

## IV. FUNCTIONAL ACCOMPLISHMENTS

*Flood Damages   Electric Energy   Irrigation   Navigation   Recreation   Water Quality  
Fisheries Operation*

The hydrological conditions and the reservoir regulation described in the preceding two chapters have produced significant effects on many aspects of life in the Pacific Northwest. These effects are discussed and quantified within the following benefit categories: flood control, energy generation, irrigation, navigation, recreation, water quality, and fishery operation. These discussions are not intended to be thorough or complete but are cursory and contain only the salient features.

### A. FLOOD DAMAGES

The effect of reservoir regulation on downstream river flow is determined by routing (the calculation of travel time, diversions, etc) and comparing regulated and unregulated (*i.e.*, natural or pre-project) flows. The flood damages given in [Table 17](#) are for selected sites associated with reservoir flood control operation and show both the observed flows and damages and the unregulated flows (those that would have been observed without the flood control dams) and the damages prevented (the additional damages that would have occurred without the flood control reservoir operation). The reduction in the river stage or flow that resulted from the reservoir regulation was used to index the value of damages prevented.

The flood damages prevented by reservoir operation in the Northwest was \$826,325,000. Damages prevented in the Willamette Basin constituted 96% of this total and over 3% of the total was in the Snake Basin. Eighty percent of the Snake Basin prevented damages occurred in the upper Snake River sub-basin near Idaho Falls.

The damages prevented for WY-2000, about \$0.8 billion, was similar to the \$0.98 billion in WY-98, low compared to the \$3.9 billion in WY-97 and the \$2.1 billion in WY-96 which included the seawall extension in downtown Portland. These tables of damages and damages prevented are for Corps projects and do not include damages on uncontrolled streams or at Section 7 projects.

[Table 18](#) is a tabulation of damages prevented by major flood control projects in the Columbia Basin for the period since 1948 through 2000. Damages prevented for the lower Columbia and for the entire Columbia Basin represent the damage for the cost and development of the year of occurrence. At today's cost and development level, the amounts in past years would be much larger. The damage prevented by control of winter floods on tributary streams is not shown.

### B. ELECTRIC ENERGY

The Bonneville Power Administration is a federal agency, under the U.S. Department of Energy, that markets wholesale electrical power and operates and markets transmission services in the Pacific Northwest. The power comes from 31 federal hydro projects, which are operated by the U.S. Army Corps of Engineers and the Bureau of Reclamation, one nonfederal nuclear plant and several other nonfederal power plants. [Figure 8](#) displays the sources of the generation received by BPA. The hydro projects and the electrical system are known as the Federal Columbia River Power System (FCRPS). About 45 percent of the electric power used in the Northwest comes from BPA. BPA's transmission system accounts for about three-quarters of the region's high-voltage grid, and includes major transmission links with other regions.

BPA is a self-funding agency, which pays for its costs through power and transmission sales. Both power and transmission are sold at cost, and BPA repays any borrowing from the U.S. Treasury with interest. BPA's customers include publicly owned and investor-owned utilities, as well as some large industries. BPA also sells or exchanges power with utilities in Canada and the western United States. Revenues BPA earns help it fulfill public responsibilities that include low-cost and reliable power and investments in energy conservation and renewable resources. BPA also funds the region's efforts to

protect and rebuild fish and wildlife populations in the Columbia River Basin.

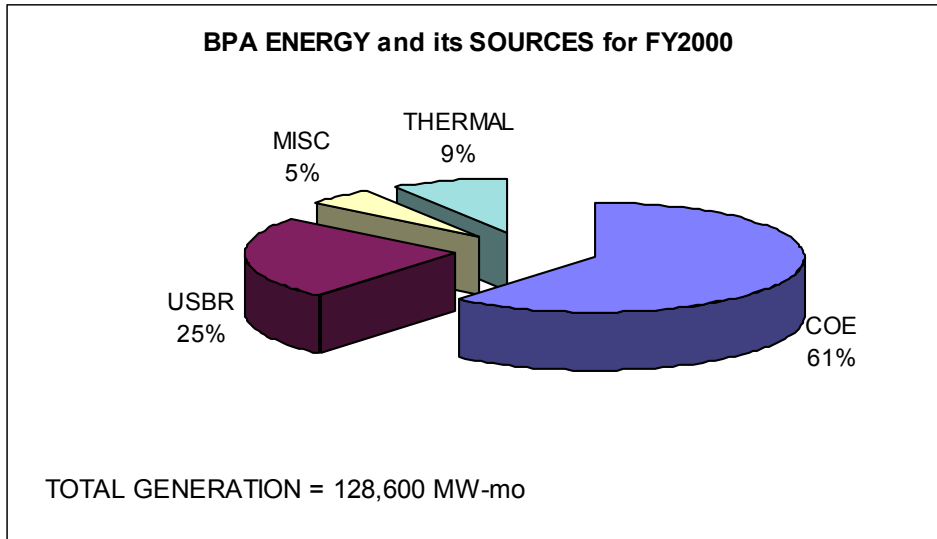


Figure 8. Generation Received in Water Year 2000

## 1. Power Operations

Power operations reference two major entities, the Coordinated System and the FCRPS. Although participants of the Coordinated System operate their own reservoirs, the power system is operated as a “one owner” system to optimize both energy production and management of the water resources in the Pacific Northwest.

The Coordinated System storage level at the beginning of the 1999-2000 operating year was 99.87 percent full as of 1 August 1999 as measured in the Pacific Northwest Coordination Agreement (PNCA) Actual Energy Regulation (AER). The Treaty Storage operation in the AER is fixed from the Treaty Storage Regulation (TSR) study. Since the system was 99.87 percent full, 1st-year firm energy load carrying capability (FELCC) was adopted for the U.S. system from the PNCA critical period studies. The system generally operated to Operating Rule Curve (ORC) or flood control for the entire period, producing large amounts of surplus energy. The coordinated system storage level reached 97.07 percent full on 31 July 2000, as measured in the AER, and the system adopted 1<sup>st</sup>-year FELCC from the 2000-01 PNCA Final Regulation study.

## 2. The West Coast Power Market

The BPA was fortunate during FY2000. Its foundation in hydroelectric generation positioned it to be less affected by the price spikes that hit the West Coast in the wake of California’s experiment in deregulation than utilities that relied more on power generated by natural-gas-fired combustion turbines or on purchased power.

The first hint of what the summer would hold came on May 26 when the California Independent System Operator (CAISO) declared a stage 2 emergency, which led to curtailment of interruptible loads in California. In late June, power prices prevailed at levels as high as \$1400 a megawatt-hour in California as demand far exceeded supply. It got worse in August. CAISO declared multiple stage 2

emergencies and brushed up against stage 3, in which rolling involuntary blackouts could hit areas of the state. BPA, fulfilling what it sees as its public service role, scrambled successfully to find sufficient transmission and generation to come to California's aid. As a result, the CAISO credited BPA for helping the state narrowly avert rolling blackouts.

BPA was not immune to power shortages of its own. In both June and August, BPA declared operating emergencies and turned to the market. Operating emergencies mean the ability to keep the lights on can only be maintained through the use of extraordinary measures. BPA is required to declare them if it is necessary to modify fish operations in order to meet firm power obligations. BPA and its partners in the FCRPS operate the hydro system in a way that gives first priority to aiding threatened and endangered anadromous and resident fish. Both times BPA declared operating emergencies during the year, the modifications lasted only a few hours and had negligible effect on fish.

August was the most volatile month. On August 18, the Columbia Generating Station (the nuclear plant formerly known as WNP-2) was forced to reduce generation to 60 percent of capacity for 2 weeks before shutting down for repairs. That came on top of low summer flows on the Columbia and the decision of regional fish and wildlife managers to use more of the available water in early August rather than in late August. As a result, the agency faced the possibility it would be 1500 average megawatts short of meeting firm load for the rest of the month. The agency warned the region that it was on the verge of a power emergency. BPA resolved to pay whatever it took to buy power to avoid harm to threatened and endangered fish runs. As prices went up, BPA's traders found enough power to avoid the emergency. The result was that BPA spent over \$331 million to buy power in August and September. This was a powerful reminder that, while BPA's hydroelectric base cushions it from some of the extremes of the power market, it is by no means insulated from the market.

### **3. The Power Rate Case**

The Power Business Line (PBL) entered FY2000 with its rate case for fiscal years 2002-2006 well under way. After holding many public hearings, the PBL issued its formal initial rate proposal in late November 1999. The agency issued a power rates record of decision on May 15, 2000, sent it to the Federal Energy Regulatory Commission for review and set about signing contracts. As FERC was reviewing the record of decision, the staff and managers of the PBL, and the agency conferred on the implications of the late summer price volatility and the upward trend in natural gas prices. In a move to assure BPA's fiscal integrity, the agency asked FERC to suspend consideration of the earlier filing while BPA called for a reconsideration of parts of the case. BPA believed that if the trends continued, its rates in the out years would be too low to assure that the agency could cover all its costs.

The Power Business Line met with customers in an attempt to reach agreement on a revision to the cost recovery adjustment clause (CRAC) in the 2002-2006 rates. The CRAC is an automatic increase in power rates that is triggered when BPA's actual accumulated net revenues fall below a certain threshold. The goal is to strengthen the agency's ability to recover its costs if the price of purchased power rises beyond the original rate case projections. Customer groups could not agree on a settlement, and, as the fiscal year came to an end, the agency began preparations to conduct a limited rate process in FY 2001.

### **4. Power Subscription**

Rate making set the price for BPA power while the Subscription process addressed how much power various customer groups would commit to purchase from BPA. Subscription and the rate case also addressed incentives for conservation and renewable development and provided the underpinning for the agency's ability to meet its fish and wildlife obligations. Given the widely differing points of view in the region on these matters, it was no surprise that both processes proved to be controversial. Customers had until Oct. 31, 2000, to subscribe to (sign contracts for) BPA power for periods as short as three and as long

as 10 years. They subscribed for 3000 average megawatts more power than the federal system produces on a firm-planning basis. This will require BPA to go to the market to meet its Subscription obligations.

## **5. A Regional Transmission Organization**

While the power price spikes and California's supply problems grabbed headlines, BPA's Transmission Business Line (TBL) was working with eight investor-owned utilities (Avista Corp., Idaho Power Co., Montana Power Co., Nevada Power Co., PacifiCorp, Portland General Electric, Puget Sound Energy and Sierra Pacific Power) to create a historic restructuring of the regional transmission system. As the fiscal year came to a close, the TBL and the IOUs were working diligently to meet an Oct. 16, 2000, filing deadline with the FERC. The filing was the initial step in forming a regional transmission organization (RTO) to be called RTO West.

BPA believes that an RTO is the best way to assure reliability in an environment of open competition for the supply of power. The FERC issued an order in December 1999 calling on all transmission providers in the country to create and join RTOs. Even though BPA is not a jurisdictional utility – that is, one that falls under FERC's jurisdiction for this purpose – it voluntarily complied. BPA is guided by a set of principles designed to assure that its traditional public responsibilities will be maintained under an RTO.

## **6. The Transmission Rate Case**

FY 2000 also was an unusual year for rate cases. The agency conducted two: one for power and one for transmission. This reflects the administrative separation of the power merchant function from the transmission function under FERC orders 888 and 889 of 1996. During FY 2000, TBL conducted its first rate case as a separate business line. The process went smoothly with the initial rate proposal being published in March and a stipulated agreement being reached with the parties in May. The final record of decision on the transmission and ancillary service rate proposal was signed on Aug. 18 and was submitted to FERC for approval to be effective Oct. 1, 2001, for a two-year period. Settling quickly and without a full-blown rate case allowed BPA's customers to have a clear idea of the total cost of wholesale power while going into Subscription. Even with rate increases, BPA retained its position as a very low-cost transmission provider in the Pacific Northwest. The two years will act as a bridge to the time that a regional transmission organization will be functioning.

## **7. International Issues**

After more than five years of talks, the U.S. and Canadian entities reached agreement on handling issues regarding the U.S. operations at Libby Dam on the Kootenai River. In addition to power production in the U.S., the dam is being operated to protect salmon and white sturgeon. In the spirit of cooperation that the U.S. and Canada have enjoyed in over 30 years of implementing the treaty, the U.S. has agreed to let Canada mitigate for any power losses it experiences from the salmon and sturgeon operations. B.C. Hydro accomplishes this through provisional drafts of Arrow Reservoir in Canada and power exchanges with BPA that don't involve any economic loss to BPA.

## **8. BPA Financial Condition**

The 2000 operating revenues were \$3,040 million, an increase of \$421 million from the previous year. Despite a slightly below-average water year, revenues were up primarily because market prices for

discretionary power sales increased to 29 mills from the previous year average of 20 mills. Net revenues were \$241 million in 2000, the highest net revenues in nine years.

Total FCRPS operating and net interest expenses increased by \$304 million in 2000 to \$2799 million, an increase of 12 percent over the previous year. Operating expenses increased primarily because of an increase in purchased power expense. BPA had to purchase more power in the spring when colder than normal weather kept the snow pack from melting and again in the summer when water was spilled for fish operations, which reduced generation capacity. The megawatt-hours purchased increased 6 percent in 2000 from 1999 levels. The average cost of purchased power increased from 28 mills in 1999 to 57 mills in 2000.

In 2000, BPA's year-end financial reserves – cash and deferred borrowing authority – were \$811 million. BPA made its annual payment of \$732 million to the U.S. Treasury in 2000, making it the seventeenth consecutive year in which BPA has made its payment on time and in full. The payment consisted of \$316 million for principal, \$403 million for interest and \$13 million for operations and maintenance on the federal dams operated by the U.S. Army Corps of Engineers and the Bureau of Reclamation. The payment in 1999 was \$628 million.

## **9. Anticipating the Future**

The summer shortages in California were a portent of what could happen to the Northwest during winter months. For several years BPA's annual assessment of regional loads and resources has warned of the growing possibility of winter power shortages. That concern was supported by a Northwest Power Planning Council study released in December 1999 that found the region has, roughly, a one in four chance of being unable to meet demand in a cold, dry winter. The study said that getting the region up to historic industry reliability levels would require bringing almost 3000 megawatts of new capacity on line. The council observed that market forces would not bring that much new generation into operation before 2004 at the earliest.

## **C. IRRIGATION**

Irrigation service from Bureau of Reclamation projects was available to an estimated 2,870,000 acres in 2000 and there were no reported water shortages. The water came from 52 reservoirs with an active capacity of about 10,090,000 acre-ft (af). This does not include 8,214,000 af of storage in Franklin D. Roosevelt Lake (behind Grand Coulee Dam) and Hungry Horse Reservoir in western Montana.

## **D. NAVIGATION**

The Corps of Engineers operates navigation locks on three waterways in the Pacific Northwest: the Columbia-Snake River Inland Waterway in Washington, Oregon, and Idaho, the Willamette Falls Lock in western Oregon, and the Lake Washington Ship Canal in Seattle. The Columbia-Snake River Inland Waterway, extending 465 river miles from the Pacific Ocean to Lewiston, Idaho, provides safe passage for ocean-going vessels for more than 100 river miles up to Vancouver, Washington, (on the Columbia River) and Portland (on the Willamette River) and for shallow-draft tugs, barges, log rafts, and recreational vessels from Portland, Oregon, to Lewiston, Idaho. Four of the nations top 100 ports, based on total domestic and foreign cargo tonnage, are located on the Columbia/Willamette Rivers, downstream of the dams and navigation locks. The combined tonnage of these ports would place them twelfth in the nation, more than that of either Los Angeles or Norfolk Harbor. The major commodities exported through these ports are farm and timber products while the imports are petroleum products and chemicals.

Navigation on the shallow draft portion of the Columbia Inland Waterway from Portland to Pasco, Washington, is made possible by four locks that elevate the river from 8 ft mean sea level (msl) below Bonneville Dam (river mile 146), 42 miles east of Portland, to the mouth of the Snake River (river mile 324) in McNary Reservoir at an elevation of 340 ft msl. This latter pool extends to Pasco on the Columbia and to Ice Harbor Dam (river mile 9.7) on the Snake River. Navigation on the Snake River from its confluence with the Columbia near Pasco, to Lewiston (river mile 140), is made possible by four locks that elevate the river from 340 ft at Ice Harbor Dam to 738 ft at Lewiston on the Lower Granite reservoir.

The nominal size of these eight locks is 86 ft wide and 675 ft long. All the locks were closed simultaneously during March for annual maintenance.

Navigational flow requirements on the Columbia and Snake rivers were met by streamflows and pool levels determined from other project requirements. Cargo was generally transported without any special operational requirements, although occasionally some unusual navigation requirements demand special regulation. However, these special requirements did not generally alter the Columbia River regulation enough to have a significant effect on other project purposes.

The special project operations were necessary to meet navigational requirements during this year had to do with vessel groundings, emergency operation at projects, and for transportation and off loading of decommissioned defueled submarine nuclear reactor cores at Hanford, Washington. The latter special operations were required at both upstream and downstream projects to hold the McNary pool at a constant elevation during the several hours required to off load the reactor cores.

Commercial cargo through the Columbia-Snake locks consists chiefly of farm, lumber, and petroleum products with down-bound cargo consists mostly of the first two and up-bound the latter. March tonnages are less than other months due to the annual closure for maintenance. More information on these projects can be found on the Corps web site at: <http://www.wrsc.usace.army.mil/ndc/>

The Willamette Falls Lock, located on the Willamette River at Oregon City, uses four chambers to lock vessels, loaded mainly with sand and gravel or wood by-products, around the 40-foot high Willamette Falls. Efforts to rebuild the locks with a single chamber have never been funded. More information on this project can be found on the Corps web site at: <http://www.nwp.usace.army.mil/co/st/nl/index.htm>.

## **E. RECREATION**

Although many agencies provide recreational facilities, the only agencies to also have project operational activities are the Corps of Engineers and the Bureau of Reclamation. These operational activities include not only those activities for which the projects were authorized but also those ancillary activities which benefit the public without adversely impacting the authorized operations. The added benefits include maintaining some reservoirs within certain elevation ranges throughout the recreation season while at other projects it may be regulating downstream discharges for the activities. Recreational activities include boating, fishing, sailing, hunting, rafting, wind surfing, hydroplane racing, and cross channel swimming. In some cases, the reservoirs are maintained at high elevations during the camping and picnicking season for aesthetic reasons.

Historically, the Corps and Reclamation use different methods to count visitation-days and consequently they could not be directly compared. Now both agencies will be using the visitor-hour/visitor-day method. The difference in the two systems used in the past was that a recreation-day equaled a visit by one person to an area for all of or any part of a 24-hour day; whereas a visitor-hour equated to actual time spent on an area. Twelve visitor-hours equals one visitor day.

### **1. Corps of Engineers**

The total capital investment in recreation development is over \$45 million that generates significant benefits each year. Recreational use at Corps administered water resource projects was an estimated 9.0 million 12-hour visitor-days, or 110 million visitor-hours. Three Corps projects each exceeded half-million visitor-days of use and one project, Bonneville Dam, exceeded 1 million visitor-days.

Sightseeing continues to be the leading recreation activity. Facilities such as visitor centers, overlooks, and interpretive facilities are provided to accommodate this use. Swimming, boating, fishing, and general day use activities are other recreational opportunities sought by visitors to Corps projects. Wind surfing, particularly on the Columbia River projects, has become a highly visible activity over the past several years.

### **2. Bureau of Reclamation**

Reclamation reservoirs provide water-based recreation opportunities unique to the surrounding areas in some of the more arid portions of the region. Reclamation's Pacific Northwest Region has 79 recreation areas on 66 reservoirs, providing 395,000 acres of water surface and 2,400 miles of shoreline. Reclamation works cooperatively with state, county, irrigation districts, and federal agencies, as well as private concessionaires in developing and managing many of the recreation areas at Reclamation reservoirs. Recreation facilities include 6,250 campsites in 148 campgrounds; 150 picnic areas; 39 swimming beaches, and 196 boat-launch ramps. Recreation facilities are evaluated in terms of visitor safety and accessibility and upgraded as needed.

The 2000 recreation season was extremely successful for water dependent recreation activities at Reclamation reservoirs. A new Recreation Use Data Report developed by Reclamation with OMB approval will be implemented in the Fall of 2001 which will more accurately inventory Reclamation recreation facilities, survey the user public and identify the growth rate of recreation use on Reclamation reservoirs. Unfortunately, visitor use data has not been collected since 1992, but demand for water-relation recreation activities on Federal manmade lakes is growing and becoming a powerful recreation attraction according to a National Recreation Lakes Commission study conducted published in June 1999.

The Bureau of Reclamation's general legislative authority to manage recreation on Reclamation lands is the Federal Water Project Recreation Act, (PL 89-72) as amended by the Recreation Management Act of 1992 (Title 28). The major focus and direction of this legislation is developing partnerships to manage and administer the recreation areas and resources at Reclamation projects. These partnerships with state and local governments require that Reclamation participate, on a cost-sharing basis, in the planning, development and expansion of the recreation facilities to meet the recreation and resource needs associated with the area. These partnerships are critical to the continued efficient management of Reclamation lands for public recreation purposes. In general, Reclamation has been able to minimize O&M costs and insure high quality recreation facilities under these

authorities. A GAO audit in 1993 directed Reclamation to find non-Federal management partners for recreation areas that did not have them.

The PN Region Title 28 Program obligated \$1,096,000, or 99.06 percent of funding in FY 2000. The budget totaled \$1,165,000 (includes administrative costs) and a total of 26 projects were cost shared; 19 projects at 50/50 for a total of \$958,000 and 7 projects at 75/25 for a total of \$138,000. Reclamation's non-Federal partners have matched or surpassed Federal levels of cost sharing since inception of the Program. This serves as testimony to both the need for rehabilitation of facilities and the good faith efforts of Reclamation in promoting the Program. Examples of Title 28 partnerships in action follow.

#Reclamation cost shared with Washington County, Oregon, at Henry Hagg Lake to continue improving access to and safety of recreation facilities at Scoggins day use area and for a South Shore water conversion project. Henry Haag Lake is located about 1-hour out of Portland and receives very high levels of visitation. These improvements will help to alleviate crowding, sanitation and accessibility problems.

#Reclamation cost shared with Oregon State Parks at Prineville Reservoir in Central Oregon to construct and provide parking at the state managed boat ramp. The site will be paved and designates parking for vehicles and trailers. Public safety will be improved and reservoir water quality protected.

#Reclamation cost shared with Jackson County at Emigrant Lake for RV campground development, a fish habitat enhancement project, and implement needed improvements identified in the Agate Lake Resource Management Plan at Agate Lake.

#In addition, Reclamation has ongoing cost-sharing agreements with the Washington Parks and Recreation Department at Banks Lake, and Potholes Reservoir, Idaho Department of Parks and Recreation at Lake Cascade and lands adjacent to Reclamation's diversion dam below Lucky Peak reservoir, Bonneville County at Ririe Reservoir, and the city of American Falls at American Falls reservoir.

## **F. WATER QUALITY**

Water quality conditions at most reservoirs and lakes in the Northwestern Division, North Pacific Region remained practically unchanged from the previous years. Operation of the Corps lower four Snake River dams and the Corps lower Columbia River dams for Clean Water Act compliance was good. Water year 2000 volume runoff was 96 percent of average, therefore, it was considered near normal.

The Corps of Engineers and the Bureau of Reclamation conducted operations-related water quality activities, checking for impacts of project performance in relation to federal and state water quality standards and their fishery effects on stream water quality. Most of the design and/or operational actions associated with the salmon and steelhead recovery effort continued to drive many of the water quality programs in the North Pacific Region.

**1. Total Dissolved Gas (TDG) Monitoring.** The Columbia/Snake River Total Dissolved Gas Monitoring Program was an annual continuing activity started in 1984. Its primary objective was to collect total dissolved gas and water temperature data needed to schedule real-time reservoir releases and spill operations during the anadromous fish migration season (April-August). Monitoring also continued at a few stations past August of each year and through the following winter seasons.

Total Dissolved Gas (TDG) and temperature were monitored throughout the Columbia River basin using fixed monitoring stations (FMSs). There were a total of 41 FMSs in the United States portion of the Columbia River basin. The US Bureau of Reclamation, Chelan and Grant County Public Utility District (PUD) maintain four stations each. Two stations were maintained by Douglas County PUD. The US Army Corps of Engineers maintained the remaining stations. It should be noted that the Corps dams on the Pend Oreille River (Albeni Falls Dam) and on the Kootenai River (Libby Dam) were not part of the fixed



monitoring station program. Readers can reference the 2000 Total Dissolved Gas Monitoring Columbia and Snake Rivers Report. Appendix A contains a map of the fixed monitoring stations and a brief description of each of the Corps FMSs.

All the data collection instruments were fully automated. All data was compiled and posted along with pertinent reservoir and flow information on the CROHMS database, and the Technical Management Team (TMT) webpage. Reference web site: [www.npd-wc.usace.army.mil/](http://www.npd-wc.usace.army.mil/)

According to the 2000 Fish Passage Report prepared by the National Marine Fisheries Service and Fish Passage Center, a total of 21,391 juvenile salmon had been examined between April and August 2000. Only 96 fish or 0.4 percent showed signs of gas bubble trauma in fins, eyes, or lateral lines. Only three fish with signs were observed in the lower Columbia River sites.

NMFS continued to request interim standards waivers from the states and the Nez Perce Tribe to make it possible for the spill for-fish-passage and other flow augmentation measures to occur to NMFS Biological Opinion levels. Waivers from Oregon and Washington projects have been granted covering part or all of the April 1-August 31 period, temporarily raising the dissolved gas standards from 110 percent to 120 percent in the tailwater of the spilling dam, and from 110 percent to 115 percent in the forebay of the next downstream dam. A waiver from the state of Idaho was not pursued.

Total Dissolved Gas (TDG) standard exceedances ranged from 1 day at John Day forebay to 58 days at Camas/Washougal during the 190-day spring/summer-monitoring season at Bonneville Dam and the 168-day spring/summer-monitoring season at the remainder of the locations.

**2. Water Temperature Monitoring.** Monitoring of water temperature conditions throughout the Columbia and Snake River main stems were conducted as part of the dissolved gas monitoring. Water temperature had also been recorded at the project turbine scroll case (or comparable location) since construction of each project. These daily data provide an historical database of water temperatures since project construction. Water temperatures were also recorded at the forebay and tailwater FMS.

Water temperature standard exceedances ranged between 13 and 51 days at the monitoring sites on the Columbia River, between 0 and 63 days at the Snake River sites, and between 1 and 3 days on the Clearwater sites.

**3. Reports.** See web site at:  
<http://www.nwd-wc.usace.army.mil/TMT/wqwebpage/mainpage.htm>

**a. 2000 Total Dissolved Gas Monitoring Columbia and Snake Rivers.** This Annual Dissolved Gas Monitoring Program Report for 2000 was prepared with a new format based on internal Corps review comments and on requests from the National Marine Fisheries Service Regional Forum Water Quality Team. The report provides Program descriptions in Sections 1 through 5. Included were sections on Clean Water Act and Endangered Species Act, monitoring station descriptions, a reference to the detailed 2000 Plan of Action prepared for the Technical Management Team, a summary of 2000 runoff conditions, and a summary of spill conditions. The report summarizes Program results in Sections 6 and 7. They include a review of water quality exceedances and a summary discussion of 2000 fish passage. Detailed reviews of the Program were found in Sections 8 through 12; they include detailed review of the total dissolved gas and water temperature monitoring results, a discussion of data analysis, station analysis, operational considerations, and lessons learned.

**b. 2000 Water Quality Annual Report.** This report on the 2000 Water Quality Program

was prepared in conformance with ER 1110-2-8154 and NPDR 1110-2-101. Dredging was also included for reference purposes. The report only covers programs and activities within the North Pacific Region of the Northwestern Division (Portland, Seattle and Walla Walla Districts).

#### **4. Other Water Quality Activities listed below for the Division and the three Districts.**

##### **a. Northwestern Water Management Division.**

- Day-to-day coordination of the basin wide TDG monitoring program
- Participation in the activities of the Technical Management Team (TMT), a regional inter-agency group to advise on the weekly reservoir operation for the salmon recovery.
- Water quality staff operated and maintained an Internet homepage that provides the real-time project information needed for basin wide water management.
- Active contribution to the preparation of the following annual planning documents: (1) 2000 Water Management Plan for the Columbia and Snake River system, for use by the TMT, (2) 2000 TDG Management Plan (for attachment to the TMT's Water Management Plan) and (3) Plan of Action for the 2000 TDG monitoring.
- Refinement and application of statistical procedures for predicting dissolved gas saturation levels, including (1) evaluation of the increase in TDG mass caused by spill up to the 120% TDG target, (2) review of a one-dimensional water temperature model developed for DGAS by Battelle, and (3) review and use of a system TDG spreadsheet based model developed as an extension of the Chief Joseph-Grand Coulee TDG Abatement Study.
- Continued active participation in other regional forums dealing with water quality, including coordination of TDG-related regional research plans in NMFS Forum Water Quality Team, the Clean Water Action Plan's Regional Watershed Coordination Team, and coordination with EPA, the states and tribes..
- The US-Canada Tran boundary Gas Group (TGG) continued to meet in 2000. This international technical group was designed to cooperatively undertake TDG abatement studies on a system wide basis. Representatives of NMFS, EPA and the Northwest Power Planning Council were currently the US leads on this effort.

##### **b. Portland District.**

- Completion of the fifth year of successful assumption of direct responsibility for dissolved gas monitoring at 8 stations on the lower Columbia River starting from John Day forebay, using the services of the USGS. Data loss for WY 2000 was less than 1 percent.
- Completion of a summary water quality report for the Willamette Projects Detroit, Big Cliff, Green Peter, Foster, Blue River and Cougar that encompassed water quality since the projects became operational.
- Participation in a cooperative effort with the U. S. Forest Service/ City of Salem concerning turbidity studies in the upper Santiam River watershed.
- Continuous findings of no contamination in dredged material samples collected from selected NWP's project sites.
- Water continued to be released from Lost Creek and Applegate to improve Spring Chinook and

Fall Chinook salmon spawning conditions. Flow and water temperature targets were again met. Routine water quality monitoring for nutrients and limnological parameters continued at both projects.

- In the Willamette River Basin turbidity was measured at Detroit Lake outflows in cooperation with a watershed-monitoring program involving the USFWS, COE, USGS and the City of Salem. Water temperatures were monitored at 9 locations – 3 in the mainstem Willamette and 6 below Willamette projects – to observe effects of flow volume on mainstem temperatures. Ten temperature-monitoring sites were set up in the South fork of the Santiam River to assist the State in developing a temperature TMDL.
- The selective withdrawal structure at Willow Creek Lake was used to help improve downstream water temperatures in Willow Creek. The device was lowered to a depth of approximately 17 ft where cooler waters were available. Outflows were monitored for temperature, DO and pH immediately below the project. About 1 mile downstream, at Morgan Street temperature was again measured to determine extent of temperature improvement. The point of the study was to aid locals in improving conditions in the creek so that, in the future, the stretch immediately below the dam could be removed from the 303d list.
- The District is coordinating with resource agencies water quality monitoring during construction of the temperature tower at Cougar. This year the USFS profiled the lake at three sites delimiting the area of the 106 acre residual pool that will result during construction. The USGS added temperature and turbidity to the upstream and downstream gaging stations and DO to the downstream station to monitor construction impacts on water quality.

c. **Seattle District**

- The District continues to be an active participant in the Instream Flow Commission, a multi-agency commission to establish flows for the Cedar River, a tributary to Lake Washington.
- The District continued to monitor water temperature at Wynoochee Dam, owned by the City of Aberdeen and operated by Tacoma Public Works Department.
- The District continued to study the effect of increased conservation storage at Howard A. Hanson Dam. The installation of the environmental mitigation has been completed.
- The spring had “normal runoff” in the Columbia River basin including the Kootenai River. This allowed for only one sturgeon pulse at full powerhouse discharge, which provided 25 kcfs at Bonners Ferry for 17 days. The strategy was to obtain flows that would benefit sturgeon larvae releases from Kootenai Indian Tribe’s Fish hatchery.
- TDG was monitored at the two permanent water quality sites (forebay and tailwater) at Chief Joseph Dam.
- The District continued to pursue a dissolved gas abatement study at Chief Joseph Dam in consultation with Washington State and the NMFS Regional Forum. As called for in the 1998 NMFS Biological Opinion for salmon, the merits of operating Chief Joseph and Grand Coulee Dams jointly for dissolved gas abatement were examined in a system wide study.
- In July and August 2000 the District performed a study to determine how the operations of Hiram Chittenden Locks can effect DO, salinity and temperature upstream of the locks. This study will

help to determine if lock operations can create/enhance an estuarine environment around the locks for migrating salmon species. The water quality data will also be joined with hydroacoustic monitoring of salmon to determine if salmon follow a specific water quality parameter.

- The District continued to monitor water quality throughout the ship canal (5 permanent water quality stations), Lake Koocanusa and the Kootenai River via a contract with USGS (6 permanent water quality stations) and at Howard Hanson dam (8 sampling sites).
- A two-dimensional water quality model was used to simulate saltwater intrusion into the Lake Washington Ship Canal.
- A 2 dimensional model of the Sammamish River was updated to the CE-QUAL-W2 (version 3) and recalibrated using 1999 data.
- The District continues to participate in the numerous fish studies through out the Green and Cedar River basins to improve the water quality and habitat of salmonids.

**d. Walla Walla**

- Fiscal year 00 was a very challenging year for the water quality program in the Walla Walla District. The U.S. EPA issued a letter of Violation for the Lower Granite Public Owned Wastewater Treatment (POTW) discharging in excess of its National Pollution Elimination Discharge System (NPDES) permit. The Washington Department of Health issued a Notice of Violation (NOV) to the Lower Granite Illia housing unit water supply system for violation of fecal coliform and public notification in the water supply tank at the point of issue.
- Dworshak Dam and the Dworshak National Fish Hatchery water systems were operating under voluntary consent orders with the State of Idaho. Corrective actions to bring these systems up to Safe Drinking Water Standards were scheduled for December 2003 and 2002 respectively. The new system update for Big Eddy Marina at Dworshak was just completed and approved after a 2-year struggle with equipment and supply water problems.
- At the Ice Harbor Dam a NOV was received from the Washington Department of Health for exceeding the nitrate standards in the drinking water system monitoring and reporting violations. Ice Harbor has also been notified that well #3 at the dam is not a permitted well, and is not to be operated as a public water supply until approved.
- The McNary Project, at Hood Park; Washington Department of Health notified the Corps that Well #1 is not a permitted well and shall not be operated as a public water supply until approval. Problems continue to plague this water supply system with both source water and distribution systems.
- Walla Walla District personnel conducted a sediment sampling in the Snake River and Clearwater Confluence. Sediments were analyzed for a variety of organic and inorganic constituents. The planned FY2000 dredging was cancelled because it failed to meet NEPA and the Endangered Species Act coordination. Efforts to meet these objectives were under study in the Dredge Material Management Program study.
- Previous juvenile salmon mortality at collection facilities was attributed by some agencies representatives to be a direct cause of thermal stress in the collection system, and in the reservoir itself. This controversial topic was further evaluated. The District placed more temperature

monitoring devices into the ladder and collection systems. A report is scheduled for release in FY2001.

- The nine district swim beaches were monitored for fecal coliform bacteria. Last year approximately 600 individual samples were collected. In previous years, the swim beach at Swallows Park experienced closures. This last year due to the dredging and good water year there were no public beach closures due to water quality problems.
- Temperature measurements were made in the Dworshak Reservoir and monitoring is continuing. At eight different locations there were point thermisters and chains to collect yearly temperature cycling data. This data is to be used by the water quality staff to advise operations when operating for temperature and to select additional locations for temperature monitoring as needed.

## G. FISHERY OPERATIONS

Fishery operations were implemented in accordance with the Corps' Fish Passage Plan (FPP), which describes the manner in which the Corps' mainstem projects on the lower Snake and Columbia Rivers will operate throughout the year to provide safe fish passage. This was in compliance with National Marine Fisheries Service (NMFS) Biological Opinion (BiOp), dated 1995 and with NMFS 1998 and 2000 Supplemental BiOps, which contains other measures, including flow augmentation in the Columbia River, additional 427 kaf from the upper Snake River, in-season water management process, flows for chum spawning below Bonneville and operating the lower Snake River reservoirs at minimum operating pool (MOP) and John Day reservoir to the minimum level needed for irrigation pumping. The Technical Management Team (TMT) provided in-season management of river operations. The Implementation Team (IT), consisting of representatives from the Corps, USBR, BPA, NMFS, USFWS, ODFW, WDFW, IDFG, and state of Montana, provided dispute resolution and policy guidance. CRITFC still remained withdrawn from the in-season process although they participated in some meetings and made system operations requests.

**1. Actual Operation.** This year the Columbia basin runoff ranged from 75% - 99% of normal. Significant project operations for fish included: at Bonneville, special releases for fall chinook and chum salmon spawning, spill for the Spring Creek hatchery release and a spill test that varied the daytime spill level between the normal 75 kcfs spill (adult fallback) limit and spilling to the 120% TDG gas cap; at John Day a daytime spill test with the daytime spill alternating between 0% and 30%; at Libby a discharge pulse was provided for sturgeon spawning attraction; and, at Dworshak, cold water was released to reduce water temperatures in the Snake River. This year several power system emergencies caused some of the normal fish related operations to be changed for short periods of times.

**2. Spill and Flows for Fish.** This year the spill for juvenile fish passage was provided in accordance with the 1998 supplemental BiOp as modified by a memo issued by NMFS in April 2000. The two major changes in the spill program spelled out in this memo are, spilling 24 hours a day (instead of 12) at Lower Monumental and reducing the spill percentage at The Dalles from 64% to 40%. The 1998 BiOp has a goal of mostly spilling the maximum amount (up to the TDG Cap) during specified spill times. Individual projects vary in the timing and amount of spill. Because of the increased amount of spill, minimum generation requirements are in place. [Table 19](#) summarizes the actual spill of the projects this year. Spring spill for fish started between April 4th and April 10th this year for the lower Snake projects instead of the normal April 3rd planning date. Spring spill for fish started April 13 - 19 for the lower Columbia projects instead of the normal April 20 planning date. Spill at projects that were transporting fish in the summer (McNary, Lower Monumental, Little Goose, Lower Granite dams) stopped on June 20th for the lower Snake projects and McNary. All other spill for fish stopped at midnight August 31. Spill at the projects was for some short periods of time modified for navigation concerns and to allow the fish transport barges to load. The seasonal

flow objectives were managed on a weekly basis by the TMT and Federal action agencies. Neither the spring (96.3 KCFS) and summer flow objective (51.33 KCFS) was met for the Snake River, measured at Lower Granite Dam. Weekly flows exceeded the seasonal objective two of eleven weeks in the spring at Lower Granite and one of ten weeks in the summer at Lower Granite. Columbia River flows, measured at McNary Dam, did not meet the seasonal flow objective in both the spring (260 KCFS) and the summer (200 KCFS). Weekly flows exceeded the flow objective at McNary in four of eleven weeks in the spring. Weekly flows never exceeded the summer seasonal objective at McNary. The spring flow objective at Priest Rapids of 135 KCFS was exceeded. It was exceeded nine of twelve weeks. See Chapter III for more details.

**3. Juvenile Fish Runs.** Salmonids are hatched either in hatcheries or in the river (called wild fish) where they grow until their time for migration to the ocean. In some case, selected hatchery fry are placed in the river to grow in a natural setting before they beginning their natural migration to the ocean. Some species begin their migration in the year of their hatching while others winter in the river before beginning their migration to the ocean. Juveniles are subjected to many perils while migrating, including predation from other fish and birds, spill at dams that can cause high levels of total dissolved gas and gas bubble disease, physical injuries that may occur during dam passage, stress, diseases, and other problems. Depending upon the location in the basin of the hatcheries or redds, young fish will have to traverse up to nine dams on their out-migration. To help mitigate these dangers an alternate method of transportation has been developed for the juveniles. Specially designed barges and tanker trucks transport the young fish past the dams where they are released back into the river downstream of Bonneville Dam. This reduces their travel mortality rate for most species while maintain their biological timing for arrival at the ocean.

**a. HATCHERY RELEASES.** Hatchery fish released into the Columbia basin streams and rivers above Bonneville Dam totaled approximately 86.2 million juvenile salmon, about 8 million greater than in 1999. The major difference in the 2000 totals versus 1999 was in the large increase in numbers of tule fall chinook that were released into the Columbia River from Spring Creek NFH. Note that about 3.1 million ("tules") were released in December 1999 as unfed fry but survivors would be expected to migrate in year 2000. Hatchery production was closer to normal from most agencies this year. The release of spring/summer chinook from hatcheries on the Snake was reduced about 3.7 million from the 1999. The release of steelhead was near normal in the Snake and Columbia River basins. Release of subyearling and yearling fall chinook was near normal with exception of the tule fall chinook listed above. Coho salmon increased about 1 million above the 1999 total and are now released on a continuing basis in the Snake River basin as well as the Mid-Columbia. A summary of the hatchery releases for the Columbia River basin can be obtained from the FPC website.

**b. COLLECTION OF JUVENILES.** Lower Granite, Little Goose, Lower Monumental, and McNary dams are "collector dams" that are equipped with submersible traveling screens, bypass facilities, and raceways capable of holding large number of fish for later transport past the dams in barges or trucks. Operation of the fish collection facilities at Lower Granite, Little Goose, and Lower Monumental continued through October. The facilities at McNary were scheduled to operate as long as fish were present and passing the project and while conditions permitted. It should be noted in the onset that the number of juveniles collected, bypassed, or transported is not a good indicator of the size of the juvenile fish run. Collection efficiency, spill rate and timing, and other factors all play key rolls in juvenile passage. With the high flows this year the fish managers decided to let more of the juveniles migrate in the river, despite the higher TDG values. In 2000 the number of juvenile fish collected was 96% of what it was in 1999. The number of juvenile fish bypassed was around half (52%) of what was bypassed the previous year. The actual counts of fish collected and bypassed are summarized in [Table 20](#).

**c. TRANSPORTATION.** Barge transportation of fish on the lower Snake and Columbia rivers began in 1977 replacing most of the truck transportation, which had begun several years earlier. Transportation was initiated to reduce juvenile mortality resulting from passage through powerhouse turbines

and project reservoirs. Juveniles are transported from upstream collector projects to a location downstream of Bonneville, the most downstream dam. This year the juvenile transport season began in late March/ early April and ended in October at Lower Granite, Little Goose, and Lower Monumental. Transport at McNary began 22 June. Collection facilities at McNary remained in operation as long as juvenile fish continued to arrive at the project or until the facilities had to be closed for safety. In general trucking was limited to periods when daily collection was less than 20,000 fish per day. The total count of juveniles listed by transport mode and project is given in [Table 21](#). The total number of fish transported by barge and truck was slightly greater than last year.

**4. Adult Fish Runs.** Adult fish counts were obtained at twelve of the thirteen mainstream Columbia and Snake River dams that have fish passage facilities. Although many species were counted only the salmonid race and species counts at three major dams are reported here, showing their 10-year averages and counts of the previous three years ([Table 22](#)). The difference between the McNary and Ice Harbor counts is an index to the mid-Columbia return. This was a very good year for adult fish passage. As shown on [Table 22](#) all counts except for fall chinook at Bonneville were higher than last year. Again this year, as was the case last year, there was a high number of chinook jacks returning. This indicates a potential for a large adult run next year. All counts shown in [Table 22](#) were higher than the 10-year averages. At Ice Harbor the coho count was 4568% of the 10-year average and 216 sockeye were counted, a significant increase from the 8 that were counted the year before. The spring chinook count at both Bonneville and McNary were the highest in the period from 1977 – 2000 and the spring chinook count at Ice Harbor was the second highest during the same period. Summer chinook counts were also high, at Bonneville the second highest during 1977 – 2000 period, at McNary they were the third highest and at Ice Harbor they were the sixth highest. At Ice harbor the fall chinook counts were the highest during the same period and were in the top 10 at both Bonneville and McNary. The steelhead counts were all in the top 10, for all three projects, during the 1977 – 2000 period. The sockeye counts at both Bonneville and Ice Harbor were the third highest and at McNary they were in the top 10. At Bonneville and Ice Harbor the coho count were the second higher and at McNary they were the third highest during the period.

More detailed information on fish passage can be found on the world wide web at the following sites.  
<http://www.nwp.usace.army.mil/op/fishdata/adultfishcounts.htm> (the Corps' new adult count page site)  
or <http://www.fpc.org/adult.html> (the Fish Passage Center's adult count page)  
or <http://www.cqs.washington.edu/dart/adult.html> (University of Washington adult count page)

Table 17

**SUMMARY OF FLOOD DAMAGE OBSERVED AND PREVENTED**  
**Columbia River and Tributaries**  
**Water Year 2000**

POINT	RIVER	UNREGULATED <sup>1</sup>			OBSERVED			CALCULATED DAMAGES	
		Flow (kcfs)	Stage (ft)	Date	Flow (kcfs)	Stage (ft)	Date	\$1000	
								Obsv'd	Prev'd <sup>2</sup>
Bonniers Fry, ID	Kootenai		64.7	May 24		57.1	June 15	0	0
Columbia Falls, MT	Flathead	50.7		May 23	32.9		May 23	0	0
Hope, ID	Pend Oreille		2057.6	June 1		2052.6	July 7	0	0
Newport, WA	Pend Oreille	66.2		June 1	52.1		June 19	0	0
Cle Elum, WA	Yakima	11.8		Dec 16	7.4		Dec 18	0	65
Parker, WA	Yakima	20.7		Nov 26	13.5		Dec 18	0	984
Flat Creek, WY	Snake	17.2		May 26	13.4		May 30	12	2,205
Heise, ID	Snake	26.8		May 27	15.7		May 30	0	520
Shelly, ID	Snake	35.2		May 27	11.6		May 29	20	25,126
Carey, ID	Little Wood	0.5		Apr 9	0.47		Apr 5	0	2
Boise, ID	Boise	8.9		May 24	3.4		Apr 18	0	1,906
Owyhee, OR	Owyhee	3.7		Apr 4	0.3		Apr 29	0	0
Emmett, ID	Payette	11.7		May 25	7.6		May 25	0	55
Weiser, ID	Snake	60.1		May 31	31.8		Apr 14	0	1,062
Spalding, ID	Clearwater	54.1		May 23	42.9		May 4	0	0
Lower Granite, WA	Snake	153.5		May 24	115.4		Apr 23	0	0
The Dalles, OR <sup>3</sup>	Columbia	449.6		May 27	375.1		Apr 23	0	
Vancouver, WA	Columbia		16.5	May 27		12.0	Nov 27	0	3,400
					<b>COLUMBIA BASIN SUBTOTAL</b>				35,325
Salem, OR	Willamette	162.3	31.5	Nov 27	98.9	23.0	Nov 27	0	791,000
					<b>GRAND TOTAL</b>			32	826,325

<sup>1/</sup> In the Columbia River Basin, flows are those which would have resulted without regulation by Mica, Libby, Duncan, Arrow Lakes, Hungry Horse, Flathead, Noxon Rapids, Pend Oreille, Grand Coulee, Chelan, Jackson Lake, Palisades, American Falls, Dworshak, run-of-river projects, Grand Coulee pumping, and major irrigation diversions in the Snake and Yakima River Basins.

In the Willamette River basin, flows are those which would have resulted without regulation by Hills Creek, Lookout Point, Fall Creek, Cottage Grove, Dorena, Fern Ridge, Blue River, Cougar, Detroit, Green Peter, and Foster.

<sup>2/</sup> Damages prevented are those prevented by reservoirs and diversions noted above. Additional damages prevented by levees and channel improvements are not included in the prevented amounts. Observed damages in uncontrolled tributaries are not included.

<sup>3/</sup> Damages are included in the Vancouver, WA values.



Table 18

**EFFECT OF RESERVOIR REGULATION ON FLOOD PEAKS AND DAMAGES**  
**Columbia River Basin**

Water Year	Maximum Annual Mean Daily Peak <sup>1</sup> @The Dalles (kcfs)		Damages Prevented (\$1 million)		Water Year	Maximum Annual Mean Daily Peak <sup>1</sup> @The Dalles (kcfs)		Damages Prevented (\$1 million)	
	Unreg	Observed	Lower Columbia <sup>2</sup>	Columbia Basin <sup>3</sup>		Unreg	Observed	Lower Columbia <sup>2</sup>	Columbia Basin <sup>3</sup>
1948	1010	1010	*	*	1976	637	419	15.65	43.08
1949	660	624	0.67	*	1977 <sup>5</sup>	276	183	0.00	0.00
1950	823	744	9.80	*	1978	565	313	6.00	30.61 <sup>4</sup>
					1979	482	306	1.50	4.65
1951	672	602	0.80	*	1980	544	341	5.16	15.26 <sup>R</sup>
1952	579	561	0.34	*					
1953	672	612	1.18	*	1981	579	436	10.91	45.26 <sup>R</sup>
1954	590	560	0.26	*	1982	759	422	15.22	78.62
1955	614	551	0.62	*	1983	732	400	18.48	131.00 <sup>R</sup>
					1984	628	376	10.71	107.29
1956	940	823	25.00	37.67	1985	550	274	10.45	23.46
1957	820	705	6.60	11.11					
1958	735	593	3.55	7.83	1986	719	388 <sup>R</sup>	0.24 <sup>R</sup>	72.06 <sup>R</sup>
1959	642	555	0.88	2.6	1987 <sup>5</sup>	439	284	0.00	9.09
1960	493	470	0.08	0.58	1988 <sup>5</sup>	342	236	0.00	2.74
					1989	512	312	6.30	37.10
1961	789	699	6.50	7.7	1990	511	372	1.66	15.75
1962	503	460	0.09	1.79					
1963	481	437	0.03	0.65	1991	568	348	2.64	101.16
1964	764	662	7.60	22.91	1992 <sup>5</sup>	328	232	0.00	0.71
1965	669	520	1.44	7.18	1993	602	382 <sup>R</sup>	0.00 <sup>R</sup>	81.37
					1994 <sup>5</sup>	381	224	0.00	11.74
1966	455	396	0.00	0.43	1995	552	296	0.03	61.54
1967	781	622	14.21	20.80					
1968	533	404	0.26	1.07	1996	719	456	4.32 <sup>R</sup>	227.03 <sup>R</sup>
1969	628	449	2.61	5.51	1997	898	571	48.33	378.64
1970	634	429	1.16	6.34	1998	617	442	1.44	88.09
					1999	715	379	0.17	95.97
1971	740	557	8.49	25.76	2000 <sup>5</sup>	450	375	0.00	35.33
1972	1053	618	213.10	260.49					
1973 <sup>5</sup>	402	221	0.00	0.52					
1974	1010	590	239.73	306.36					
1975	669	423	9.41	40.97					

<sup>1</sup> Observed discharges are preliminary values calculated from project data.

<sup>2</sup> Damages are for the Columbia River below McNary Dam. [Dollar values are for the year of the flood. Willamette excluded.]

<sup>3</sup> Totals are damages prevented by major projects above The Dalles during the spring and summer runoff. Damages prevented in Canada and/or by levees and channel improvements are not included.

<sup>4</sup> Damages are based on the flood of December 1977.

<sup>5</sup> No flood control operations [i.e., unregulated flow does not exceed 450 kcfs at The Dalles].

<sup>R</sup> Revised

### Actual Spill Operations for Juvenile Fish Passage

Notes

1. Spill Days > 120% is the number of days that the daily average spill was above the 120% spill cap
2. Spill for fish began 4/4/00 at 1800 at LMN, IHR
3. Spill for fish began 4/7/00 at 1800 at LWG
4. Spill for fish began 4/10/00 at 1800 at LGS
5. Spill at LMN was changed to 24 hours a day starting 4/13/00 at 1800
6. Spill at LWG was 24 hours a day for Surface Bypass Collector test from 4/10/00 0800 to 5/28/00 0800
7. Spill for fish began 4/13/00 at 1800 at MCN
8. Spill for fish began 4/16/00 at 1800 at JDA
9. Spill for fish began 4/17/00 at 2359 at TDA
10. Spill for fish began 4/19/00 at 2359 at BON
11. Spill for fish ended 6/20/00 at LWG, LGS, LMN, and MCN
12. All Remaining Spill for fish ended 8/31/00
13. Spill test at JDA 0% or 30% daytime ran from 4/20/00 to 8/29/00
14. Spill test at BON 75 Kcfs spill or Spill to Gas Cap daytime ran from 4/20/00 to 8/29/00

Table 20

## Summary of Fish Disposition at Collector Dams for Water Year 2000

	Juvenile Fish Collected and Transported					
	Chinook		Steelhead	Coho	Sockeye	Total
	yearlings	subyearlings				
<b>LWR GRANITE</b>						
Collected	2,449,270	681,726	5,036,788	121,363	6,811	8,295,958
Bypassed	114,079	78	221,811	400	16	336,384
Trucked	7,223	145,460	17,471	611	1,030	171,795
Barged	2,323,701	522,529	4,795,259	120,107	5,665	7,767,261
Total Transported	2,330,924	667,989	4,812,730	120,718	6,695	7,939,056
<b>LITTLE GOOSE</b>						
Collected	1,356,680	365,317	1,050,949	41,804	3,770	2,818,520
Bypassed	0	0	0	0	0	0
Trucked	4,474	69,673	9,326	1,516	367	85,356
Barged	1,347,256	293,184	1,040,173	40,193	3,301	2,724,107
Total Transported	1,351,730	362,857	1,049,499	41,709	3,668	2,809,463
<b>LWR MON'TAL</b>						
Collected	608,625	188,718	766,356	19,171	4,333	1,587,203
Bypassed	24,802	19,842	2,240	284	3	47,171
Trucked	26,066	21,913	1,800	626	92	49,949
Barged	556,123	146,077	761,551	18,206	4,243	1,486,200
Total Transported	582,189	167,990	763,351	18,832	4,335	1,536,149
<b>McNary</b>						
Collected	1,164,627	9,250,320	365,807	169,061	95,955	11,045,266
Bypassed	1,137,415	707,631	354,534	140,970	59,804	2,400,354
Trucked	16	582,659	99	281	6,753	589,467
Barged	25,848	7,808,892	10,611	26,742	27,074	7,899,167
Total Transported	25,864	8,391,551	10,710	27,023	33,827	8,488,634
<b>Total</b>						
Collected	5,579,202	10,486,081	7,219,900	351,399	110,869	23,746,947
Bypassed	1,276,296	727,551	578,585	141,654	59,823	2,783,909
Trucked	37,779	819,705	28,696	3,034	8,242	896,567
Barged	4,252,928	8,770,682	6,607,594	205,248	40,283	19,876,735
Total Transported	4,290,707	9,590,387	6,636,290	208,282	48,525	20,773,302

**Table 21****JUVENILE FISH TRANSPORT BY PROJECT, 1978-2000**

<b>YEAR</b>	<b>LOWER GRANITE</b>	<b>LITTLE GOOSE</b>	<b>LOWER MONU- MENTAL</b>	<b>McNARY</b>	<b>TOTAL</b>
1978	1,980,600	997,285		82,211	3,059,906
1979	2,367,446	1,453,615		1,247,120	5,068,181
1980	3,830,747	2,282,987		1,740,545	7,854,279
1981	2,730,866	1,464,991		4,112,993	8,308,850
1982	1,851,616	1,234,110		3,003,853	6,089,579
1983	2,368,049	868,937		4,326,013	7,562,999
1984	2,046,020	2,274,307		4,708,632	9,028,959
1985	4,459,438	2,008,980		8,321,649	14,790,067
1986	4,683,260	2,050,130		6,760,421	13,493,811
1987	5,470,751	1,910,026		9,655,789	17,036,566
1988	7,504,860	1,708,401		10,820,592	20,033,853
1989	6,703,360	2,310,458		6,364,143	15,377,971
1990	9,336,878	2,319,978		9,789,733	21,446,589
1991	8,420,639	2,245,587		4,808,476	15,474,702
1992	6,766,364	1,777,940		8,997,836	17,542,140
1993	7,577,782	1,325,364	955,195	5,205,420	15,063,761
1994	6,839,755	1,453,818	1,410,024	5,750,590	15,456,181
1995	9,058,442	2,400,917	1,657,567	5,435,658	18,552,584
1996	5,136,914	1,879,029	1,264,057	2,907,322	11,187,340
1997	4,546,108	557,584	729,779	5,246,702	11,100,173
1998	6,729,743	2,508,221	1,487,417	8,030,574	18,755,955
1999	5,460,538	6,788,774	3,657,000	3,389,133	19,295,445
2000	7,939,056	2,809,463	1,536,149	8,488,634	20,773,302

Note: Lower Monumental began counting transport in 1993.

