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PORTLAND

(ALL)

September 1984  
IA-4-18

M. Carpenter

## Yakima Basin Passage Improvement

Over the next four years, BPA will spend up to \$13.5 million on fish passage facilities to increase Yakima Basin salmon and steelhead runs. More than half of this will be spent in 1984 and 1985.

This Issue Alert outlines BPA's and other's involvement in the 20 projects along the Yakima River. The projects dot the map all the way from the city of Richland, where the Yakima meets the Columbia, to the town of Easton, almost 200 miles upstream.

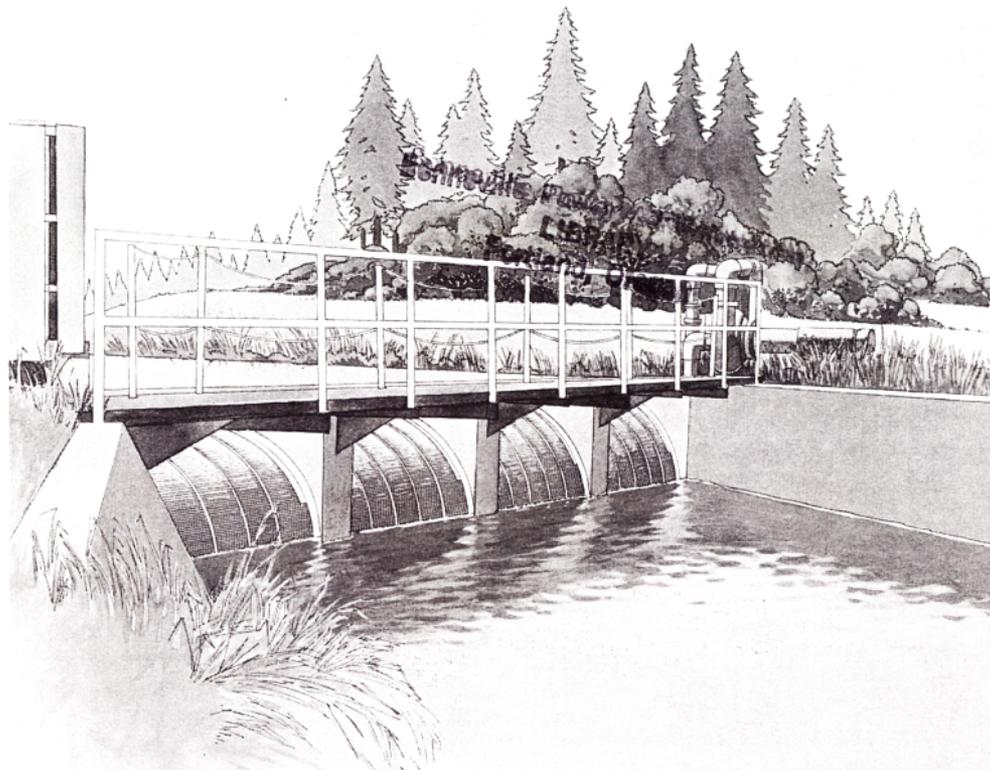
Fish and wildlife efforts in the Yakima Basin will compensate for losses due to hydroelectric development and operation on the mainstem Columbia River.

*"Nowhere else in the region does a better opportunity exist to improve dramatically the returning runs of anadromous fish."*

*Peter Johnson, BPA Administrator*

Fishery experts agree that, of all the areas in the Columbia River Basin, the spawning grounds of the Yakima have the greatest potential for boosting migratory fish populations.

Plans for the Yakima Basin involve complex biological issues and the cooperation of more than a dozen government entities. This cooperative effort could increase the Yakima's annual fish runs six-fold from 2,000 to 12,000.



*BPA will contribute funds to build fish passage facilities for the Yakima Basin. The facilities represent the first step in increasing Yakima fish runs.*

### Introduction

Once the land was prairie. Now in spring and summer, the green fields and orchards stretch into the distance, where the brown hills speak of what used to be. Water flowing from the Yakima River, through many miles of canals and ditches, has turned the semi-arid valley into one of the most productive agricultural regions in the nation.

But farmers are not the only ones who use the water. It is also used by cities and industries. It generates electricity. It is enjoyed by recreationists. And it is essential to sustain the life cycle of anadromous fish, such as the salmon. That last need has now become a major concern.

Salmon spend most of their lives in the ocean but ascend freshwater

streams and rivers to spawn. Water that is pumped to irrigate the dry land is not always available to fish returning from the sea to the Yakima and its tributaries.

The dams that divert irrigation water and generate electricity can block adult fish passage and endanger young fish just starting downstream for their sojourn in the ocean. Over the last eight decades, these structures have contributed to the decline of the now badly depleted runs.

The Bonneville Power Administration (BPA), consistent with the Northwest Power Planning Council's (Council) Columbia River Basin Fish and Wildlife Program and in cooperation with the U.S. Department of Interior's Bureau of Reclamation (BR), other



Early settlers in the Yakima Valley.

federal agencies, several Washington state governmental agencies, the Yakima Indian Nation, the city of Yakima, and a number of irrigation districts, has now undertaken a program to renovate or replace several fish passage facilities in the Yakima Basin.

Fish ladders, built 40 or 50 years ago, used the best engineering then available. They will be brought up to current standards. New state-of-the-art ladders will be added. Fish screens were originally built to prevent juvenile fish from entering irrigation canals and generator turbines.

Those that have deteriorated will be repaired or replaced. Additional screens will be installed where needed.

BPA will fund or partially fund improvements at several Bureau of Indian Affairs (BIA) and non-Federal projects. The BR, along with the BIA and local irrigation districts, will also renovate fish ladders and screens. These groups operate and maintain their respective projects on the Yakima and its tributaries.

BPA is also acting as a coordinator in this team effort. The agency has developed a work schedule fully describing activities and tasks. BPA will track this schedule closely to insure the prompt design and construction of all facility improvements.

The Yakima effort is one of over 90 BPA-funded projects aimed at improving migratory fish runs in the Columbia River Basin.

### **History**

The first settlers came to the Yakima Basin in the 1860's, lured there by miles of open grasslands. They brought cattle and horses to graze in places to which they gave such names as "Horse Heaven Hills".

Farmers followed quickly, attracted by the fertile soils--soils that needed only a little more water.

Annual precipitation in the basin is only 7.5 inches. Most of it falls as snow on the steep rocky hills that define the valleys. The snowfall can vary from 2 to 74 inches per year. But, high or low, it melts rapidly and rushes away in the spring torrents. Little remains to carry a farmer's crops through a long dry summer.

Early settlers used primitive irrigation techniques. The first irrigation ditch on record, dug in 1864, carried water from Ahtanum Creek to a small garden above a Catholic mission. Later private canal-building companies were formed. By 1902 they had irrigated nearly 120,000 acres with water diverted from the Yakima and its tributaries.

Passage of the Reclamation Act of 1902 opened the way for the Federal government to provide the technical

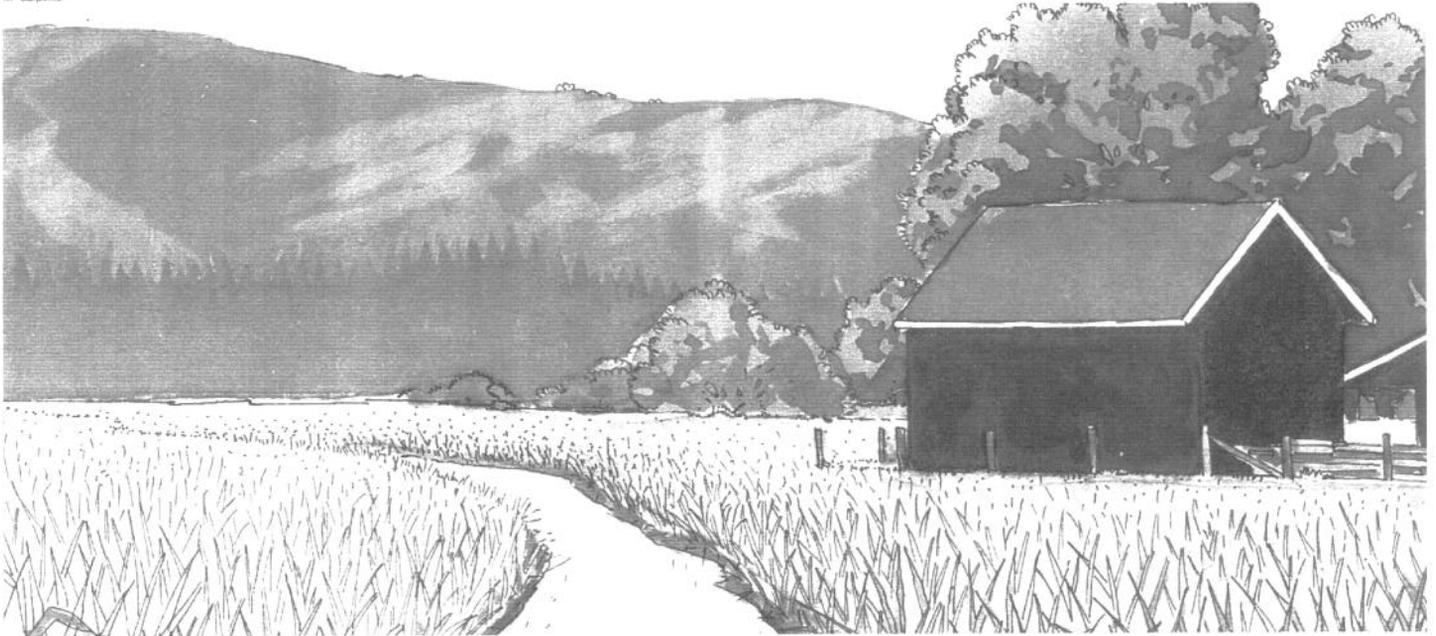
and financial assistance needed for the development or improvement of irrigation projects in arid or semi-arid basins. The residents of Yakima County quickly took advantage of this opportunity to petition the Secretary of the Interior for assistance. In 1903 they requested comprehensive development of their valley's water resources.

The BR immediately began studying the feasibility of a Federal Yakima project and construction began in 1906.

### **The Yakima Project**

Nearly eight decades later, the BR's Yakima Project has seven divisions: Storage, Sunnyside, Tieton, Kittitas, Wapato, Roza, and Kennewick. Wapato is operated by the BIA. The Yakima Project provides water to irrigate or partially irrigate almost a half million acres and supply water for another 45,000 acres that are irrigated privately. Its facilities include six storage dams, 416 miles of canals, 1,701 miles of laterals, 30 pumping plants, 145 miles of drains, two small powerplants, and 74 miles of transmission lines. Private interests, under water supply contracts with the BR, irrigate another 45,000 acres.

The results of this massive irrigation effort have been spectacular. They have earned the basin the label, "Fruit Bowl of the Nation." There are orchards of cherries, apples, pears,



Irrigation turned the Yakima Basin into the "Fruit Bowl of the Nation".

peaches, and apricots. There are vineyards and fields of sugar beets, hops, mint, corn, wheat, potatoes, tomatoes, asparagus, and forage. In 1981, the value of these and all other crops grown in the basin was estimated at more than \$506 million. The industries that process, store, ship, and market the agricultural harvest multiply this value many times in the region's economy. Irrigation improves and stabilizes farm income. Everyone in the community benefits.

When those first canals and diversion dams were installed, few had considered the effect irrigation diversions would have on the water required to sustain all forms of aquatic life, especially migratory fish.

### **The Fishery**

In the early decades of the century, those who developed the Yakima's irrigation systems and the basin's other natural resources lacked sufficient understanding of fish and wildlife needs. The anadromous fish runs by now have almost disappeared, not only because of irrigation and farming, but also because of the effects of logging, industry, mainstem Columbia River hydropower development, and overfishing.

When the first settlers arrived in the 1860's, there were probably 500,000 to 600,000 adult fish returning from the ocean each year. The runs had

originally included steelhead trout; spring, summer, and fall chinook salmon; coho salmon; and sockeye salmon. By the 1920's, fish runs had dropped to about 11,000. Summer chinook and sockeye disappeared completely.

Several factors contributed to the declines. Diversion dams were constructed without adequate fish passageways. Canals lacked screens; fish that strayed out of the river or its tributary streams were lost in these blind channels. So much water was diverted into the irrigation canals that, during summer, some stretches of the river were completely dry.

In low water years, the river became a series of slackwater pools surrounded by bleached river rock immediately below the diversion dams. Migrating fish were trapped, unable to continue their journey. Many died as the sun warmed the shallow water to fatal temperatures. Resident trout also died out.

When the irrigation water returned to the river channel farther downstream, it often contained sediment and agricultural chemicals. Industrial wastes, as well as sediments from logging sites, added to the pollution.

Often flows were still too low and the water too warm for fish and other aquatic life to survive.

In the 1930s and 40s, many of the most serious problems were

recognized and partially corrected. Fish ladders and screens were installed. Sewage treatment plants were constructed and logging practices improved. The runs began to increase slowly. They peaked at about 19,000 in 1960. Yet as more land was opened for agriculture and other natural resources developed further, the runs again began to decline. Now, only about 2,000-3,000 adult fish return to the Yakima's waters each year.

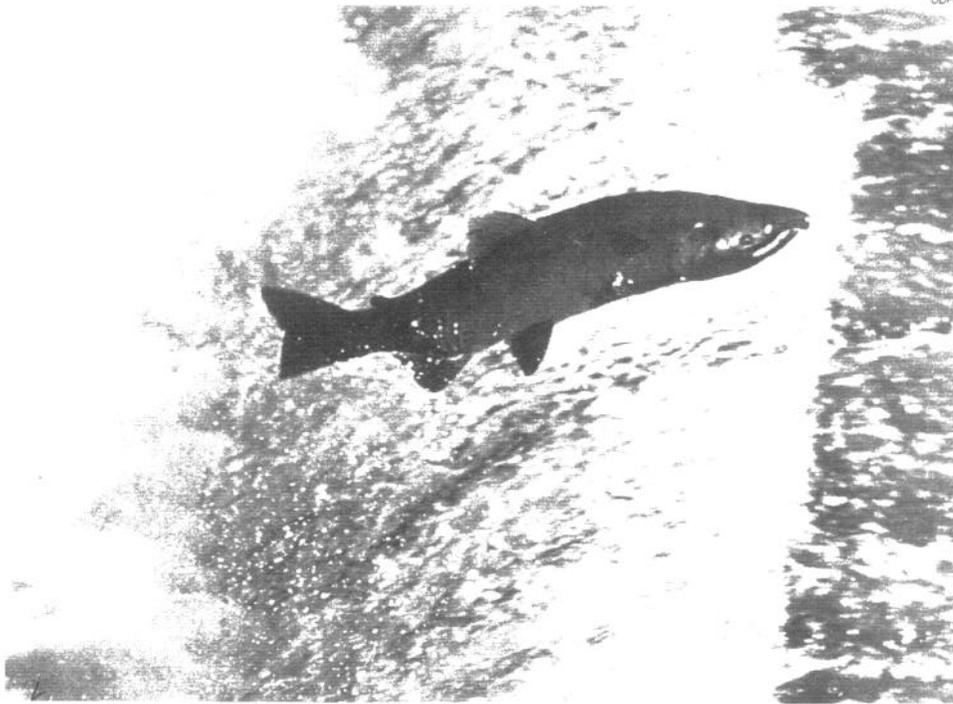
The disappearance of migratory fish has become a very real concern, and to no one more than to the Native Americans of the Yakima Indian Nation.

### **The Yakima Nation**

The Yakima Reservation covers 1,200,000 acres in the southern part of the basin. The members of the Yakima Nation irrigate their crops with water diverted from the river. They built an industrial park at Wapato. But their ancestors have lived in the valley for thousands of years, centering their culture around the salmon. The great fish has been their livelihood and sustenance for generations. It was, and for many still is, the focal point of their religion.

### **Yakima Basin Passage Improvement**

The urgent need for measures to save the salmon - to preserve that resource - has united BPA with the



Chinook salmon leaps ladder.

Council's Fish and Wildlife Program and will play a large role in enhancing the anadromous runs of the entire Columbia River Basin. Virtually all the damage to the Yakima's fish runs is due to irrigation, not hydropower. But BPA will use the Yakima Basin as an opportunity to make up for fishery losses caused by Federal hydroelectric projects elsewhere.

Obstruction of migratory fish passage, rather than destruction of habitat, caused declines in the Yakima fish runs. Most of the spawning gravels remain undisturbed. For the most part, the gravels have not been flooded, washed away, or heavily silted. They would still provide good spawning habitat if the fish could reach them and if there were adequate waterflows.

The fish and wildlife agencies, the Yakima Nation and irrigation districts

*"The Yakima Fish Passage Improvement Program is the cornerstone of the Northwest Power Planning Council's Fish and Wildlife Program."*

*Peter Johnson, BPA Administrator*

are working with the BR to improve waterflows. Their plans will establish additional upstream storage to improve water quality and guarantee adequate water flow at all fish passage facilities.

At the same time, BPA and others will fund improvements to fishways and fish screens at 20 separate irrigation facilities owned or operated by the BIA, irrigation districts, and private owners. BPA has already funded preliminary engineering work at eight high priority sites: Roza Diversion Dam, Roza Powerplant Wasteway, Sunnyside Diversion Dam, Old Reservation Canal, Easton Diversion Dam, Wapato Diversion Dam, Toppenish Creek/Satus Unit Diversion, and Horn Rapids (Richaland Canal.)

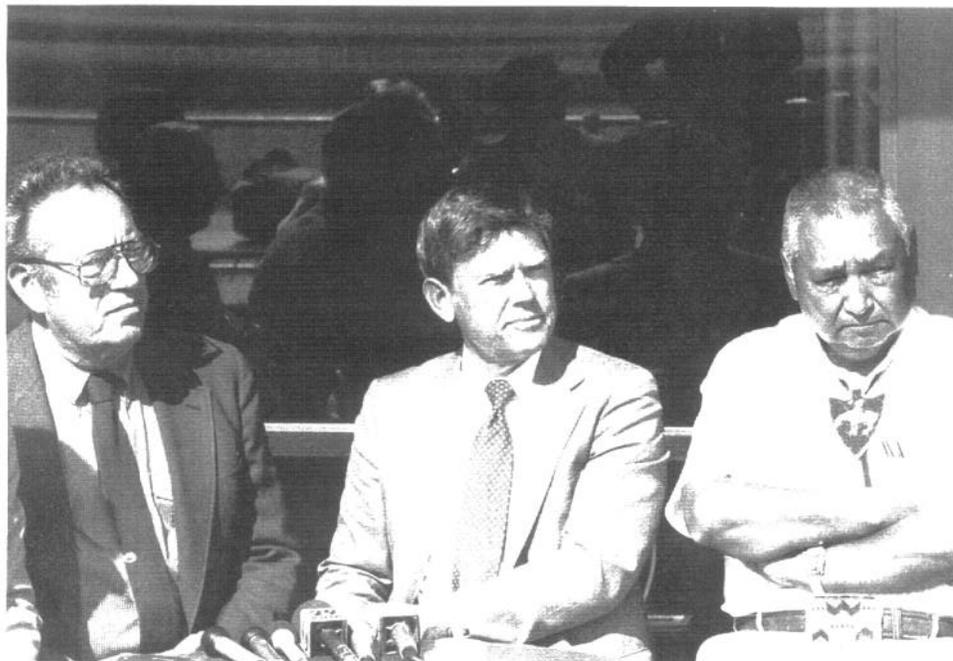
A Yakima Study Team, comprised of BPA, BR, the Council, the Washington State Department of Fisheries (WDF), the Yakima Nation,

Yakima Nation, the Council, BR, other government agencies, irrigation districts, and private property owners in a plan to enhance the fish runs on the Yakima River and its tributaries.

The Pacific Northwest Electric Power Planning and Conservation Act of 1980 (P.L. 96-501) brought these groups together. The Act assigned to BPA and other Federal agencies who held major roles in electric power

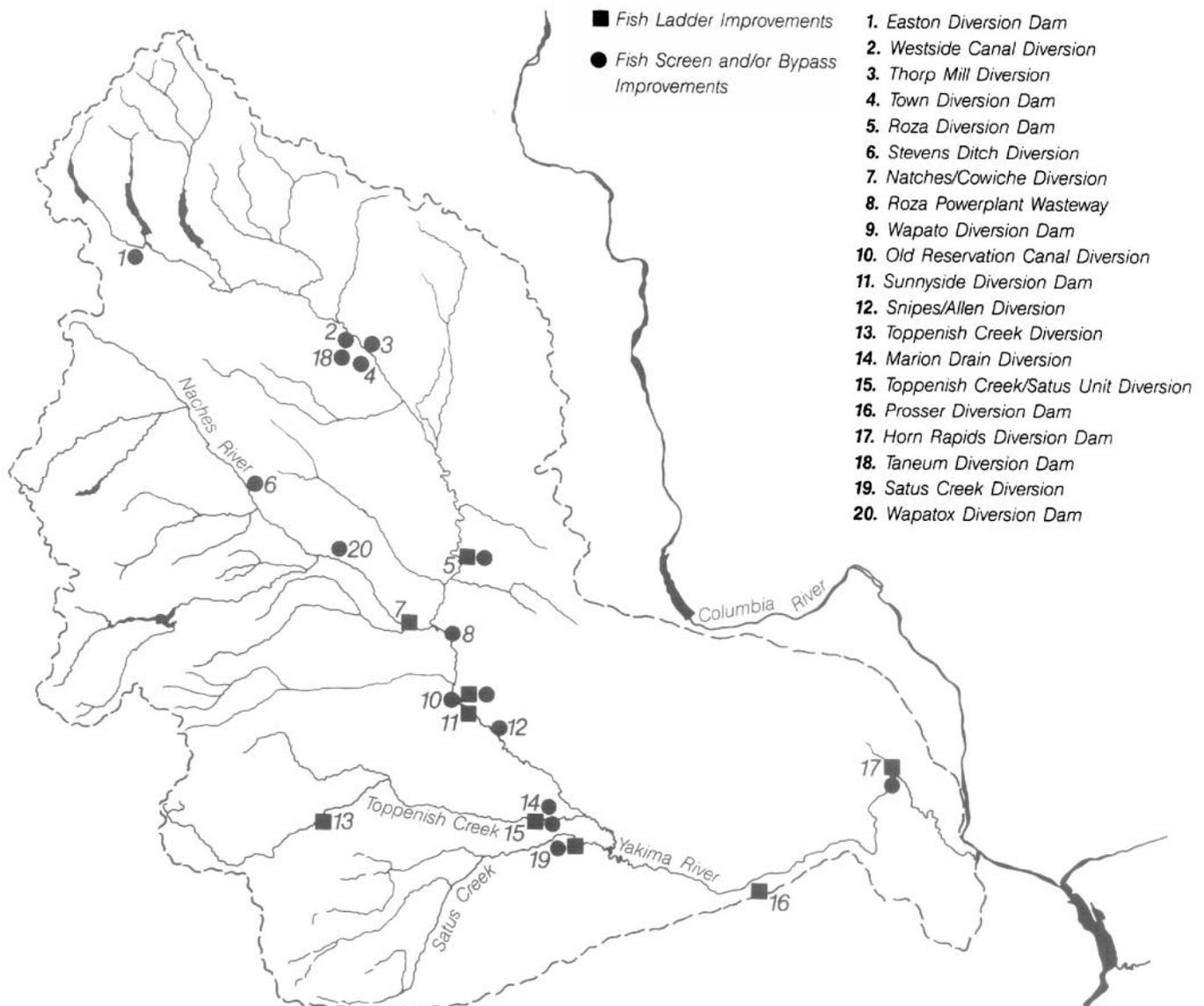
development expanded responsibilities to "protect, mitigate, and enhance" fish and wildlife affected by Columbia River Basin hydroelectric facilities. The Act also authorized the Council to develop and adopt a comprehensive fish and wildlife program and called for BPA and other Federal agencies to follow the guidance of that program.

Bringing the fish back to the Yakima River is a key element of the



Administrator, Peter Johnson (center), meets with Don Moos, WDOE and Bill Yallup, Yakima Indian Nation to discuss details of the Yakima Fish Passage Improvement Program.

## Yakima Basin Fish Passage Improvements



National Marine Fisheries Service (NMFS), and U.S. Fish and Wildlife Service (USFWS); selected the sites, ranked their priority, and determined the types of modifications needed. NMFS, WDF, and USFWS are developing design criteria for the fish facilities.

From the initial list of eight priority sites, the agencies have selected five as "fast-track" projects: Sunnyside, Wapato, Old Reservation Canal, Toppenish Creek/Satus Unit, and Horn Rapids (Richland Canal). Construction will begin in the fall of 1984 and end by the spring of 1986. The other projects, still in the design

process, are scheduled for construction later in 1986 or in 1987.

Once the projects are completed, the agencies expect that runs will increase to about 12,000 returning adults. With improvements to increase waterflows, runs could reach 100,000. In addition, BPA and the Council are looking at ways to supplement the wild fish runs with fish produced in hatcheries.

### **Sunnyside Diversion Dam.**

The BR constructed Sunnyside 1907. The dam is federally owned but is operated and maintained by the

Sunnyside Valley Irrigation District. One fish ladder was built on the left (east) bank. A second ladder was added on the right side in 1922 and a third ladder in the center in 1929. Only the center ladder remains operable. The BR and the USFWS jointly maintain it.

One fish ladder at the dam is not enough. Adult fish are frequently observed jumping at Sunnyside Dam as they struggle to continue upstream. This can injure fish, predisposing them to disease. It prevents some fish from passing the dam at all. At the least, jumping wastes the valuable energy fish need

## BPA-Funded Yakima Fish Passage Improvements

**Sunnyside Diversion Dam and Canal.** Replace two fish ladders and one screen set, install new ladder. Completion: November 1985.

**Wapato Diversion Dam.** Replace two ladders, install a new ladder, replace a screen set. Completion: March 1986.

**Old Reservation Canal.** Install a new screen. Completion: March 1986.

**Toppenish Creek/Satus Unit.** Construct ladder, install screen set. Completion: March 1986.

**Horn Rapids/Richland Canal.** Two ladders and two screen sets. BPA will fund a screen set for Richland Canal. Completion date: March 1985.

**Satus Creek Diversion.** Construct ladder, install screen set. Completion: FY 1986-87.

**Toppenish Creek (Upper) Division.** Construct ladder, install screen set. Completion: FY 1986-87.

**Marion Creek Diversion.** Construct ladder. Completion: FY 1986.

**Westside Ditch.** Replace screen set. Completion: FY 1986-87.

**Town Diversion Dam, Ellensburg.** Construct ladder, replace screen set (BPA will fund the screen). Completion: FY 1986-87.

**Stevens Ditch.** Replace screen set. Completion: FY 1986-87.

**Snipes/Allen Canal Diversion.** Replace screen set and bypass. Completion: FY 1986-87.

to complete their journey and spawn successfully.

Fish screens at Sunnyside's irrigation canal are also inadequate. They were installed perpendicular to the river's flow. Swift currents often impinge young fish on the screens. Concrete foundation piers extend 6 feet upstream, creating bays and blocking the bypass entrance. These obstructions can cause injury or death. By delaying downstream migration, they expose the juvenile fish to increased predation.

BPA will replace the three fish ladders at Sunnyside Dam and install a new fish screen facility on the canal.

### **Wapato Diversion Dam.**

The BR built this diversion dam as part of the Wapato Project in 1917. The dam is owned and operated by the BIA. The Wapato Project operates the ladders and USFWS maintains the screens on the main irrigation canal.

Wapato Dam was originally constructed without fish passage

facilities. It has two branches divided by an island in the river. In the 1930's, east branch fish ladders were built, one in the center of the branch and another on the right bank. Fish screens were installed on the main canal one-half mile downstream from the canal headworks.

Fish passage problems at Wapato are similar to those at Sunnyside. Water flows through the right bank ladder, but it is inoperable. The left branch is completely obstructed. Fish struggle to pass through the center ladder. The screen on the main canal is also perpendicular to the flow and water velocities at the screen are excessive. However supporting piers are flush with the face of the screen. Bypass tunnels are open and well-located, moving the young fish safely back to the Yakima River.

Improvements will include the replacement of 2 ladders and the construction of one new ladder. In the main canal, new fish screens and supporting structures will be installed just upstream from the existing screens.

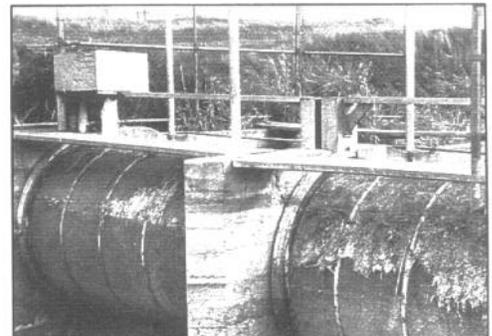
## **Old Reservation Canal.**

BIA constructed Old Reservation Canal in the 1890's as part of its Wapato Project. It is located on the west side of the Yakima River on a small side channel about a one-half mile upstream from the Sunnyside Dam. It is still owned and operated by the BIA. It has no fish facilities.

Juvenile fish maturing in the vicinity of the canal or those migrating downstream can be swept into the irrigation system and lost. To prevent this, BPA will install a screen at the head of the canal. Placing the screen parallel to the river's flow will return straying juveniles directly into the main river channel and eliminate the need for a bypass.

### **Toppenish Creek/Satus Unit Diversion.**

Satus Unit Diversion is on Toppenish Creek about 7 miles southeast of Toppenish. BIA built the dam as part of its Wapato Project. The dam diverts Yakima River water through the Marion (main) drain into



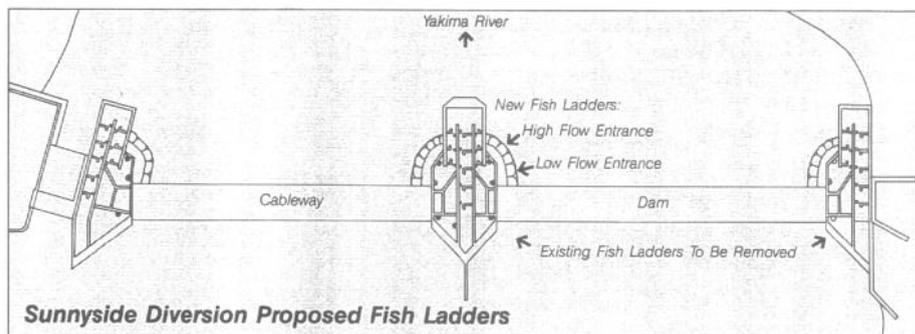
BPA will rehabilitate Richland Canal's fish screens.

The primary design criteria for screens consider approach velocity, screen mesh size, screen orientation, sweeping velocity, and bypass features.

Juvenile fish migrating downstream to the ocean or maturing in an area near a diversion structure are often swept into an irrigation canal and trapped there. To prevent this, the screens must physically exclude the young fish from all diversion structures, while guiding them away from irrigation canals, returning them quickly and safely to the main stream.

The Yakima Study Team has established the following general design criteria for all fishways:

1. A fishway should operate over a wide range of river flows;
2. Fish should not need to jump out of the water to ascend the fishway;
3. A minimum depth should be maintained in the fishway;
4. Fish should be able to locate fishway entrances easily;
5. Attraction flows should minimize delays in entering the fishways;
6. Exits should be located so that fish are not swept back over the dam; and
7. Fishways should be covered to reduce vandalism to the structure, harassment of the fish, and poaching.



BPA will replace two fish ladders at Sunnyside Dam and install a new ladder and fish screens.

Toppenish Creek just above the Satus Unit. Satus Irrigation Canal diverts water from both the Marion Drain and Toppenish Creek.

The Satus Unit has no fish facilities. Water diversion prevents adult fish from migrating upstream. Juvenile fish migrating down Toppenish Creek can be carried through the Marion Drain into Satus Canal and lost in the irrigation ditches. Most, if not all, juveniles are lost, regardless of the level of flow.

BPA's corrective measures include construction of an adult fishway on Toppenish Creek and a fish screen on the Satus Main Canal. BPA will also build a single bypass on the left bank of the canal to carry the juvenile fish downstream away from the screen.

### **Horn Rapids/Richland Canal.**

The Horn Rapids Diversion Structure is owned and operated by the

Columbia Irrigation District. It has fish passage problems similar to that of Satus Unit. Washington Department of Ecology will construct two new vertical-slot fishways at Horn Rapids Diversion Dam and screens on the nearby Columbia Irrigation District Canal while BPA will renovate the fish screen facility on Richland Canal.

### **Other Projects.**

Contractors will complete fish passage facility construction at the three remaining priority projects - Roza Diversion Dam, Roza Powerplant Wasteway, and Easton Diversion - from 1986 through 1988. BR will install a bar screen at Roza Powerplant Wasteway. At Roza Dam, improvements include renovation of the fishway for adult passage and repairs and improvements to the screen for the protection of juveniles. Easton Dam requires installation of both a fishway and a set of screens.

### **Program Costs**

The fish passage improvement planned for the Yakima Basin will cost approximately \$33 million. BPA expects to spend approximately \$13.5 million for project design and construction. The BR, builders of many of the original irrigation projects, expects to invest another \$17 million, subject to Congressional appropriations. During the summer of 1984, Congress accelerated BR's construction of Prosser and Roza's fish passage facilities, earmarking \$4.8 million for the job. The BIA, Washington State Department of Ecology, the city of Yakima, and Pacific Power & Light are expected to fund another 2.5 million in improvements.

### **Summary**

Over the last eight decades, irrigation waters have turned the dry fertile soils of the Yakima Basin into some of the

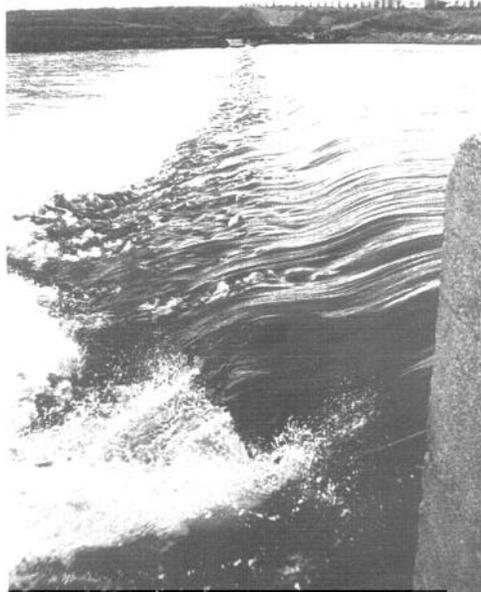
most productive agricultural lands in the world. But this was not accomplished without cost.

The withdrawal of water for irrigation combined with the development of other natural resources severely reduced the river's flows and caused a significant deterioration of water quality. Irrigation facilities, such as diversion dams, often blocked the passage of the anadromous fish on their journey to the sea and back again. As a result, the annual runs of salmon and steelhead trout dwindled from 500,000 to 600,000 returning adults to fewer than 3,000.

Efforts to save the Yakima's runs must begin immediately. Existing fish passage facilities must be renovated and updated. New facilities must be built where none exist. BPA has joined with BR; the Yakima Nation; the Washington State Departments of Ecology, Fisheries, and Game; irrigation districts; USFWS, NMFS; and BIA; and many individual landowners to undertake this task as outlined in the Fish and Wildlife Program, developed by the Council.

Fish passage facilities will be installed at 20 sites. Eight lower and mid-stream sites have been given priority, with work at the first five to be completed during 1985 and the

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WDOE will build two fishways at Horn Rapids Diversion.



Spawning steelhead trout.

*"Fish ladders will be brought up to current standards. New state-of-the-art ladders will be added. Fish screens will be repaired or replaced. Additional screens will be installed where needed."*

spring of 1986. With these facilities in place, Yakima Basin migratory fish runs could increase to 12,000 each year.

BPA is funding project design and construction at an estimated cost of \$13.5 million and is coordinating the efforts of all the groups and agencies involved in this complex project. The BR expects to invest \$17 million in the enhancement effort, subject to Congressional appropriation. BIA, state and private funds will make up the balance for a total estimated program cost of \$33 million.

BPA funds fish passage improvements at the Yakima's irrigation facilities to make up for losses at the mainstem Columbia's hydroelectric dams. BPA's Administrator, Peter Johnson, has described the Yakima Fish Passage Improvement Program as "the cornerstone of the Northwest Power Planning Council's Fish and Wildlife Program," saying that "Nowhere else in the region does a better

opportunity exist to improve dramatically the returning runs of anadromous fish."

If you have any questions about the Yakima Basin fish passage improvements or other aspects of BPA's fish and wildlife protection, mitigation and enhancement efforts, contact your nearest BPA Area or District Office;

BPA Division of Fish and Wildlife,  
P.O. Box 3621, Portland, Oregon 97208;

or the

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P.O. Box 12999, Portland, Oregon 97212.

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