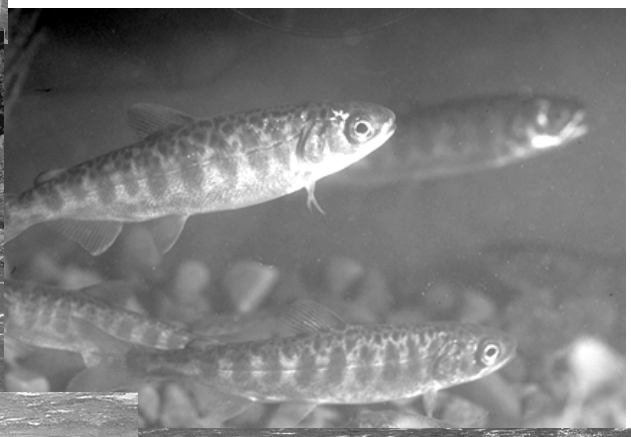
US Army Corps
of Engineers ®
Portland District

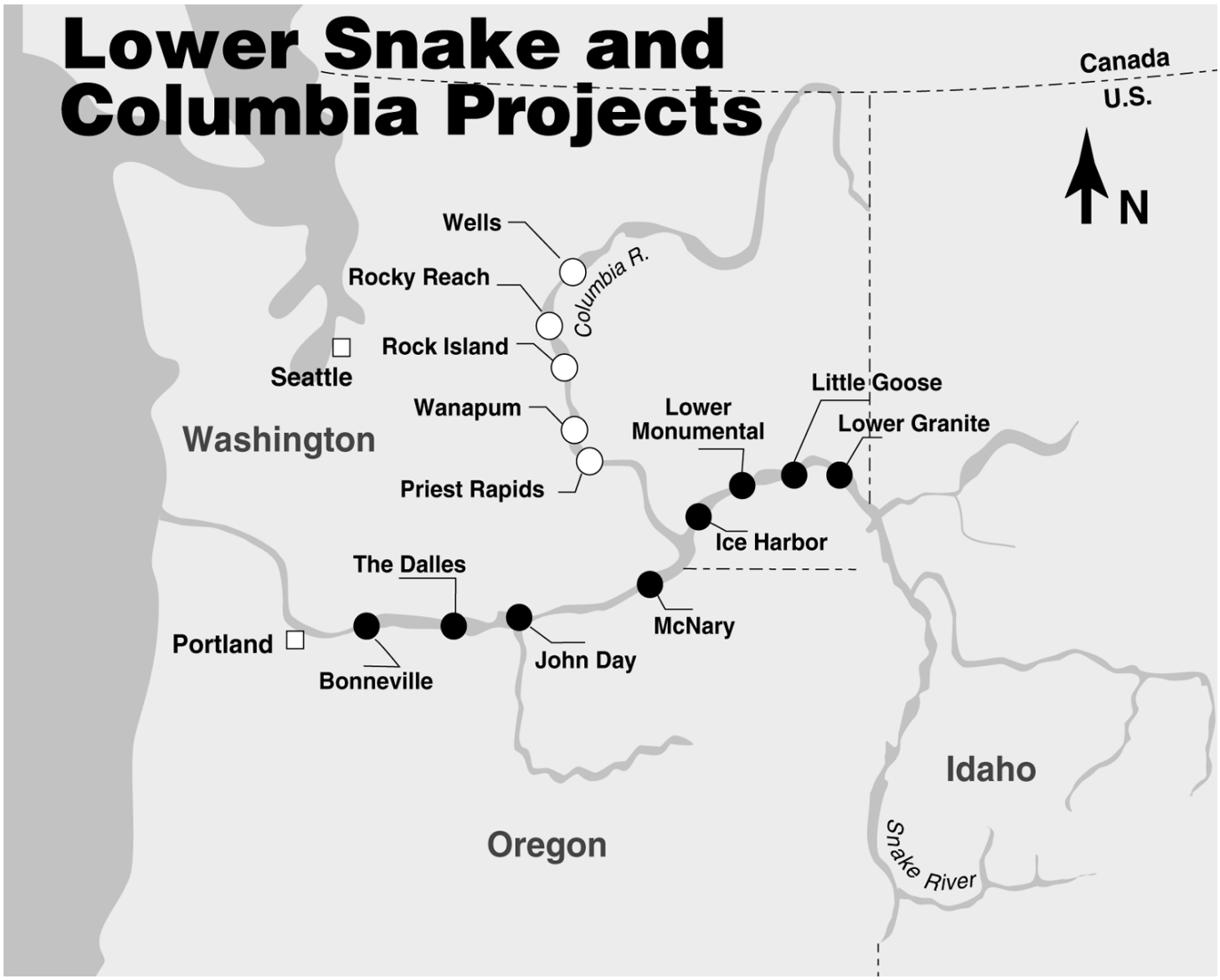
Summary

Salmon Recovery through John Day Reservoir

John Day Drawdown Phase 1 Study



September 2000


Lower Snake and Columbia Projects
Canada
U.S.
N
Wells
Rocky Reach
Columbia R.
Rock Island
Seattle
Wanapum
Priest Rapids
Washington
Lower Monumental
Little Goose
Lower Granite
Ice Harbor
The Dalles
McNary
Portland
Bonneville
John Day
Idaho
Oregon
Snake River

US Army Corps
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Portland District

To the U.S. Congress:

In 1998, you directed the U. S. Army Corps of Engineers to conduct the first phase of a two-phase study of drawdown options for John Day Dam. The Corps of Engineers, Portland District, operates John Day Dam, which spans the Columbia River between Washington and Oregon 215 miles from the Pacific Ocean. John Day creates a 76-mile-long reservoir (Lake Umatilla), pooling water between John Day and McNary dams. A drawdown lowers reservoirs to levels that are substantially below the normal operating range. Per your direction, the Corps of Engineers limited the first phase to two options for lowering the river: "spillway crest" and "natural river level." Both options were evaluated "with" and "without" flood control. The Corps of Engineers Phase I Study, summarized herein, evaluates biological, environmental, social and economic impacts; the costs of each option; and the potential physical impacts at John Day Dam.

Normal reservoir operating level is elevation 265 (normal pool). At spillway crest, about 50 feet lower than normal pool, fish passage systems at John Day Dam would have to be modified. There also would be effects on other river users. At natural river drawdown, about 100 feet lower than normal pool, the John Day Dam or a portion of the dam would be removed. Effects on navigation, irrigation, recreation, fisheries, wildlife, hydropower production, cultural resources and water supplies would be dramatic. This Summary details potential biological benefits to endangered species, as well as impacts on all uses of the river, plus hydraulics and hydrology affects, and associated structural changes at John Day Dam.

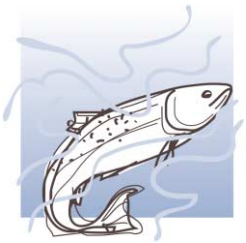
The public involvement process for the Phase I Study provided involvement opportunities for the general public, tribes, congressional offices, special interest groups/organizations, state and Federal agencies, counties, cities, ports, the System Configuration Team, and the Northwest Power Planning Council. Two rounds of public meetings were held. Comments on the draft report were received orally at public meetings, and in written form, both via the postal service and by electronic mail. All comments submitted were considered as the final report was prepared. In some cases, changes were made in the final report to reflect new or additional information provided by the public, interest groups and government agencies. In general, the majority of comments were in support of eliminating further study of the John Day Drawdown. However, there were some requests for further study.

The Corps of Engineers' assessment of potential biological benefits and economic costs results in the recommendation that no further study be conducted. The Corps of Engineers recommends that the John Day Dam continue to be operated as authorized for the purposes of hydropower, navigation and flood control.

For your convenience, this Summary provides the essence of the Study in one manageable booklet.

Sincerely,

Randall J. Butler
Colonel, Corps of Engineers
District Engineer



Why is this Study Needed?

The impetus for the study originated in 1991, when the National Marine Fisheries Service (NMFS) proposed listing wild Snake River sockeye, spring/summer chinook, and fall chinook salmon as "endangered" or "threatened" under the Endangered Species Act. NMFS and other natural resource agencies believed that reservoir drawdown could improve conditions for these species.

The regional goals for a drawdown of John Day Reservoir, as identified in the NMFS draft Recovery Plan for Snake River salmon, the Tribal Restoration Plan, and the Northwest Power Planning Council's Fish and Wildlife Program, are as follows:

- Improve migration and rearing conditions for juvenile spring, summer, and fall chinook salmon; sockeye salmon; and winter and summer steelhead
- Reduce water temperature and total dissolved gas to comply with Clean Water Act criteria and standards
- Improve spawning potential for fall chinook salmon

In 1998, the U.S. Army Corps of Engineers (USACE) was directed by the Senate Subcommittee on Energy and Water Development to study alternatives for drawing down the John Day Reservoir. Initially, only two alternatives were to be evaluated: operation at spillway crest resulting in a reservoir elevation that would vary from about 217 to 230 feet, or lowering to natural river level.* Subsequently, the study was expanded to include alternatives both with and without flood control storage.

The four drawdown alternatives evaluated in the Phase I Study are:

Alternative 1:	Drawdown to spillway crest without flood control
Alternative 2:	Drawdown to spillway crest with flood control
Alternative 3:	Drawdown to natural river without flood control
Alternative 4:	Drawdown to natural river with flood control

Further, the study includes "the social and economic impacts of each proposed drawdown, including effects on irrigation operations, hydraulics and hydrology, fisheries, flood control, hydropower production, navigation, transportation, structural changes to federal projects, and other impacts related to cultural resources, recreational activities, and municipal water supply" (U.S. Senate Subcommittee on Energy and Water Development, 1998).

This Phase I report was developed primarily from existing documents developed as part of USACE's studies on the breaching of four Lower Snake River dams. During the course of this study, USACE has coordinated its efforts with regional policy and technical workgroups, and has considered all comments received. Though this study is not intended to select among the four alternatives, it will be used to recommend to Congress the need for a Phase II feasibility study.

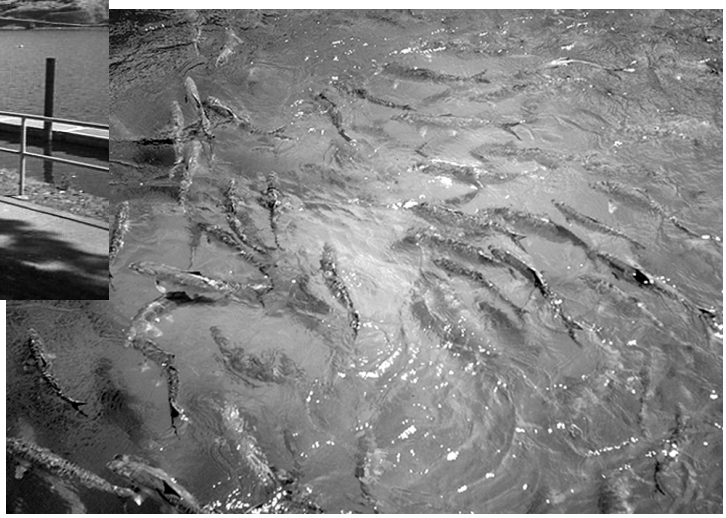
*All elevations referred to in this Phase I Study are referenced to the National Geodetic Vertical Datum (NGVD).

Goals of the Study

The goals of this Phase 1 Study were to:

- Evaluate the potential of a John Day Reservoir drawdown to protect, mitigate, and enhance fish (particularly anadromous fish) and wildlife populations and habitat of the Columbia River and its tributaries, and evaluate how drawdown might contribute to an increase in the number of harvestable anadromous fish.
- Evaluate the social, economic, and biological benefits and costs of a drawdown of the John Day Reservoir to spillway crest or natural river levels; and conduct a preliminary evaluation, based on direct economic costs and on available information concerning the survival of anadromous fish.
- Provide needed input to USACE's *Lower Snake River Juvenile Salmon Migration Feasibility Report/Environmental Impact Statement*.
- Develop information for use in determining whether it is appropriate to continue to a more detailed Phase II Study.

Although this study is limited to four drawdown alternatives at John Day Dam, the impacts of these actions would have regional implications in a number of areas. Consequently, both the study and this report consider direct impacts to the reservoir and nearby communities, as well as indirect effects to other regional communities, including those in Oregon, Washington, Idaho, and Montana, and fishing communities in southeast Alaska.



Project Background

Study Area

John Day Dam and Reservoir are part of the Columbia-Snake Inland Waterway. This shallow-draft navigation channel extends 465 miles from the Pacific Ocean at the mouth of the Columbia River to Lewiston, Idaho. The reach of the Columbia River under consideration in this report extends from John Day Lock and Dam at river mile (RM) 215.6, to McNary Lock and Dam RM 291. The body of water impounded by John Day Dam extends 76 miles upstream to McNary Dam.

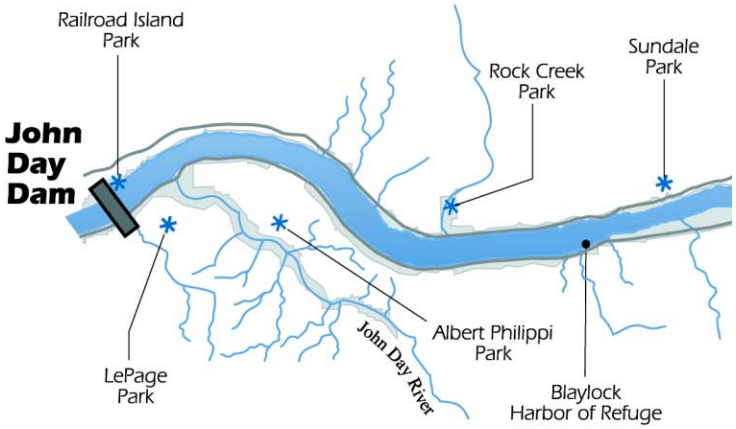
The adjoining region is mostly open country with widely scattered population centers. The climate of the region is semiarid. Agricultural uses, open space, and large farms predominate.

The mid-Columbia River area is served by a well-developed regional transportation system consisting of navigation channels, highways, and railroads. In addition to the main navigation channel, smaller channels provide access to numerous ports and harbors along the river. Highways parallel the southern and northern shores of John Day Reservoir. Interstate 84, a divided multilane highway on the south shore, runs parallel to the Columbia River from Portland, Oregon, to points east. It is a major freight corridor. Washington State Route 14 on the north shore parallels the Columbia River from Vancouver to McNary Dam. Umatilla Bridge at RM 290.5, downstream from McNary Dam, is the only highway bridge in the reservoir linking Oregon and Washington across the Columbia River.

Two major railroad lines also run next to John Day Reservoir on both the northern and southern shores. The Burlington Northern and Santa Fe (BNSF) Railway runs parallel to the Columbia River on the Washington shore, from Longview to McNary Dam and points east. On the Oregon shore, Union Pacific Railroad (UPRR) also parallels the Columbia River, from Portland to Hermiston and points east.

John Day Project

The John Day Lock and Dam project comprises one unit in the comprehensive development for multi-purpose uses of the water resources of the Columbia River and its tributaries. The dam provides approximately 76 miles of slack-water navigation from the head of The Dalles Reservoir to McNary Dam, completing the slack-water navigation improvements from the Pacific Ocean to the Pasco-Kennewick area in Washington and on the lower Snake River to Lewiston, Idaho.

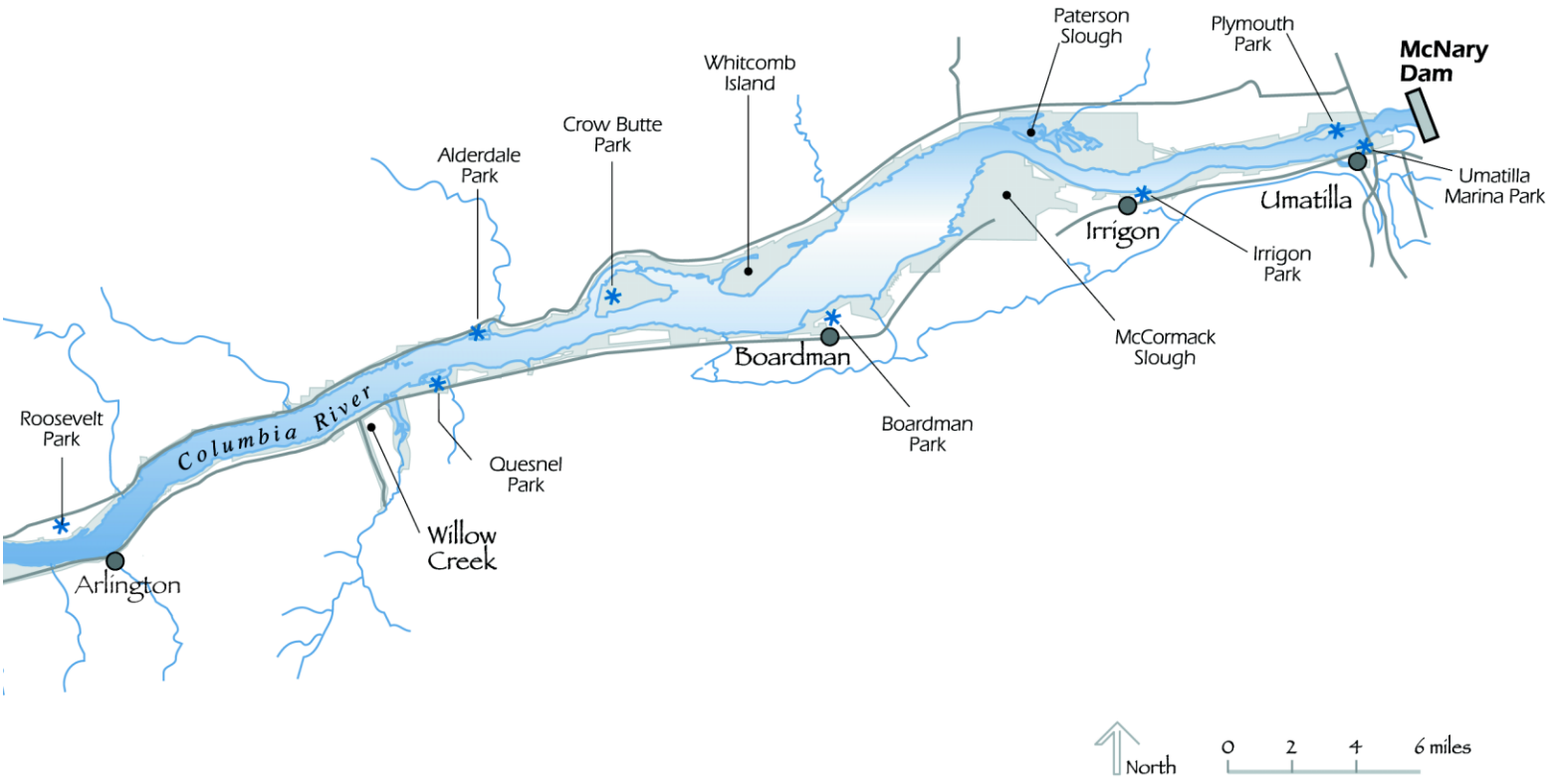


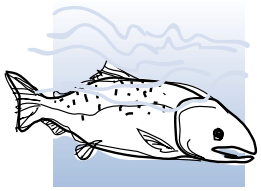
The John Day Project consists of a south embankment dam, powerhouse, spillway, navigation lock, and north embankment dam, with a total project length of approximately 5,900 feet. The normal gross hydraulic head of the dam from headwater to tailwater is 105 feet. The powerhouse consists of 16 generating units with a maximum capacity of 2,484,000 kilowatts, and includes space for an additional four units. The spillway consists of twenty 50-foot-wide spillway bays, which are controlled by radial gates to safely pass the spillway design flood of 2,250,000 cubic feet per second. The project includes a draft navigation lock that provides a maximum lift of 113 feet for a barge tow configuration up to 85 feet by 650 feet. Two adult fish ladders (north shore and south shore) allow upstream migrating adult salmonids to pass the project. Downstream migrating juvenile fish are currently guided away from the turbines by submersible traveling screens to a juvenile bypass system, which directs them either to the tailrace or through an existing juvenile fish monitoring facility.

John Day Reservoir is the only lower Columbia River dam and reservoir project with allocated flood control storage. The approximately 500,000 acre-feet of flood control space in John Day Reservoir provides an opportunity for final regulation to the target discharges for the downstream control points, especially in the Portland-Vancouver area. The flood control storage space for the project is primarily operated to compensate for unavoidable irregularities in operation of upstream reservoirs, and to regulate flows from uncontrolled tributaries upstream from the John Day Project.

McNary Project

McNary Dam fish passage facilities were in operation prior to the completion of the John Day Dam and the filling of the John Day Reservoir. The original upstream passage facilities include the north shore fish ladder, a pressure fish lock, and the south shore fish ladder. The south shore ladder collects Oregon shore fish as well as fish collected at entryways along the downstream face of the powerhouse. With the construction of the John Day Project, the McNary facilities were modified to accommodate an increase in tailwater elevations.

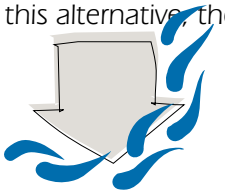




Alternatives for Drawdown

Alternative 1: Spillway Drawdown without Flood Control

In this alternative, the gates would be raised and the river would flow uncontrolled over the existing spillway, resulting in a pool elevation that would vary from elevation 217 feet to 230 feet. The existing 20-bay spillway would be operated differently from current operations, but no structural modifications would be required.

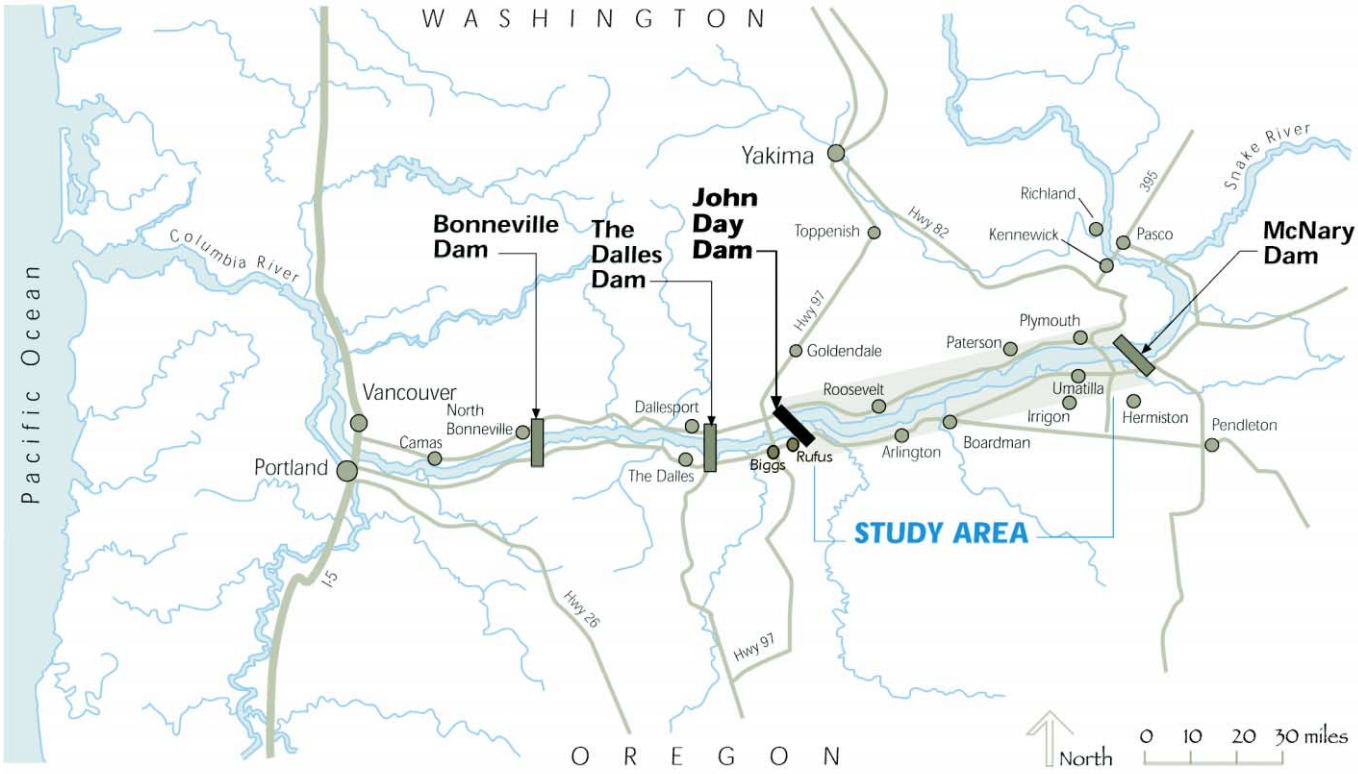


This alternative would require approximately 8 years to plan and design and about 5½ years to construct.

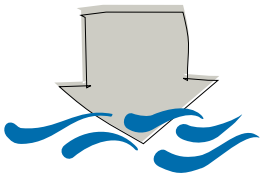
Alternative 2: Spillway Drawdown with Flood Control

As with Alternative 1, the gates would be raised and the river would flow uncontrolled over the existing spillway. During a flood event, the spillway gates would be used to control the downstream flows using the 500,000 acre-feet of flood control storage. The existing 20-bay spillway would be operated differently from current operations, but no structural modifications would be required.

This alternative would require 8 years to plan and design and about 6 years to construct.



Alternative 3: Natural River Drawdown without Flood Control



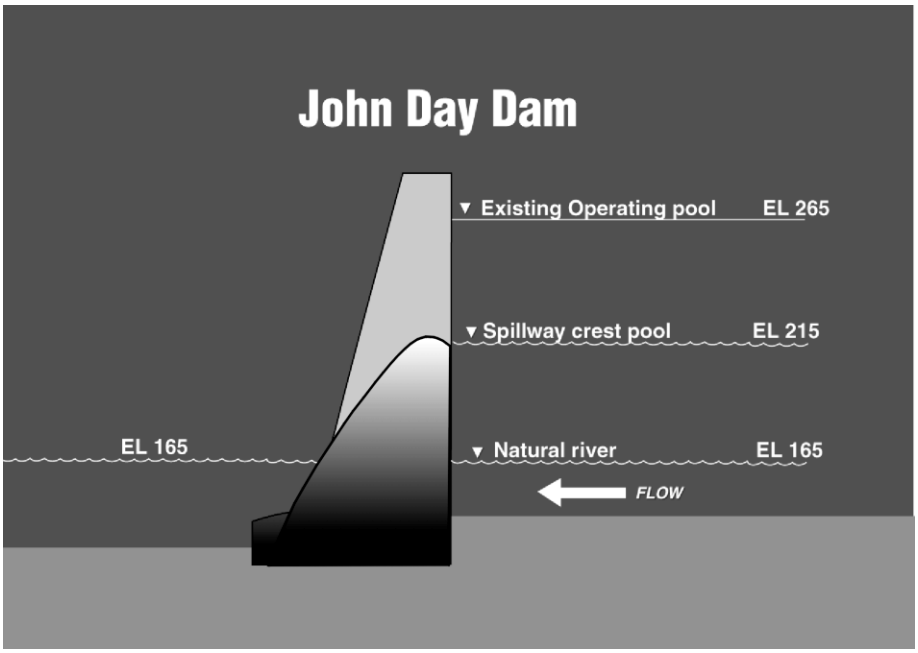
In this alternative, the river would be drawn down to approximate natural river conditions. Fish would pass and navigate through the opening in the dam created by removing the spillway and a portion of the powerhouse. It is envisioned that the dam would be removed in two construction stages.

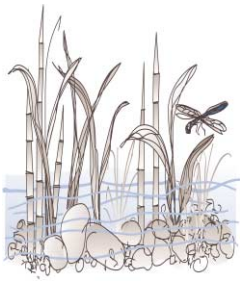
The studies and design for the drawdown would take an estimated 8 years to complete, and construction would take approximately 4½ years.

Alternative 4: Natural River Drawdown with Flood Control

In this alternative, part of the dam would be removed and the reservoir drawn down to approximate natural river conditions; a gate structure would be added to regulate flow for flood control. During low flow periods the spillway gates would be fully opened and the river would flow uncontrolled over the spillway. During a flood event, the spillway gates would be used to control the downstream flows using the flood control storage.

The studies and design for this drawdown alternative would take an estimated 8 years to complete, and construction would take about 10½ years.

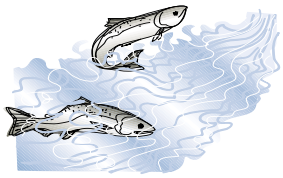




Potential Effects of Alternatives

Hydrology and Hydraulics

Existing Conditions



John Day Reservoir currently provides approximately 500,000 acre-feet of flood control storage space. A computer model of the existing condition was developed to simulate conditions under low, normal, high, and flood flows. The results of modeling provide estimates of current water surface elevations, channel velocities, and reservoir capacity under a variety of flow conditions. In addition, average monthly, peak flows, average annual, and annual flow-duration statistics were determined, for the major tributaries (John Day and Umatilla rivers, Willow and Rock creeks).

The critical factor is the travel time of flows through John Day Reservoir, given that slow flows and long travel times affect downstream fish migration. The analysis of water particle travel times for all alternatives (with and without flood control) was based on five major flood events. Under existing conditions, water particle travel times vary from more than 3 weeks at a flow of 50,000 cfs to over 3 days at the 2-year flow (353,000 cfs). For large flows (i.e., greater than the 2-year flow), travel times are relatively short on the order of 1 to 2 days.

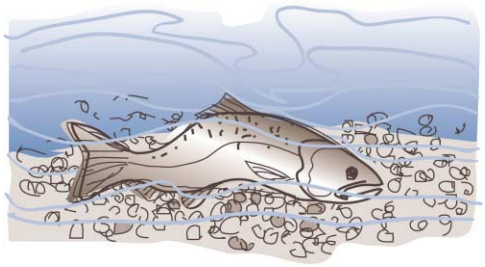
Potential Effects

The natural river drawdown alternatives result in water particle travel times of approximately 1 day for flows less than the 2-year flow (or perhaps 1-1/2 to 2 days during very low flows). The spillway drawdown alternatives could result in water particle travel times varying from more than a week at 50,000 cfs to nearly 2 days at 353,000 cfs (2-year flow).

Sedimentation

Existing Conditions

Since John Day Dam was constructed, the majority of erosion appears to have occurred around islands and reservoir slopes in the upper third of the reservoir. Landslides may have been an additional source of sediment. Sedimentation has concentrated in the natural river channel, with minor amounts of deposition on the side slopes. Sedimentation due to backwater from the reservoir has greatly changed the geometry of some tributaries. Existing structures (e.g., culverts) currently block sediment from entering the John Day Reservoir from many tributaries.



Potential Effects and Modifications

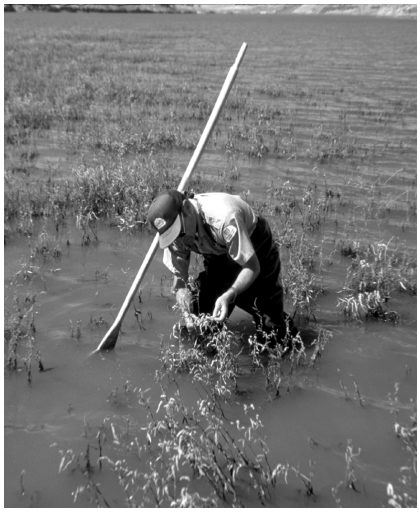
Under the proposed alternatives, drawdown would result in changes in hydraulics and channel morphology and consequently changes in sediment transport.

Initial dredging of Umatilla River, Willow Creek, and Rock Creek would open the channel to adult fish passage under the proposed drawdown conditions. Thereafter, some degree of annual maintenance dredging would be required as the channel adjusts to the new hydraulic and sediment transport conditions. Changes in flow velocity or volume could both remove existing blockages to fish passage or create new blockages.

Sediment Quality

Existing Conditions

Sediment samples were collected at Messner Cove (Port of Morrow, Boardman, Oregon) in March 1999 and tested for chemical composition. The chemical analyses included metals, total organic carbon, pesticides/PCBs, phenols, phthalates, miscellaneous extractables, and polynuclear aromatic hydrocarbons. The potential sources (point and non-point) of sediment contamination include the Hanford facility; Goldendale Aluminum Reduction Plant; commercial farming; ports, barges, and boat basins; wood products industry; recreation facilities; and municipal waste discharges.



Potential Effects and Modifications

Because physical and chemical data on sediment quality in the John Day Reservoir are limited, the determination of potential effects from the four drawdown alternatives was based on related studies and on known physical and chemical changes occurring with drying and rehydrating of sediments. Potential contaminants may either be bound to or mixed with inundated sediment. Drawdown of the John Day Reservoir would result in exposing or redistributing sediments and potential contaminants. Exposed contaminants could then become mobile in the environment through a number of transport effects such as resuspension in the water and volatilization.

In addition to erosion, both drawdown alternatives would require dredging of sediments for new navigation channels, fish passage, and modifications of recreation and commodity distribution sites. The analysis of sediment samples taken from the Port of Morrow indicates that material dredged from the John Day Reservoir would be considered acceptable for both unconfined in-water and upland disposal.

Water Quality

Existing Conditions

Water in the study area has been characterized as having cool temperatures, very low levels of suspended solids, low nutrient content, and an absence of microbial contaminants. Data concerning pollutants in John Day Reservoir is lacking. From what little data was found, ranges of concentrations for heavy metals suggest that some standards have been exceeded. No relevant data concerning organic pesticides and herbicides have been located.

Potential Effects and Modifications

Reservoir drawdown under any of the four proposed alternatives may adversely affect water quality in the short term. Short-term negative impacts may include increased turbidity and suspended solids, resuspension of pollutants, increased nutrients, and possible downstream reductions in dissolved oxygen. These impacts would dissipate over time (an estimated 2 to 15 years), and water quality would return to pre-drawdown conditions.

Long-term benefits would be in the form of reduced total dissolved gases downstream from the John Day reach, increased water velocities, and water temperature regimes shifting toward pre-impoundment conditions.

Shoreline Conditions

Existing Conditions

The existing shoreline in the reservoir is characterized by natural materials (soil, bedrock), embankment fill, and riprap protection. Shoreline is limited to a pool impingement zone of approximately 11 vertical feet. The shoreline within the John Day Reservoir can be divided into four categories: benches cut in bedrock with the water against bedrock; embankments with water against riprap; natural soil with sufficient distance for beach formation; and placed material with gravel protection or self-armoring characteristics.

The mid-Columbia River area is served by a well-developed regional transportation system consisting of interstate and state highways and two railroads (Burlington Northern & Santa Fe and Union Pacific).

Potential Effects and Modifications

Drawdown would increase unprotected shoreline exposure to erosion, undercutting, and rapid dewatering of embankment material, all of which would affect bank stability. The reservoir includes a 15-mile zone of landslide topography that might be susceptible to increased slope failure caused by erosion of clay-shale interbeds during drawdown. Unconsolidated, fine-grained alluvial slopes at the mouths of tributaries might fail as a result of rapid dewatering. An additional impact would be an increase in blowing sand and dust as submerged sediment is exposed and dried out.

Some railroad and highway embankments are located in vulnerable areas where wave impingement, undercutting, erosion, and rapid dewatering are likely to occur during and after drawdown operations. Rapid dewatering, and subsequent flood events, would cause portions of the railroad embankments to fail or result in misalignment of track. Adjacent roads might undergo movement, cracking, and slumping, to varying degrees. Drawdown may create scour that could potentially undermine bridge piers. Modifications of bridges and culverts would be as follows.

- Bridges: The SR-14 and BNSF bridges over Rock Creek WA would have to be modified and lengthened to 330 feet for the spillway drawdown alternatives, and to 460 feet for the natural river drawdown alternatives. Approximately 118,000 cubic yards and 299,000 cubic yards of embankment would be dredged and removed under spillway and natural river drawdown conditions respectively.

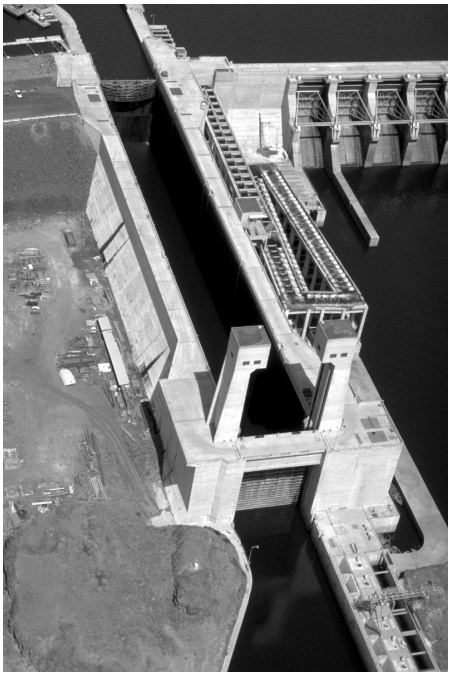
- Perched culverts: Nine perched culverts (culverts that leave ponded water trapped upstream) would be replaced with culverts low enough to empty the entire pond and pass inflows.

- Other culverts: Modifications such as riprap and corrugated downspouts may be required to reduce erosion caused by culverts that spill directly onto the reservoir embankments.

Navigation

Existing Conditions

Navigation through the John Day Reservoir is achieved by means of a lock at the dam and a dredged navigation channel. Dimensions for the navigation channel are maintained at 250 feet wide by 14 feet minimum depth and allow for two-way barge traffic along the entire length of the reservoir. This arrangement facilitates the transport of modern barge tow configurations of one tug and 4 barges (i.e. lengths up to 650 feet and widths up to 85 feet). About 9 million tons of commodities, the majority including wheat, barley, petroleum, wood chips, and logs, move through the John Day Lock each year.



Potential Effects and Modifications

All four drawdown alternatives considered would affect the flow of commodities on the Columbia and Snake rivers. Each alternative would make the John Day Reservoir too shallow for the current fleet of 14-foot draft barges and tugs. The result would functionally end commercial barge navigation above RM 263. Closure of the John Day Reservoir to navigation would force producers and manufacturers to find other means of shipping goods, resulting in increased truck and rail traffic and increased costs.

Modifications to allow commercial navigation, in the form of a new dredged channel through the lowered reservoir, would be possible under all four alternatives, but costs would vary according to the extent of drawdown. Even with a redesigned channel, towboats would have to increase horsepower and steering capabilities because of the increased velocity of the river and sharper channel bends. In addition, it would require more time and fuel to navigate this reach of the river and there may be safety concerns during times of poor visibility.

Ports and marinas may encounter facility replacement needs and subsequent sediment and rock removal, a decline in port business, contracts, and marina use, and greater fluctuations in water elevations at new sites.

Puget Sound Naval Shipyard inactivates and disposes of naval nuclear powered ships in Bremerton, Washington. After decommissioning, reactor compartment packages are then shipped up the Columbia River to Richland, Washington for land burial at the Hanford Site. Since river transportation is the only feasible means of transporting the reactor compartment packages because of their large size and weight, permanent elimination of navigation through the John Day Reservoir would stop the Navy's disposal of decommissioned nuclear powered ships.

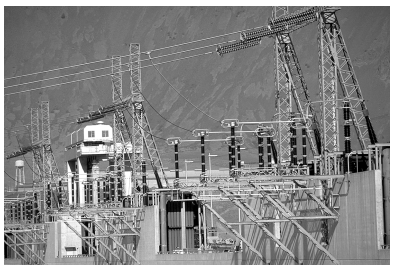
Hydropower Operation

Existing Conditions

Columbia River Basin hydropower projects are a major element in the Pacific Northwest electrical industry, providing about 60 percent of total regional energy needs and 70 percent of total electrical generating capacity, on average. The amount of energy generated annually by John Day Dam makes up about 5 percent of all energy generated in the Pacific Northwest and about 11 percent of the annual energy sales by the Bonneville Power Administration.

Potential Effects

Drawdown of John Day Reservoir would alter the configuration of power generation facilities in the Pacific Northwest. Because the transmission grid was constructed in combination with the generation system, loss of John Day generating capacity would affect the transmission system's ability to move bulk power and serve regional loads. Additionally, power demands would have to be met by other means (e.g., fossil fuels or geothermal energy, wind and solar power, cogeneration), all of which may carry higher costs than hydroelectric power.



Ancillary services, (services in addition to the energy), capacity, and transmission support benefits are a necessary element of a safe and reliable power system. They would be curtailed or eliminated by reservoir drawdown. John Day could not continue to provide Automatic Generation Control under drawdown to spillway crest because the project configuration at that level would not allow for small, instantaneous changes in generation required for flexible operation of the system. Drawdown would also affect the role of the John Day Project in providing reserves for the federal power system during heavy load periods.

Flood Control System and Operation

Existing Conditions

John Day Dam is the largest of the lower Columbia River lock and dam projects, and is the only one with allocated flood control space. Uncertainties in weather and timing of runoff complicate flood control operations. The approximately 500,000 acre-feet of flood control storage space provides an opportunity for final regulation of peak flood flows for the Portland-Vancouver area, identified as the primary damage control point of the Columbia River Basin.

Potential Effects and Modifications

Models have been developed to examine the passage of hydrologic events through the John Day Reservoir. Five separate historical flood events, including the 1948, 1974, 1982, 1996, and 1997 floods, were used for each model to determine outputs such as maximum water surface elevations, flows, and velocities along the length of the channel.

For spillway drawdown conditions without flood control, the reservoir would be maintained between elevations 223 and 249 feet for all five flood events. With flood control, the reservoir would increase by almost 20 feet in depth and would require between 19 and 26 days of water releases at maximum flow before the flood control volume returns to zero. As modeled, flood control would only lessen peak discharges by about 5 percent, but would increase the length of time of relatively large releases.

For natural river drawdown conditions without flood control, the maximum river level would vary between elevations 165 and 178 feet. With flood control, however, maximum river level could increase by nearly 60 feet at the dam.

Utilities

Existing Conditions

Twenty-three utilities have been identified in the John Day Reservoir study area.

Potential Effects and Modifications

Of the twenty-three utilities, seven would be affected by drawdown, including an electric utility (Benton Rural Electric Association), a natural gas pipeline (Williams Company), and five sanitary sewer outfalls (Umatilla, Arlington, Boardman, Roosevelt, and Goldendale Aluminum). Impacts to the electrical utility crossing, the gas pipeline crossing, and the Umatilla sanitary sewer outfalls would be the same for each of the four alternatives. Impacts to the other four sanitary sewer outfalls would differ under each alternative.

- Benton Rural Electric Association: This underwater electrical utility between Plymouth and Plymouth Park, Washington may be exposed, which would require relocation.
- Williams Company gas pipeline-west: Increased flow velocities after drawdown may result in scour at the location of two 20-inch-diameter gas pipelines that cross the river approximately 4 miles upstream from Irrigon (RM 286.3), thereby necessitating riprap or other scour protection.
- Sanitary sewer outfalls: These five outfalls would be exposed after drawdown, resulting in National Pollutant Discharge Elimination System (NPDES) permit violations. All would require extensions into the lowered river level.

Irrigation

Existing Conditions

There are approximately 182,000 acres of irrigated lands supported by the John Day Reservoir. Twelve irrigation pump stations on the Washington side serve 92,000 acres. Eighteen pump stations on the Oregon side irrigate 90,000 acres.

Potential Effects and Modifications

Under each of the four alternatives, all 30 irrigation pump stations would be adversely affected. Impacts would include excessive head loss, intakes that no longer function due to the lowered water level, increased pumping costs due to higher lift distances and the need for additional pumps, and increased operation and maintenance due to higher sediment loads in the lowered reservoir. Interim pumping during construction of pump station modifications would be required to reduce impacts to multi-year irrigated crops.

All pump stations would require new intakes with fish screens, and most would require new low-lift pumps with fish screens to deliver water from the lowered reservoir to the existing pump stations.

Two other irrigation options were considered. In Washington, a major pump station would lift water from the McNary pool to a canal along the shore for approximately 42 miles. In Oregon, a major pump station would lift water from the McNary pool to a canal extending along the shore for approximately 37 miles.

Water Supply

Existing Conditions

Most residents near the John Day Reservoir rely directly or indirectly on the reservoir for their water supply. The majority of the estimated 2,200 water supply systems in the study area (excluding irrigation pump stations) are private wells for domestic use. Of the 15 public users in the area, many operate multiple systems. Although some water supply systems draw water directly from the reservoir, most consist of one or more wells that draw from groundwater, either in overburden or bedrock. Next to the reservoir, however, much of the groundwater recharge comes from the river, particularly in the case of the alluvial aquifer that overlies the bedrock in the area.

Potential Effects and Modifications

Any significant change in operating levels of the reservoir would affect the efficiency of those well systems that depend on it for groundwater recharge. Some well systems would respond markedly to such changes, and others would be rendered unusable in their current configurations. Reservoir drawdown, under either the spillway crest or natural river level alternatives, would first affect the alluvial aquifer, the one directly recharged by the reservoir. Recharge of the basalt aquifer would also be affected at natural river level drawdown elevations and to a lesser extent under the spillway crest drawdown elevations.

All Ranney wells in the reservoir would be affected by insufficient head in the intake lateral lines, greatly decreased water inflows, and subsequent inflow of sands and silts into the system. These conditions would lead to progressive shutdown of the Ranney wells.

Necessary modifications for drawdown actions would include the following.

- Canals: If a canal option is chosen instead of irrigation pump station modifications, then the canals could also supply water to all users able to draw from the canals. Users would need to locate pumps at the canal, install pipeline to their existing water supply or distribution lines, and provide for water treatment. Associated issues might include property acquisition for canal or pipeline alignments; access rights-of-way; easements for secondary canals, pipelines, and electrical lines; siting of pumps or booster pumps.

- Private wells: Owners of shallow wells may need to drill deeper wells in order to place the well screen below post-drawdown reservoir water levels. This is not an option for users of the basalt aquifer in Oregon because the Oregon Water Resources Department has halted further drilling and withdrawal. Alternatively, new wells could be constructed.

- New intake pump stations: Affected public users will require new intake pumps and treatment to replace affected wells.

Recreation

Existing Conditions

The John Day Reservoir provides a broad range of recreational opportunities, including picnicking, camping, swimming, boating, windsurfing, fishing, and hunting. There are a total of 16 established river access sites consisting of 11 operating recreation sites, three closed recreation sites (Railroad Island, Rock Creek, and Sundale), and two emergency harbors-of-refuge.

Potential Effects and Modifications

All of the drawdown alternatives would limit river access and recreational opportunities by increasing the distance between the river and the recreational facilities (e.g., boat ramps, beaches, campsites). Under all drawdown conditions, especially Alternative 3 (drawdown to natural river level without flood control), the river would narrow, velocities would increase, and backwaters and large eddies would no longer exist. Boat launching would be difficult unless breakwaters and groins are constructed. Safe swimming beaches would be eliminated, and the only alternative is the swift-flowing Columbia River, which may be too fast for safe swimming access. The aesthetic experience of camping near the river would also diminish at existing camp sites once the water level drops. River access facilities would be dry under both drawdown alternatives with exceptions during flood events.

Necessary modifications of recreation sites would include:

- Relocation of swimming beaches, requiring excavating, contouring, and placing of sand
- Extension of ramps or relocation of boat docks for both the public and tribal fishermen
- Installation of floating breakwaters combined with rock groins, or a series of rock-filled breakwaters
- Construction of access roads
- Extensive excavation and grading to locate roads on steep riverbanks
- Excavation or relocation of existing marinas

Hazardous, Toxic, and Radioactive Waste

Existing Conditions

The potential for encountering hazardous, toxic, and radioactive waste under drawdown conditions is greatest at towns that were totally or partially relocated during construction of the John Day Project, (i.e., Umatilla, Boardman, Arlington, and Roosevelt), at the Goldendale Aluminum smelter located just upstream from John Day Dam, and at disposal sites used during construction of the dam.

Potential Effects and Modifications

Most of these potential sites would not be adversely affected by drawdown because they are not located along the present riverbank. All four alternatives would result in exposure of a construction debris disposal site on the Washington shore, which could interfere with construction activities and might affect water quality as materials oxidize.

- John Day Dam: If hydropower generation ceased, all chemical products stored at the dam would have to be removed and disposed of. Two underground storage tanks (USTs) near the warehouse would need to be decommissioned or removed.
- Goldendale Aluminum: Six hydraulically connected groundwater aquifers beneath the plant are contaminated, and the lower two are hydraulically connected to the John Day Reservoir. Under drawdown conditions, greater contaminant loading from the aquifers to the reduced river would be expected. If contaminated sediments are present and exposed during drawdown, efforts to cap or contain them would be required.
- Relocated Town Sites: Underground storage tanks were in common use when the towns/ municipalities were relocated during the 1960s, and some probably remain in place, along with septic tanks. Under current regulations, USTs would have to be removed or decommissioned.

Wildlife Resources

Existing Conditions

The project area currently includes substantial areas of riparian, wetland, island, and shallow-water habitats (including ponds, embayments, and tributary backwaters) that support a variety and abundance of wildlife species. Steppe and shrub-steppe upland habitats predominate, but are not directly influenced by fluctuations in reservoir elevation.

Project Impacts and Modifications

All existing wetland, riparian, and shallow-water habitats would be de-watered and subsequently lost. The area of islands would increase and drawdown would yield a barren drawdown zone. Habitats of the Umatilla National Wildlife Refuge and other wildlife management areas would be affected to the greatest extent, with losses of existing wetland, riparian, and shallow-water habitat. A small portion of the drawdown zone may be suitable for establishing wetland and riparian habitats. All other drawdown areas, including islands, would be seeded to vegetate and stabilize barren slopes.

Drawdown alternatives would result in a loss of waterfowl nesting habitat and shallow water habitat used by wintering waterfowl, and an increase in available brood rearing habitat. In the long-term, suitable nesting habitat would become established, but similar shallow-water habitat would not be restored. There would be a long-term reduction in suitable foraging habitat for great blue heron and black-crowned night heron. In the short term stranded fish, amphibians, and other prey would be abundant. Caspian terns, Forester's terns, and gulls may benefit in the short-term and long-term due to the increase in island area. Shorebirds would benefit in the short-term and long-term by the provision of favorable nesting and foraging habitat. Loss of the riparian, emergent, and shallow-water habitats would result in short-term and long-term decline in local populations of a variety of nongame birds including neotropical migrants. Woodpeckers would benefit from the creation of snags in what is currently forested riparian habitat. Upland game birds would generally be unaffected. Short-term increase in prey availability may benefit some raptors, but nesting and perching habitat for these species would be lost in the long term.

Beaver may be adversely affected in the short term due to loss of denning and foraging habitat, and may become a nuisance in the establishment of woody riparian vegetation along the new river channel. Otter, muskrat, and mink populations may be subject to short-term and potentially long-term reduction in emergent wetland and shallow-water habitats. Some terrestrial furbearers may positively respond in the short-term due to increased vulnerability of small mammals, amphibians, reptiles, fish, ground-nesting birds, and other potential prey. However, a reduction in suitable denning habitat near water may increase their vulnerability to predation. No substantial reduction in population is likely to occur. Most species that rely primarily on upland habitats are not likely to be directly affected. However, impacts to mule deer would result from loss of habitats used for cover, forage, and fawning.

In the long-term, amphibian and reptile species may be relatively unaffected. However, western painted turtles located in the Irrigon Wildlife Management Area and McCormack Slough of the Umatilla National Wildlife Refuge are expected to incur severe population reductions. Turtles would be subject to predation upon drawdown, and it is not known whether a viable population could be maintained in the long-term as there is no suitable habitat. Northern leopard frog and Woodhouse's toad may similarly be adversely affected in both the short-term and long-term.

Cultural Resources

Existing Conditions

Approximately 254 cultural resource sites are recorded in the John Day Reservoir study area. The reservoir has inundated over 70 sites, and others are subject to erosion, vandalism, and looting.

Potential Effects and Modifications

Drawdown was evaluated in terms of effects on archeological sites and historic properties listed in or potentially eligible for the National Register of Historic Places. It is anticipated that many new cultural resource sites would be exposed if John Day Reservoir were drawn down. Impacts of drawdown to known cultural resource sites include fluctuating pool levels, changes in groundwater and soil conditions, and slumping. These impacts would increase in the zones of newly uncovered land following drawdown. Based on computer modeling and experience with other reservoir drawdowns, the impacts to formerly inundated cultural resources would be severe due to loss of protective vegetation, some loss of mantling soils, greater potential for erosion, and more obvious exposure to looting and depredation. Drawdown to natural river would have the greatest impact on cultural resource sites and would expose more archeological sites. Adding flood control (Alternatives 2 and 4) would increase potential erosion during and after flood events.

Tribal Resources

Existing Conditions

Native American losses in the region of the Columbia River were extensive and compounded by the construction of the Columbia River lock and dam projects. Their losses involved social and cultural values and included some of the remaining, permanently and intermittently occupied settlements; sophisticated fishing procurement and preservation methods; and places where ceremonial traditions were practiced. The losses accrued with the construction of the Columbia River projects came in addition to the consequences from contact with Euro-Americans, not quite a century ago. To mitigate for the extensive losses that the Native Americans endured as a result of the construction of the Columbia River Hydropower System, Congress passed Public Law 100-581 (Title IV). The law directed the Corps of Engineers to provide access to usual and accustomed fishing facilities for members of the Nez Perce Tribe, the Confederated Tribes of the Umatilla Indian Reservation, the Confederated Tribes of the Warm Springs Reservation of Oregon, and the Confederated Tribes and Bands of the Yakama Indian Nation. USACE has constructed 13 Treaty Fishing Access sites on the John Day Reservoir in response to this law.

Potential Effects and Modifications

As with the construction of John Day Dam, implementation of a drawdown at John Day Reservoir would impact the traditional Native American cultural values, properties, and practices. Initial and ongoing consultation with the Four Treaty Tribes and other Native American groups would be essential. Regardless of alternative, fishing practices would need to be modified in response to the change in hydrology and channel morphology. Treaty Fishing Access sites would need to be relocated and modified if a drawdown is implemented. Additionally, net fishermen would need to move to other pools along the Columbia River, which in turn could create the need for reallocation of the netting stations.

Fish Passage

Turbines

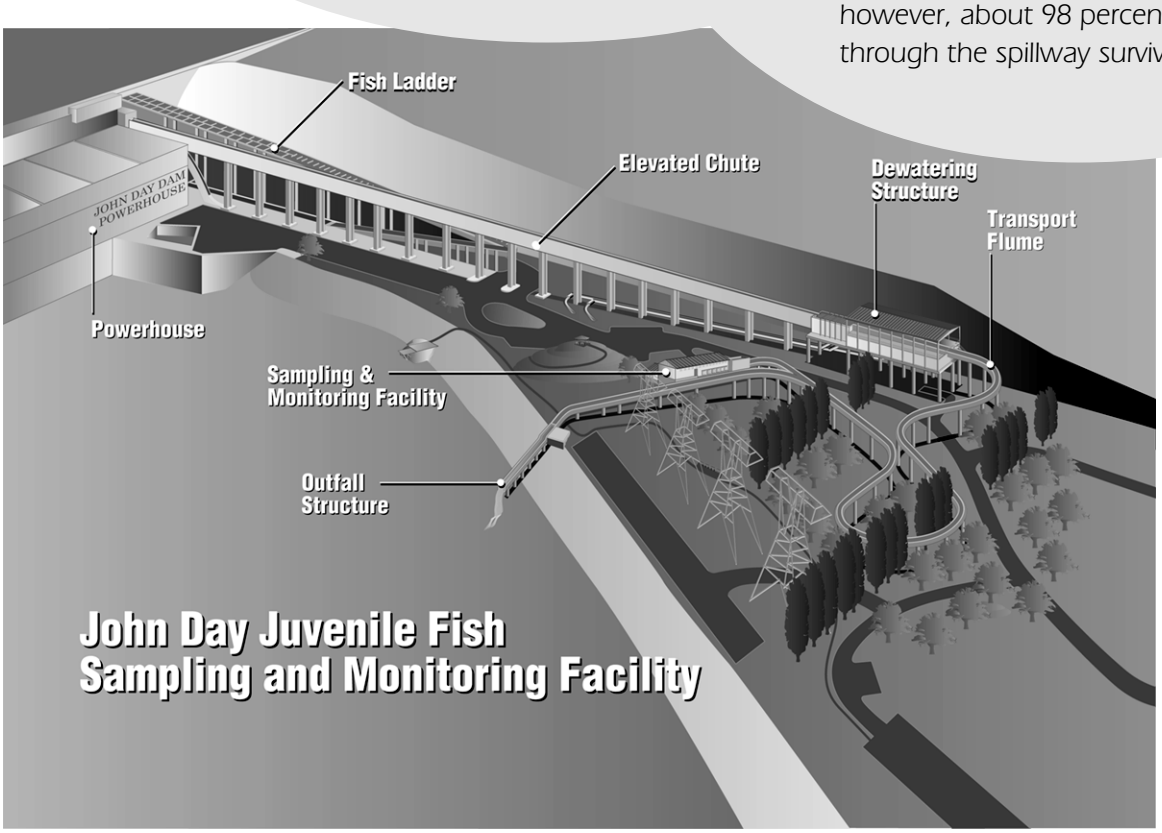
Some juvenile fish may enter the intake openings of the powerhouse, move with water through the turbines and exit on the other side. The fish may experience trauma from pressure changes, turbulent water conditions, or striking the machinery; however, about 87 to 98 percent of fish entering the turbines survive past the dam.

Bypass

Most juvenile fish are guided away from the turbines by submerged screens. Above McNary Dam juvenille fish are collected into channels that bypass the dam into the lower river or into holding tanks where they can be loaded onto barges or trucks and transported past the lower Snake River and Columbia River dams. The collected and transported fish may suffer delays and handling stress; however, about 98 to 99 percent of the transported fish survive to the point of release below Bonneville Dam.

Spillway

Some juvenile fish travel in water passing through the spillway and falling to the lower river. The fish may be damaged in the fall or be affected by dissolved gasses in the water; however, about 98 percent of fish passing through the spillway survive.



Aquatic Resources

Existing Conditions

The John Day Reservoir provides a variety of aquatic habitats for migration, spawning, and rearing (juvenile growth and development) for a number of resident and anadromous fish species. Species in the John Day Reservoir that are listed as threatened and endangered under the Endangered Species Act are Snake River sockeye salmon, Snake River spring/ summer and fall chinook salmon, Upper Columbia River spring chinook salmon, Snake River steelhead, Upper Columbia River steelhead, and possibly bull trout. Mid-Columbia River fall chinook salmon (known as Upriver Bright fall chinook salmon) also occur in the John Day Reservoir. They are not listed and are the most abundant and commercially important stock of salmon remaining in the Columbia River Basin above Bonneville Dam.

Chinook

Development of the Columbia River Basin hydropower system converted a free-flowing river into a series of reservoirs behind dams. Four dams were constructed on the lower Snake River, and four more were constructed on the lower Columbia River. Anadromous salmon and steelhead runs from tributaries of the Snake River above these dams migrate downstream as juveniles to the ocean (outmigrate), where they grow to maturity. When mature, they migrate back up the Columbia and Snake Rivers to the spawning areas where they originated to produce succeeding generations of fish.

Reservoirs and dams present barriers to adult and juvenile fish migration that increase the time and effort it takes them to migrate, which has reduced their survival rates. Fish ladders at dams provide a fairly effective way of enabling adult fish to pass upstream, however, providing safe passage for juvenile fish is more difficult.

The primary factors affecting juvenile fish survival rates are passage through turbines at dams, predation while passing through reservoirs, and "gas bubble disease" caused by high levels of nitrogen gas below dams spilling large volumes of water to move migrating juveniles through the spillway. Various efforts have been made to aid juvenile fish migration and to increase their survival rate as they migrate seaward.

Juvenile fish bypass systems now collect and pass most fish safely through dams. Hydropower turbine configurations have been improved to reduce fish mortality. In addition, many juvenile fish are collected at dams, loaded onto barges or trucks, and transported downstream. Most of the fish collected at the upper three dams on the lower Snake River (Lower Granite, Little Goose, and Lower Monumental dams) and at McNary Dam (located just below the confluence of the Snake River with the Columbia River), are loaded onto barges or trucks, transported, and released at a point just below Bonneville Dam from which they have unobstructed access to the ocean. Below Bonneville they are released into main channel currents to help them avoid predators.

Under favorable ocean conditions, when fish survival rates are high, potential spawning habitat currently available could accommodate approximately 5,500 fall chinook salmon between John Day and McNary Dams (i.e., the John Day

Wild Sockeye

Reach). These spawners could produce an estimated average of 10,600 harvestable (i.e., permitted to be taken through commercial and recreational fishing) adult fish annually. Current hatchery production from about 30,000 adult spawners, to mitigate for lost natural production due to construction of the John Day Dam, would contribute an additional 138,000 harvestable fish annually under good ocean conditions. The total of current potential natural and hatchery production is approximately 148,600 harvestable fall chinook salmon annually.

Potential Impacts and Benefits

Drawdown under all four alternatives would eliminate most submerged, rooted aquatic vegetation because the existing shallow reservoir habitat would be dewatered and exposed. The change to a riverine (free-flowing) environment characterized by gravel and cobble streambed would prevent re-establishment of rooted aquatic vegetation, which does not tolerate fast water or coarse streambed.

The shallow, swifter flow and variable streambed would create a greater diversity of aquatic insects. Caddisflies, stoneflies, mayflies, and true flies that prefer faster currents would become abundant. An increase in aquatic insects could increase food supply for juvenile salmonids.

The number of native resident fish species, such as chiselmouth, peamouth, chub, and redside shiner, would likely increase under drawdown conditions since they prefer a natural stream environment. They may eventually dominate the fish community in number and weight.

White sturgeon may benefit by a return to more riverine conditions. However, rearing conditions for juvenile sturgeon may not improve with drawdown, because they prefer deeper pools with slow currents. Unchanged white sturgeon rearing conditions would potentially limit the overall number of sturgeon in the John Day reach.

The abundance of the three aquatic predators with the greatest influence on juvenile salmonid numbers (northern pikeminnow, channel catfish, and smallmouth bass) are expected to stay approximately the same. The number of walleye, yellow perch, and various sunfish would likely decrease because of the loss of shallow, side channel areas. Pikeminnow and smallmouth bass would likely be restricted to relatively slow-moving waters, back eddies, embayments, and nearshore areas and might have less long-term access to juvenile salmonids.

A major goal of the assessment of anadromous salmonids was to determine the maximum potential benefit (i.e., increase in survival rates and abundance) to stocks of anadromous salmon listed under the Endangered Species Act that might result from drawdown of the John Day Reservoir. Studies have shown that the outmigration survival of juvenile salmon to a point below Bonneville Dam is substantially higher for fish that are captured and barged or trucked through the lower Snake River and Columbia River dams than for fish that swim through them (in-river migrants). Conversely, ocean survival of transported fish is thought to be substantially lower than for in-river migrants.

The current transportation of juvenile salmon by barge would not be possible under any of the drawdown alternatives. Loss of barging would substantially reduce overall survival of juvenile Snake River spring/summer chinook unless low ocean survival of transported fish is assumed (i.e., low fish transportation effectiveness). Consequently, in order to estimate the maximum potential benefit of reservoir drawdown, the overall survival rate of fish currently transported was assumed to be relatively low.

Biological life-cycle modeling encompassing all life stages of salmon was used to assess the potential benefits to Columbia and Snake River fall chinook salmon stocks resulting from

National Marine Fisheries Service Concurrence

"We concur that the analytical approach you (USACE) used covers an appropriate range of assumptions and uncertainties. The survival effects on listed salmon runs of the alternative John Day project configurations that you report are consistent with available information and reasonable for an assessment at the reconnaissance level."

drawdown of the John Day Reservoir. Based on an assumption of low fish transportation effectiveness, the biological life-cycle modeling indicated that drawdown of the reservoir would contribute little to the probability of survival and recovery of listed Snake River fish. The number of spawning Snake River fall chinook salmon following equilibrium (when conditions stabilize after drawdown) would likely

increase by a maximum of 6,179 fish. Of these, however, an increase of 5,631 fish would be attributable just to discontinuing transportation of juvenile salmon, rather than to any physical or other changes that would otherwise result from drawdown of the reservoir. No potential benefit to Snake River spring/summer chinook salmon from drawdown would be likely. Alternatively, if the ocean survival rate of transported fish is high (i.e., equal to that of in-river migrants), no benefits are likely to result to either Snake River spring/summer or fall chinook salmon.

The potential effects of drawdown on Upper Columbia River stocks of chinook salmon vary widely. Upper Columbia River spring chinook salmon numbers would likely increase; however, the survival and number of currently healthy and commercially important Upriver Bright fall chinook, produced naturally in the Hanford Reach above McNary Dam, would likely decrease.

At river flows of approximately 100,000 cfs, the John Day Reservoir, below McNary Dam, currently contains roughly 1,113 acres of potential fall chinook spawning habitat (primarily in the upper 10 miles), which could support an estimated 5,500 naturally spawning Upriver Bright fall chinook salmon. Under drawdown to natural river level, an estimated 11,170 acres of potential spawning habitat could eventually develop, which could support as many as 55,000 naturally spawning fall chinook adults. This could provide an approximate 8- to 10-fold increase in naturally spawning potential for fall chinook salmon compared with current levels in the John Day reach. Drawdown to spillway crest level would result in perhaps 50 to 75 percent of the potential benefit achieved under natural river drawdown. Adding flood control to either the spillway crest or natural river alternatives would not change the expected amount of potential spawning habitat.

The analysis presented above indicated that drawdown would likely reduce the number of Upriver Bright fall chinook naturally produced in the Hanford Reach above McNary Dam. However, potential natural production of fall chinook in the restored John Day Reach below McNary Dam would be expanded. The combination of these production changes under drawdown to natural river conditions would result in a net increase in potential total returns of naturally produced Upriver Bright fall chinook salmon to the mouth of the Columbia River by approximately 102,000 fish. If loss of production from the current mitigation hatchery program is also considered, potential total returns to the mouth of the Columbia River would decrease by approximately 66,000 fish. Effects of drawdown to spillway crest on fall chinook production from above and below McNary Dam would result in reduced potential total returns to the mouth of the Columbia River. This is true whether change in natural production alone is considered (about 3,000 fish decrease) or change in both natural and mitigation hatchery production are considered (about 171,000 fish decrease).

Principle factors that influence the in-river survival of juvenile salmonids migrating downstream through the John Day Reservoir include fish passage at the John Day Dam, predation, and "gas bubble disease caused by high dissolved nitrogen in the water.

Drawdown of John Day Reservoir would eliminate impacts to juvenile migrants in the reservoir and might result in lower levels of dissolved nitrogen gas in the water under high flow conditions. Exposure of juvenile migrants to predation may be related to the time that it takes them to pass through a river reach

(i.e., travel time), although such a relationship has not been documented. For the purpose of assessing potential drawdown benefits, survival rates of juvenile in-river migrants were assumed to be related to their travel time.

Species that outmigrate as yearlings or older juveniles (e.g., spring/summer chinook, steelhead, and sockeye salmon) do not rear or spend a significant amount of time in the reservoir. Subyearling (less than 1 year old) fall chinook salmon rear in the reservoir and spend a large period of time there. During average flow conditions for the juvenile outmigration season (approximately 300,000 cfs), drawdown to spillway crest and natural river levels would reduce the travel time of juvenile salmon through the John Day reach by an estimated 1 and 2 days, respectively. Because of their relatively small size, slower migration rate, and relatively late timing of their migration, juvenile fall chinook have the greatest exposure to potential predators, and are therefore most at risk from predators during outmigration. Consequently, faster travel time would likely benefit juvenile fall chinook out-migrants.

The effect of drawdown on fall chinook rearing habitat is uncertain. Drawdown to natural river level would eliminate approximately 1,400 acres of rearing habitat currently used by fall chinook and could substantially affect their productivity. However, based on assessment of potential changes to physical habitat features, the natural river drawdown alternatives may offer approximately the same or slightly more potential rearing habitat for fall chinook.

Under drawdown to natural river level and assuming complete restoration of natural production in the John Day Reach (i.e., without hatchery production), an estimated 280,000 harvestable fall chinook could be produced. This is approximately 77% of the current number of harvestable fish that could be produced under the combination of natural and mitigation hatchery production.

Potential Impacts of John Day Drawdown

- Increase in spawning areas for fall chinook below McNary Dam
- Increase in available wildlife rearing habitat on islands
- Increase in short-term jobs associated with project construction
- Significant short-term reductions of wetland, shallow water and riparian habitats, resulting in direct impacts to wildlife
- Spillway Crest alternatives would significantly reduce power production at John Day Dam
- Natural River alternatives eliminate hydropower production at John Day Dam
- Navigation with existing fleet would not be possible
- Eliminates ability to transport fish by barge
- Long-term regional economic impact would be an annual personal income loss of $80 million
- Alternatives 1 and 3 would eliminate flood control operation at the John Day Reservoir
- Irrigation pumps would require significant modification to operate
- Recreational sites would not provide river access without relocation of the boat ramps and swim beaches
- Treaty fishing access sites would not have river access without boat ramp relocation

Drawdown Effects at the McNary Project

All four alternatives are assumed to have an identical effect on the tailwater and fish passage at the McNary Dam for flows less than 600,000 cfs. Changes required would include re-establishing sill elevations at the fish ladder entrances, modifying the auxiliary water systems, adjusting several weir crests in the lower reaches of the north and south shore fish ladders, modifying juvenile fish return outfalls, and perhaps making some minor modifications to the fenders and fish loading system at the barge facilities. Additionally, all drawdown alternatives would strand the spill deflectors. The deflectors would be removed and relocated. No changes to the hydroturbine operations are anticipated.

Economic Effects

The objective of the John Day drawdown economic analysis was to quantify the costs and benefits associated with operating John Day Dam at spillway crest or natural river levels. Seven primary areas of economic impact were addressed in the Phase I Study.

- Implementation Costs
- Flood Control
- Hydropower
- Navigation
- Water Supply and Irrigation
- Recreation
- Commercial Fishing
- Irrigation

Each impact is addressed from three different perspectives. The Federal or national view considers the net effects to the nation. The regional perspective identifies gains and losses to specific sub-regions in terms of income and employment. The third perspective presents some of the possible social impacts on local communities and individuals. For this Phase 1 Study, the project life for cost purposes was assumed to be 100 years.

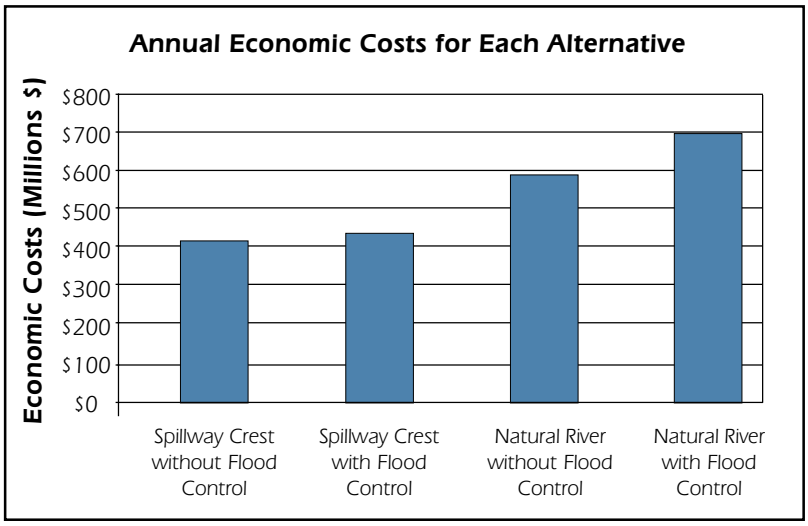
National Economic Development

National Economic Development (NED) costs and benefits are the increase or decrease in the value of the national output of goods and services expressed in dollars. NED figures reflect costs and benefits to the nation and not to a particular region. The total drawdown implementation cost summary table shows the first cost required to implement each alternative.

Total Drawdown Implementation Cost Summary

	First Cost (Million $)			
Feature	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Dam Modifications	$402	$442	$1,364	$2,653
Shoreline Costs	$856	$845	$863	$1,208
Irrigation	$425	$420	$427	$441
Municipal & Industrial Water Supply	$122	$121	$122	$127
Utilities	$20	$20	$19	$20
Recreation	$27	$26	$27	$28
Erosion Seeding/Habitat Restoration	$49	$49	$67	$69
Cultural Costs (including relocation of treaty fishing assess sites)	$138	$138	$190	$195
Total Implementation Costs	**$2,039**	**$2,059**	**$3,079**	**$4,741**
Implementation Costs Annualized	**$135**	**$137**	**$204**	**$315**

*Numbers in this table may not add exactly, due to rounding



The annual economic cost table summarizes the annual costs realized for each alternative.

Annual Economic Impact

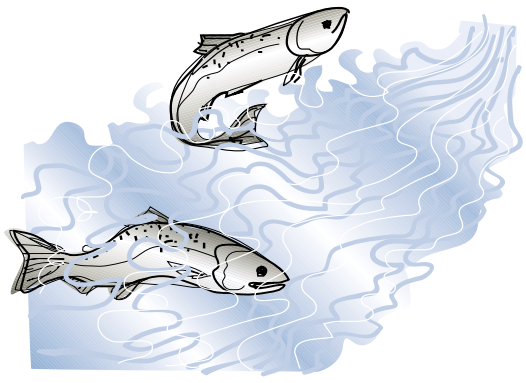
	Annual Cost (Million $)			
Feature	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Drawdown Implementation	$135	$137	$204	$315
Flood Damage	$0.95		$0.95	
Navigation	$95	$95	$95	$95
Hydropower	$144	$144	$265	$265
Recreation	$30	$30	$2.4	$2.4
Commerical Fishing	($2)	($2)	($3.5)	($3.4)
Total Annual Economic Impacts	**$403**	**$403**	**$564**	**$673**

The NED costs are:

- Implementation costs for modification to the dam/spillway, bank protection, road and railroad modifications, cultural resource mitigation, relocation of tribal treaty fishing sites, modification of recreation facilities, erosion seeding and habitat restoration, and modifications to utilities.
- Cost increases associated with replacement of lost hydropower.
- Transportation cost increases associated with the shift of barge transported commodities to more costly truck and rail systems.
- Costs incurred as a result to users presently withdrawing water from John Day Reservoir.
- Recreation impacts as a result in the decline of non-fishing recreational activities, which include motor boating, swimming, water skiing, and windsurfing.
- Decline in recreational fishing for the spillway crest alternatives.

NED benefits are:

- Increased recreational fishing opportunities for the natural river alternatives.
- Increased natural river recreation opportunities for natural river alternatives.
- Commercial fishing benefits from increased fish runs.



Regional Economic Development

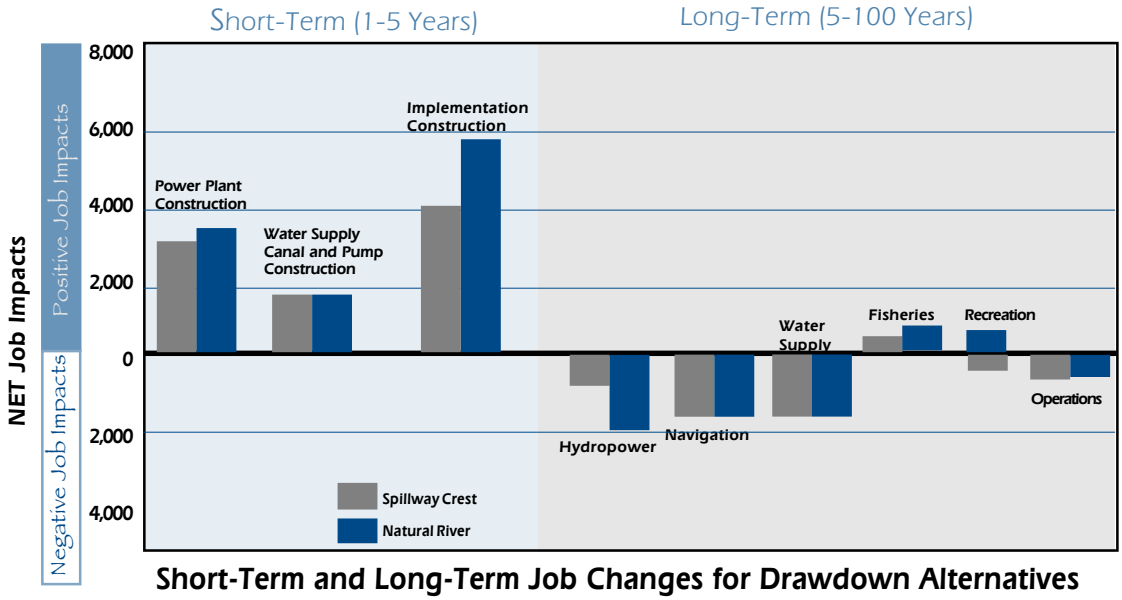
Regional Economic Development (RED) measures regional economic impacts and benefits in terms of jobs and income. Direct changes in one sector of the region effect other sectors. Employment and income effects occur over a broad range of economic sectors. Job totals include both full- and part-time employment.

The table to the right presents the annual change in personal income for both the short-term and the long-term under the natural river alternatives. In the short term, it is expected that implementation actions will bring a small boost to local economies. In the long term, however, the impact is an annual loss of $80 million in personal income, including benefits associated with commercial fishing that would likely not be fully realized until thirty years after drawdown.

Impacts to Regional Annual Income for the Natural River Alternative (Millions $)

Feature	Short-Term (1 to 5 years)	Long-Term
Power	-88.7	-41.3
Transportation	-43.8	-43.8
Irrigation	21.4	-31
M&I Water	5.9	-2.8
Commercial Fishing		26.5
Recreation		12.25
Implementation	125.4	0
Total	**20.2**	**-80.15**

The same is seen for impacts to regional jobs. For the short-term, construction increases job numbers by up to 10,000 jobs. However, in the long-term a net total of jobs would be lost.



Short-Term and Long-Term Job Changes for Drawdown Alternatives

Social Impacts

For each of the categories of impact (navigation, hydropower, irrigation, etc.), there is also a potential social impact. For example, there is a potential that the combined effects of increased transportation costs, irrigation costs, and power costs could have a widespread effect on agriculture in the region. The transition would be difficult potentially pushing some farmers into insolvency. This would be particularly troublesome to farmers and their communities if the changes occurred at a time of low agricultural commodity prices.

The social effects analysis describes the impacts to the quality of life, fiscal impacts to local governments, changes to population distributions, and changes in employment and income distributions. The social effects analysis is qualitative in nature, describing some of the human impacts associated with the NED and RED impacts.

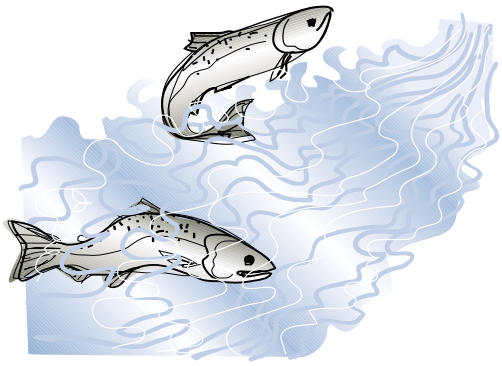
Public Involvement

The public involvement process for the Phase I Study provided involvement opportunities for the general public, tribes, congressional offices, special interest groups/organizations, state and federal agencies, counties, cities, ports, the System Configuration Team, and the Northwest Power Planning Council.

During the Phase I study period two rounds of public meetings were held. The first, in February through April 1999, were held to gather factual input from the general public, media, interest groups, tribes and congressional representatives. The second round was held in February and March 2000, as part of the Lower Snake River Study/ EIS and the Federal "All-H" Process (renamed: Salmon Recovery Strategy). Two meetings specifically presenting the John Day study findings were held in Umatilla, Oregon and Goldendale, Washington.

Comments on the draft report were received orally at public meetings, and in written form, both via the postal service and by electronic mail. In general, the majority of comments were in support of eliminating further study of John Day Drawdown. There were some requests, however, for further study. Oral comment transcripts, written comments and an overall comment summary are included as part of the Public Involvement/Agency Coordination Appendix in the final report. All comments submitted were considered as the final report was prepared. In some cases, changes were made in the final report to reflect new or additional information provided by the public, interest groups and government agencies.

For More Information: The final report and appendices can be found on the Portland District Home Page at http://www.nwp.usace.army.mil



Recommendations

After assessing the potential biological benefits and economic costs, the recommendation is that no further study is required for Congress and the Region to decide on drawdown of the John Day Reservoir, or removal of the John Day Dam.

The Phase I Study indicated that drawdown of the John Day Reservoir contributes little to the probability of survival and recovery of listed Snake River salmon stocks.

Effects on Upper Columbia stocks vary widely. Survival and numbers of endangered Upper Columbia spring chinook would likely increase. The population level of the healthy and commercially important upriver bright fall chinook stock, produced naturally in the Hanford Reach above McNary Dam, would likely decrease.

Significant short-term loss of riparian, wetland, and shallow water habitats would result in direct and immediate negative impacts to wildlife, particularly at the Umatilla National Wildlife refuge and other wildlife management areas.

The up-front costs to achieve drawdown range from $2.0 billion to $4.7 billion depending on the alternative. The total annual costs range from $403 million to $673 million, averaged over a period of 100 years.

The effects of all four alternatives on fish were evaluated in this study, and the maximum potential fisheries benefits were considered in formulating a recommendation. The maximum benefits to threatened and endangered Snake River and Upper Columbia chinook salmon species are derived from drawdown to natural river without flood control. Refined benefit estimates that would be developed during a Phase II study are likely to be substantially less than those reported, further supporting the recommendation not to proceed with Phase II. While the magnitude of all major impacts has been identified in the Phase I study, additional studies also could refine the economic impacts associated with drawdown. The cost, or economic impact, however, would likely increase from what is presented in this report, therefore further supporting the recommendation not to continue with John Day Drawdown studies.