1070.	1206.	558.	1888.	844.	1063.	2039.	1613.	314.	535.	227.	982.
1964	204.	372.	403.	566.	404.	330.	847.	2060.	4253.	1794.	578.	489.	1023.
1965	322.	398.	1004.	1147.	1583.	li34.	2514.	2732.	2684.	917.	430.	402.	1267.
1966	165.	312.	290.	237.	213.	404.	1754.	3103.	1898.	784.	380.	305.	823.
1967	167.	**347.**	1064.	717.'	841.	488.	677.	2971.	4054.	1129.	386.	352.	1099.
1968	448.	835.	913.	1413.	2184.	1726.	792.	1832.	1857.	678.	397.	494.	1128.
1969	321.	1037.	619.	771.	415.	661.	1868.	4685.	2815.	372.	392.	372.	1214.
1970	251.	343.	283.	424.	308.	731.	879.	3159.	3623.	699.	329.	243.	956.
1971	150.	362.	484.	864.	1648.	558.	993.	4570.	3835.	2287.	576.	470.	1398.
1972	340.	432.	371.	453.	1143.	3614.	1667.	5170.	5805.	2332.	632.	486.	**1872.**
1973	383.	423.	**928.**	896.	436.	387.	724.	1300.	1005.	237.	333.	212.	627.
1974	166.	524.	189.	2301.	912.	932.	2073.	3279.	6232.	2308.	780.	316.	1769.
1973	232.	332.	394.	946.	638.	716.	959.	3020.	4333.	1800.	493.	486.	1217.

YAKIMA RIVER DIGITAL MODEL BASE STUDY WITH 500 CLE SEPT 7-DEC-89

01973-1982 AVG W/O 1973,1977,1979 6-8-84

NACHES R, TIETON R-CLIFFDELL CFS UNITS

TEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AVERAGE
1976	315.	918.	3065.	1656.	958.	533.	1359.	3748.	2576.	1878.	728.	571.	1530.
1977	330.	319.	241.	257.	253.	262.	623.	535.	665.	52.	299.	282.	343.
1978	113.	960.	2929.	590.	868.	1623.	2040.	2587.	2326.	901.	512.	503.	1332.
1979	255.	352.	329.	336.	478.	082.	895.	2936.	1475.	500.	428.	99.	750.
1980	72.	148.	1001.	555.	531.	1153.	2669.	3105.	1800.	569.	605.	265.	1040.
1981	171.	662.	1716.	1262.	2001.	1149.	1054.	1682.	1416.	536.	363.	243.	1015.
1962	230.	366.	474.	798.	2014.	1085.	1089.	3326.	4391.	1516.	490.	599.	1357.
1983	315.	390.	716.	1257.	899.	1994.	1692.	3285.	2543.	1308.	473.	491.	1283.
1984	334.	1191.	607.	1883.	1077.	1188.	1361.	2402.	3919.	2222.	410.	703.	1440.
1985	383.	400.	277.	206.	233.	370.	1846.	2804.	2198.	398.	413.	267.	817.
1986	173.	487.	293.	304.	971.	1614.	1328.	2026.	1679.	641.	351.	464.	859.
1987	211.	442.	401.	382.	388.	1269.	1973.	2885.	1124.	296.	403.	195.	833.
TOTAL	513078.	1108505.	1621244.	1389187.	1327678.	1614738.	2968781.	5656106.	4939845.	1877283.	830669.	649584.	24496696.
AVERAGE	267.	596.	844.	723.	758.	840.	1596.	2943.	2656.	977.	432.	349.	1082.

Station: BUCNELSPG Date: 03-19-1989
Water Temperature: 48
Air Temperature: 51
Flow in CFS: 9.2

Press RETURN to continue...

Station: BUCNELSPG

Date	Flow	Air Temp	Water Temp	Station
03-19-1989	9.2	51	48	BUCNELSPG
06-05-1989	14.0	88	58	BUCNELSPG
06-15-1989	15.0	66	59	BUCNELSPG
07-06-1989	20.5	88	62	BUCNELSPG
07-27-1989	20.0	70	60	BUCNELSPG
08-16-1989	23.0	70	61	BUCNELSPG
09-22-1989	26.0	76	59	BUCNELSPG
10-04-1989	20.0	58	53	BUCNELSPG
10-17-1989	18.0	60	56	BUCNELSPG
11-08-1989	14.6	50	54	BUCNELSPG

Do you want a plot of the data?

S SUNNY WARM. WARM LAST SEVERAL DAYS AND SUNNY. SEVERAL 6" TO 12" TROUT AT OUTLET. D.O.=9.4ppm E.C.=330um/cm.

Press RETURN to continue...

Station: BUCSPGABVNEL

Date	Flow	Air Temp	Water Temp	Station
03-19-1989	5.1	51	44	BUCSPGABVNEL
04-12-1989	6.0	0	55	BUCSPGABVNEL
04-24-1989	5.0	69	55	BUCSPGABVNEL
05-10-1989	5.0	0	55	BUCSPGABVNEL
06-15-1989	10.0	66	60	BUCSPGABVNEL
07-06-1989	12.4	88	63	BUCSPGABVNEL
07-27-1989	12.4	66	61	BUCSPGABVNEL
08-15-1989	13.9	70	62	BUCSPGABVNEL
09-05-1989	14.1	72	59	BUCSPGABVNEL
09-22-1989	15.9	76	59	BUCSPGABVNEL
10-04-1989	8.0	58	53	BUCSPGABVNEL
10-17-1989	11.0	60	55	BUCSPGABVNEL
11-08-1989	9.2	0	56	BUCSPGABVNEL

Do you want a plot of the data?

Flow in CFS: 4.0
D.O.=9.3ppm E.C.=430um/cm.

Press RETURN to continue...

Station: NELSPGABVBUC

Date	Flow	Air Temp	Water Temp	Station
03-19-1989	3.2	51	49	NELSPGABVBUC
04-12-1989	4.0	0	55	NELSPGABVBUC
04-24-1989	3.0	69	54	NELSPGABVBUC
05-10-1989	7.0	0	55	NELSPGABVBUC
06-15-1989	5.0	66	59	NELSPGABVBUC
07-06-1989	7.8	88	60	NELSPGABVBUC
07-27-1989	7.3	67	57	NELSPGABVBUC
08-16-1989	8.3	70	59	NELSPGABVBUC
09-05-1989	7.7	72	59	NELSPGABVBUC
10-04-1989	8.0	58	53	NELSPGABVBUC
10-17-1989	6.5	60	57	NELSPGABVBUC
11-08-1989	5.4	0	56	NELSPGABVBUC

Do you want a plot of the data?

Station	KLICKITAT RIVER NEAR GLENWOOD, WASH.			Id	14110000
Parameter	Streamflow (cfs)			Statistic	Mean
Year	1910-1971	Drainage Area	360	Hydrolog Unit	17070106
Site Code	Stream	Contribute Area	0.00	Geologic Unit	
State	WA	Gage Datum	1703.00	Aquifer Type	?????
County	077	Well Depth	No value	Agency	USGS
Latitude	46:05:20	Sample XSection	No value	Agency Office	WA
Longitude	121:15:30	Sample Depth	No value	Sequence#	0 0

62	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Year
D Cnt	1891	1830	1891	1891	1723	1891	1830	1891	1830	1891	1922	1860	22341
D Avg	453	578	658	637	656	694	1178	1849	1552	859	542	441	841
D Max	2000	6250	8790	4100	3330	3490	3410	4410	4490	3670	1400	1380	8790
D Min	238	236	241	264	265	296	364	520	480	350	297	283	236
M Cnt	61		61	61	61	61	61	61	61	61	62	62	60
M Std	116	2::	349	296	275	280	358	528	590	320	134	82	171
M Skw			2.4	2.1		2.3	0.26	0.29	0.32	1.8	1.6	0.74	0.24
M Max	0878	1709	2248	1846	1567	2017	2120	3059	3021	2298	1134	719	1231
M Min	265	298	302	339	310	374	516	916	570	421	323	305	475

Coverage 5 6 7 8 9 0 1 2 3 4 5 6 7 8

Appendix C

Summary Tables of Facility Water Supply Variances From Alaska Aquaculture Criteria

YAV170
46 12 49.0 119 46 22.0 3
CHANDLER CANAL AT HEADWORKS SEC 2 8N 24E
53005 WASHINGTON BENTON
PACIFIC NORTHWEST 130400
/TYPA/AMBNT/STREAM YAKIMA RIVER
1119USBR 830327 17030003
0000 FEET DEPTH 190 METERS ELEVATION

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 88/08/02 TO 88/08/02

	01105 ALUMINUM AL,TOT UG/L	00612 UN-IONZD NH3-N MG/L	01002 ARSENIC AS,TOT UG/L	01007 BARIUM BA,TOT UG/L	01027 CADMIUM CD,TOT UG/L	0040s CO' MG/L	50064 CHLORINE FREE AVL MG/L	00940 CHLORIDE TOTAL MG/L	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L
NO OF VALUES	1	1		1	1	1	0	1	1	1
MEAN	440.00	0.0008	5.00	5000.	2.000	1.000	0.0000	5.318	2.000	2.
MEDIAN	440.00	0.0008	5.00	5coo.	2.000	1.000	*********	5.318	2.000	2.
NO OF VIOLS	i	0	0	0	0	0	0	1	0	0
PERCENT VIOL	100.	0.	0.	J.	0.	0.	0.	100.	0.	0.
MINIMUM VIOL	440.00	0.0000	0.00	0.	0.000	0.000	0.0000	5.318	0.000	0.
MEAN VIOL	440.00	0.0000	0.00	0.	0.000	0.000	0.0000	5.318	0.000	0.
MAXIMUM VIOL	440.00	0.0000	0.00	0.	0.000	0.000	0.0000	5.318	0.000	0.
MIN CRITERIA	*********	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	10.00	0.0125	10.00	5000.	5.000	1.000	0.0100	4.000	2.000	7000.

YAV170
46 12 49.0 119 46 22.0 3
CHANOLER CANAL AT HEADWORKS SEC 2 8N 24E
53005 WASHINGTON BENTON
PACIFIC NORTHWEST 130400
YAKIMA RIVER
1119USBR 880827 17030003
0000 FEET DEPTH 190 METERS ELEVATION

/TYPA/AMBNT/STREAM

SUMMARY OF VIOLATIONS Oh; SAMPLES COLLECTED FROM 88/08/02 TO 88/08/02

	00300 DO MG/L	00950 FLUDRIDE F,DISS MG/L	71975 H2S MG/L	0104s IRON FE,TOT UC/L	01051 LEAD PB,TOT UG/L	00925 MGNSIUM MG,DISS MG/L	01055 MANGNESE MN UG/L	71900 MERCURY HG,TOTAL UG/L	01067 NICKEL NI,TOTAL UG/L	00631 NO2&NO3 N-DISS MG/L
NO OF VALUES	1	1	1	1	1	1	1	1	1	1
MEAN	11.300	0.180	0.0100	420.	2.00	10.34	140.00	0.200	10.00	1.120
MEDIAN	11.300	3.160	0.0100	420.	2.00	10.34	140.00	0.200	10.00	1.120
NO OF VIOLS	0	0	0	0	0	0	1	0	0	1
PERCENT VIOL	0.	0.	0.	0.	0.	0.	100.	0.	0.	100.
MINIMUM VIOL	0.000	0.000	0.0000	0.	0.00	0.00	140.00	0.000	0.00	1.120
MEAN VIOL	0.000	0.000	0.0000	0.	0.00	0.00	140.00	0.000	0.00	1.120
MAXIMUM VIOL	0.000	0.303	0.0003	0.	0.00	0.00	140.00	0.000	0.00	1.120
MIN CRITERIA	7.300	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	*********	0.500	0.0100	1003.	20.00	15.00	10.00	0.200	10.00	1.000

C3

STORET RETRIEVAL DATE 89/12/15 - STAND - VCRSIJN CF MAY 1988 STN 2.SUUHARY.3

YAV170
46 12 49.0 119 46 22.0 3
CHANDLER CANAL AT HEADWORKS SEC 2 8N 24E
53005 YASHINGTON BENTON
PACIFIC NORTHUEST 130400
/TYPA/AMBNT/STREAM
YAKIMA RIVER
1119USBR 830327 17030003
0000 FEET DEPTH 190 METERS ELEVATION

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTEG FROM 88/08/02 TD 88/08/02

	00613 NO2-N DISS MG/L	73004 NIT + AR GAS SATR % SAT	00555 OIL-GRSE FREON-GR MG/L	30400 PH SU	00935 PTSSIUM K,DISS MG/L	01147 SELENIUM SE,TOT UG/L	01077 SILVER AG,TOT UG/L	01092 ZINC ZN,TOT UG/L	00930 SODIUM NA,DISS MG/L	00946 SULFATE SO4-DISS MG/L
NO OF VALUES	1		1	1	1	1	1	1	1	1
MEAN	0.040	53.0	1.500	8.370	3.128	5.00	2.000	5.00	16.32	16.81
MEDIAN	0.040	36.0	1.300	8.370	3.129	5.00	2.000	5.00	16.32	16.81
NO OF VIOLS	0	0	0	1	0	0	0	0	0	0
PERCENT VIOL	0.	3.	3.	100.	0.	0.	0.	0.	0.	0.
MINIMUM VIOL	0.000	0.0	0.000	8.370	0.300	0.00	0.000	0.00	0.00	0.00
MEAN VIOL	0.000	3.0	0.000	3.373	0.000	0.00	0.000	0.00	0.00	0.00
MAXIMUM VIOL	0.000	0.0	3.000	5.370	0.300	0.00	0.000	0.00	0.00	0.00
MIN CRITERIA	*********	*********	*********	6.500	*********	*********	*********	*********	15.00	*********
MAX CRITERIA	0.100	103.0	1.000	a.000	5.000	10.00	3.000	10.00	75.00	50.00

STORET RETRIEVAL DATE 89/12/15 - STAND - VERSION OF MAY 1983 STN 2.SUMMARY.4

YAV170
46 12 49.0 119 46 22.0 3
CHANDLER CANAL AT HEADWORKS SEC 2 8N 24E
53005 WASHINGTON BENTON
PACIFIC NORTHWEST 130400
/TYPA/AMBNT/STREAM YAKIMA RIVER
1119USBR 880827 17030003
0000 FEET DEPTH 190 METERS ELEVATION

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 88/08/02 TO 88/08/02

	00010 WATER TEMP CENT	70301 DISS SOL SUM MG/L	00530 RESIDUE TOT NFLT MG/L
NO OF VALUES	1	1	1
MEAN	22.90	174.3	44.00
MEDIAN	22.90	174.0	44.03
NO OF VIOLS	1	0	0
PERCENT VIOL	100.	0.	0.
MINIMUM VIOL	22.90	0.3	0.00
MEAN VIOL	22.50	0.0	0.00
MAXIMUM VIJL	22.90	0.0	0.00
MIN CRITERIA	*********	*********	*********
MAX CRITERIA	15.00	400.3	30.00

C5

STORET RETRIEVAL DATE 89/12/15 - STAND - VERSION OF MAY 1988 STN 1.SUMMARY.1

12510500
46 1s 13.0 119 28 37.0 2
YAKIMA RIVER AT KIONA, WASH.
53005 WASHINGTON BENTON
130492

/TYPA/AMBNT/STREAM

112WRD HQ 17030003003 0011.830 OFF
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 47/06/05 TO 89/07/20

	01105 ALUMINUM AL,TOT UG/L	00612 UN-IONZD NH3-N MG/L	01002 ARSENIC AS,TOT UG/L	01007 BARIUM BA,TOT UG/L	010.27 CADMIUM CD,TOT UG/L	00405 CO2 MG/L	50064 CHLORINE FREE AVL MG/L	00940 CHLORIDE TOTAL MG/L	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L
NO OF VALUES	17	220	33	25	32	434	0	574	36	38
MEAN	928.82	0.0533	2.61	ae.	5.056	3.132	0.0000	5.421	7.222	11.
MEDIAN	320.00	0.0011	3.00	100.	1.000	2.400	*********	5.500	0.000	9.
NO OF VIOLS	17	7	0	0	0	393	0	422	7	0
PERCENT VIOL	100.	3.	0.	0.	0.	95.	0.	74.	19.	0.
MINIMUM VIOL	40.00	0.0169	0.00	0.	0.000	1.100	0.0000	4.000	10.000	0.
MEAN VIOL	928.32	0.0462	0.00	0.	0.000	3.261	0.0000	6.305	15.714	0.
MAXIMUM VIOL	10000.00	5.1133	0.00	0.	0.000	23.300	0.0000	39.000	30.000	0.
MIN CRITERIA	*********	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	10.03	0.0125	10.00	5000.	5.000	1.000	0.0100	4.000	2.000	7000.

C8

STORET RETRIEVAL DATE 89/12/15 - STANO - VERSION OF MAY 1988 STN 1.SUMMARY.2

12510500
45 15 13.0 119 28 37.0 2
YAKIMA RIVER AT KIONA, WASH.
5 3 0 0 5 WASHINGTON BENTON
130492

/TYPA/AMBNT/STREAM

112WRD HQ 17030003003 0011.880 OFF
0003 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 47/06/05 TO 89/07/20

	00300 DO MG/L	00350 FLUORIDE F,DISS MG/L	71875 H2S MG/L	01045 IRON FE,TOT UG/L	01051 LEAD PB,TOT UG/L	00925 MGNSIUM MG,DISS MG/L	01055 MANGNESE MN UG/L	71900 MERCURY HG,TOTAL UG/L	01067 NICKEL NI,TOTAL UG/L	00631 NO2&NO3 N-DISS MG/L
NC OF VALUES	251	401	0	94	36	577	38	96	22	89
WEAN	10.719	a.217	0.0000	728.	53.89	8.61	78.16	0.457	5.50	1.036
MEDIAN	10.400	0.200	*********	55.	6.00	3.60	60.00	0.500	4.50	1.100
NC OF VIOLS	1	0	0	14	0	3	37	17	4	48
PERCENT VIOL	0.	0.	0.	15.	0.	1.	97.	18.	18.	54.
MINIMUM VIOL	6.700	0.000	0.0003	1200.	0.00	16.00	30.00	0.200	11.00	1.070
MEAN VIOL	6.700	0.000	0.0000	3654.	0.00	28.33	60.00	0.629	14.00	1.288
MAXIMUM VIOL	6.700	0.000	0.0000	18000.	0.00	53.00	420.00	4.100	18.00	1.900
MIN CRITERIA	7.000	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	*********	0.500	0.0100	1000.	20.00	15.00	10.00	0.200	10.00	1.000

STORET RETRIEVAL DATE 89/12/15 - STAND - VERSION OF MAY 1988 STN 1.SUMMARY.3

12510500
46 15 13.0 119 28 37.0 2
YAKIMA RIVER AI KIONA. WASH.
53005 WASHINGTON BENTON
130492

/TYPA/AMBNT/STREAM

112WRD HQ 17030003003 0011.880 OFF
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 47/06/05 TO 89/07/20

	00613 NO2-N DISS MG/L	73004 NIT + AR GAS SATR % SAT	00556 OIL-GRSE FREON-GR XC/L	00400 PH SU	30935 PTSSIUM K,DISS MG/L	01147 SELENIUM SE,TOT UG/L	01077 SILVER AG,TOT UG/L	01092 ZINC ZN,TOT UG/L	00930 SODIUM NA,DISS MG/L	00946 SULFATE SO4-DISS MG/L
NO OF VALUES	57	0	3	647	505	33	26	38	622	0
MEAN	0.016	0.0	0.003	7.301	2.732	0.58	1.033	33.16	14.99	0.00
MEDIAN	0.010	*********	*********	7.300	2.700	1.00	0.000	20.00	15.00	*********
NO OF VIOLS	0	0	0	233	2	0	0	31	305	0
PERCENT VIOL	0.	0.	0.	36.	0.	0.	0.	82.	49.	0.
MINIMUM VIOL	0.003	0.0	0.000	8.000	5.000	0.00	0.000	20.00	5.40	0.00
MEAN VIOL	0.000	3.0	0.000	8.225	5.400	0.00	0.000	38.39	10.45	0.00
MAXIMUM VIOL	0.000	0.0	0.000	9.200	5.800	0.00	0.000	160.00	15.00	0.00
MIN CRITERIA	*********	*********	*********	6.500	*********	*********	*********	*********	15.00	*********
MAX CRITERIA	0.100	153.0	1.000	8.000	5.000	10.00	3.000	10.00	15.00	50.00

12510500
46 15 13.0 119 28 37.0 2
YAKIMA RIVER AT KIONA,WASH.
53005 WASHINGTON BENTON
130492

/TYPA/AMBNT/STREAM

112WRD Ha 17030003003 0011.880 OFF
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 47/06/05 TO 89/07/20

	00013 WATER TEMP CENT	70301 DISS SOL SUM MG/L	00530 RESIDUE TOT NFLT MG/L
NO OF VALUES	416	295	70
MEAN	13.30	165.0	29.66
MEDIAN	13.60	165.0	21.00
NO OF VIOLS	178	0	4
PERCENT VIOL	43.	0.	6.
MINIMUM VIOL	15.00	3.0	103.00
MEAN VIOL	19.74	0.0	148.50
MAXIMUM VIOL	28.50	0.0	256.00
MIN CRITERIA	*********	*********	*********
MAX CRITERIA	15.00	400.0	80.00

CW

STORET RETRIEVAL DATE 90/01/30 - STAND - VERSION OF MAY 1988 STN 4.SUMMARY.1

YAV208
46 12 57.0 119 45 24.0 4
PROSSER WELL 9N 24E 360CC
53005 WASHINGTON BENTON
PACIFIC NORTHWEST 130400
/TYPA/AMBNT/WELL
Y AKIHA RIVER
1119USBR 891223 17030003
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 89/12/20 TO 89/12/20

	01105 ALUMINUM AL,TOT UG/L	00612 UN-IONZD NH3-N MG/L	01002 ARSENIC AS,TOT UG/L	01007 BARIUM BA,TOT UG/L	01027 CADMIUM CD,TOT UG/L	00405 CO2 MG/L	50064 CHLORINE FREE AVL MG/L	00940 CHLORIDE TOTAL MG/L	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L
NO OF VALUES		1	1	1	1	1	1	1	1	1
MEAN	15.00	0.0000	5.00	5000.	2.000	20.600	0.100	12.053	3.000	5.
MEDIAN	15.00	0.0000	5.0;	5000.	2.000	20.600	a.100	12.053	3.000	5.
NO OF VIOLS	1	0	0	0	0	1	0	1	1	0
PERCENT VIOL	100.	0.	0.	0.	0.	100.	0.	100.	100.	0.
MINIMUM VIOL	15.00	0.0000	0.00	0.	0.000	23.600	0.000	12.053	3.000	0.
MEAN VIOL	15.00	0.0000	0.09	3.	0.000	20.600	3.303	12.053	3.000	0.
MAXIMUM VIOL	15.00	0.0000	0.00	0.	0.000	23.603	0.000	12.053	3.000	0.
MIN CRITERIA	*******	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	10.00	0.0125	10.00	5000.	5.000	1.000	0.100	4.000	2.000	7000.

C10

YAV208
46 12 57.0 119 45 24.0 4
PROSSER WELL 9N 24E 360CC
53035 YASHINGTON BENTON
PACIFIC NORTHWEST 130400
/TYPA/AMBNT/WELL YAKIMA RIVES
1119USBR 8 9 1 2 2 3 17035003
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 89/12/20 TO 89/12/20

	00300 DO MG/L	00950 FLUORIDE F,DISS MG/L	71875 H2S MG/L	01045 IRON FE,TOT UG/L	01351 LEAD PB,TOT UG/L	90325 MGNSIUM MG,DISS MG/L	01055 MANGNESE MN UG/L	71900 MERCURY HG,TOTAL UG/L	01067 NICKEL NI,TOTAL UG/L	00631 NO2&NO3 N-DISS MG/L
NO OF VALUES	1	1	1	1	1	1	1	1	1	1
MEAN	5.500	0.340	0.0100	1350.	4.00	15.93	15.00	0.200	10.00	3.550
MEDIAN	5.503	s.343	0.0100	1350.	4.00	15.93	15.00	0.200	10.00	3.350
NO OF VIOLS	1	0	0	1	0	1	1	0	0	1
PERCENT VIOL	100.	0.	0.	100.	0.	100.	100.	0.	0.	100.
MINIMUM VIOL	5.500	0.000	0.0000	1350.	0.00	15.93	15.00	0.000	0.00	3.550
MEAN VIOL	5.503	0.000	0.0000	1350.	0.00	15.93	15.00	0.000	0.00	3.550
MAXIMUM VIOL	5.503	0.000	0.0000	1350.	0.00	15.93	15.00	0.000	0.00	3.550
MIN CRITERIA	7.000	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	*********	0.500	0.0100	1000.	20.00	15.00	10.00	0.200	10.00	1.000

C11

STORET RETRIEVAL DATE 90/01/30 - STAND - VERSION OF W A Y 1988 STN 4.SUMMARY.3

YAV208
461257.0 119 4524.0 4
PROSSER W E L L 9N 24E 36DCC
5 3 0 9 5 WASHINGTON BENTON
PACIFIC NORTHWEST 130400
/TYPA/AMBNT/WELL
YAKIMA RIVER
1119USBR 891223 17030003
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 89/12/20 TO 89/12/20

	00613 NO2-N DISS MG/L	73004 NIT + AR GAS SATR % SAT	00556 OIL-GRSE FR SON-CR MG/L	00400 PH su	00935 PTSSIUM K,DISS MC/L	01147 SELENIUM SE,TOT UG/L	01077 SILVER AG,TOT UG/L	01092 ZINC ZN,TOT UG/L	00930 SODIUM NA,DISS MG/L	00946 SULFATE SO4-DISS MG/L
NO OF VALUES	0	1	1	1	1	1	1	1	1	1
MEAN	0.000	111.0	1.003	7.350	4.301	5.00	2.000	10.00	22.53	36.53
MEDIAN	*********	111.0	1.300	7.350	4.301	5.00	2.000	10.00	22.53	35.50
NO OF VIOLS	U	1	0	0	0	0	0	0	0	0
PERCENT VIOL	3.	100.	0.	0.	0.	0.	0.	0.	0.	0.
MINIMUM VIOL	0.000	111.0	0.000	0.000	0.000	0.00	0.000	0.00	0.00	0.00
MEAN VIOL	0.000	111.0	0.000	0.000	0.000	0.00	0.003	0.00	0.00	0.00
MAXIMUM VIOL	2.300	111.0	0.000	0.300	0.000	0.00	0.003	0.00	0.00	0.00
MIN CRITERIA	*********	*********	*********	6.500	*********	*********	*********	*********	15.00	*********
MAX CRITERIA	0.100	103.0	1.000	8.000	5.000	10.00	3.000	10.00	75.00	50.00

YAV208
45 12 57.0 119 45 24.0 4
PROSSER WELL 9N 24E 36DCC
53005 WASHINGTON BENTON
PACIFIC NORTHWEST 130400
YAKIMA RIVER
1119USBR 891223 17030003
0000 FEET DEPTH

/TYPA/AMBNT/WELL

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 89/12/20 TO 89/12/20

	00010 WATER TEMP CENT	70301 DISS SOL SUM MG/L	00530 RESIDUE TOT NFLT MG/L
NO OF VALUES	1	1	1
MEAN	11.70	342.0	2.00
MEDIAN	11.70	342.0	2.00
NO OF VIOLS	0	0	0
PERCENT VIOL	0.	0.	0.
MINIMUM VIOL	0.00	0.0	0.00
MEAN VIOL	0.00	0.0	0.00
MAXIMUM VIOL	0.00	0.0	0.00
MIN CRITERIA	*********	*********	*********
MAX CRITERIA	15.00	400.0	80.00

STORET RETRIEVAL DATE 89/12/15 - STAND - VERSION OF MAY 1988 STN 7.SUMMARY.1

YAV169
46 29 50.0 120 26 34.0 3
YAKIMA RIVER 100 FT BELOW SUNNYSIDE DAM
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST 1 3 0 4 0 0
YAKIMA RIVER
1113USBR 880827 17030003
0000 FEET DEPTH 271 METERS ELEVATION

/TYPA/AMBNT/STREAM

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 88/08/02 TO 88/08/02

	31105 ALUMINUM AL,TOT UG/L	00612 UN-IONZD NH3-N MG/L	01002 ARSENIC AS,TOT UG/L	01007 BARIUM BA,TOT UG/L	01027 CADMIUM CD,TOT UG/L	00405 CO2 MG/L	50064 CHLORINE FREE AVL MG/L	00940 CHLORIDE TOTAL MG/L	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L
NO OF VALUES	1	1	1	1	1	1	0	1	1	1
MEAN	230.03	0.0002	5.00	5000.	2.000	2.000	0.0000	1.064	2.000	2.
MEDIAN	200.00	0.0002	5.00	5000.	2.000	2.000	*********	1.064	2.000	2.
NO OF VIOLS	1	0	0	0	0	1	0	0	0	0
PERCENT VIOL	100.	0.	0.	0.	3.	100.	0.	0.	0.	0.
MINIMUM VIOL	200.03	0.0000	0.00	0.	0.000	2.000	0.0000	0.000	0.000	0.
MEAN VIOL	230.00	0.0000	0.00	0.	0.000	2.000	0.0000	0.000	0.000	0.
MAXIMUM VIOL	200.00	0.0000	0.00	0.	0.000	2.500	0.0000	0.000	0.000	0.
MIN CRITERIA	*********	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	10.00	0.0125	10.00	5000.	5.000	1.000	0.0100	4.000	2.000	7000.

YAV169
46 29 SO.0 120 26 34.0 3
YAKIMA RIVER 100 FT BELOW SUNNYSIDE DAM
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
Y AKIMA RIVER
1119USBR 830827 17030003
0000 FEET DEPTH 271 METERS ELEVATICN

/TYPA/AMBNT/STREAM

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 88/08/02 TO 88/08/02

	05300 DO MG/L	3095; FLUORIDE F,DISS MG/L	31975 H2S MG/L	01045 IRON FE,TOT UG/L	01051 LEAD PB,TOT UG/L	00925 MGYSIUM MG,DISS MG/L	01055 HANGNESE MN UG/L	71900 MERCURY HG,TOTAL UG/L	01067 NICKEL NI,TOTAL UG/L	00631 NO2&NO3 N-DISS MG/L
NO OF VALUES	1	1	1	1	1	1	1	1	1	1
MEAN	5.470	0.100	0.0100	130.	2.00	3.69	20.00	0.200	10.00	0.120
MEDIAN	3.675	0.100	0.0100	180.	2.00	3.09	20.00	0.200	10.00	0.120
NO OF VIOLS	0	0	0	0	0	0	1	0	0	0
PERCENT VIOL	0.	0.	0.	3.	0.	0.	100.	0.	0.	0.
MINIMUM VIOL	0.000	0.300	0.0300	0.	0.00	0.00	20.00	0.000	0.00	0.000
MEAN VIOL	0.303	0.000	0.0000	0.	0.00	0.00	20.00	0.000	0.00	0.000
MAXIMUM VIOL	0.000	i1.003	0.0000	0.	0.00	0.00	20.00	0.000	0.00	0.000
MIN CRITERIA	7.003	*********	*********	*********	*********	*********	********	*********	*********	*********
MAX CRITERIA	*********	0.500	0.0100	1000.	20.00	15.00	10.00	0.200	10.00	1.000

?EVAL DATE 89/12/15 - STAND - VERSION OF MAY 1988 STN 7.SUMMARY.3

YAV169
46 29 50.0 120 26 34.0 3
YAKIMA RIVER 103 FT BELOW SUNNYSIDE DAM
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
Y AKIMA RIVER
1119USBR 880827 17030003
0000 FEET DEPTH 271 METERS ELEVATION

/TYP./AMBNT/STREAM

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 88/08/02 TO 88/08/02

	00613 NO2-N DISS MG/L	73004 NIT + AR GAS SATR % SAT	00556 OIL-GRSE FREON-GR MG/L	00400 PH SU	00935 PTSSIUM K,DISS MG/L	01147 SELENIUM SE,TOT UG/L	01077 SILVER AG,TOT UG/L	01092 ZINC ZN,TOT UG/L	00930 SODIUM NA,DISS MG/L	00946 SULFATE SO4-DISS MG/L
NO OF VALUES	1	1	1	1	1	1	1	1	1	1
MEAN	0.010	101.0	1.003	7.640	1.173	5.00	2.000	5.00	4.83	3.36
MEDIAN	0.013	101.0	1.000	7.643	1.173	5.00	2.000	5.00	4.83	3.36
NO OF VIOLS	0	0	0	0	0	0	0	0	1	D
PERCENT VIOL	0.	0.	0.	0.	0.	3.	0.	0.	100.	0.
MINIMUM VIOL	0.000	0.0	0.000	c-300	0.000	0.00	0.000	0.00	4.83	0.00
MEAN VIOL	0.000	0.0	0.000	0.000	0.000	0.08	0.000	0.00	4.83	0.00
MAXIMUM VIOL	0.000	0.0	0.009	0.000	0.000	0.00	0.000	0.00	4.83	0.00
MIN CRITERIA	*********	*********	*********	6.500	*********	*********	*********	*********	15.00	*********
MAX CRITERIA	0.100	103.0	1.000	8.000	5.000	10.00	3.000	10.00	75.00	50.00

YAV169
46 29 50.0 120 26 34.0 3
YAKIMA RIVER 100 FT BELOW SUNNYSIDE DAM
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
/TYPA/AMBNT/STREAM YAKIMA RIVER
1119USBR 880327 17030003
0000 FEET DEPTH 271 METERS ELEVATION

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 88/08/02 TO 88/08/02

	00010 WATER TEMP CENT	70301 DISS SOL SUM MG/L	00530 RESIDUE TOT NFLT MG/L
NO OF VALUES	1	1	1
MEAN	16.90	64.0	10.00
MEDIAN	15.90	64.0	10.00
NO OF VIOLS	1	0	0
PERCENT VIOL	100.	0.	3.
MINIMUM VIOL	16.90	0.0	0.00
MEAN VIOL	14.90	0.0	0.00
MAXIMUM VIOL	16.90	0.0	0.00
MIN CRITERIA	*********	*********	*********
MAX CRITERIA	15.00	400.0	80.00

STORETRETRIEVALDATE 89/12/15 - STAND - VERSION OF MAY 1988 STN 1.SUMMARY.1

YAV140
47 11 33.0 120 56 56.0 1
YAKIMA R AT CLEELUM
53037 WASHINGTON KITTITAS
PACIFIC NORTHWEST
/TYPA/AMBNT/STREAM YAKIMA RIVER BASIN
1119USBR 760223 HQ 17030001032 0006.620 Off
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 74/03/21 TO 87/03/02

	01105 ALUMINUM AL,TOT UG/L	00612 UN-IONZD NH3-N MG/L	01002 ARSENIC AS,TOT UG/L	01007 BARIUM BA,TOT UG/L	01027 CADMIUM CD,TOT UG/L	00405 CO2 MG/L	50064 CHLORINE FREE AVL MG/L	00940 CHLORIDE TOTAL MG/L	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L
NO OF VALUES	0	135	2	0	2	0	0	1	2	2
MEAN	0.00	0.0301	7.51)	0.	2.000	0.000	0.0000	7.440	2.000	6.
MEDIAN	*********	0.0000	7.50	*********	2.000	*********	*********	7.440	2.000	6.
NO OF VIOLS	C	0	0	0	0	0	0	1	0	0
PERCENT VIOL	0.	0.	3.	0.	0.	0.	0.	100.	0.	0.
MINIMUM VIOL	0.00	0.0035	0.00	0.	0.000	0.000	0.0000	7.440	0.000	0.
MEAN VIOL	0.00	0.0300	0.00	0.	0.000	0.000	0.0000	7.440	0.000	0.
MAXIMUM VIOL	0.00	0.0000	0.00	0.	0.000	0.000	0.0000	7.440	0.000	0.
MIN CRITERIA	*********	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	10.00	0.0125	10.00	5000.	5.000	1.000	0.0100	4.000	2.000	7000.

YAV140
47 11 33.0 120 56 56.0 1
YAKIMA R AT CLE ELUM
53037 WASHINGTON KITTITAS
PACIFIC NORTHWEST
/TYPA/AMBNT/STREAM YAKIMA RIVER BASIN
1119USBR 760223 HQ 17030001032 0006.620 OFF
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 74/03/21 TO 87/03/02

	00300 DO MG/L	00950 FLUORIDE F,DISS MG/L	71875 H2S MG/L	01045 IRCN FE,TOT UG/L	01051 LEAD PB,TOT UG/L	00925 MGNSIUM MG,DISS MG/L	0105s MANGNESE MN UG/L	71900 MERCURY HG,TOTAL UG/L	01067 NICKEL NI,TOTAL UG/L	00631 NO2&NO3 N-DISS MG/L
NO OF VALUES	123	0	0	2	2	1	2	1	0	57
MEAN	10.874	0.000	0.0000	135.	2.03	2.43	10.00	0.200	0.00	0.096
MEDIAN	10.300	*********	*********	135.	2.00	2.43	10.00	0.200	*********	0.100
no OF VIOLS	4	0	0	0	0	0	1	0	0	0
PERCENT VIOL	3.	0.	0.	0.	0.	0.	50.	0.	0.	0.
MINIMUM VIOL	6.503	0.000	0.0000	0.	0.00	0.00	15.00	0.000	0.00	0.000
MEAN VIOL	6.725	0.000	0.0000	0.	0.00	0.00	15.00	0.000	0.00	0.000
MAXIMUM VIOL	6.500	3.000	0.0000	0.	0.00	0.00	15.00	0.000	0.00	0.000
MIN CRITERIA	7.000	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	*********	0.500	0.0100	1000.	20.00	15.00	10.00	0.200	10.00	1.000

C19

STORET RETRIEVAL DATE 89/12/15 - STAND - VERSION OF MAY 1988 STN 1.SUMMARY.3

YAV140
47 11 33.0 120 56 56.0 1
YAKIMA R AT CLE ELUM
53037 WASHINGTON KITTITAS
PACIFIC NORTHWEST
YAKIMA RIVER BASIN
/TYPA/AMBNT/STREAM 1119USBR 760223 HQ 17030001032 0006.620 OFF
0330 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 74/03/21 TO 87/03/02

	00613 NO2-N DISS MG/L	73004 NIT + AR GAS SATR % SAT	00556 OIL-GRSE FREON-GR MG/L	03400 PH SU	00335 PTSSIUM K,DISS MG/L	01147 SELENIUM SE,TOT UG/L	01077 SILVER AG,TOT UG/L	01092 ZINC ZN,TOT UG/L	00930 SODIUM NA,DISS MG/L	00946 SULFATE SOC-OISS MG/L
NO OF VALUES	0	0	0	10	1	2	0	2	1	1
MEAN	0.000	0.0	0.000	7.450	1.170	5.00	0.000	3.50	4.60	0.96
MEDIAN	*********	*********	*********	7.400	1.170	5.00	444444444	3.50	4.60	0.96
NO OF VIOLS	C	0	0	0	0	0	0	0	1	0
PERCENT VIOL	0.	0.	3.	0.	0.	0.	0.	0.	100.	0.
MINIMUM VIOL	0.000	3.0	0.000	0.000	0.000	0.00	0.000	0.00	4.60	0.00
MEAN VIOL	0.003	0.0	0.000	0.000	0.000	0.00	0.000	0.00	4.60	0.00
MAXIMUM VIOL	5.000	0.0	0.000	0.00iJ	0.000	0.00	0.000	0.00	4.60	0.00
MIN CRITERIA	*********	*********	*********	5.500	444444444	*********	*********	*********	15.00	444444444
MAX CRITERIA	3.100	103.0	1.000	3.000	5.000	10.00	3.000	10.00	75.00	50.00

YAV140
47 11 33.0 120 56 56.0 1
YAKIMA R AT CLE ELUM
53037 WASHINGTON KITTITAS
PACIFIC NORTHWEST
/TYPA/AMBNT/STREAM YAKIMA RIVER RASIN
1119USBR 760223 HQ 17030001032 0006.620 OFF
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 74/03/21 TO 87/03/02

	00010 WATER TEMP CENT	70301 DISS SOL SUM MG/L	00530 RESIDUE TOT NFLT MG/L
NO OF VALUES	138	0	127
MEAN	8.89	0.0	10.00
MEDIAN	8.65	*********	3.00
NO OF VIOLS	17	0	2
PERCENT VIOL	12.	0.	2.
MINIMUM VIOL	15.40	0.0	100.00
MEAN VIOL	16.65	0.0	253.50
MAXIMUM VIOL	18.10	0.0	407.00
MIN CRITERIA	*********	*********	*********
MAX CRITERIA	15.00	400.0	80.00

STORET RETRIEVAL DATE 90/01/30 - STAND - VERSION OF MAY 1986 STN 2.SUMMARY.1

YAV140
47 11 33.0 120 56 56.0 1
YAKIMA R AT CLE ELUM
33037 WASHINGTON KITTITAS
PACIFIC NORTHWEST
YAKIMA RIVER BASIN
1119USBR 760223 HQ 17030001032 0036.620 OFF
3003 FEET DEPTH

/TYPA/AMBNT/STREAM

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 89/12/19 TO 89/12/19

	01105 ALUMINUM AL,TOT UG/L	00612 UN-IONZD NH3-N MG/L	01002 ARSENIC AS,TOT UG/L	01307 BARIUM BA,TOT UG/L	01027 CADMIUM CD,TOT UG/L	00405 CO2 MG/L	50064 CHLORINE FREE AVL MG/L	00940 CHLORIDE TOTAL MG/L	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L
NO OF VALUES	1	1	1	1	1	1	1	1	1	1
MEAN	40.00	0.0002	5.03	5000.	2.000	0.200	0.101)	0.709	2.000	2.
MEDIAN	40.00	0.0002	5.00	5030.	2.000	0.200	0.1013	0.709	2.000	2.
NO OF VIOLS	1	0	0	0	0	0	0	0	0	0
PERCENT VIOL	100.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MINIMUM VIOL	40.00	0.0000	0.00	0.	0.000	0.000	0.000	0.000	0.000	0.
MEAN VIOL	40.00	0.0000	0.00	0.	0.000	0.000	0.000	0.000	0.000	0.
MAXIMUM VIOL	40.00	0.0000	0.00	0.	0.000	0.000	0.000	0.000	0.000	0.
MIN CRITERIA	*********	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	10.00	0.0125	10.00	5000.	5.000	1.000	0.100	4.000	2.000	7030.

YAV140
4 7 1133.0 120 56 50.0 1
YAKIMA R AT CLE ELUM
53037 WASHINGTON KITTITAS
PACIFIC NORTHWEST
YAKIMA RIVER BASIN
1119USBR 750223 HQ 1753000103~ 0036.620 OFF
0000 FEET DEPTH

/TYPA/AMBNT/STREAM

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 89/12/19 TO 89/12/19

	00300 DO MG/L	00950 FLUORIDE F,DISS MG/L	71875 H2S MG/L	01045 IRON FE,TOT UG/L	01051 LEAD PB,TOT UG/L	00925 MGNSIUM MG,DISS MG/L	01055 MANGNESE MN UG/L	71900 MERCURY HG,TOTAL UG/L	01067 NICKEL NI,TOTAL UG/L	00631 NO2&NO3 N-DISS MG/L
NO OF VALUES	1	1	1	1	1	1				
MEAN	12.500	0.100	0.0100	90.	2.00	2.31	5.00	0.200	5.00	0.030
MEDIAN	12.500	0.100	0.0100	90.	2.00	2.31	5.00	0.200	5.00	0.030
NO OF VIOLS	0	0	0	0	0	0	0	0	0	0
PERCENT VIOL	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MINIMUM VIOL	0.000	0.000	0.0000	0.	0.00	0.00	0.00	0.000	0.00	0.000
MEAN VIOL	0.000	0.000	0.0000	0.	0.00	0.00	0.00	0.000	0.00	0.000
MAXIMUM VIOL	0.000	0.000	0.0000	0.	0.00	0.00	0.00	0.000	0.00	0.000
MIN CRITERIA	7.000	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	*********	0.500	0.0100	1000.	20.00	15.00	10.00	0.200	10.00	1.000

STORET RETRIEVAL DATE 90/01/30 - STAND - VERSION OF MAY 1986 STN Z.SUMMARY.3

YAV140
47 11 33.0 120 56 56.0 1
YAKIMA R AT CLE ELUM
53037 WASHINGTON KITTITAS
PACIFIC NORTHWEST
/TYPA/AMBNT/STREAM YAKIMA RIVER BASIN
1119USBR 760223 HQ 17030001032 0036.620 OFF
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 89/12/19 TO 89/12/19

	00613 NO2-N DISS MG/L	73004 NIT + CR GAS SATR % SAT	00556 OIL-GRSE FREON-GR MG/L	00400 PH SU	00935 PTSSIUM K,DISS MG/L	01147 SELENIUM SE,TOT UG/L	01717 SILVER AG,TOT UG/L	01092 ZINC ZN,TOT UG/L	00930 SODIUM NA,DISS MG/L	00946 SULFATE SO4-DISS MG/L
NO OF VALUES	0	1	1	1	1	1	1	1	1	1
MEAN	0.000	98.2	1.000	8.470	0.391	5.00	2.000	5.00	2.30	1.4;
MEDIAN	*********	98.2	1.000	8.470	0.391	5.30	2.000	5.00	2.30	1.44
NO OF VIOLS	0	0	0	1	0	0	0	0	1	0
PERCENT VIOL	0.	0.	0.	100.	0.	0.	3.	0.	100.	0.
MINIMUM VIOL	0.000	0.0	0.000	8.470	0.000	0.00	0.000	0.00	2.30	0.00
MEAN VIOL	0.000	0.0	0.000	8.470	0.000	0.00	0.000	0.00	L.35	0.00
MAXIMUM VIOL	0.000	0.0	0.000	8.470	0.000	G.03	0.000	0.00	2.35	0.03
MIN CRITERIA	*********	*********	*********	6.500	*********	*********	*********	*********	15.00	*********
MAX CRITERIA	0.100	103.0	1.000	8.000	5.000	10.00	3.501	10.00	75.00	50.00

C24

STORET RETRIEVAL DATE 90/01/30 STAND - VERSION OF MAY 1988 STN 2.SUMMARY.4

YAV140
47 1: 33.0 120 56 56.0 1
YAKIMA R A T C L E ELUM
53037 WASHINGTON KITTITAS
PACIFIC NORTHWEST
/TYPA/AMBNT/STREAM
YAKIMA RIVER BASIN
1119USBR 760223 HQ 17035001332 9006.420 OFF
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 89/12/19 TO 89/12/19

	00010 WATER TEMP CENT	70301 DISS SOL SUM MG/L	00530 RESIDUE TOT NFLT MG/L
NO OF VALUES	1	1	1
MEAN	3.00	44.0	2.00
MEDIAN	3.00	44.0	2.00
NO OF VIOLS	0	0	0
PERCENT VIOL	0.	0.	0.
MINIMUM VIOL	0.00	0.0	0.00
MEAN VIOL	0.00	0.0	0.00
MAXIMUM VIOL	0.00	0.0	0.00
MIN CRITERIA	*********	*********	*********
MAX CRITERIA	15.00	400.0	80.00

C25

STORET RETRIEVAL DATE 90/01/30 - STAND - VERSION OF MAY 1988 STN 5.SUMMARY.1

YAV210
47 11 28.0 120 58 00.3 4
CLE ELUM UELL 20N 15E 28DDD
5 3 0 3 7 WASHINGTON KITTITAS
PACIFIC NORTHWEST 130400
/TYPA/AMBNT/WELL YAKIMA RIVER
1119USBR 891216 17030001
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 89/12/19 TO 89/12/19

	01105 ALUMINUM AL,TOT UG/L	00612 UN-IONZD NH3-N MG/L	3100' ARSENIC AS,TOT UG/L	01007 BARIUM BA,TOT UG/L	01027 CADMIUM CD,TOT UG/L	00405 CO2 MG/L	50064 CHLORINE FREE AVL MG/L	00940 CHLORIDE TOTAL MG/L	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L
NO OF VALUES		1	1	1	1	1	1	1	1	1
MEAN	20.00	0.030:	5.00	5000.	2.000	1.300	0.100	6.027	2.000	3.
MEDIAN	20.00	0.0002	5.00	5000.	2.000	1.300	0.100	6.027	2.000	3.
NO OF VIOLS		0	0	0	0	1	0	1	0	0
PERCENT VIOL	100.	0.	0.	0.	0.	100.	0.	100.	0.	0.
MINIMUM VIOL	20.00	0.0000	0.00	0.	0.003	1.800	0.000	6.027	0.000	0.
MEAN VIOL	20.00	0.0000	0.00	0.	0.000	1.300	0.000	6.027	0.000	0.
MAXIMUM VIOL	20.00	0.0000	0.00	0.	0.000	1.800	0.000	6.027	0.000	0.
MIN CRITERIA	*********	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	10.00	3.1~125	10.00	5000.	5.000	1.000	0.100	4.000	2.000	7000.

STORET RETRIEVAL DATE 90/01/30 - STAND - VERSION OF MAY 1988 STN 5.SUMMARY.2

YAV210
47 11 28.0 120 58 00.0 4
CLE ELUN WELL 20N 15E 28DDD
53037 WASHINGTON KITTITAS
PACIFIC NORTHWEST 130400
/TYPA/AMBNT/WELL
YAKIMA RIVER
1119USBR 891216 17030001
0003 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 89/12/19 TO 89/12/19

	00300 DO MG/L	30950 FLUORIDE F,DISS MG/L	71875 H2S MG/L	01045 IRON FE,TOT UG/L	01051 LEAD PB,TOT UG/L	00925 MGNSIUM MG,DISS MG/L	01055 MANGNESE MN UG/L	71900 MERCURY HG,TOTAL UG/L	01067 NICKEL NI,TOTAL UG/L	00631 NO2&NO3 N-DISS MG/L
NO OF VALUES	1	1	1	1		1	1	1	1	1
MEAN	0.700	0.100	0.0100	100.	2.00	15.32	35.00	0.200	5.00	0.020
MEDIAN	0.700	0.100	0.0100	100.	2.00	15.32	35.00	0.200	5.00	0.020
NO OF VIOLS	1	0	0	0	0	1	1	0	0	0
PERCENT VIOL	100.	0.	0.	0.	0.	100.	100.	0.	0.	0.
MINIMUM VIOL	0.700	0.000	0.0000	0.	0.00	15.32	35.00	0.000	0.00	0.000
MEAN VIOL	0.700	0.000	0.0000	0.	0.00	15.32	35.00	0.000	0.00	0.000
MAXIMUM VIOL	0.700	0.000	0.0000	0.	0.00	15.32	35.00	0.000	0.00	0.000
MIN CRITERIA	7.000	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	*********	0.500	0.0100	1000.	20.00	15.00	10.00	0.200	10.00	1.000

YAV210
47 11 28.0 120 53 00.0 4
CLE ELUM YELL 20N 15E 28DDD
5 3 0 3 7 WASHINGTON KITTITAS
PACIFIC NORTHWEST 130400
/TYPA/AMBNT/WELL YAKIMA RIVER
1119USBR 891216 17030001
0303 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 89/12/19 TO 89/12/19

	00615 NO2-N DISS MG/L	73004 NIT + AR GAS SATR % SAT	00556 OIL-GRSE FREON-GR MG/L	00400 PH SU	00935 PTSSIUM K,DISS MG/L	31147 SELENIUM SE,TOT UG/L	01077 SILVER AG,TOT UG/L	01092 ZINC ZN,TOT UG/L	00930 SODIUM NA,DISS MG/L	00446 SULFATE SO4-DISS MG/L
NO OF VALUES	0	1	1	1	1	1	1	1	1	1
MEAN	0.000	126.5	1.000	6.150	3.782	5.00	2.000	5.00	4.31	11.53
MEDIAN	*********	126.5	1.000	5.153	0.782	5.00	2.000	5.00	4.37	11.53
NO OF VIOLS	0	1	0	1	0	0	0	0	1	0
PERCENT VIOL	0.	100.	0.	100.	0.	0.	0.	0.	100.	0.
MINIMUM VIOL	0.000	126.5	0.000	6.150	0.000	0.00	0.003	0.00	4.31	0.00
MEAN VIOL	0.000	126.5	0.000	3.153	0.000	0.00	3.000	0.00	4.37	0.00
MAXIMUM VIOL	0.000	126.5	0.000	3.150	3.000	0.00	0.000	0.00	4.37	0.00
MIN CRITERIA	*********	*********	*********	6.500	*********	*********	*********	*********	15.00	*********
MAX CRITERIA	0.100	103.0	1.000	3.000	5.000	10.00	3.000	10.00	75.00	50.00

YAV210
CLE ELUM 120 52 0N 015E 4 280DD
53037 WASHINGTON KITTITAS
PACIFIC NORTHWEST 130400
YAKIMA RIVER
1119USBR 891216 17030001
0003 FEET DEPTH

/TYPA/AMBNT/WELL

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 89/12/19 TO 89/12/19

	00010 WATER TEMP CENT	70301 DISS SOL SUM MG/L	00530 RESIDUE TOT NFLT MG/L
NO OF VALUES	1	1	1
MEAN	7.93	162.3	2.00
MEDIAN	7.90	162.3	2.00
NO OF VIOLS	0	0	0
PERCENT VIOL	0.	0.	0.
MINIMUM VIOL	0.03	0.0	0.00
MEAN VIOL	0.03	0.0	0.00
MAXIMUM VIOL	0.00	0.0	0.00
MIN CRITERIA	*********	*********	*********
MAX CRITERIA	15.00	400.0	80.00

STORET RETRIEVAL DATE 89/12/15 - STAND - VERSION OF MAY 1988 STN 9.SUMMARY.1

YAV172
46 44 54.0 120 48 06.0 3
NACHES RIVER AT OLD YAKIMA INTAKE
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
/TYPA/AMBNT/STREAM YAKIMA RIVER
1119USBR 890422 17030002
0000 FEET DEPTH 494 METERS ELEVATION

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 89/04/10 TO 89/04/10

	01105 ALUMINUM AL,TOT UG/L	00612 UN-IONZD NH3-N MG/L	01202 ARSENIC AS,TOT UG/L	01007 BARIUM BA,TOT UG/L	01027 CADMIUM CD,TOT UG/L	00405 CO2 MG/L	50064 CHLORINE FREE AVL MG/L	00940 CHLORIDE TOTAL MG/L	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L
NO OF VALUES	0	1	0	0	0	0	0	1	0	0
MEAN	0.00	0.0001	0.03	0.	0.003	0.000	0.0000	0.709	0.000	0.
MEDIAN	*********	0.0001	*********	*********	*********	*********	*********	0.709	*********	*********
NO OF VIOLS	0	0	0	0	0	0	0	0	0	0
PERCENT VIOL	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MINIMUM VIOL	0.00	0.0000	0.00	0.	0.000	0.000	0.0000	0.000	0.000	0.
MEAN VIOL	0.00	0.0000	0.03	0.	3.000	0.000	0.0000	0.000	0.000	0.
MAXIMUM VIOL	0.00	0.0000	0.00	0.	0.000	0.000	0.0000	0.000	0.000	0.
MIN CRITERIA	*********	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	10.00	0.0125	10.00	5000.	5.000	1.000	0.0100	4.000	2.000	7000.

YAV172
46 44 54.0 120 48 06.0 3
NACHES RIVER AT OLD YAKIMA INTAKE
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
/TYPA/AMBNT/STREAM YAKIMA RIVER
1119USBR a90422 17030002
0000 FEET DEPTH 494 METERS ELEVATION

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 89/04/10 TO 89/04/10

	00300 DO MG/L	00950 FLUORIDE F,DISS MG/L	71375 H2S MG/L	01045 IRON FE,TOT UG/L	01051 LEAD PB,TOT UG/L	50925 MGNSIUM MG,DISS MG/L	01055 MANGNESE MN UG/L	71900 MERCURY HG,TOTAL UG/L	01067 NICKEL NI,TOTAL UG/L	00631 NO2&NO3 N-DISS MG/L
NO OF VALUES	1	0	0	0	0	1	0	0	0	1
MEAN	11.603	0.000	0.0000	0.	0.30	1.70	0.00	0.000	0.00	0.013
MEDIAN	11.600	*********	*********	*********	*********	1.70	*********	*********	*********	0.010
NO OF VIOLS	0	0	0	0	0	0	0	0	0	0
PERCENT VIOL	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MINIMUM VIOL	0.000	0.000	0.0300	0.	0.00	0.00	0.00	0.000	0.00	0.000
MEAN VIOL	0.000	0.000	0.0000	0.	0.00	0.00	0.00	0.000	0.00	0.000
MAXIMUM VIOL	0.000	0.000	0.0000	0.	0.00	0.03	0.00	0.000	0.00	0.000
MIN CRITERIA	7.300	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	*********	0.500	0.0100	1030.	20.00	15.00	10.00	0.200	10.00	1.000

STORET RETRIEVAL DATE 89/12/15 - STAN5 - VERSION OF M A Y 1988 STN 9.SUMMARY.3

YAV172
4644 54.0 120 4806.0 3
NACHES RIVER AT OLD YAKIMA INTAKE
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
/TYPA/AMBNT/STREAM YAKIMA RIVER
1119USBR 690422 17030002
0000 FEET DEPTH 494 METERS ELEVATION

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 89/04/10 TO 89/04/10

	00613 NO2-N DISS MG/L	73004 NIT + AR GAS SATR % SAT	00556 OIL-GRSE FREON-GR MG/L	00400 PH su	00935 PTSSIUM K,DISS MG/L	01147 SELENIUM SE,TOT UG/L	01077 SILVER AG,TOT UG/L	01092 ZINC ZN,TOT UG/L	00930 SODIUM NA,DISS MG/L	00946 SULFATE SO4-DISS MG/L
NO OF VALUES	0	0	3	0	1	0	0	0	1	1
MEAN	0.000	0.0	0.000	0.000	0.782	0.00	0.000	0.00	3.45	3.84
MEDIAN	*********	*********	*********	*********	0.782	*********	*********	*********	3.45	3.04
NO OF VIOLS	0	0	0	0	0	0	0	0	1	0
PERCENT VIOL	0.	0.	0.	0.	0.	0.	0.	0.	100.	0.
MINIMUM VIOL	0.000	0.0	0.000	0.000	0.000	0.00	0.000	0.00	3.45	0.00
MEAN VIOL	0.000	0.0	0.000	0.000	0.000	0.00	0.000	0.00	3.45	0.00
MAXIMUM VIOL	0.000	0.0	0.000	0.000	0.000	0.00	0.000	0.00	3.45	0.00
MIN CRITERIA	*********	*********	*********	6.500	*********	*********	*********	*********	15.00	*********
MAX CRITERIA	0.100	103.0	1.000	8.000	5.005	10.00	3.000	10.00	75.00	50.00

YAV172
46 44 54.0 120 48 06.0 3
NACHES RIVER AT OLD YAKIMA INTAKE
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
YAKIMA RIVER
1119USBR 890422 17030002
0000 FEET DEPTH 494 METERS ELEVATION

/TYPA/AMBNT/STREAM

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 89/04/10 TO 89/04/10

	00010 WATER TEMP CENT	70301 DISS SOL SUH MG/L	00530 RESIDUE TOT NFLT MG/L
NO OF VALUES	1	1	1
MEAN	7.21	57.0	20.00
MEDIAN	7.20	57.0	20.00
NO OF VIOLS	0	0	0
PERCENT VIOL	0.	0.	0.
MINIMUM VIOL	0.00	0.0	0.00
MEAN VIOL	0.00	0.0	0.00
MAXIMUM VIOL	0.00	0.0	0.00
MIN CRITERIA	*********	*********	*********
MAX CRITERIA	15.00	400.0	80.00

STORET RETRIEVAL DATE 89/12/15 - STAND - VERSION OF MAY 1988 STN 8.SUMMARY.1

YAVO32
46 44 58.0 120 49 13.0 3
SEEPAGE POND AT OLD YAKIMA MUNI INTAKE S3415N16E
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
YAKIMA RIVER
1119USBR 880827 17030002
0000 FEET DEPTH 501 METERS ELEVATION

/TYPA/AMBNT/LAKE

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 88/08/01 TO 88/08/01

	01105 ALUMINUM AL,TOT UG/L	00612 UN-IONZD NH3-N MG/L	01002 ARSENIC AS,TOT UG/L	01007 BARIUM BA,TOT UG/L	01027 CADMIUM CD,TOT UG/L	00405 co2 MG/L	50064 CHLORINE FREE AVL MG/L	00940 CHLORIDE TOTAL MG/L	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU, TOT UG/L
NO OF VALUES	1	1	1	1	1	1	0	1	1	1
MEAN	150.00	0.0013	5.00	5000.	2.000	1.000	0.0000	0.354	2.000	2.
MEDIAN	150.00	0.0013	5.00	5000.	2.000	1.000	*********	0.354	2.000	2.
NO OF VIOLS	1	0	0	0	0	0	0	0	0	0
PERCENT VIOL	100.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MINIMUM VIOL	150.00	0.0000	0.00	0.	0.000	0.000	0.0000	0.000	0.000	0.
MEAN VIOL	150.00	0.0000	0.00	0.	0.000	0.000	0.0000	0.000	0.000	0.
MAXIMUM VIOL	150.03	0.0000	0.00	0.	0.000	0.000	0.0000	0.000	0.000	0.
MIN CRITERIA	*********	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	10.00	0.0125	10.00	5000.	5.000	1.000	0.0100	4.000	2.000	7000.

C34

STORET RETRIEVAL DATE 89/12/15 - STAND - VERSION OF MAY 1988 STN 8.SUMMARY.2

YAV032
46 44 58.0 120 49 13.0 3
SEEPAGE POND AT OLD YAKINA MUNI INTAKE S3415N16E
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
YAKIMA RIVER
1119USBR 880827 17030002
0000 FEET DEPTH 501 METERS ELEVATION

/TYPA/AMBNT/LAKE

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 88/08/01 TO 88/08/01

	00300 DO MG/L	30950 FLUORIDE F,DISS MG/L	71373 H2S MG/L	01044 IRON FE,TOT UG/L	01051 LEAD PB,TOT UG/L	00925 MGNSIUM MG,DISS MG/L	01055 MANGNESE MN UG/L	71900 MERCURY HG,TOTAL UG/L	01067 NICKEL NI, TOTAL UG/L	00631 NO2&NO3 N-DISS MG/L
NO OF VALUES	1	1	1	1	1	1	1	1	1	1
MEAN	11.100	0.100	0.0100	130.	2.00	1.34	20.00	0.200	10.00	0.010
MEDIAN	11.100	0.103	0.0103	130.	2.00	1.34	20.00	0.200	10.00	0.010
NO OF VIOLS	0	0	0	0	0	0	1	0	0	0
PERCENT VIOL	0.	0.	0.	0.	0.	0.	100.	0.	0.	0.
MINIMUM VIOL	0.000	0.000	0.0000	0.	0.00	0.00	20.00	0.000	0.00	0.000
MEAN VIOL	0.000	0.000	0.0000	0.	0.00	0.00	20.00	0.000	0.00	0.000
MAXIMUM VIOL	0.503	0.000	0.0000	0.	0.00	0.00	20.00	0.000	0.00	0.000
MIN CRITERIA	7.000	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	*********	0.500	0.0100	1000.	20.00	15.00	10.00	0.200	10.00	1.000

C35

STORET RETRIEVAL OATE 89/12/15 - STAND - VERSION OF MAY 1988 STN 8.SUMMARY.3

YAV032
46 44 58.0 120 49 13.0 3
SEEPAGE POND AT OLD YAKIMA MUNI INTAKE S3415N16E
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
YAKIMA RIVER
1119USBR 839827 11030002
0000 FEET DEPTH 501 METERS ELEVATION

/TYPA/AMBNT/LAKE

SUMMARY OF VIOLATIONS OR SAMPLES COLLECTED FROM 88/08/01 TO 88/08/01

	00613 NO2-N DISS MG/L	73004 NIT + AR GAS SATR % SAT	00556 OIL-GRSE FREGN-GR MG/L	00400 PH su	00935 PTSSIUM K,DISS MG/L	01147 SELENIUM SE,TOT UG/L	01077 SILVER AG,TOT UG/L	01092 ZINC ZN,TOT UG/L	00930 SODIUM NA,DISS MG/L	00946 SULFATE SOS-DISS MG/L
NO OF VALUES	1	1	1	1	1	1	1	1	1	1
MEAN	0.010	99.0	1.000	8.880	0.782	5.00	2.000	5.00	3.22	2.40
MEDIAN	0.010	39.0	1.000	0.880	0.782	5.00	2.000	5.00	3.22	2.40
NO OF VIOLS	0	0	0	1	0	0	0	0	1	0
PERCENT VIOL	0.	0.	0.	100.	0.	0.	0.	0.	100.	0.
MINIMUM VIOL	0.000	0.0	0.000	8.880	0.000	0.00	0.000	0.00	3.22	0.00
MEAN VIOL	0.000	0.0	0.000	0.830	0.000	0.00	0.000	0.00	3.22	0.00
MAXIMUM VIOL	0.000	0.0	0.000	8.880	0.000	0.00	0.000	0.00	3.22	0.00
MIN CRITERIA	*********	*********	*********	6.500	*********	*********	*********	*********	15.00	*********
MAX CRITERIA	0.100	103.0	1.000	0.000	5.000	10.00	3.000	10.00	75.00	50.00

STORET RETRIEVAL DATE 89/12/15 - STAND - VERSION OF MAY 1388 STN 8.SUMMARY.4

YAV032
46 44 58.0 120 49 13.0 3
SEEPAGE POND AT OLD YAKIMA MUNI INTAKE S3415N16E
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
YAKIMA RIVER
1119USBR 880827 17030002
0000 FEET DEPTH 501 METERS ELEVATION

/TYPA/AMBNT/LAKE

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTEO FROM 88/08/01 TO 88/08/01

	03010 WATER TEMP CENT	70301 DISS SOL SUM MG/L	00530 RESIDUE TOT NFLT MG/L
NO OF VALUES	1	1	1
MEAN	19.90	49.0	5.00
MEDIAN	19.90	49.0	5.00
NC OF VIOLS	1	0	a
PERCENT VIOL	103.	0.	0.
MINIMUM VIOL	19.40	3.0	0.00
MEAN VIOL	19.90	0.0	0.00
MAXIMUM VIOL	19.90	0.0	0.00
MIN CRITERIA	*********	*********	*********
MAX CRITERIA	15.00	400.0	80.00

C37

STORET RETRIEVAL DATE 90/01/30 - STAND - VERSION OF MAY 1988 STN l.SUI14ARY.l

YAV206
46 45 05.0 120 48 56.0 4
OAK FLAT WELL #1 15N 16E 24BAD
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
YAKIHA RIVER
1119USBR 891216 17030002
0000 FEET DEPTH

/TYPA/AMBNT/WELL

SUMMARY OF VIDLATICNS ON SAMPLES COLLECTED FROM 89/12/19 TO 89/12/19

	01105 ALUMINUM AL,TOT UG/L	00512 UN-IONZD NH3-N MG/L	01002 ARSENIC AS, TOT UG/L	01007 BARIUM BA,TOT UG/L	01327 CADMIUM CD,TOT UG/L	00405 cot MG/L	50064 CHLORINE FREE AVL MG/L	00940 CHLORIDE TOTAL MG/L	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L
NO OF VALUES	1	1	1	1	1	1	1	1	1	1
MEAN	77.00	0.0008	5.00	5000.	2.000	0.400	0.103	1.064	6.00.1	2.
MEDIAN	77.00	0.0008	5.00	5050.	2.303	5.405	0.100	1.064	6.000	2.
NO OF VIOLS	1	0	0	0	0	0	0	0	1	0
PERCENT VIOL	100.	0.	0.	0.	0.	0.	3.	0.	100.	0.
MINIMUM VIOL	77.00	0.0000	0.00	0.	3.000	0.000	0.003	0.000	6.000	0.
MEAN VIOL	77.00	0.0000	0.00	0.	0.000	0.000	0.000	0.000	6.000	0.
MAXIMUM VIOL	77.00	0.0000	0.00	0.	0.000	0.000	0.000	0.000	6.000	0.
MIN CRITERIA	*********	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	10.00	0.0125	10.00	5000.	5.000	1.000	0.100	4.000	2.000	7000.

YAV206
46 45 05.0 120 48 56.0 4
OAK FLAT WELL*/15N16E24BAD
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
/TYPA/AMBNT/WELL YAKIMA RIVER
1119USBR 891216 17030002
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 89/12/19 TO 89/12/19

	00300 DO MG/L	00950 FLUORIDE F,DISS MG/L	71975 H2S MG/L	01045 IRON FE,TOT UG/L	01051 LEAD PB,TOT UG/L	00925 MGNSIUM MG,DISS MG/L	01355 MANGNESE MN UG/L	71900 MERCURY HG,TOTAL UG/L	01067 NICKEL NI,TOTAL UG/L	00631 NO2&NO3 N-DISS MG/L
NO OF VALUES**	1	1	1	1	1	1	1	1	1	1
MEAN	3.500	0.100	0.0100	350.	2.00	2.43	5.00	0.200	5.00	0.080
MEDIAN	3.500	0.100	0.0100	350.	2.00	2.43	5.00	0.200	5.00	0.080
NO OF VIOLS	1	0	0	0	0	0	0	0	0	0
PERCENT VIOL	100.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MINIMUM VIOL	3.500	0.000	0.0000	0.	0.00	0.00	0.00	0.000	0.00	0.000
MEAN VIOL	3.500	0.000	0.0000	0.	0.00	0.00	0.00	0.000	0.00	0.000
MAXIMUM VIOL	3.500	0.000	0.0000	0.	0.00	0.00	0.00	0.000	0.00	0.000
MIN CRITERIA	7.000	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	*********	0.500	0.0100	1000.	20.00	15.00	10.00	0.200	10.00	1.000

STORET RETRIEVAL DATE 90/01/30 - STAND - VERSION OF WAY 1983 STN 1.SUMMARY.3

YAV206
46 45 05.0 120 48 56.0 4
OAK FLAT WELL #1 15N 16E 24BAO
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
/TYPA/AMBNT/WELL
YAKIMA RIVER
1119USBR 891216 17030002
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 89/12/19 TO 89/12/19

	00613 NO2-N DISS MG/L	73304 NIT + AR GAS SATR % SAT	00556 OIL-GRSE FREON-GR MG/L	00400 PH SU	00935 PTSSIUM K,DISS MG/L	01147 SELENIUM SE,TOT UG/L	01077 SILVER AG,TOT UG/L	01092 ZINC ZN,TOT UG/L	00930 SODIUM NA,DISS MG/L	00944 SULFATE SO4-DISS MG/L
NO OF VALUES	0	1	1	1	1	1	1	1	1	1
MEAN	0.000	124.5	1.000	il.410	2.346	5.00	2.000	5.00	4'.a3	4.32
MEDIAN	********	124.5	1.000	8.410	2.346	5.00	2.000	5.00	4.83	4.32
NO OF VIOLS	0	1	0	1	0	0	0	0	1	0
PERCENT VIOL	0.	105.	0.	100.	0.	0.	0.	0.	100.	0.
MINIMUM VIOL	0.003	124.5	0.000	a.410	0.000	0.00	0.000	0.00	4.83	0.00
MEAN VIOL .	0.003	124.5	0.003	3.410	0.000	0.00	0.000	0.00	4.83	0.00
MAXIMUM VIOL	0.000	124.5	0.000	6.410	0.000	0.00	0.000	0.00	4.83	0.00
MIN CRITERIA	*********	*********	*********	6.500	*********	*********	*********	*********	15.00	*********
MAX CRITERIA	0.100	103.0	1.000	8.000	5.000	10.09	3.001)	10.00	75.00	50.00

C40

YAV206
45 45 05.0 120 48 56.0 4
OAKFLAT WELL#1 15N 16E24BAD
5 3 0 7 7 WASHINGTON YAKIMA
PACIFIC NORTHWEST 139400
/TYPA/AMBNT/WELL YAKIMA RIVER
1119USBR 891216 17030002
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 89/12/19 TO 89/12/19

	00010 WATER TEMP CENT	70301 DISS SOL SUM MG/L	00530 RESIDUE TOT NFLT MG/L
NO OF VALUES	1	1	1
MEAN	10.50	91.0	4.00
MEDIAN	10.50	91.0	4.00
NO OF VIOLS	0	0	0
PERCENT VIOL	0.	0.	0.
MINIMUM VIOL	0.00	0.0	0.00
MEAN VIOL	0.00	0.0	0.00
MAXIMUM VIOL	0.00	0.0	0.00
MIN CRITERIA	*********	*********	*********
MAX CRITERIA	15.00	400.0	80.00

C41

STORET RETRIEVAL DATE 90/01/30 - STAND - VERSION OF MAY 1988 STN 3.SUMMARY.1

YAV204
4644 55.0 120 4823.0 4
OAK FLAT WELL #2 15N16E34ACA
5 3 0 7 7 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
YAKIMA RIVER
1119USBR 891215 17030002
0000 FEET DEPTH

/TYPA/AMBNT/WELL

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 89/12/19 TO 89/12/19

	01105 ALUMINUM AL,TOT UG/L	00612 UN-IONZD NH3-N MG/L	01002 ARSENIC AS,TOT UG/L	01007 BARIUM BA,TOT UG/L	01027 CADMIUM CD,TOT UG/L	00405 CO2 MG/L	50064 CHLORINE FREE AVL MG/L	00940 CHLORIDE TOTAL MG/L	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L
NO OF VALUES	1	1	1	1	1	1	1	1	1	1
MEAN	82.00	0.0003	6.00	5000.	2.003	0.305	0.100	3.900	18.000	3.
MEDIAN	82.00	0.0003	6.00	5000.	2.000	0.800	0.100	3.900	18.000	3.
NO OF VIOLS	1	0	0	0	0	0	0	0	1	0
PERCENT VIOL	100.	3.	5.	C.	0.	a.	0.	0.	100.	0.
MINIMUM VIOL	82.00	0.0000	0.00	0.	0.000	0.000	0.000	3.000	18.000	0.
MEAN VIOL	32.06	0.0000	0.00	0.	0.000	0.000	0.000	0.000	18.000	0.
MAXIMUM VIOL	82.00	0.0000	0.00	0..	0.000	0.000	0.000	0.000	18.000	0.
MIN CRITERIA	*********	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	10.00	0.0125	10.00	5000.	5.000	1.000	0.100	4.000	2.000	7000.

STORET RETRIEVAL DATE 90/01/30 - STAND - VERSION OF HAY' 1988 S T N 3.SUMMARY.2

YAV204
46 44 55.0 120 48 23.0 4
OAK FLAT WELL #2 15N 16E 34ACA
5 3 0 7 7 WASHINGTON YAKIMA
PACIFIC NORTHYEST 130400
YAKIMA RIVER
1119USBR 891216 17030002
0 0 0 3 FEET DEPTH

/TYPA/AMBNT/WELL

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 39/12/19 TO 89/12/19

	05300 DO MG/L	00950 FLUORIDE F,DISS MG/L	71875 H2S MG/L	01045 IRON FE,TOT UG/L	01051 LEAD PB,TOT UG/L	JO925 MGNSIUM MG,DISS MG/L	01355 MANGNESE MN UG/L	71900 MERCURY HG,TOTAL UG/L	01067 NICKEL NI,TOTAL UG/L	00631 NO2&NO3 N-OXSS MG/L
NC OF VALUES	1	1	1	1	1	1	1	1	1	1
MEAN	i-503	a.441	0.0100	4150.	2.00	2.31	85.00	0.200	5.00	0.010
MEDIAN	1.500	3.440	0.0100	4150.	2.00	2.31	85.00	0.200	5.00	0.010
NO OF VIOLS	1	0	0	1	0	0	1	0	0	0
PERCENT VIOL	100.	0.	0.	100.	0.	0.	103.	0.	0.	0.
MINIMUM VIOL	1.505	3.005	0.0000	4150.	0.00	0.00	85.00	0.000	0.00	0.000
MEAN VIOL	1.500	3.300	0.0000	4150.	0.00	0.00	85.00	0.000	0.00	0.000
MAXIMUM VIOL	1.500	il.003	0.0000	4150.	0.00	0.00	as.00	0.000	0.00	0.000
MIN CRITERIA	7.000	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	*********	3.505	0'.0100	1000.	20.00	15.00	10.00	0.200	10.00	1.000

C43

STORET RETRIEVAL DATE 90/01/30 - STAND - VERSION OF MAY 1988 STN 3.SUMMARY.3

YAV204
46 44 55.0 120 48 23.0 4
OAK FLAT WELL #2 15N 16E 34ACA
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
/TYPA/AMBNT/WELL
Y AKIMA RIVER
1119USBR 891216 17030002
0000 FEET DEPTH

SUMMARY OF VIOLATIONS OF SAMPLES COLLECTED FROM 89/12/19 TO 89/12/19

	00613 NO2-N DISS MG/L	73004 NIT + AR GAS SATK % SAT	00556 OIL-GRSE FREON-GR MG/L	00400 PH su	20335 PTSSIUM K,DISS MG/L	01147 SELENIUM SE,TOT UG/L	01077 SILVER AG,TOT UG/L	01092 ZINC ZN,TOT UG/L	00930 SODIUM NA,DISS MG/L	00946 SULFATE SO4-DISS MG/L
NO OF VALUES	0	1	1	1	1	1	1	1	1	1
MEAN	0.000	123.4	1.000	8.250	3.128	5.00	2.003	150.00	20.00	2.88
MEDIAN	*********	123.4	1.000	9.250	3.129	5.00	2.000	150.00	20.00	2.88
NO OF VIOLS	0	1	0	1	0	0	0	1	0	0
PERCENT VIOL	0.	100.	0.	100.	0.	0.	0.	100.	0.	0.
MINIMUM VIOL	0.000	123.4	0.000	8.250	0.000	0.00	0.000	150.00	0.00	0.00
MEAN VIOL	0.000	123.4	0.000	8.250	0.000	0.00	0.000	150.00	0.00	0.00
MAXIMUM VIOL	0.000	123.4	0.000	8.250	0.000	0.00	0.000	150.00	0.00	0.00
MIN CRITERIA	*********	*********	*********	6.500	*********	*********	*********	*********	15.00	*********
MAX CRITERIA	0.100	103.0	1.000	8.000	5.000	10.00	3.000	10.00	75.00	50.00

C44

STORET RETRIEVAL DATE 90/01/30 - STAND - VERSION OF MAY 1988 STN 3.SUMMARY.4

YAV204
46 44 55.0 120 48 23.0 4
OAK FLAT WELL#2 15N 16E 34ACA
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
YAKIMA RIVER
1119USBR 891216 17030002
0000 FEET DEPTH

/TYPA/AMBNT/WELL

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 89/12/19 TO 89/12/19

	00010 WATER TEMP CENT	70301 DISS SOL SUM MG/L	00530 RESIDUE TOT NFLT MG/L
NO OF VALUES	1	1	1
MEAN	10.50	128.0	2.00
MEDIAN	10.50	128.0	2.00
NO OF VIOLS	0	0	0
PERCENT VIOL	0.	3.	0.
MINIMUM VIOL	6.00	0.0	0.00
MEAN VIOL	0.03	3.0	0.00
MAXIMUM VIOL	0.03	0.0	0.00
MIN CRITERIA	*********	*********	*********
MAX CRITERIA	15.00	400.0	80.00

C45

STORET RETRIEVAL DATE 89/12/15 - STAND - VERSION OF MAY 1988 STN 4.SUMMARY.1

YAV168
46 38 04.0 120 34 53.0 3
BUCKSKIN CK 150 ABV CONFLUENCE WITH SPRING CK
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
/TYPA/AMBNT/STREAM YAKIMA RIVER
1119USBR 8130927 17030002
0000 FEET DEPTH 360 METERS ELEVATION

SUMMARY OF VIOLATIONS ON SAMPLES CDLLECTEO FROM 88/08/01 TO 89/04/11

	C1105 ALUMINUM AL,TOT UG/L	00612 UN-IONZD NH3-N MG/L	01002 ARSENIC AS,TOT UG/L	01007 BARIUM BA,TOT UG/L	01027 CADMIUM CD,TOT UG/L	00405 CO2 MG/L	50064 CHLORINE FREE AVL MG/L	00940 CHLORIDE TOTAL MG/L	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L
NO OF VALUES	1	i	1	1	1	1	0	2	1	1
MEAN	230.00	0.0301	5.03	5000.	2.000	20.000	0.0000	7.090	2.000	2.
MEDIAN	230.03	0.0001	5.00	5000.	2.000	20.000	*********	7.090	2.000	2.
NC OF VIOLS	1	0	0	0	0	' 1	0	2	0	0
PERCENT VIOL	100.	0.	0.	0.	0.	100.	0.	100.	0.	0.
MINIMUM VIOL	230.00	0.0000	0.00	0.	0.000	20.000	0.0000	4.609	0.000	0.
MEAN VIOL	230.03	0.0000	0.00	0.	0.000	20.000	0.0000	7.090	0.000	0.
MAXIMUM VIOL	230.00	0.0000	0.00	0.	0.000	20.000	0.0000	9.572	0.000	0.
MIN CRITERIA	*********	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	10.00	0.0125	10.00	5000.	5.000	1.000	0.0100	4.000	2.000	7000.

C46

/TYPA/AMBNT/STREAM

YAV168
46 38 04.0 120 34 53.0 3
BUCKSKIN CK 150 ABV CONFLUENCE WITH SPRING CK
53077 WASHINGTON YAKIMA
PACIFIC NORTHUEST 130400
YAKIMA RIVER
1113USBR 880827 17030002
0000 FEET DEPTH 360 METERS ELEVATION

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 88/08/01 TO 89/04/11

	00300 DO MG/L	00950 FLUORIDE F,DISS MG/L	71815 H2S MG/L	01045 IRON FE,TOT UC/L	01051 LEAD PB,TOT UG/L	00925 MGNSIUM MG,DISS MG/L	01055 MANGNESE MN UG/L	71900 MERCURY HG, TOTAL UG/L	01067 NICKEL NI,TOTAL UG/L	00631 NO2&NO3 N-DISS MG/L
NC OF VALUES	2	1	1	1	1	2	1	1	1	2
MEAN	9.545	0.140	0.0300	120.	2.00	8.88	10.00	0.200	10.00	2.060
MEDIAN	3.545	0.140	0.0300	120.	2.00	8.88	10.00	0.200	10.00	2.060
NO OF VIOLS	0	0	1	0	0	0	0	0	0	2
PERCENT VIOL	0.	0.	100.	0.	0.	0.	0.	0.	0.	100.
MINIMUM VIOL	0.000	0.000	0.0300	0.	0.00	0.00	0.00	0.000	0.00	1.325
MEAN VIOL	0.000	0.000	0.0300	0.	0.00	0.00	0.00	0.000	0.00	2.060
MAXIMUM VIOL	0.000	0.000	0.0300	0.	0.03	0.00	0.00	0.000	0.00	2.200
MIN CRITERIA	7.000	*********	*********	*********	*********	*********	*********	444444444	444444444	444444444
MAX CRITERIA	*********	0.500	0.0100	1000.	20.00	15.00	10.00	0.200	10.00	1.300

47

STORET RETRIEVAL DATE 89/12/15 - STAND - VERSION OF MAY 1388 STN 4.SUHItARY.3

YAV168
4638 04.0 120 34 53.0 3
BUCKSKIN CK 150 ABV CONFLUENCE WITH SPRING CK
5 3 0 7 7 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
/TYPA/AMBNT/STREAM YAKIMARIVER
1119USBR 880827 17030002
0000 FEET DEPTH 360 METERS ELEVATION

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 88/08/01 TO 89/04/11

	00613 NO2-N DISS MG/L	73004 NIT + AR GAS SATR % SAT	00556 OIL-GRSE FREON-GR MG/L	00400 PH SU	00935 PTSSIUM K,DISS MG/L	01147 SELENIUM SE,TOT UG/L	01077 SILVER AG,TOT UG/L	01092 ZINC ZN,TOT UG/L	00930 SODIUM NA,DISS MG/L	00946 SULFATE SO4-DISS MG/L
NO OF VALUES	1	1		1	2	1	1	1	2	2
MEAN	0.010	101.0	1.000	7.060	3.323	5.00	2.000	5.00	13.91	13.93
MEDIAN	0.010	101.0	1.000	7.063	3.323	5.00	2.003	5.00	13.91	13.93
NO OF VIOLS	0	0	0	0	0	0	0	0	2	0
PERCENT VIOL	0.	0.	0.	0.	0.	0.	0.	0.	100.	0.
MINIMUM VIOL	0.000	0.3	0.000	0.000	0.000	0.00	0.000	0.00	13.79	0.00
MEAN VIOL	0.000	0.0	3.000	0.000	0.000	0.00	0.000	0.00	13.91	0.00
MAXIMUM VIOL	0.003	0.0	0.000	0.000	0.000	0.00	0.00U	0.00	14.02	0.00
MIN CRITERIA	*********	*********	*********	6.500	*********	*********	*********	*********	15.00	*********
MAX CRITERIA	0.100	103.0	1.000	8.000	5.000	10.00	3.000	10.00	75.00	50.00

C4-

STORET RETRIEVAL DATE 89/12/15 - STAND - VERSION OF MAY 1988 STN 4.SUMMARY.4

YAV168
4b 38 04.0 120 34 53.0 3
BUCKSKIN CK 150 ABV CONFLUENCE WITH SPRING CK
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
YAKIMA RIVER
1119USBR 880827 17030002
0000 FEET DEPTH 360 METERS ELEVATION

/TYPA/AMBNT/STREAM

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 88/08/01 TO 89/04/11

	00010 WATER TEMP CENT	70301 DISS SOL SUM MG/L	00530 RESIDUE TOT NFLT MG/L
NO OF VALUES	2	2	2
MEAN	15.20	173.0	13.00
MEDIAN	15.20	173.0	13.00
NO OF VIOLS	1	0	U
PERCENT VIOL	50.	0.	0.
MINIMUM VIOL	17.50	0.0	0.00
MEAN VIOL	17.60	3.0	0.00
MAXIMUM VIOL	17.60	0.0	0.00
MIN CRITERIA	*********	*********	*********
MAX CRITERIA	15.00	400.0	80.00

C49

STORET RETRIEVAL DATE 89/12/15 - STAND - VERSION OF WAY 1988 STN 5.SUWIARY.I

YAV902
46 38 05.0 120 34 50.0 3
NELSON SPRINGS SO FT ABOVE HATCHERY OUTFLOY
5 3 0 7 7 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
/TYPA/AMBNT/SPRING YAKIMA RIVER
1119USBR 880827 17030002
0000 FEET DEPTH 360 METERS ELEVATION

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 88/08/01 TO 89/04/11

	31105 ALUMINUM AL,TOT UG/L	00612 UN-IONZD NH3-N MG/L	01002 ARSENIC AS,TOT UG/L	01007 BARIUM BA,TOT UG/L	01027 CADMIUM CD,TOT UG/L	00405 co2 MG/L	50064 CHLORINE FREE AVL MG/L	00940 CHLORIDE TOTAL MG/L	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L
NO OF VALUES	1	2	1	1	1	1	0	2	1	1
MEAN	230.00	0.0304	5.00	5000.	2.000	19.000	0.0000	6.558	2.000	2.
MEDIAN	290.00	0.0004	5.00	5000.	2.000	19.000	*********	6.558	2.000	2.
NO OF VIOLS	1	0	0	0	0	1	0	2	0	0
PERCENT VIOL	100.	3.	0.	0.	0.	100.	0.	100.	0.	0.
MINIMUM VIOL	230.00	0.0000	0.00	U.	0.000	19.000	0.0000	5.318	0.000	0.
MEAN VIOL	290.00	0.0000	0.00	U.	0.000	19.300	0.0000	6.558	0.000	0.
MAXIMUM VIOL	290.00	0.0000	0.00	0.	0.000	19.000	0.0000	7.799	0.000	0.
MIN CRITERIA	*********	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	10.00	0.0125	10.00	5000.	5.000	1.000	0.0100	4.000	2.000	7000.

C50

YAV932
46 39 05.0 120 34 50.0 3
NELSON SPRINGS 50 FT ABOVE HATCHERY OUTFLOW
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
/TYPA/AMBNT/SPRING YAKIMA RIVER
1119USBR 980827 17030002
0000 FEET DEPTH 360 METER.5 ELEVATION

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 88/08/01 TO 89/04/11

	00300 DO MG/L	03953 FLUORIDE F,DISS MG/L	71875 H2S MG/L	01045 IRON FE,TOT UG/L	01051 LEAD PB,TOT UG/L	00925 MGNSIUM MG,DISS MG/L	01055 MANGNESE MN UG/L	71900 MERCURY HG,TOTAL UG/L	01067 NICKEL NI,TOTAL UG/L	00631 NO2&NO3 N-DISS MG/L
NO OF VALUES	2	1	1	1	1	2	1	1	1	2
MEAN	9.050	0.180	0.0200	100.	2.00	12.71	10.00	0.200	10.00	1.770
MEDIAN	9.050	0.180	0.0200	100.	2.00	12.71	10.00	0.200	10.00	1.770
NO OF VIOLS	0	0	1	0	0	0	0	0	0	2
PERCENT VIOL	0.	0.	100.	0.	0.	0.	0.	0.	0.	100.
MINIMUM VIOL	0.000	0.000	0.0200	0.	0.00	0.00	0.00	0.000	0.00	1.440
MEAN VIOL	0.000	0.000	0.0200	0.	0.00	0.00	0.00	0.000	0.00	1.770
MAXIMUM VIOL	0.000	0.000	0.0200	0.	0.00	0.00	0.00	0.000	0.00	2.100
MIN CRITERIA	7.000	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	*********	0.500	0.0100	1000.	20.00	15.00	10.00	0.200	10.00	1.000

STORET RETRIEVAL DATE 89/12/15 - STAND - VERSION OF MAY 1988 STN 5.SUMMARY.3

YAV902
46 38 05.0 120 34 50.0 3
NELSON SPRIYGS SO FT ABOVE HATCHERY OUTFLOU
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
/TYPA/AMBNT/SPRING YAKIMA RIVER
1119USBR 830827 17030002
0000 FEET DEPTH 360 METERS ELEVATION

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 88/08/01 TO 89/04/11

	00513 NO2-N DISS MG/L	73304 NIT + AR GAS SATR 4 SAT	00556 OIL-GRSE FREON-GR MG/L	00400 PH su	0093s PTSSIUH K,DISS MG/L	01147 SELENIUM SE,TOT UG/L	01077 SILVER AG,TOT UG/L	01092 ZINC ZN,TOT UG/L	00930 SODIUM NA,DISS MG/L	00946 SULFATE SO4-DISS MG/L
NO OF VALUES	1	1	1	1	2	1	1	1	2	2
MEAN	0.010	102.0	1.000	7.190	3.519	5.00	2.000	5.00	19.54	17.29
MEDIAN	0.010	102.0	1.000	7.190	3.519	5.00	2.000	5.00	19.54	17.29
NO OF VIOLS	0	0	0	0	0	0	0	0	0	0
PERCENT VIOL	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MINIMUM VIOL	0.000	0.0	0.000	0.000	0.000	0.00	0.000	0.00	0.00	0.00
MEAN VIOL	0.000	0.0	0.000	0.000	0.000	0.00	0.000	0.00	0.00	0.00
MAXIMUM VIOL	0.000	0.0	0.000	5.000	0.000	0.00	0.000	0.00	0.00	0.00
MIN CRITERIA	*********	*********	*********	6.500	*********	*********	*********	*********	15.00	*********
MAX CRITERIA	0.100	103.0	1.000	8.000	5.000	10.00	3.000	10.00	75.00	50.00

C52,

STORET RETRIEVAL DATE 89/12/15 - STAND - VERSION OF MAY 1988 STN 5.SUMMARY.C

YAV902
463805.0 120 34 50.0 3
NELSON SPRINGS 50 FT ABOVE HATCHERY OUTFLOW
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
YAKIMA RIVER
1119USBR 880827 17030002
0000 FEET DEPTH 360 METERS ELEVATION

/TYPA/AMBNT/SPRING

SUMMARY OF VIOLATIONS OK SAMPLES COLLECTED FROM 88/08/01 TO 89/04/11

	00010 WATER TEMP CENT	70301 DISS SOL SUM MG/L	30530 RESIDUE TOT NFLT MG/L
NC OF VALUES	2	2	2
MEAN	14.65	230.0	15.50
MEDIAN	14.65	235.3	15.50
NC OF VIOLS	1	0	0
PERCENT VIOL	50.	0.	0.
MINIMUM VIOL	16.00	0.0	0.03
MEAN VIOL	16.00	0.0	0.00
MAXIMUM VIOL	16.00	0.0	0.00
MIN CRITERIA	*********	*********	*********
MAX CRITERIA	15.00	400.0	80.00

C53

STORET RETRIEVAL DATE 89/12/15 - STAND - VERSION OF MAY 1988 STN 6.SUMIARY.1

YAV904
46 38 00.0 120 34 51.0 3
MORRIS SPR 100 YDS BLW HATCHERY AI BUCKSKIN CK
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
YAKIMA RIVER
1119USBR 880827 17030002
0000 FEET DEPTH 360 METERS ELEVATION

/TYPA/AMBNT/SPRING

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 88/08/01 TO 89/04/11

	01105 ALUMINUM AL,TOT UG/L	00612 UN-IONZD NH3-N MG/L	01002 ARSENIC AS,TOT UG/L	01307 BARIUM BA,TOT UG/L	01027 CADMIUM CD,TOT UG/L	00405 cc2 MG/L	50064 CHLORINE FREE AVL MG/L	00940 CHLORIDE TOTAL MG/L	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L
NO OF VALUES	1	2	1	1	1	1	0	2	1	1
MEAN	36.00	0.0000	5.00	5000.	2.000	46.000	0.0000	10.635	2.000	2.
MEDIAN	36.00	0.0000	5.00	5000.	2.000	46.000	*********	10.635	2.000	2.
NO OF VIOLS	1	0	0	0	0	1	0	2	0	0
PERCENT VIOL	100.	0.	0.	0.	0.	100.	0.	100.	0.	0.
MINIMUM VIOL	36.00	0.0000	0.03	0.	0.000	46.000	0.0000	8.508	0.000	0.
MEAN VIOL	36.00	0.0000	0.03	0.	0.000	46.000	0.0000	10.535	0.000	0.
MAXIMUM VIOL	36.00	0.0000	0.00	0.	0.000	46.000	0.0000	12.762	0.000	0.
MIN CRITERIA	*********	*********	*********	*********	*********	*********	*********	*********	*********	444444444
MAX CRITERIA	10.00	0.0125	15.00	5000.	5.000	1.003	0.0103	4.000	2.000	7000.

STORET RETRIEVAL DATE 89/12/15 - STAN3 - VERSION OF MAY 1988 STN 6.SUHHARY.2

YAV904
46 38 00.0 120 34 51.0 3
MORRIS SPR 100 YOS BLW HATCHERY AT BUCKSKIN CK
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
/TYPA/AMBNT/SPRING YAKIMA RIVER
1119USBR 880327 17030002
0000 FEET DEPTH 360 METERS ELEVATION

SUMMARY OF VIOLATIONS IN SAMPLES COLLECTED FROM 88/08/01 TO 89/04/11

	00300 DO MG/L	00950 FLUORIDE F,DISS MG/L	71375 H2S MG/L	01045 IRON FE,TOT UG/L	01051 LEAD PB,TOT UG/L	00925 MGNSIUM MG,DISS MG/L	01055 MANGNESE MN UG/L	71500 MERCURY HG,TOTAL UG/L	01067 NICKEL NI,TOTAL UG/L	00631 NO2&NO3 N-DISS MG/L
NO OF VALUES	2	1	1	1	1	2	1	1	1	2
MEAN	6.450	0.130	0.0200	45.	2.00	5.90	10.00	0.200	10.00	1.270
MEDIAN	5.450	0.130	0.0200	40.	2.00	5.90	10.00	0.200	10.00	1.270
NO OF VIOLS	1	0	1	0	0	0	0	0	0	2
PERCENT VIOL	50.	3.	100.	0.	0.	0.	0.	0.	0.	100.
MINIMUM VIOL	3.700	0.000	0.0200	0.	0.00	0.00	0.00	0.000	0.00	1.040
MEAN VIOL	3.700	0.503	0.0200	0.	0.00	0.00	0.00	0.000	0.00	1.270
MAXIMUM VIOL	3.700	0.000	0.0200	0.	0.00	0.00	0.00	0.000	0.00	1.500
MIN CRITERIA	7.000	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	*********	0.500	0.0100	1000.	20.00	15.00	10.00	0.200	10.00	1.000

C cn 5

STORET RETRIEVAL DATE 89/12/15 - STAND - VERSION OF MAY 1988 STN 6.SUMMARY.3

YAV904
46 38 00.0 120 34 51.0 3
MORRIS SPR 100 YDS BLW HATCHERY AT BUCKSKIN CK
5 3 0 7 7 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
/TYPA/AMBNT/SPRING YAKIMA RIVER
1119USBR 0 8 0 3 2 7 17030002
0000 FEET DEPTH 360 METERS ELEVATION

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 88/08/01 TO 89/04/11

	00313 NO2-N DISS MG/L	73004 NIT + AR GAS SATR % SAT	00556 OIL-GRSE FREON-GR MG/L	00400 PH SU	00335 PTSSIUM K,DISS MG/L	01147 SELENIUM SE,TOT UG/L	01077 SILVER AG,TOT UG/L	01092 ZINC ZN,TOT UG/L	00930 SODIUM NA,DISS MG/L	00946 SULFATE SO4-DISS MG/L
NO OF VALUES	1	1	1	1	2	1	1	1	2	2
MEAN	0.010	111.0	1.000	6.503	2.541	5.00	2.000	5.00	9.31	9.13
MEDIAN	0.010	111.0	1.000	6.500	2.541	5.00	2.000	5.00	9.31	9.13
NO OF VIOLS	0	1	0	0	0	0	0	0	2	0
PERCENT VIOL	0.	100.	0.	0.	0.	0.	0.	0.	100.	0.
MINIMUM VIOL	0.000	111.0	3.000	0.000	0.000	0.00	0.003	0.00	0.97	0.00
MEAN VIOL	0.000	111.0	0.000	0.000	0.000	0.00	0.000	0.00	9.31	0.00
MAXIMUM VIOL	0.000	111.3	3.003	0.000	0.000	0.00	5.000	0.00	9.66	0.00
MIN CRITERIA	*********	*********	*********	6.500	*********	*********	*********	*********	15.00	*********
MAX CRITERIA	0.100	103.0	1.000	3.000	5.000	10.00	3.000	10.00	75.00	50.00

C56

YAV904
46 38 00.0 120 34 51.0 3
MORRIS SPR 100 YDS BLW HATCHERY AT BUCKSKIN CK
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
YAKIMA RIVER
1119USBR 880327 17030002
0030 FEET DEPTH 350 METERS ELEVATION

/TYPA/AMBNT/SPRING

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 88/08/01 TO 89/04/11

	00010 WATER TEMP CENT	70301 DISS SOL SUM MG/L	00530 RESIDUE TOT NFLT MG/L
NO OF VALUES	2	2	2
MEAN	12.05	133.5	4.00
MEDIAN	12.05	130.5	4.00
NO OF VIOLS		0	0
PERCENT VIOL	50.	0.	0.
MINIMUM VIOL	15.20	0.0	0.00
MEAN VIOL	15.20	0.3	0.00
MAXIMUM VIOL	15.20	0.0	0.00
MIN CRITERIA	*********	*********	*********
MAX CRITERIA	15.00	400.0	80.00

, C57 ,

STORET RETRIEVAL DATE 89/12/15 - STANO - VERSION OF MAY 1988 STW 11.SUMMARY.1

KLI104
46 02 29.0 121 11 00.0 3
KLICKITAT RIVER AT WDF FISH HATCHERY S4 6N 13E
53039 WASHINGTON KLICKITAT
PACIFIC NORTHWEST 131000
/TYPA/AMBNT/STREAM COLUMBIA RIVER BELOW YAKIHA RIVER
1119USBR 880827 17070106027 0'002.840 ON
0000 FEET DEPTH 387 METERS ELEVATION

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 88/08/04 TO 89/09/12

	01105 ALUMINUM AL,TOT UG/L	00012 UN-IONZO NH3-N MG/L	01002 ARSENIC AS,TOT UG/L	01007 BARIUM BA,TOT UG/L	01027 CADMIUM CD,TOT UG/L	00405 co2 MG/L	50064 CHLORINE FREE AVL MG/L	00940 CHLCRIOE TOTAL MG/L	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L
NC OF VALUES	2	7	2	2	2	1	0	7	2	2
MEAN	520.00	0.0301	5.00	2503.	1.250	6.000	0.0000	0.729	2.000	5.
MEDIAN	520.03	0.0001	5.00	2503.	1.250	6.000	*********	0.709	2.000	5.
NO JF VIOLS	1	0	0	0	0	1	0	0	0	0
PERCENT VIOL	53.	0.	0.	3.	0.	100.	0.	0.	0.	0.
MINIMUM VIOL	1040.03	0.0000	0.00	0.	0.000	6.000	0.0000	0.000	0.000	0.
MEAN VIOL	1040.00	0.0000	0.00	0.	3.000	6.300	0.0003	0.000	0.000	0.
MAXIMUM VIOL	1040.00	0.0905	0.00	0.	0.000	6.000	0.0000	0.000	0.000	0.
MIN CRITERIA	*********	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	10.00	0.3125	10.00	5000.	5.000	1.000	0.0100	4.000	2.000	7000.

KLI104
46 02 29.0 121 11 00.0 3
KLICKITAT RIVER AT WDF FISH HATCHERY S4 6N 13E
53039 WASHINGTON KLICKITAT
PACIFIC NORTHWEST 131000
/TYPA/AMBNT/STREAM COLUMBIA RIVER BELOW YAKIMA RIVER
1119USBR d80827 17070106027 0002.840 ON
0000 FEET DEPTH 3 3 7 METERS ELEVATION

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 88/08/04 TO 89/09/12

	00300 DO MG/L	00950 FLUORIDE F,DISS MG/L	71375 H2S MG/L	01045 IRON FE,TOT UG/L	01051 LEAD PB,TOT UG/L	00925 MGNSIUM MG,DISS MG/L	01055 MANGNESE MN UG/L	71900 MERCURY HG,TOTAL UG/L	01067 NICKEL NI,TOTAL UG/L	00631 NO2&NO3 N-DISS MG/L
NO OF VALUES	7	2	1	2	2	7	2	2	2	7
MEAN	11.571	0.100	0.0100	355.	2.00	2.57	15.00	0.300	10.00	0.063
MEDIAN	10.500	0.100	0.0100	355.	2.03	2.55	15.00	0.300	10.00	0.100
NO OF VIOLS	0	0	C	0	0	0	1	1	0	0
PERCENT VIOL	0.	0.	0.	0.	0.	0.	50.	50.	0.	0.
MINIMUM VIOL	5.000	0.000	0.0000	0.	0.00	0.30	20.00	0.400	0.00	0.000
MEAN VIOL	0.000	0.000	0.0000	0.	0.03	0.00	20.00	0.400	0.00	0.000
MAXIMUM VIOL	0.300	0.000	0.0000	0.	0.00	0.00	20.00	0.400	0.00	0.000
MIN CRITERIA	7.005	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	*********	0.500	0.0100	1000.	20.00	15.00	10.00	0.200	10.00	1.000

C59

/ RETRIEVAL DATE 89/12/15 - STAND - VERSION OF HAY 1998 STN 11.SUMMARY.3

KLI104
46 02 23.0 121 11 00.0 3
KLICKITAT RIVER AT WOF FISH HATCHERY S4 6N 13E
53039 WASHINGTON KLICKITAT
PACIFIC NORTHWEST 131000
/TYP/AMBNT/STREAM COLUMBIA RIVER BELOW YAKIMA RIVER
1119USBR 880327 17070106027 0002.840 ON
0000 FEET DEPTH 387 METERS ELEVATION

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 88/08/04 TO 89/09/12

	00613 NO2-N DISS MG/L	73004 NIT + AR GAS SATR % SAT	00556 OIL-GRSE FREON-GR MG/L	00400 PH SU	00335 PTSSIUM K,DISS MG/L	01147 SELENIUM SE,TOT UG/L	01077 SILVER AG,TOT UG/L	01092 ZINC ZN,TOT UG/L	00930 SODIUM NA,DISS MG/L	00946 SULFATE SO4-DISS MG/L
NO OF VALUES	1	1	1	2	7	2	2	2	7	7
MEAN	0.010	100.0	1.000	7.175	1.497	7.50	2.000	7.50	3.78	2.81
MEDIAN	0.010	103.0	1.000	7.175	1.564	7.50	2.000	7.50	3.91	2.88
NO OF VIOLS	0	0	0	0	0	0	0	0	7	0
PERCENT VIOL	0.	0.	0.	0.	0.	0.	0.	0.	100.	0.
MINIMUM VIOL	0.000	0.0	0.000	0.000	0.000	0.03	0.000	0.00	2.76	0.00
MEAN VIOL	0.000	0.0	0.000	0.000	0.300	0.00	0.000	0.00	3.78	0.00
MAXIMUM VIOL	0.000	0.0	0.000	0.000	0.000	0.00	0.000	0.00	4.60	0.00
MIN CRITERIA	*********	*********	*********	6.500	*********	*********	*********	*********	15.	*********
MAX CRITERIA	0.100	103.0	1.000	8.000	5.000	10.00	3.000	10.00	75.0'3	50.00

C60

STORET RETRIEVAL DATE 89/12/15 - STAND - VERSION OF MAY 1988 STN 11.SUMMARY.4

KLI104
46 02 29.0 121 11 00.0 3
KLICKITAT RIVER AT WDF FISH HATCHERY SC 6N 13E
53039 WASHINGTON KLICKITAT
PACIFIC NORTHWEST 131000
/TYPA/AMBNT/STREAM
COLUMBIA RIVER BELOW YAKIMA RIVER
1119USBR 880827 17070106027 0002.840 ON
0000 FEET DEPTH 337 METERS ELEVATION

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 88/08/04 TO 89/09/12

	00010 WATER TEMP CENT	70301 DISS SOL SUM MG/L	00530 RESIDUE TOT NFLT MG/L
NO OF VALUES	7	7	7
MEAN	9.90	64.0	42.43
MEDIAN	10.00	63.0	14.00
NO OF VIOLS	0	0	1
PERCENT VIOL	0.	0.	14.
MINIMUM VIOL	0.00	0.0	196.00
MEAN VIOL	0.00	0.0	196.00
MAXIMUM VIOL	0.00	0.0	196.00
MIN CRITERIA	*********	*********	*********
MAX CRITERIA	15.00	400.0	30.00

C61

STORET RETRIEVAL DATE 89/12/15 - STAND - VERSION OF MAY 1988 STN lS.SUAMARY.l

KLI902
46 01 06.0 121 09 21.0 3
CASCADE SPRINGS NR KLICKITAT R Al RM 40
53039 WASHINGTON KLICKITAT
PACIFIC NORTHWEST 131000
/TYPA/AMBNT/SPRING COLUMBIA RIVER BELOW YAKIMA RIVER
1119USBR 880827 17010106027 0000.340 OFF
0000 FEET DEPTH 357 METERS ELEVATION

SUMMARY CF VIOLATIONS ON SAMPLES COLLECTED FROH 89/06/20 TO 89/06/20

	01105 ALUMINUM AL,TOT UG/L	00612 UN-IONZD NH3-N MG/L	01002 ARSENIC AS,TOT UG/L	01007 BARIUM BA,TOT UG/L	01027 CADMIUM CD,TOT UC/L	30405 CO2 MG/L	50064 CHLORINE FREE AVL MG/L	00940 CHLORLOE TOTAL MG/L	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UC/L
NO OF VALUES	1	1	1	1	1	1	1	1	1	1
MEAN	10.00	0.0001	5.00	5.	0.500	1.800	0.0100	0.354	2.000	5.
MEDIAN	10.00	0.0001	5.00	5.	0.500	1.80')	0.0100	0.354	2.000	5.
NO OF VIOLS	0	0	0	0	0	1	0	0	0	0
PERCENT VIOL	0.	0.	0.	0.	0.	100.	0.	0.	0.	0.
MINIMUM VIOL	0.00	0.0000	0.00	0.	0.000	1.800	0.0000	0.000	0.000	0.
MEAN VIOL	0.00	0.0000	0.00	0.	0.000	1.800	a.0000	0.000	0.000	0.
MAXIMUM VIOL	0.00	0.0000	0.00	0.	0.000	1.800	0.0000	0.000	0.000	0.
MIN CRITERIA	*********	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	10.00	0.0125	10.00	5000.	5.000	1.000	0.0100	4.000	2.000	7000.

C62,

KL1902
46 01 06.0 121 09 21.0 3
CASCADE SPRINGS NR KLICKITAT R AT RM 40
5 3 0 3 9 WASHINGTON KLICKITAT
PACIFIC NORTHWEST 131000
/TYPA/AMBNT/SPRING
COLUMBIA RIVER BELOW YAKIMA RIVER
1119USBR 880827 17070106027 0000.340 OFF
0000 FEET DEPTH 357 METERS ELEVATION

SUMMARY OF VIOLATIONS ON S A M P L E S COLLECTED FROM 89/06/20 TO 89/06/20

	00300 DO MG/L	00950 FLUORIDE F,DISS MG/L	71875 H2S MG/L	01045 IRON FE,TOT UG/L	01051 LEAD PB,TOT UG/L	00925 MGNSIUM MG,DISS MG/L	01055 MANGNESE MN UG/L	71900 MERCURY HG,TOTAL UG/L	01067 NICKEL NI,TOTAL UG/L	00631 NO2&NO3 N-DISS MG/L
NO OF VALUES	1	1	1	1	1	1	1	1	1	1
MEAN	11.300	0.100	0.0100	10.	2.00	3.28	5.00	0.200	10.00	0.200
MEDIAN	11.900	0.100	0.0133	10.	2.00	3.29	5.00	0.200	10.00	0.200
NO OF VIOLS	0	0	0	0	0	0	0	0	0	0
PERCENT VIOL	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MINIMUM VIOL	0.000	0.000	0.0000	0.	0.00	0.00	0.00	0.000	0.00	0.000
MEAN VIOL	0.000	3.000	0.0000	0.	0.00	0.00	0.00	0.000	0.00	0.000
MAXIMUM VIOL	0.000	3.000	0.0300	0.	0.00	0.00	0.00	0.000	0.00	0.000
MIN CRITERIA	7.000	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	*********	0.500	0.0100	1000.	20.00	15.00	10.00	0.200	10.00	1.000

C63

STORET RETRIEVAL CATE 89/12/15 - STAND - VERSION OF HAY 1988 STN 15.SUMMARY.3

KLI902
46 01 06.0 121 09 21.0 3
CASCADE SPRINGS NR KLICKITAT R AT RM 40
53039 WASHINGTON KLICKITAT
PACIFIC NORTHWEST 131000
/TYPA/AMBNT/SPRING COLUMBIA RIVER BELOW YAKIMA RIVER
1119USBR 880827 17070106027 0000.340 OFF
0000 FEET DEPTH 357 METERS ELEVATION

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 89/06/20 TO 89/06/20

	00513 NO2-N DISS MG/L	73304 NIT + AR GAS SATR %SAT	00556 OIL-GRSE FREON-GR MG/L	00400 PH SU	00335 PTSSIUH K,DISS MG/L	01147 SELENIUM SE,TOT UG/L	01077 SILVER AG,TOT UG/L	01092 ZINC ZN,TOT UG/L	00930 SODIUM NA,DISS MG/L	00946 SULFATE SO4-DISS MG/L
NO OF VALUES	0	1	1	1	1	1	1	1	1	1
MEAN	0.000	100.0	1.005	7.620	1.355	10.00	2.000	10.00	3.68	0.43
MEDIAN	*********	100.5	1.000	7.620	1.955	10.00	2.000	10.00	3.68	0.48
NO OF VIOLS	0	0	C	0	0	0	0	0	1	0
PERCENT VIOL	0.	0.	0.	0.	0.	0.	0.	0.	100.	0.
MINIMUM VIOL	0.000	0.0	0.000	0.000	0.000	0.00	0.000	0.00	3.68	0.00
MEAN VIOL	0.003	0.9	0.000	0.000	0.000	0.00	0.000	0.00	3.68	0.00
MAXIMUM VIOL	0.000	0.0	0.000	0.000	0.000	0.00	0.000	0.00	3.68	0.00
MIN CRITERIA	*********	*********	*********	6.500	*********	*********	*********	*********	15.00	*********
MAX CRITERIA	0.100	103.0	1.000	9.000	5.000	10.00	3.000	10.00	75.00	50.00

C64

STORET RETRIEVAL DATE 89/12/15 - STAND - VERSION OF MAY 1988 STN 15.SUMMARY.4

KLI902
46 01 04.0 121 09 21.0 3
CASCADE SPRINGS NR KLICKITAT R AT RM 40
5 3 0 3 9 WASHINGTON KLICKITAT
PACIFIC NORTHWEST 131000
/TYPA/AMBNT/SPRING COLUMBIA RIVER BELOW YAKIMA RIVER
1119USBR 880327 17070106027 0000.340 OFF
0000 FEET DEPTH 357 METERS ELEVATION

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 89/06/20 TO 89/06/20

	00010 WATER TEMP CENT	70301 DISS SOL SUM MG/L	00530 RESIDUE TOT NFLT MG/L
NO OF VALUES	1	1	1
MEAN	7.30	75.0	1.00
MEDIAN	7.30	75.0	1.00
NO OF VIOLS	0	0	0
PERCENT VIOL	0.	0.	0.
MINIMUM VIOL	0.00	0.0	0.00
MEAN VIOL	0.00	0.0	0.00
MAXIMUM VIOL	0.00	0.0	0.00
MIN CRITERIA	*********	*********	*********
MAX CRITERIA	15.00	400.0	30.00

STORET RETRIEVAL DATE 89/12/15 - STAND - VERSION Of MAY 1988 STN 16.SUMMARY.1

KLI908
46 01 42.0 121 09 50.0 4
KIDDER SPRINGS NR KLICKITAT R AT RM 41
53039 WASHINGTON KLICKITAT
PACIFIC NORTHWEST 131000
/TYPA/AMBNT/SPRING COLUMBIA RIVER BELOW YAKIMA RIVER
1119USBQ 890701 17070106
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 89/06/20 TO 89/06/20

	01105 ALUMINUM AL,TOT UG/L	00612 UN-IONZD NH3-N MG/L	01002 ARSENIC AS,TOT UG/L	01007 BARIUM BA,TOT UG/L	01027 CADMIUM CD,TOT UG/L	00405 CO2 MG/L	50064 CHLORINE FREE AVL MG/L	00940 CHLORIDE TOTAL MG/L	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L
NO OF VALUES	1	1	1	1	1	1	1	1	1	1
MEAN	15.03	0.0000	5.00	5.	0.505	6.703	0.0100	0.354	2.000	5.
MEDIAN	15.00	0.0000	5.00	5.	0.500	6.700	0.0100	0.354	2.000	5.
NO OF VIOLS	1	0	0	0	0	1	0	0	0	0
PERCENT VIOL	100.	0.	0.	0.	0.	100.	0.	0.	0.	0.
MINIMUM VIOL	15.00	0.0000	0.00	0.	0.000	6.700	0.0000	0.000	0.000	0.
MEAN VIOL	15.00	0.0000	0.00	0.	0.000	6.700	0.0000	0.000	0.000	0.
MAXIMUM VIOL	15.00	0.0000	0.00	0.	0.000	6.700	0.0000	0.000	0.000	0.
MIN CRITERIA	*********	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAXCRITERIA	10.00	0.0125	10.00	5000.	5.000	1.300	0.0100	4.000	2.000	7000.

KLI906
4.5 01 42.0 121 09 50.0 4
KIDDER SPRINGS NR KLICKITAT R AT RN 41
53039 YPSHINGTON KLXCKITAT
PACIFIC NORTHWEST 131000
/TYPA/AMBNT/SPRING COLUMBIA RIVER BELOW YAKIMA RIVER
1119USBR 890701 17070106
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 89/06/20 TO 89/06/20

	00300 DO MG/L	00950 FLUORIDE F,DISS MG/L	71875 H2S MG/L	31045 IRON FE,TOT UG/L	51351 LEAD PB,TOT UG/L	00925 MGNSIUM MG,DISS MG/L	01355 MANGNESE MN UG/L	71900 MERCURY HG,TOTAL UG/L	01067 NICKEL NI,TOTAL UG/L	00631 NO2&NO3 N-DISS MG/L
NO OF VALUES	1	1	1	1	1	1	1	1	1	1
MEAN	11.300	0.100	0.0100	40.	2.00	3.16	5.00	0.200	10.00	0.100
MEDIAN	11.300	0.100	0.0100	40.	2.00	3.16	5.00	0.200	10.00	0.100
NO OF VIOLS	0	0	0	0	3	0	0	0	0	0
PERCENT VIOL	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MINIMUM VIOL	0.000	5.000	0.0000	0.	0.00	0.30	0.00	0.000	0.00	0.000
MEAN VIOL	0.000	0.000	0.0000	0.	0.00	0.00	0.00	0.000	0.00	0.000
MAXIMUM VIOL	0.000	0.000	0.0000	0.	0.03	0.00	0.00	0.000	0.00	0.000
MIN CRITERIA	7.000	*********	*********	*********	*********	*********	*********	*********	*********	*********
MAX CRITERIA	*********	0.500	0.0100	1000.	20.00	15.00	10.00	0.200	10.00	1.000

KLI908
46 01 42.0 121 09 50.0 4
KIDDER SPRINGS NR KLICKITAT R AT RM 41
53039 WASHINGTON KLICKITAT
PACIFIC NORTHWEST 131000
COLUMBIA RIVER BELOW YAKIMA RIVER
1119USBR 890701 17070106
0000 FEET DEPTH

/TYPA/AMBNT/SPRING

SUMMARY OF VIOLATIONS ON SAMPLES CDLLECTEO FROM 89/06/20 TO 89/06/20

	00513 NO2-N DISS MG/L	73004 NIT + AR GAS SATR % SAT	00556 OIL-GRSE FREON-GR MG/L	00400 PH SU	00935 PTSSIUM K,DISS MG/L	01147 SELENIUM SE,TOT UG/L	01077 SILVER AG,TOT UG/L	01092 ZINC ZN,TOT UG/L	00930 SODIUM NA,DISS MG/L	00946 SULFATE SO4-DISS MG/L
NO OF VALUES	0	1	1	1	1	1	1	1	1	1
MEAN	0.000	100.0	1.303	7.033	1.955	10.00	2.000	10.00	3.68	0.48
MEDIAN	*********	100.0	1.000	7.030	1.955	10.00	2.000	10.00	3.68	0.48
NO OF VIOLS	0	0	0	0	0	0	0	0	1	0
PERCENT VIOL	0.	0.	0.	0.	0.	0.	0.	0.	100.	0.
MINIMUM VIOL	0.000	3.0	0.000	3.005	0.000	0.00	0.000	0.00	3.68	0.00
MEAN VIOL	0.000	0.0	3.000	il.003	0.000	0.00	0.000	0.00	3.60	0.00
MAXIMUM VIOL	0.000	il.3	0.000	0.303	0.000	0.00	0.000	0.00	3.68	0.00
MIN CRITERIA	*********	*********	*********	6.500	*********	*********	*********	*********	15.00	*********
MAX CRITERIA	0.100	103.0	1.000	I.000	5.053	10.00	3.000	10.00	75.00	50.00

C68

STORET RETRIEVAL DATE 89/12/15 - STAND - VERSION OF MAY 1988 STN 16.SUMMARY.4

KLI908
46 01 42.0 121 09 50.0 4
KIDDER SPRINGS NR KLICKITAT R AT RM 41
53039 WASHINGTON KLICKITAT
PACIFIC NORTHWEST 131000
COLUMBIA RIVER BELOW YAKINA RIVER
1119USBR 890701 17070106
0000 FEET DEPTH

/TYPA/AMBNT/SPRING

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 89/06/20 TO 89/06/20

	00010 WATER TEMP CENT	70301 DISS SOL SUM MG/L	00530 RESIDUE TOT NFLT MG/L
NO OF VALUES		1	1
MEAN	7.30	73.5	1.00
MEDIAN	7.33	73.:	1.00
NO OF VIOLS	0	0	C
PERCENT VIOL	0.	0.	3.
MINIMUM VIOL	0.00	0.3	0.03
MEAN VIOL	0.00	0.0	0.00
MAXIMUM VIOL	0.00	0.0	0.00
MIN CRITERIA	*********	*********	*********
MAX CRITERIA	15.00	400.0	80.00

C69

Appendix D

Summary Tables of Variances from Aquatic Life Criteria for Potential Outplanting Streams in the Yakima and Klickitat River Basins

STORET RETRIEVAL DATE 89/11/29 - STAND - VERSION OF MAY 1986 STN 6.SUMMARY.1

12510500
46 15 13.0 119 28 37.0 2
YAKIMA RIVER AT KIONA, WASH.
53005 WASHINGTON BENTON
130492

/TYPA/AMBNT/STREAM

112WRD HQ 17030003003 0011.680 OFF
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 53/01/31 TO 89/07/20

	00011 WATER TEMP FAHN	00010 WATER TEMP CENT	00076 TURB TRBIDMTR HACH FTU	00400 PH SU	00403 PH LAB SU	00300 DO MG/L	01042 COPPER CU,TOT UG/L	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	71900 MERCURY HG, TOTAL UG/L
NO OF VALUES	416	416	93	647	67	251	38	32	36	96
MEAN	55.94	13.30	10.15	7.901	8.136	10.719	10.632	6.066	7.	0.457
MEDIAN	56.48	13.60	6.00	7.300	a.100	10.400	8.500	1.000	0.	0.500
NJ SF VIOLS	108	53	2	18	5	0	19	1	0	17
PERCENT VIOL	20.	13.	2.	3.	7.	0.	50.	3.	0.	18.
MINIMUM VIOL	65.30	21.03	64.00	8.600	a.500	0.000	7.000	2.000	0.	0.200
MEAN VIOL	70.88	23.45	97.00	8.734	8.620	0.000	11.474	2.000	0.	0.629
MAXIMUM VIOL	83.30	23.50	130.00	5.200	8.800	0.000	23.000	2.000	0.	4.100
MIN CRITERIA	*********	*********	*********	6.500	6.500	6.500	*********	*********	*********	*********
MAX CRITERIA	65.00	21.00	50.00	8.500	8.500	*********	6.500	1.800	2200.	0.100

STORET RETRIEVAL DATE 89/11/29 - STAND - VEQSION Of MAY 1988 STN 6.SIJMMARY.2

12510500
46 15 13.0 119 28 37.0 2
YAKIMA RIVER AT KIONA, WASH.
5 3 0 0 5 WASHINGTON BENTON
130492

/TYPA/AMBNT/STREAM

112WRD HQ 17030003003 0011.880 OFF
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 53/01/31 TO 89/07/20

	01051 LEAD PB,TOT UG/L	01147 SELENIUM SE,TOT UG/L	01092 ZINC ZN,TOT UG/L
NO OF VALUES	36	33	38
MEAN	53.89	0.574	33.2
MEDIAN	6.00	1.000	20.0
NO OF VIOLS	0	0	0
PERCENT VIOL	0.	0.	0.
MINIMUM VIOL	0.00	0.000	0.0
MEAN VIOL	0.00	0.000	0.0
MAXIMUM VIOL	0.00	0.000	0.0
MIN CRITERIA	*********	*********	*********
MAX CRITERIA	34.00	5.000	180.0

D3

STORET RETRIEVAL DATE 89/11/29 - STAND - VERSION OF MAY 1988 STN 2.SUMMARY.1

YAV125
46 13 54.0 119 59 54.0 1
YAKIMA RATBRIDGE NR MABTON
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST
/TYPA/AMBNT/STREAM YAKIMA RIVER BASIN
1119US8R 760223 HP 17030003005 0019.100 OFF
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 71/01/21 TO 81/09/14

	00011 WATER TEMP FAHN	00010 WATER TEMP CENT	00076 TURB TRBIDMTR HACH FTU	00400 PH SU	00403 PH LAB SU	00300 DO MG/L	01042 COPPER CU,TOT UG/L	01027 CADMIUN CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	71900 MERCURY HG,TOTAL UG/L
NO OF VALUES	74	74	74	3	74	64	0	0	0	0
MEAN	54.89	12.72	8.76	8.267	7.719	9.698	0.000	0.000	0.	0.000
MEDIAL	54.50	12.50	6.00	8.100	7.700	9.500	*********	*********	*********	*********
NO OF VIOLS	13	5	0	1	0	0	0	0	0	0
PERCENT VIOL	24.	7.	0.	33.	0.	0.	0.	0.	0.	0.
MINIMUM VIOL	66.02	22.00	0.03	9.700	0.000	0.000	0.000	0.000	0.	0.000
MEAN VIOL	69.34	22.4:	0.09	a.700	0.000	0.000	0.000	0.000	0.	0.000
MAXIMUM VIOL	73.40	23.00	0.00	8.700	0.000	0.000	0.000	0.000	0.	0.000
MIN CRITERIA	*********	*********	*********	6.500	6.500	6.500	*********	*********	*********	*********
MAX CRITERIA	65.00	21.00	50.00	a.500	a.500	*********	6.500	2.000	2200.	0.200

D4

STORET RETRIEVAL DATE 89/11/29 - STAND - VERSION OF MAY 1988 STN 1.SUMMARY.1

YAV124
46 20 06.0 120 11 47.0 1
YAKIHA R AT BRIDGE NR GRANGER
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST
/TYPA/AMBNT/STREAM YAKIMA RIVER BASIN
1119USBR 760223 HO 17030003007 0002.220 OFF
OOOJ FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 74/03/20 TO 81/09/14

	00011 WATER TEMP FAHN	30015 WATER TEMP CENT	GO375 TURB TRBIDMTR HACH FTU	00400 PH SU	30403 PH LA3 su	00300 00 MG/L	01042 COPPER CU,TOT UG/L	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	71900 MERCURY HG,TOTAL UG/L
NO OF VALUES	72	72	72	3	72	63	0	0	0	0
MEAN	52.45	11.36	7.57	7.567	7.655	9.368	0.000	0.000	0.	0.000
MEDIAN	52.25	11.25	6.00	7.600	7.635	9.700	*********	*********	*********	*********
NO OF VIOLS	d	0	0	3	0	0	0	0	0	0
PERCENT VIOL	11.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MINIMUM VIOL	65.30	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.	0.000
MEAN VIOL	07.17	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.	0.000
MAXIMUM VIOL	69.60	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.	0.000
MIN CRITERIA	*********	*********	*********	6.505	6.500	6.500	*********	*********	*********	+a**+*++*
MAX CRITERIA	65.00	21.00	50.00	9.500	8.500	*********	6.500	2.000	2200.	0.200

D5

STORET RETRIEVAL DATE 89/11/29 - STAND - VERSION OF MAY 1988 STN 3.SUMARY.1

YAV148
46 51 22.0 120 28 58.0 1
YAKIMA R AT UMTANUM
53037 WASHINGTON KITTITAS
PACIFIC NORTHWEST
/TYPA/AMBNT/STREAM YAKIMA RIVER BASIN
1119USBR 760223 HQ 17030001008 0004.520 OFF
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 74/03/21 TO 87/03/02

	00011 WATER TEMP FAHN	00010 WATER TEMP CENT	30075 TURB TRBIDMTR HACH FTU	00400 PH SU	30403 PH LAB SU	00300 DO MG/L	01042 COPPER CU,TOT UG/L	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	71900 MERCURY HG,TOTAL UG/L
NO OF VALUES	139	138	130	11	130	128	2	2	2	2
MEAN	47.76	8.82	5.53	7.864	7.535	11.151	6.000	2.000	2.	0.200
MEDIAN	46.94	6.40	2.03	7.800	7.565	11.150	6.000	2.000	2.	0.200
NO OF VIOLS	1	0		0	0	1	1	0	0	0
PERCENT VIOL	1.	0.	2.	0.	0.	1.	50.	0.	0.	0.
MINIMUM VIOL	67.62	0.00	72.00	0.000	0.000	6.400	10.003	0.000	0.	0.000
MEAN VIOL	57.a2	0.00	81.00	0.000	0.000	6.400	10.000	0.000	0.	0.000
MAXIMUM VIOL	67.82	0.00	90.00	0.000	0.000	6.400	10.000	0.000	0.	0.000
MIN CRITERIA	*********	*********	*********	6.500	6.500	6.500	*********	*********	*********	*********
MAX CRITERIA	65.00	21.00	50.00	8.500	8.500	*********	6.500	2.000	2200.	0.200

D6

YAV148
46 51 22.0 120 28 58.0 1
YAKIMA R AT UMTANUM
53037 UASHINGTON KITTITAS
PACIFIC NORTHWEST
YAKIMA RIVER BASIN
/TYPA/AMBNT/STREAM 1119USBR760223 HQ 17030001303 0054.520 OFF
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 74/03/21 TO 87/03/02

	01051 LEAD PB,TOT UG/L	01147 SELENIUM SE,TOT UG/L	01092 ZINC ZN,TOT UG/L
NO OF VALUES	2	2	2
MEAN	2.00	5.000	21.5
MEDIAN	2.00	5.000	21.5
NO OF VIJLS	0	0	0
PERCENT VIOL	0.	0.	0.
MINIMUM VIOL	0.00	0.000	0.0
MEAN VIOL	0.00	0.000	0.0
MAXIMUM VIOL	0.00	0.000	0.0
MIN CRITERIA	*********	*********	*********
MAX CRITERIA	34.00	5.000	180.0

D7

STORET RETRIEVAL DATE 89/11/29 - STAND - VERSION OF MAY 1988 STN 4.SUMMARY.1

YAV140
47 11 33.0 120 56 56.0 1
YAKIMA R AT CLE ELUM
53037 WASHINGTON KITTITAS
PACIFIC NORTHWEST
YAK'HA RIVER BASIN
1119USBR 76022 3 HQ 17030001032 0006.620 OFF
0000 FEET DEPTH

/TYPA/AMBNT/STREAM

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 74/03/21 TO 87/03/02

	00011 WATER TEMP FAHN	03313 WATER TEMP CENT	00076 TURB TRBIDMTR HACH FTU	00400 PH SU	30403 PH LAB su	00300 DO MG/L	01042 COPPER CU,TOT UG/L	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	71900 MERCURY HG,TOTAL UG/L
NO OF VALUES	138	132	123	10	129	123	2	2	2	1
MEAN	48.51	a.89	4.21	7.450	7.375	10.874	6.000	2.000	2.	0.200
MEDIAN	s7.57	8.65	1.00	7.405	7.400	10.900	6.000	2.000	2.	0.200
NO Of VIOLS	0	5		0	1	0	1	0	0	0
PERCENT VIOL	0.	0.	1.	0.	1.	0.	50.	0.	0.	0.
MINIMUM VIOL	0.00	0.00	216.00	0.000	6.420	0.000	10.000	0.000	0.	0.000
MEAN VIOL	0.00	0.00	216.00	0.005	6.420	0.000	10.000	0.000	0.	0.000
MAXIMUM VIOL	0.00	0.00	216.00	0.000	6.420	0.000	10.000	0.000	0.	0.000
MIN CRITERIA	*********	*********	*********	6.500	6.500	6.500	*********	*********	*********	*********
MAX CRITERIA	65.00	21.00	50.00	8.500	8.500	*********	6.500	2.000	2200.	0.200

STORET RETRIEVAL DATE 89/11/29 - STAND - VERSION OF HAY 1988 STN 4.SUMMARY.2

YAV140
47 11 33.0 120 56 56.0 1
YAKIMA R AT CLE ELUM
53037 WASHINGTON KITTITAS
PACIFIC NORTHWEST
/TYPA/AMBNT/STREAM YAKIMA RIVER BASIN
1119USBR 760223 HQ 17030001032 0006.620 OFF
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 74/03/21 TO 87/03/02

	01051 LEAD PB,TOT UG/L	01147 SELENIUM SE,TOT UG/L	01092 ZINC ZN,TOT UG/L
NO Of VALUES	2	2	2
MEAN	2.00	5.000	3.5
MEDIAN	2.00	5.000	3.5
NO OF VIOLS	0	0	0
PERCENT VIOL	0.	0.	0.
MINIMUM VIOL	0.00	0.000	0.0
MEAN VIOL	0.00	0.000	0.5
MAXIMUM VIOL	0.00	0.300	0.0
MIN CRITERIA	*********	*********	*********
MAX CRITERIA	34.00	5.000	180.0

D9

STORET RETRIEVAL DATE 89/11/29 - STAND - VERSION OF MAY 1988 STN 6.SUMMARY.1

YAV138
46 14 32.0 119 40 48.0 1
SPRING C AT HESS RO
5 3 0 0 5 WASHINGTON BENTON
PACIFIC NORTHWEST
/TYPA/AMBNT/STREAM YAKIHA RIVER BASIN
1119USBR 760223 HQ 17030003003 0025.150 OFF
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES CJLLECTEO FROM 74/05/21 TO 81/02/19

	00011 WATER TEMP FAHN	00010 WATER TEMP CENT	50076 TURB TRBIDMTR HACH FTU	00400 PH SU	00403 PH LAB SU	00300 DO MG/L	01042 COPPER CU,TOT UG/L	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	71900 MERCURY HG,TOTAL UG/L
NO OF VALUES	67	67	66	3	67	56	0	0	0	. 0
MEAN	55.75	t3.20	27.29	8.400	7.970	10.209	0.000	0.000	0.	0.000
MEDIAN	55.22	12.90	a. 50	6.300	7.360	10.100	*********	*********	*********	*********
NO OF VIOLS	15	5	7	1	1	0	0	0	0	0
PERCENT VIOL	22.	7.	11.	33.	1.	0.	0.	0.	0.	0.
MINIMUM VIOL	65.12	21.20	58.00	8.800	8.600	0.000	0.000	0.000	0.	0.000
MEAN VIOL	b0.73	22.10	155.86	8.800	a.600	0.000	0.000	0.000	0.	0.000
MAXIMUM VIOL	73.76	23.20	520.00	8.800	8.600	0.000	0.000	0.000	0.	0.000
MIN CRITERIA	*********	*********	*********	6.500	6.500	6.500	*********	*********	*********	*********
MAX CRITERIA	65.00	21.00	50.00	8.500	a.500	*********	6.500	2.000	2200.	0.200

D10

STORET RETRIEVAL DATE 89/11/29 - STAND - VERSION OF MAY 1983 STN 7.SUMMARY.1

YAV139
46 14 03.0 119 41 02.0 1
SNIPES C. AT OLD INLAND EMPIRE R
53005 WASHINGTON BENTON
PACIFIC NORTHWEST
YAKIMA RIVER BASIN
1113USBR 760223 HQ 17030003003 0025.640 OFF
0000 FEET DEPTH

/TYPA/AMBNT/STREAM

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 74/05/21 TO 81/02/19

	00011 WATER TEMP FAHN	00010 WATER TEMP CENT	00076 TURB TRBIDMTR HACH FTU	00400 PH SU	00403 PH LAY SU	00300 OIL MG/L	01042 COPPER CU,TOT UG/L	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	71900 MERCURY HG,TOTAL UG/L
NO OF VALUES	64	64	63	2	64	53	0	0	0	0
MEAN	55.81	13.23	25.22	8.500	7.837	10.032	0.000	0.000	0.	0.000
MEDIAN	55.94	13.30	6.00	8.500	7.810	9.600	*********	*********	*********	*********
NO OF VIOLS	15	6	S	1	0	0	0	0	0	0
PERCENT VIOL	23.	3.	d.	50.	0.	0.	0.	0.	0.	0.
MINIMUM VIOL	65.48	22.00	60.00	8.800	0.000	0.000	0.000	0.000	0.	0.000
MEAN VIOL	6Y.40	22.65	140.60	8.800	0.000	0.000	0.000	0.000	0.	0.000
MAXIMUM VIOL	74.30	23.50	340.00	8.800	0.000	i1.000	0.001)	0.000	0.	0.000
MIN CRITERIA	*********	*********	*********	6.500	6.503	6.500	*********	*********	*********	*********
MAX CRITERIA	65.00	21.00	50.00	8.500	8.500	*********	6.500	2.000	2200.	0.200

D11

STORET RETRIEVAL DATE 89/11/29 - STAND - VERSION OF MAY 1988 STN 8.SUMMARY.1

YAV121
46 14 39.0 121 01 09.0 1
SULPHUR C WW AT MCGEE RO
53037 WASHINGTON YAKIMA
PACIFIC NORTHWEST
/TYPA/AMBNT/STREAM YAKIMA RIVER BASIN
1119USBR 700223 HP 17030003026 0003.990 OFF
0300 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 74/03/19 TO 81/09/14

	00011 WATER TEMP FAHN	00010 WATER TEMP CENT	00076 TURB TRBIDMTR HACH FTU	00400 PH SU	00403 PH LAB SU	00300 DO MG/L	01042 COPPER CU,TOT UG/L	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	71900 MERCURY HG,TOTAL UG/L
NO OF VALUES	73	73	73	3	73	64	0	0	0	0
MEAN	55.05	12.81	30.52	0.067	7.839	9.298	0.000	0.000	0.	0.000
MEDIAN	54.50	12.50	13.00	8.000	7.820	9.300	*********	*********	*********	*********
NO OF VIOLS	10	0	8	0	0	1	0	0	0	0
PERCENT VIOL	14.	0.	11.	0.	0.	2.	0.	0.	0.	0.
MINIMUM VIOL	65.66	0.00	51.00	0.000	0.000	6.400	0.003	0.000	0.	0.000
MEAN VIOL	66.92	0.00	173.50	0.000	0.003	6.400	0.000	0.000	0.	0.000
MAXIMUM VIOL	68.54	0.00	598.00	0.000	0.303	6.400	0.000	0.000	0.	0.000
MIN CRITERIA	*********	*********	*********	6.500	6.500	6.500	*********	*********	*********	*********
MAX CRITERIA	65.00	21.00	50.00	8.500	8.500	*********	6.500	2.000	2200.	0.200

D12

STORET RETRIEVAL DATE 89/11/29 - STAND - VERSION Of MAY 1988 STN 9.SUMMARY.1

YES105 STS 12501660
46 16 23.0 120 08 44.0 2
SATUS CREEK AT BIA GAUGING STATION
53077 YASHINCTON YAKIMA
PACIFIC NORTHWEST 130400
/TYPA/AMBNT/STREAM
YAKIMA RIVER BASIN
1119USBR 610425 HQ 17330003027 0002.540 OFF
0500 FEET DEPTH

SUMMARY GF VIOLATIONS ON SAMPLES COLLECTED FROM 81/03/25 TO 84/08/28

	00011 WATER TEMP FAHN	00010 WATER TEMP CENT	00076 TURB TRBIDMTR HACH FTU	00409 PH SU	00403 PH LAB SU	00300 DO MG/L	01042 COPPER CU,TOT UG/L	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	11900 MERCURY HG,TOTAL UG/L
NG OF VALUES	37	37	35	0	35	34	0	0	0	0
MEAN	55.04	12.80	5.11	0.000	7.567	9.628	0.000	0.000	0.	0.000
MEDIAN	54.85	12.70	2.00	*********	7.550	9.900	*********	*********	*********	*********
NJ OF VIOLS	11	4	0	0	0	1	0	0	0	0
PERCENT VIOL	30.	11.	0.	0.	0.	3.	0.	0.	0.	0.
MINIMUM VIOL	66.20	21.20	0.03	0.000	3.000	6.000	0.000	0.000	0.	0.000
MEAN VIOL	70.08	23.17	0.00	0.000	0.000	6.000	0.000	0.000	0.	0.000
MAXIMUM VIOL	78.83	26.00	0.00	0.000	0.000	6.000	0.000	0.000	0.	0.000
MIN CRITERIA	*********	*********	*********	6.505	6.500	6.500	*********	*********	*********	*********
MAX CRITERIA	65.00	21.03	50.00	a.500	8.500	*********	6.500	2.000	2200.	0.200

D13

STORET RETRIEVAL DATE 89/11/29 - STAND - VERSION OF MAY 19&M STN 11.SUMMARY.1

YES104 TIS 12506000
46 18 39.0 120 11 20.0 2
TOPPENISH CREEK AT BIA GAUGE
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
/TYPA/AMBNT/STREAM YAKIMA RIVER BASIN
1119USBR 810425 HQ 17030003016 0001.930 OFF
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 81/03/25 TO 84/08/28

	00011 WATER TEMP FAHN	00010 WATER TEMP CENT	00076 TURB TRBIDMTR HACH FTU	00400 PH SU	00403 PH LAB SU	00300 DO MG/L	01042 COPPER CU,TOT UG/L	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	71900 MERCURY HG,TOTAL UG/L
NO OF VALUES	37	37	35	0	35	34	0	0	0	0
MEAN	51.33	10.76	3.60	0.500	7.525	9.739	0.000	0.000	0.	0.000
MEDIAN	49.64	9.80	2.00	*********	7.505	9.800	*********	*********	*********	*********
NO OF VIOLS	5	0	0	0	0	1	0	0	0	0
PERCENT VIOL	14.	0.	0.	0.	0.	3.	0.	0.	0.	0.
MINIMUM VIOL	66.20	0.00	0.00	0.000	0.000	5.300	0.000	0.000	0.	0.000
MEAN VIOL	67.17	0.00	0.00	0.006	3.000	5.300	0.000	0.000	0.	0.000
MAXIMUM VIOL	68.00	0.00	0.00	3.000	0.003	5.300	0.000	3.000	0.	0.000
MIN CRITERIA	*********	*********	*********	6.500	6.500	6.500	*********	*********	*********	*********
MAX CRITERIA	65.00	21.00	50.00	8.500	8.500	*********	6.500	2.000	2200.	0.200

D14

YES600 SIM
46 23 40.0 120 48 30.0 2
SIMCOE CREEK 1 MI WEST OF POWER STATION
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST 130400
/TYPA/AMBNT/STREAM YAKIMA RIVER BASIN
1119USBR 310425 HP 17030003018 0003.520 OFF
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 31/03/25 TO 84/08/28

	00011 WATER TEMP FAHN	00010 WATER TEMP CENT	30076 TURB TRBIDMTR HACH FTU	00400 PH SU	00403 PH LAB SU	00300 DO MG/L	01042 COPPER CU,TOT UG/L	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	71903 MERCURY HG,TOTAL UG/L
NO OF VALUES	37	37	35	0	35	34	0	0	0	0
MEAN	51.73	10.99	7.26	0.000	7.671	9.935	0.000	0.000	0.	0.000
MEDIAN	52.52	11.40	2.00	*********	7.660	10.200	*********	*********	*********	*********
NO OF VIOLS	2	0	2	0	0	1	0	0	0	0
PERCENT VIOL	5.	0.	6.	0.	0.	3.	0.	0.	0.	0.
MINIMUM VIOL	65.65	0.03	57.00	0.000	0.000	6.300	0.000	0.000	0.	0.000
MEAN VIOL	65.93	0.00	71.00	0.000	0.000	6.300	0.300	0.000	0.	0.000
MAXIMUM VIOL	66.23	0.00	85.00	0.000	0.000	6.300	0.000	0.000	0.	0.000
MIN CRITERIA	*********	*********	*********	6.500	6.500	6.500	*********	*********	*********	*********
MAX CRITERIA	65.00	21.00	50.00	8.500	3.500	*********	6.500	2.000	2200.	0.200

STORET RETRIEVAL DATE 89/11/29 - STAND - VERSION OF MAY 1988 STN 15.3UHMARY.l

YAV109
46 32 07.0 120 28 18.0 1
AHTANUM C At MOUTH
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST
YAKIMA RIVER BASIN
1119USBR 760223 HP 17030003003 0000.280 OFF
0000 FEET DEPTH

/TYPA/AMBNT/STREAM

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 74/03/21 TO 81/09/15

	00011 WATER TEMP FAHN	00010 WATER TEMP CENT	00076 TURB TRBIDMTR HACH FTU	00400 PH SU	00403 PH LAB SU	00300 DO MG/L	01042 COPPER CU,TOT UG/L	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	71900 MERCURY HG,TOTAL UG/L
NO OF VALUES	73	73	73	2	73	63	0	0	0	0
MEAN	52.62	11.45	6.58	8.550	7.813	10.836	0.000	0.000	0.	0.000
MEDIAN	51.80	11.00	3.00	8.550	7.840	10.800	*********	*********	*********	*********
NO OF VIOLS	8	3	2	1	0	0	0	0	0	0
PERCENT VIOL	11.	4.	3.	50.	0.	0.	0.	0.	0.	0.
MINIMUM VIOL	66.20	21.40	54.00	8.600	0.000	0.000	0.000	0.000	0.	0.000
MEAN VIOL	68.74	21.93	77.00	8.600	0.000	0.000	0.000	0.000	0.	0.000
MAXIMUM VIOL	72.55	22.50	100.00	8.600	0.000	0.000	0.000	0.000	0.	0.000
MIN CRITERIA	*********	*********	*********	6.500	6.500	6.500	*********	*********	*********	*********
MAX CRITERIA	65.00	21.00	50.00	8.500	8.500	*********	6.500	2.000	2200.	0.200

STORET RETRIEVAL DATE 89/11/29 - STAND - VERSION OF MAY 1988 STN 14.SUMMARY.1

YES100 ADM
46 31 38.0 120 46 44.0 2
AHTANUM CR 4 MI EAST OF TAMPICO BY FOOTBRIDGE
53077 WASHINGTON YAKIHA
PACIFIC NORTHWEST 130400
/TYPA/AMBNT/STREAM YAKIMA RIVER BASIN
1119USBR 810425 HO 17030003009 0016.840 OFF
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 81/03/25 TO 84/08/27

	00011 WATER TEMP FAHN	00010 WATER TEMP CENT	30375 TURB TRBIDMTR HACH FTU	00400 PH SU	00403 PH LAB su	00300 OO MG/L	01042 COPPER CU,TOT UG/L	01027 CAOHIUH CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	71900 MERCURY HG,TOTAL UG/L
NC OF VALUES	37	37	35	0	35	34	0	0	0	0
MEAN	48.10	8.94	5.94	0.000	7.426	10.701	0.000	0.000	0.	0.000
MEDIAN	45.22	7.90	2.00	*********	7.450	10.550	*********	*********	*********	*********
NO of VIOLS	1	0	1	0	0	1	0	0	0	0
PERCENT VIOL	3.	0.	3.	0.	0.	3.	0.	0.	0.	0.
MINIMUM VIOL	65.12	0.03	35.00	0.000	0.000	5.200	0.000	0.000	0.	0.000
MEAN VIOL	65.12	0.00	as.00	0.000	0.000	5.200	0.000	0.000	0.	0.000
MAXIMUM VIOL	55.12	0.00	85.00	0.000	0.000	5.205	5.000	0.000	0.	0.000
MIN CRITERIA	*********	*********	*********	6.500	6.500	6.500	*********	*********	*********	*********
MAX CRITERIA	65.00	21.00	50.00	8.500	3.500	*********	6.500	2.000	2200.	0.200

D17

STORET RETRIEVAL DATE 89/11/29 - STAND - VERSION OF MAY 1988 STN 23.SUMMARY.1

YAV156
46 59 44.0 120 35 23.0 2
MANASTASH AT BROWN RD BRIDGE
5 3 0 3 7 WASHINGTON KITTITAS
PACIFIC NORTHWEST
/TYPA/AMBNT/STREAM
YAKIMA RIVER BASIN
1119USBR 7 8 0 8 2 3 HQ 17030001073 0000.200 OFF
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FRCM 78/07/17 TO 78/09/22

	00011 WATER TEMP FAHN	00010 WATER TEMP CENT	00076 TURB TRBIDMTR HACH FTU	00403 PH SU	00403 PH LAB SU	30303 DO MG/L	01042 COPPER CU,TOT UG/L	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	71900 MERCURY HG,TOTAL UG/L
NO OF VALUES	10	10	d	10	0	10	0	0	0	0
MEAN	57.56	14.23	0.00	7.500	0.000	6.395	0.000	0.000	0.	0.000
MEDIAN	57.23	14.09	*********	7.653	*********	3.150	*********	*********	*********	*********
NO OF VIOLS	1	0	C	0	0	0	0	0	0	0
PERCENT VIOL	10.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MINIMUM VIOL	65.64	0.00	0.00	0.000	3.500	0.000	0.000	0.000	0.	0.000
MEAN VIOL	65.34	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.	0.000
MAXIMUM VIOL	65.84	0.00	0.00	0.003	3.000	0.000	0.000	0.000	0.	0.000
MIN CRITERIA	*********	*********	*********	6.500	6.500	6.500	*********	*********	*********	*********
MAX CRITERIA	65.00	21.00	50.00	8.500	8.500	*********	6.500	2.000	2200.	0.200

YAV155
47 05 16.0 123 42 39.0 2
TANEUM C ANDERSON'S LOAFING SHED
5 3 0 3 7 WASHINGTON K I T T I T A S
PACIFIC NORTHWEST
/TYPA/AMBNT/STREAM
YAKIMA RIVER BASIN
1119USBR 780823 HQ 1 7 0 3 0 0 0 1 0 7 0 0 0 0 0 . 2 9 0 O F F
0000 F E E T DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 78/07/17 TO 78/09/22

	00011 WATER TEMP FAHN	00010 WATER TEMP CENT	00076 TURB TRBIDMTR HACH FTU	00400 PH SU	00403 PH LAB SU	00300 DO MG/L	01042 COPPER CU,TOT UG/L	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	71900 MERCURY HG,TOTAL UG/L
NO OF VALUES	10	10	0	10	0	10	0	0	0	0
MEAN	61.95	16.64	0.00	7.560	0.000	6.730	0.000	0.000	0.	0.000
MEDIAN	62.24	16.80	*********	7.000	*********	8.750	*********	*********	*********	*********
NO OF VIOLS		0	0	0	0	0	0	0	0	0
PERCENT VIOL	20.	3.	0.	0.	0.	0.	0.	0.	0.	0.
MINIMUM VIOL	66.02	0.00	3.05	3.000	0.000	0.000	0.000	0.000	0.	0.000
MEAN VIOL	67.51	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.	0.000
MAXIMUM VIOL	69.80	6.03	0.00	0.003	0.000	0.000	0.000	0.000	0.	0.000
MIN CRITERIA	*********	*********	*********	6.500	6.500	6.500	*********	*********	*********	*********
MAX CRITERIA	65.00	21.00	50.00	8.500	3.500	*********	6.500	2.000	2200.	0.200

STORET RETRIEVAL DATE 89/11/29 - STAND - VERSION OF MAY 1988 STN 28.SUMMARV.I

YAV152
47 10 06.0 120 49 55.0 2
TEANAWAY RIVER AT HIWAY10BR
53037 UASHINGTON KITTITAS
PACIFIC NORTHWEST
/TYPA/AMBNT/STREAM YAKIHA RIVER BASIN
1119USBR 730823 HQ 17030001032 0000.100 OFF
0303 FEET DEPTH

SUMMARY OF VIOLATIONS UN SAMPLES COLLECTED FROM 78/07/17 TO 83/09/14

	00511 WATER TEMP FAHN	00010 WATER TEMP CENT	00376 TURB TRBIDMTR HACH FTU	00403 PH SU	00403 PH LAB SU	00300 DO MG/L	01042 COPPER CU,TOT UG/L	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	71900 MERCURY HG,TOTAL UG/L
NO OF VALUES	46	46	36	10	36	43	0	0	0	0
MEAN	51.70	10.98	7.08	7.800	7.709	9.956	0.000	0.000	0.	0.000
MEDIAN	51.44	10.80	4.00	7.800	7.735	9.800	*********	*********	*********	*********
NO OF VIOLS		1	1	0	0	1	0	0	0	0
PERCENT VIOL	9.	2.	3.	0.	0.	2.	0.	0.	0.	0.
MINIMUM VIOL	67.10	34.00	51.00	0.000	0.000	5.900	0.000	0.000	0.	0.000
MEAN VIOL	74.07	34.00	51.00	0.000	0.000	5.900	0.000	0.000	0.	0.000
MAXIMUM VIOL	93.20	34.00	51.00	0.000	0.000	5.300	0.000	0.000	0.	0.000
MIN CRITERIA	*********	*********	*********	6.500	6.500	6.500	*********	*********	*********	*********
MAX CRITERIA	65.00	21.00	50.00	8.500	8.500	*********	6.500	2.000	2200.	0.200

STORET RETRIEVAL DATE 89/11/29 - STAND - VERSION CF H A Y 1988 STN 29.SUHHhRY.I

YCE002
47 14 40.0 121 03 48.0 1
CLE ELUM R AT GAGE STATION
53037 WASHINGTON KITTITAS
PACIFIC NORTHWEST
/TYPA/AMBNT/STREAM YAKIMA RIVER BASIN
1119USBR 760322 17030001
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 72/04/25 TO 87/09/24

	00011 WATER TEMP FAHN	00010 WATER TEMP CENT	00076 TURB TRBIDMTR HACH FTU	00400 PH su	00403 PH LAB SU	30300 DO MG/L	01042 COPPER CU,TOT UG/L	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	71900 MERCURY HG,TOTAL UG/L
NO OF VALUES	23	23	22	0	24	18	0	0	0	0
MEAN	50.51	10.23	1.77	0.303	7.255	10.350	0.000	0.000	0.	0.000
MEDIAN	46.20	9.00	1.00	*********	7.260	10.250	*********	*********	*********	*********
NO OF VIOLS	1	0'	0	0	0	0	0	0	0	0
PERCENT VIOL	4.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MINIMUM VIOL	66.20	3.00	0.00	0.000	0.000	0.000	0.000	0.000	0.	0.000
MEAN VIOL	66.23	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.	0.000
MAXIMUM VIOL	66.20	5.05	0.00	0.000	0.000	0.000	0.000	0.000	0.	0.000
MIN CRITERIA	*********	*********	*********	6.500	6.500	6.500	*********	*********	*********	*********
MAX CRITERIA	65.00	21.00	50.00	8.500	6.500	*********	5.500	2.000	2200.	0.200

STORET RETRIEVAL DATE 89/11/29 - STAID - VERSION OF MAY1988 STN 32.SUMHARY.l

YAV102
46 37 55.5 120 35 11.0 1
NACHES R AT NELSON BRIDGE
5 3 0 7 7 WASHINGTON YAKIMA
PACIFIC NORTHWEST
/TYPA/AMBNT/STREAM
YAKIMA RIVER BASIN
1119USBR 760223 HQ 17030002002 0000.450 OFF
0003 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 74/03/21 TO 87/03/02

	00011 WATER TEMP FAHN	00010 WATER TEMP CENT	00376 TURB TRBIDMTR HACH FTU	30400 PH SU	00403 PH LAB SU	00300 DO MG/L	01042 COPPER CU,TOT UG/L	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	71900 MERCURY HG,TOTAL UG/L
NO OF VALUES	133	132	133	2	133	122	3	3	3	3
MEAN	47.91	8.90	4.26	6.003	7.384	11.170	4.667	2.000	2.	0.200
MEDIAN	46.40	8.00	2.00	a.000	7.370	11.200	2.000	2.000	2.	0.200
NO OF VIOLS		2	0	0	0	1	1	0	0	0
PERCENT VIOL	4.	2.	0.	0.	0.	1.	33.	0.	0.	0.
MINIMUM VIOL	66.20	71.53	0.00	0.000	0.000	6.100	10.000	0.000	0.	0.000
MEAN VIOL	73.87	28.75	0.00	0.000	0.000	6.100	10.000	0.000	0.	0.000
MAXIMUM VIOL	96.80	36.03	0.00	0.000	3.000	0.100	10.000	0.000	0.	0.000
MIN CRITERIA	*********	*********	*********	6.500	6.500	6.500	*********	*********	*********	*********
MAX CRITERIA	65.00	21.00	50.00	8.500	8.500	*********	6.500	2.000	2200.	0.200

D22

STORET RETRIEVAL DATE 89/11/29 - STAND - VERSION OF MAY 1988 STN 32.SUWWARY.2

YAV102
46 37 55.0 120 35 11.0 1
NACHES R AT NELSON BRIDGE
5 3 0 7 7 WASHINGTON YAKIMA
PACIFIC NORTHWEST
YAKIMA RIVER BASIN
1119USBR760223 HQ 17030002002 0000.450 OFF
0000 FEET DEPTH

/TYPA/AMBNT/STREAM

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 74/03/21 TO 87/03/02

	01051 LEAD PB,TOT UG/L	01147 SELENIUM SE,TOT UG/L	01092 ZINC ZN,TOT UG/L
NO OF VALUES	3	3	3
MEAN	2.00	5.300	7.0
MEDIAN	2.00	5.000	3.0
NO OF VIOLS	0	0	0
PERCENT VIOL	0.	0.	0.
MINIMUM VIOL	0.00	0.000	0.0
MEAN VIOL	0.03	0.0C0	0.0
MAXIMUM VIOL	0.00	5.000	0.0
MIN CRITERIA	*********	*********	*********
MAX CRITERIA	34.00	5.000	180.0

D23

STORET RETRIEVAL DATE 89/11/29 - STAND - VERSION OF MAY 1988 STN 33.SlJMFIARY.l

YAV028
46 37 30.0 120 34 40.0 1
COWICHE CK SE1/4 S9 13N 18E
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST
/TYPA/AMBNT/STREAM YAKIMA RIVER BASIN
1113USBQ 760106 HQ 17030002057 0000.290 OFF
0503 FEET DEPTH

SUMMARY OF VICLATIONS Ok SAMPLES COLLECTED FROM 71/09/22 TO 74/02/01

	00011 WATER TEMP FAHN	00010 WATER TEMP CENT	00076 TURB TRBIDMTR HACH FTU	00400 PH SU	00403 PH LAB SU	00300 00 MG/L	01042 COPPER CU,TOT UG/L	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	71900 MERCURY HG,TOTAL UG/L
NO OF VALUES	21	21	19	0	21	20	0	0	0	0
MEAN	52.90	11.61	a.32	0.000	7.761	10.117	0.000	0.000	0.	0.000
MEDIAN	53.96	12.20	4.00	*********	7.700	9.500	*********	*********	*********	*********
NO OF VIOLS	3	1	0	0	1	0	0	0	0	0
PERCENT VIOL	14.	5.	0.	0.	5.	0.	0.	0.	0.	0.
MINIMUM VIOL	65.30	22.00	0.00	0.000	8.650	0.000	0.000	0.000	0.	0.000
MEAN VIOL	68.30	22.00	0.00	0.000	8.650	0.000	0.000	0.000	0.	0.000
MAXIMUM VIOL	71.60	22.00	0.00	0.000	8.650	0.000	0.000	0.000	0.	0.000
MIN CRITERIA	*********	*********	*********	6.500	6.500	6.500	*********	*********	*********	*********
MAX CRITERIA	65.00	21.00	50.00	8.500	8.500	*********	6.500	2.000	2200.	0.200

YR0003
46 39 54.0 121 07 18.0 1
TIETON R BELOW DAM AT GAGE STA
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST
YAKIMA RIVER BASIN
1119USBR 750322 17030002
0000 FEET DEPTH

/TYPA/AMBNT/STREAM

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 72/04/24 TO 73/09/13

	00011 WATER TEMP FAHN	00010 WATER TEMP CENT	00076 TURB TRBIDMTR HACH FTU	00400 PH SU	00403 PH LAB su	00300 DO MG/L	01042 COPPER CU,TOT UG/L	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	71900 MERCURY HG,TOTAL UG/L
NO OF VALUES	12	12	11	0	12	12	0	0	0	0
MEAN	50.18	10.10	5.36	0.000	7.330	10.342	0.000	0.000	0.	0.000
MEDIAN	51.62	10.90	6.00	*********	7.360	10.450	*********	*********	*********	*********
NO Of VIOLS	0	0	0	0	0	1	0	0	0	0
PERCENT VIOL	0.	0.	0.	3.	0.	a.	0.	0.	0.	0.
MINIMUM VIOL	0.00	0.00	0.50	0.000	0.000	6.200	0.000	0.000	0.	0.000
MEAN VIOL	0.03	0.00	0.00	0.000	0.000	6.200	0.000	0.000	0.	0.000
MAXIMUM VIOL	0.00	0.00	0.00	0.000	0.000	6.200	0.000	0.000	0.	0.000
MIN CRITERIA	*********	*********	*********	6.500	6.500	6.500	*********	*********	*********	*********
MAX CRITERIA	65.00	21.00	50.00	a.500	a.500	*********	6.500	2.000	2200.	0.200

0
2
cn

STORET RETRIEVAL DATE 89/11/29 - STAND - VERSION OF M A Y 1988 STN 35.SUMMARY.1

YES103 RAN 12488502
46 49 10.0 120 56 07.0 2
RATTLESNAKE CR 1 MI ABOVE STATE FOREST STATION
53077 WASHINGTON YAKIHA
PACIFIC NORTHWEST 130400
/TYPA/AMBNT/STREAM YAKIHA RIVER BASIN
1119USBR 810425 HQ 17030002003 0010.360 OFF
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 81/03/26 TO 84/05/23

	00011 WATER TEMP FAHN	00010 WATER TEMP CENT	00076 TURB TRBIDMTR HACH FTU	00400 PH SU	00403 PH LAB SU	00300 DO MG/L	01342 COPPER CU,TOT UG/L	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	71900 MERCURY HG,TOTAL UG/L
NO OF VALUES	Lo	26	25	0	25	26	0	0	0	0
MEAN	46.50	3.06	3.32	0.000	1.333	10.281	0.000	0.000	0.	0.000
MEDIAN	45.59	7.55	1.00	*********	7.400	10.300	*********	*********	*********	*********
N C DF VIOLS	3	0	0	0	0	1	0	0	0	0
PERCENT VIOL	0.	J.	0.	0.	il.	4.	0.	0.	0.	0.
MINIMUM VIOL	0.00	0.00	0.00	3.000	5.000	6.200	0.000	0.000	0.	0.000
MEAN VIOL	0.00	0.00	0.00	0.000	0.000	6.200	0.000	0.000	0.	0.000
MAXIMUM VIOL	0.00	0.00	0.00	5.000	o.uoo	6.200	0.000	0.000	0.	0.000
MIN CRITERIA	*********	*********	*********	6.500	6.500	6.500	*********	*********	*********	*********
MAX CRITERIA	65.00	21.00	50.00	8.500	3.500	*********	6.500	2.000	2200.	0.200

D26

STORET RETRIEVAL DATE 89/11/29 - STAND - VERSION OF MAY 1983 STN 36.SUMMARY.1

YB0001
45 52 48.0 121 16 57.0 1
BUMPING R RES OUTLET AT NEW STA
53077 WASHINGTON YAKIMA
PACIFIC NORTHWEST
/TYPA/AMBNT/STREAM YAKIMA RIVER BASIN
1119USBR 760322 17030002
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 72/04/26 TO 81/03/27

	00011 WATER TEMP FAHN	00010 WATER TEMP CENT	00076 TURB TRBIDMTR HACH FTU	00400 PH SU	00403 PH LAB SU	00300 DO MG/L	01042 COPPER CU,TOT UG/L	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	71900 MERCURY HG,TOTAL UG/L
NO OF VALUES	13	13	12	0	13	13	0	0	0	0
MEAN	50.62	15.35	1.42	0.000	7.102	9.619	0.000	0.000	0.	0.000
MEDIAN	50.00	10.00	1.50	*********	7.090	9.000	*********	*********	*********	*********
NO OF VIOLS	1	0	0	0	0	1	0	0	0	0
PERCENT VIOL	d.	2.	0.	0.	0.	8.	0.	0.	0.	0.
MINIMUM VIOL	59.80	0.00	0.00	0.000	0.000	6.200	0.000	0.000	0.	0.000
MEAN VIOL	69.80	0.00	0.00	o.uoo	0.000	6.200	0.000	0.000	0.	0.000
MAXIMUM VIOL	69.80	0.00	O.GO	0.000	0.000	6.200	0.000	0.000	0.	0.000
MIN CRITERIA	*********	*********	*********	6.500	6.500	6.500	*********	*********	*********	*********
MAX CRITERIA	65.00	21.00	50.00	8.500	8.500	*********	6.500	2.000	2200.	0.200

D27

STORETRETRIEVAL D A T E 89/11/29 - STAND - VERSION OF MAY 1988 STN l.SUflHARY.l

14113000
45 45 24.0 121 12 32.0 2
KLICKITAT RIVER NEAR PITT, WASH.
53039 WASHINGTON KLICKITAT
131091

/TYPA/AMBNT/STREAM

112WRD HQ 17070106001 0007.230 OFF
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 48/05/31 TO 86/07/28

	00011 WATER TEMP FAHN	00010 WATER TEMP CENT	00076 TURB TRBIOMTR HACH FTU	00400 PH SU	00403 PH LAS SU	00300 OO MG/L	01042 COPPER CU,TOT UG/L	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	71900 MERCURY HG,TOTAL UG/L
NO OF VALUES	137	117	59	130	46	146	41	36	42	66
MEAN	50.03	10.05	10.21	7.606	7.822	11.462	10.195	4.389	3.	0.600
MEDIAN	49.00	9.44	3.10	7.600	7.800	11.500	8.000	1.000	0.	0.500
NO OF VIOLS	13	0	3	2	3	0	19	2	0	23
PERCENT VIOL	7.	0.	5.	1.	7.	0.	46.	6.	0.	35.
MINIMUM VIOL	65.1,	0.00	58.00	6.300	8.600	0.000	7.000	2.000	0.	0.200
MEAN VIOL	67.34	5.00	99.33	7.450	8.733	0.000	12.632	2.500	0.	1.087
MAXIMUM VIOL	69.80	0.00	170.00	8.600	8.500	0.000	21.000	3.000	0.	8.000
MIN CRITERIA	*********	*********	*********	6.500	5.500	6.500	*********	*********	*********	*********
MAX CRITERIA	65.00	21.00	50.00	8.500	a.503	*********	6.500	1.800	2200.	0.100

STORET RETRIEVAL DATE 89/11/29 - STAND - VERSION OF HAY 1988 STN 1.SUMHARY.2

14113000
45 45 24.0 121 12 32.0 2
KLICKITAT RIVER NEAR PITT, WASH.
53039 WASHINGTON KLICKITAT
131091

/TYPA/AMBNT/STREAM

112WRD HQ 17070106001 0007.230 OFF
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 48/05/31 TO 86/07/28

	01051 LEAD PB,TOT UG/L	01147 SELENIUM SE,TOT UG/L	01092 ZINC ZN,TOT UG/L
NO OF VALUES	40	36	41
MEAN	42.45	0.500	3d.J
MEDIAN	6.50	0.500	20.0
NO OF VIOLS	1	0	1
PERCENT VIOL	3.	0.	2.
MINIMUM VIOL	37.00	0.000	423.3
MEAN VIOL	37.00	0.000	423.0
MAXIMUM VIOL	37.00	0.300	420.0
MIN CRITERIA	*********	*********	*********
MAX CRITERIA	34.00	5.000	180.0

D29

STORET RETRIEVAL DATE 39/11/29 - STAND - VERSION OF MAY 1988 STN 37.SUMMARY.1

KLI134
46 02 29.0 121 11 00.0 3
KLICKITAT RIVER AT WDF FISH HATCHERY S4 6N 13E
5 3 0 3 9 WASHINGTON KLICKITAT
PACIFIC NORTHWEST 131000
COLUMBIA RIVER BELOW YAKIMA RIVER
1119USGR 880827 17070106027 0002.840 ON
0000 FEET DEPTH 387 METERS ELEVATION

/TYPA/AMBNT/STREAM

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 88/08/04 TO 89/09/12

	00011 WATER TEMP FAHN	00010 WATER TEMP CENT	00076 TURB TRBIDMTR HACH FTU	00400 PH SU	00403 PH LAB SU	00303 DO MG/L	01042 COPPER CU,TOT UG/L	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	71900 MERCURY HG, TOTAL UG/L
NO OF VALUES	7	7	6	2	5	7	2	-2	2	2
MEAN	49.82	9.90	3.33	7.175	7.524	11.571	4.500	1.250	2.	0.300
MEDIAN	50.00	10.00	2.50	7.175	7.520	10.800	4.500	1.250	2.	0.300
NO OF VIOLS	0	0	0	0	0	0	0	0	0	1
PERCENT VIJL	0.	0.	0.	0.	0.	0.	0.	0.	0.	50.
MINIMUM VIOL	0.00	0.00	0.00	5.009	0.000	0.000	0.000	0.000	0.	0.400
MEAN VIOL	0.03	0.00	0.00	0.000	3.300	0.000	0.000	0.000	0.	0.400
MAXIMUM VIOL	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.	0.400
MIN CRITERIA	*********	*********	*********	6.500	6.500	6.500	*********	*********	*********	*********
MAX CRITERIA	65.00	21.00	50.00	a. 500	a.500	*********	6.500	2.000	2200.	0.200

D30

STORET RETRIEVAL DATE 89/11/29 - STAND - VERSION OF MAY 1988 STN 2.SUMMARY.1

14112500
45 50 38.0 121 03 32.0 2
LITTLE KLICKITAT R NR WAHKIACUS, WASH
53039 WASHINGTON KLICKITAT

/TYPA/AMBNT/STREAM

112WRD 770125 HQ 17070106004 0000.290 OFF
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 76/10/05 TO 77/09/28

	00011 WATER TEMP FAHN	00010 WATER TEMP CENT	00076 TURB TRBIDMTR HACH FTU	00400 PH SU	00403 PH LAB su	00300 DO MG/L	01042 COPPER CU,TOT UG/L	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	71900 MERCURY HG,TOTAL UG/L
NO OF VALUES	24	24	0	24	0	24	0	0	0	0
MEAN	55.33	12.99	0.00	8.604	0.000	12.404	0.000	0.000	0.	0.000
MEDIAN	53.15	11.75	*********	8.600	*********	12.450	*********	*********	*********	*********
NO OF VIOLS	6	4	0	14	0	0	0	0	0	0
PERCENT VIOL	25.	17.	0.	58.	0.	0.	0.	0.	0.	0.
MINIMUM VIOL	68.90	22.70	0.00	8.600	0.000	0.000	0.000	0.000	0.	0.000
MEAN VIOL	74.60	25.22	0.00	8.871	0.000	0.000	0.000	0.000	0.	0,000
MAXIMUM VIOL	81.50	27.50	0.00	9.400	0.000	0.000	0.000	0.000	0.	0.000
MIN CRITERIA	*********	*********	*********	6.500	6.500	6.500	*********	*********	*********	*********
MAX CRITERIA	65.00	21.00	50.00	8.500	8.500	*********	6,500	1.800	2200.	0.100

D31

STORET RETRIEVAL DATE 89/11/29 - STAND - VERSION OF MAY 1988 STN 3.SUWARY.1

14110720
46 01 01.0 121 12 28.0 2
OUTLET CR NR GLENWOOD,WASH
5 3 0 3 9 WASHINGTON KLICKITAT
131091

/TYPA/AMBNT/STREAM

112WRD 17070106
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 73/12/04 TO 80/06/10

	00011 WATER TEMP FAHN	00010 WATER TEMP CENT	00076 TURB TRBIDMTR HACH FTU	00400 PH su	00403 PH LAB SU	00300 DO MG/L	01042 COPPER CU,TOT UG/L	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	71900 MERCURY HG,TOTAL UG/L
NO OF VALUES	12	12	6	6	6	6	6	6	6	7
MEAN	52.17	11.21	2.82	6.917	7.300	9.463	5.000	0.167	0.	0.471
MEDIAN	53.6'3	12.00	2.90	6.953	7.200	9.100	5.000	0.000	0.	0.200
NO OF VIOLS	2	0	0	2	0	0	1	0	0	3
PERCENT VIOL	17.	0.	0.	33.	0.	0.	17.	0.	0.	43.
MINIMUM VIOL	68.00	0.03	0.00	6.203	0.000	0.000	7.000	0.000	0.	0.200
MEAN VIOL	66.00	0.00	0.03	6.300	0.000	0.000	7.000	0.000	0.	0.900
MAXIMUM VIOL	68.00	0.03	0.00	6.400	0.000	0.000	7.000	0.000	0.	2.100
MIN CRITERIA	*********	*********	*********	6.500	6.500	6.500	*********	*********	*********	*********
MAX CRITERIA	65.00	21.00	50.00	8.500	8.500	*********	6.500	1.800	2200.	0.100

STORET RETRIEVAL DATE 89/11/29 - STAND - VERSION OF MAY 1988 STN 3.SUMMARY.2

14110720
46 01 01.0 121 12 26.0 2
OUTLET CR NR GLENWOOD,WASH
5 3 0 3 9 WASHINGTON KLICKITAT
131091

/TYPA/AMBNT/STREAM

112WRD 17070106
0000 FEET DEPTH

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 73/12/04 TO 80/06/10

	01051 LEAD PB,TOT UG/L	01147 SELENIUM SE,TOT UG/L	01092 ZINC ZN,TOT UG/L
NO OF VALUES	6	6	6
MEAN	4.55	0.000	26.7
MEDIAN	4.50	5.000	20.0
NO OF VIOLS	0	0	0
PERCENT VIOL	0.	0.	0.
MINIMUM VIOL	0.00	0.000	0.0
MEAN VIOL	0.00	0.000	0.0
MAXIMUM VIOL	0.00	0.000	0.0
MIN CRITERIA	*********	*********	*********
MAX CRITERIA	34.00	5.000	180.0

D33