REVENUE STREAM

An Economic Analysis of the Costs and Benefits of Removing the Four Dams on the Lower Snake River

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Executive Summary

Revenue Stream demonstrates that removing[1] the four lower Snake River dams in Washington state as the centerpiece of a Columbia River salmon protection plan will return significant economic dividends to the Northwest and the nation, creating a "revenue stream" of both cost savings and economic benefits from new and restored industries. Removing these four dams — four out of more than 220 major dams in the Columbia River Basin — will likely save American taxpayers and Northwest electricity ratepayers a minimum of about $12 million to $2 billion over 10 years, and $2 billion to $5 billion over 20 years, and restore Snake River salmon in the process. Beyond the billions saved, removing the four lower Snake River dams will ultimately produce as much as a five-fold increase — between almost $4 billion to $7 billion over 10 years — in new annual revenue generated from tourism, recovered fish runs and outdoor recreation.

Between 1961 and 1975, the U.S. Army Corps of Engineers constructed four federal dams on the lower Snake River. The dams — Lower Granite, Little Goose, Lower Monumental, and Ice Harbor — were built primarily to facilitate barge travel 140 miles upriver to what became the inland port of Lewiston, Idaho. They also generate a small percentage of the Northwest's electricity. While these four dams provide some benefits, they cost taxpayers and Northwest electricity ratepayers hundreds of millions of dollars each year and are jeopardizing the survival of wild Columbia and Snake River salmon and steelhead. Federal agencies have identified the federal dams as the major cause of decline in these salmon populations and have discussed whether it is necessary to remove the four lower Snake River dams in order to meet federal laws and treaties. This report explores the economic costs and benefits associated with these dams, and considers the economic case for removing them.

Previous analyses have identified some of the costs and benefits of these four dams. *Revenue Stream* builds on these earlier reports and adds new information to demonstrate that restoring wild salmon in the Snake River Basin by removing four dams can result in significant benefits to taxpayers while creating new economic activity for the Northwest. This report answers the following questions:

- What are the costs of restoring salmon with and without the dams?
- What are the economic benefits with and without the dams?

This report examines both options — with the lower Snake River dams or without them — to determine which is the most efficient choice economically, costing the least while returning the most economic benefits. The results are clear; *Revenue Stream* concludes that retaining the four lower Snake River dams would cost taxpayers billions of dollars in the future in

Dam removal will save American taxpayers and Northwest ratepayers between $2 billion and $5 billion over 20 years, and will also generate at least $9 billion in new revenue.

addition to the billions already wasted during decades of failed attempts to recover Columbia and Snake River salmon. *Revenue Stream* also shows that the energy, irrigation, and transportation benefits currently provided by the four lower Snake River dams can be replaced efficiently and cost-effectively.

From a business perspective, the financial costs of keeping and maintaining these dams far outweigh their benefits. It will be cheaper for taxpayers to remove these dams than to continue their annual subsidies, and dam removal is a cost-effective way to restore wild salmon to the Snake River. When the additional benefits from expanded commercial and recreational fishing, boating, tourism, and other recreational industries are factored into the equation, the balance sheet leans even more heavily toward removing these four dams.

Background and Methodology

Revenue Stream compiles the best and most recent information available on the economic impact of removing the four lower Snake River dams. Many previous private and federal studies on the subject, including the 2002 Environmental Impact Statement (EIS)[2] from the U.S. Army Corps of Engineers (Army Corps) on which this report relies heavily, have individually examined specific aspects of removing these dams. However, this is the first report to consider the full costs and benefits in a side-by-side analysis.[3]

This report is not exhaustive, and areas requiring more in-depth or specific economic analysis are highlighted. For example, while economic benefits of a restored recreational salmon and steelhead fishery in Idaho are well documented, similar economic data do not exist for Oregon and Washington. Nor does this report translate the economic benefits and costs of dam removal into the number of jobs gained and lost in specific sectors. While a 2002 study by the RAND Corporation concluded that removing the four lower Snake River dams would create up to 15,000 new long-term jobs in the Northwest,[4] more specific analysis is needed on the employment effects of removing the lower Snake River dams.

This report was researched and compiled by staff of sponsoring organizations and Save Our Wild Salmon.

Comparing Federal Expenses and Savings With and Without the Four Lower Snake River Dams

The costs to taxpayers and Northwest ratepayers were estimated for two scenarios:

1. The Costs of Keeping the Four Lower Snake River Dams.

This scenario examines the costs of attempting to recover Snake River salmon with the lower Snake River dams in place, plus other expenditures that will be required to keep the dams operational and to raise local levees to keep Lewiston, Idaho from flooding. Many of these expenses are currently being paid annually; others — including additional salmon recovery costs, sediment control, and dam repairs — are necessary future costs in addition to existing spending. The total costs of keeping the dams in place range from $7.8 billion to $9.1 billion over a 10-year period and from $15.7 billion to $18.2 billion over a 20-year period.

2. The Costs of Removing the Four Lower Snake River Dams.

This scenario examines the costs of physically removing the four lower Snake River dams, costs associated with replacing the benefits that the dams currently provide, and costs required for salmon restoration still needed after dam removal. The total costs of removing the dams and replacing the benefits that the dams currently provide range from $6.2 billion to $9.1 billion over a 10-year period and from $11.1 billion to $16.6 billion over a 20-year period.

The Costs of Keeping the Four Lower Snake River Dams

COST:
$600 million per year

2004 Federal Columbia and Snake River Salmon Plan

The National Oceanic and Atmospheric Administration (NOAA Fisheries) estimates the cost of the 2004 federal Columbia and Snake River salmon plan to be approximately $6 billion over its 10-year life, or about $600 million per year.[5] Despite its hefty price tag, the 2004 plan allows salmon to decline below today's already depressed numbers. In May 2005, a federal court ruled this plan — also known as a "biological opinion" or "BiOp" — illegal. As a result, this cost likely represents a conservative estimate of the cost of a legally valid plan that leaves the four lower Snake River dams in place, assuming such a plan could be developed.

COST:
$142-234 million per year

Additional Salmon Recovery Costs with Snake River Dams

Federal law requires the federal government not only to prevent extinction as described in the previous section, but also to take steps to recover salmon and steelhead to a point where they no longer need federal protections. In an attempt to meet its salmon recovery obligations, the federal government has undertaken a "recovery planning" process that, when complete, will outline recovery criteria and actions over and above those required by the $6 billion federal salmon plan.[6] The Yakama Indian Nation recently estimated that these additional recovery costs could total between $1.42 billion and $2.34 billion over 10 years, or about $142 million to $234 million per year.[7]

COST:
$33.7 million per year

Dam Operation and Maintenance

Continuing to maintain and operate the four lower Snake River dams requires significant annual federal expenditures. According to the Army Corps, taxpayers and Northwest electric ratepayers pay about $33.7 million annually to operate and maintain the dams.[8] This includes payments to keep the dams' navigation locks and power generation facilities in working order. These costs will continue throughout the lives of the dams, and include no salmon-related costs.

Sediment Control with Snake River Dams

COST:

Option 1 - $2.7-35.6 million per year

Option 2 - $93.4 million one-time cost

Lower Granite Dam, the farthest upstream of the four lower Snake River dams, traps roughly 3.2 million cubic yards of sediment annually, which raises its reservoir water level by approximately 3 inches per year.[9] Since the dam was completed in 1975, this sediment build-up has elevated the water level behind a levee in Lewiston, Idaho. As of 2002, the designated 5 feet of levee protection had been reduced to only 2 feet.[10]

The more sediment that collects behind Lower Granite Dam, the more danger this situation poses to the community of Lewiston. The Army Corps now estimates that significant rainfall during spring runoff or other periods of high river flows would put Lewiston at risk of flooding. Simply put, Lower Granite Dam increases Lewiston's flood risk.

The Army Corps has yet to fully explore long-term options and costs for alleviating Lewiston's flood risk. In a 2002 study that was later invalidated by a federal court, the Army Corps considered several options, each of which would increase costs for taxpayers and create additional problems for communities hoping to access the river and for salmon, whose habitat would be further damaged by dredging. One of the lower-cost options the Army Corps considered involved dredging about 2 million cubic yards (substantially less than the amount accumulating) annually for about 20 years, followed by reduced dredging for another 50 years. Depending on how the dredged material is disposed, this could cost between $2.7 million and $35.6 million a year.[11]

Another Army Corps option is to raise the levee at Lewiston by an additional 3 to 12 feet, further isolating the city and its residents from the river. Raising the levee would also require other actions, such as raising bridges that cross the reservoir and modifying roads and railways that line it. This option could cost up to $93.4 million (depending on the new height of the levee),[12] and due to its potential detrimental cultural and social impacts, is not fully supported by the city of Lewiston.

Major Dam Repairs

COST:

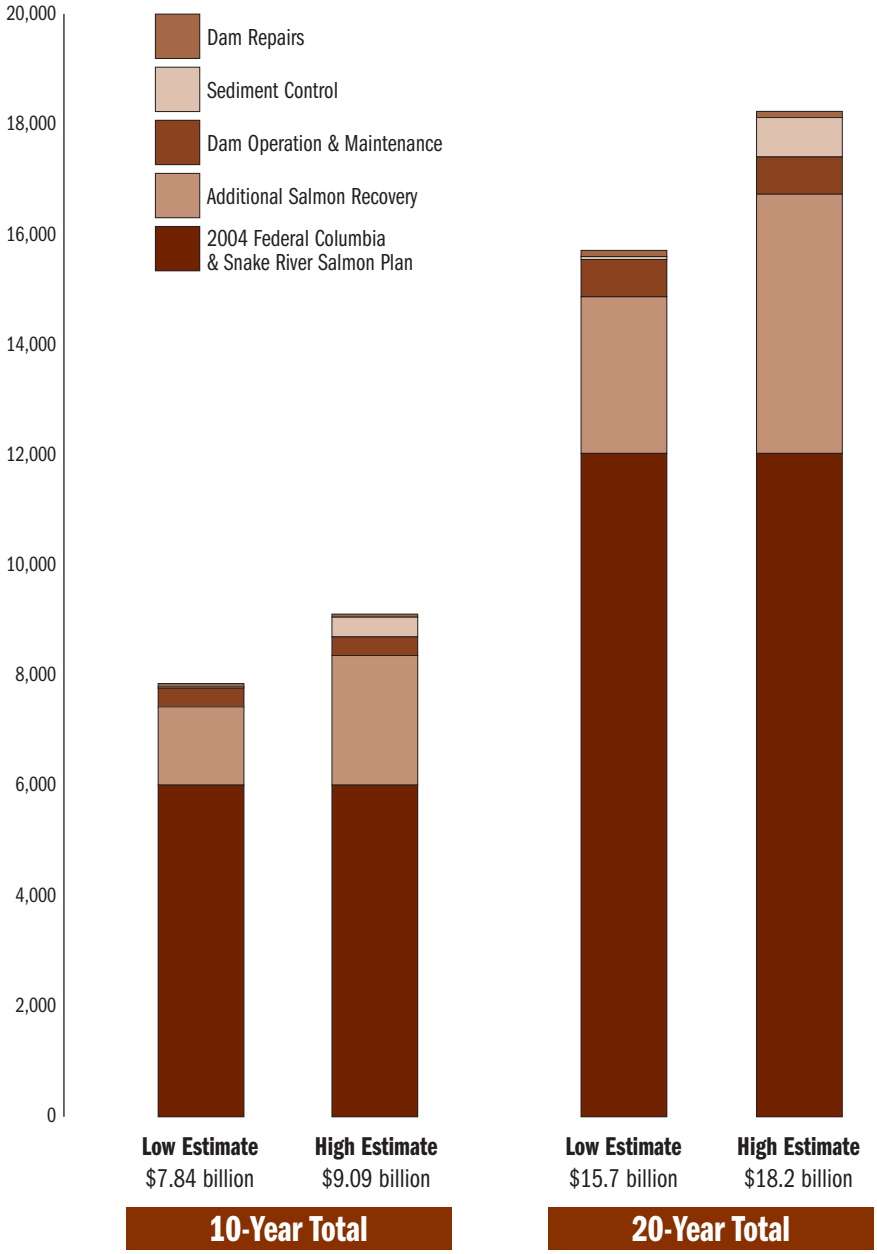
$5.6 million per year for 40 years

The turbines in all four lower Snake River dams were put into operation between 1961 and 1979, and have approximate lifespans of 25-50 years.[13] Therefore, keeping them operational will require significant and immediate work, such as repairing and upgrading the turbines and turbine blades and rewinding the generators. The Army Corps estimates that over 40 years (10 years per dam, one dam at a time) this work will cost roughly $225 million, or $5.6 million per year.[14]

The cost of salmon recovery with the dams in place ranges between about $8-9 billion in the next 10 years to $16-18 billion over the next 20 years.

Summary of Federal Expenses: Keeping the Lower Snake River Dams

($/millions)



The Costs of Removing the Four Lower Snake River Dams

New Federal Columbia and Snake River Salmon Plan

COST:
$313-452 million per year[15]

With dam removal, federal taxpayers and Northwest ratepayers would benefit from substantial savings in salmon recovery costs. According to a study compiled for the Northwest Power and Conservation Council,[16] removing the lower Snake River dams would reduce the cost of Columbia and Snake River Basin salmon restoration by 35 to 55 percent — requiring just $3.1 billion to $4.5 billion over 10 years.[17] Over 20 years, the costs would likely double.[18]

Additional Salmon Recovery Costs after Lower Snake River Dam Removal

COST:
$95.6-116 million per year

Removing the four lower Snake River dams would decrease Columbia River Basin-wide implementation costs for federally required recovery plans by about 45 percent, to between $95.6 million and $116 million per year.[19] Such reductions are possible because most tributary habitat in the Snake River Basin is in good condition, and the benefits from removing the lower Snake River dams would reduce the need for expensive tributary habitat improvements in this part of the Columbia River Basin. Remaining funds could be directed to other areas of the basin, primarily Columbia River tributaries outside the Snake River Basin, in order to maximize the positive benefit of habitat restoration investments.

Dam Removal and River Restoration

COST:
$790.5 million
one-time cost

The Army Corps estimates the one-time cost of removing the earthen portions of the four lower Snake River dams at approximately $790.5 million.[20] The Army Corps analyzed removing only the earthen portion of each dam.[21]

In addition to the physical removal of each earthen portion, the Army Corps' cost estimate includes: channelization to control the undammed river's course as reservoir levels are lowered; revegetation of the newly exposed land; and protecting highway and railroad bridges that cross the reservoirs as well as the adjoining roads and railroad tracks, among other actions.[22]

Replacing the Benefits of the Four Lower Snake River Dams

COST:
$79-170 million per year

Power Replacement

Combined, the four lower Snake River dams generate about 1,200 average megawatts (aMW) annually, representing less than 5 percent of the entire Pacific Northwest's average energy consumption.[23] However, because these are "run-of-the-river" dams with almost no ability to store water in order to generate electricity when power is most in demand, the power they generate is of low value to the Northwest. In the winter and late summer, when energy demand is higher and surplus power most valuable, river flows are at their lowest and the combined output of the four dams meets only about 2 percent of Northwest energy demand.[24]

The Northwest's highly variable precipitation pattern limits the dependability of these dams. Bonneville Power Administration (BPA), which markets the hydropower from these dams, puts their annual total firm power — the amount that can be counted on in a drought — at only 790 aMW. In December, for example, when the region needs it most, the four dams together produce only 423 aMW of firm power. Consequently, the dams are relatively unreliable for serving electricity loads. That unreliability means that the region must keep expensive, gas-fired combustion turbines on hand — but underutilized — for times when power from the dams is unavailable. This drives up the costs of these four dams.[25]

In 2002, the RAND Corporation studied the economic impact of removing the lower Snake River dams and replacing their power with clean energy (energy efficiency and wind power). The results showed that doing so would not impede economic growth, and could create as many as 15,000 long-term jobs.[26]

A NW Energy Coalition analysis estimates that replacing the power from the dams with a mix of energy efficiency and wind power would increase electrical utility costs $79 million to $170 million per year for the next 20 years.[27] Actual increases in monthly energy bills would be modest — about 65 cents per month for residential customers if spread among the millions of Pacific Northwest ratepayers, or about $2 per month if paid only by BPA's firm customers.[28]

Transportation Infrastructure Investments: Converting from Barge to Rail

COST:
$17.7-230.6 million one-time cost

Prior to the completion of the lower Snake River dams in 1975, grain and other products in the region were transported to market chiefly by rail and truck. Today, a significant portion of these products move via barge from Lewiston, Idaho, or grain-loading facilities elsewhere on the lower Snake River. Recent studies have found that the 140-mile navigation channel created by the lower Snake River dams could be affordably and effectively replaced by upgrading the Northwest's railroad lines. Upgrading railroads in southeastern Washington and Idaho to accommodate most of the grain currently moving down the lower Snake River (some would still be barged from Columbia River ports near Pasco, Washington) would cost between $17.7 million and $230.6 million.[29] The large range in this estimate reflects varying assumptions about the ability of existing rail-served grain elevators to handle higher volumes of grain after the lower Snake dams are removed.

Increased Shipping Rates

COST:
$0-13.1 million per year

Burlington Northern Santa Fe (BNSF) Railway predicts that rail shipping rates will be "fully competitive" with existing barge rates after the lower Snake River dams are removed.[30] Other observers predict a modest increase in shipping rates. A Northwest transportation consulting firm estimates that annual shipping costs for all goods and commodities currently shipped down the lower Snake River will increase $7.1 million to $13.1 million per year after lower Snake River dam removal.[31] This translates into an increase of about 3 to 7 cents per bushel of grain, which comprises more than 85 percent of all Snake River barge shipments.

Irrigation Investments

COST:
$421 million one-time cost

Ice Harbor Dam is the only one of the four lower Snake River dams that provides irrigation for farms. According to the Army Corps, a one-time investment of about $421 million would allow the 13 affected farms, irrigating a total of 37,000 acres, to continue irrigating with Snake River water after the lower Snake dams are removed.[32]

The Army Corps' estimate is based on consolidating all Ice Harbor irrigation-pumping stations into one primary station and distribution system. The $421 million includes the one-time cost of constructing the pumping station and distribution system as well as its annual operation and management costs for the following 10 years. To date, no independent study has been performed to determine if more cost-effective irrigation modification options exist.

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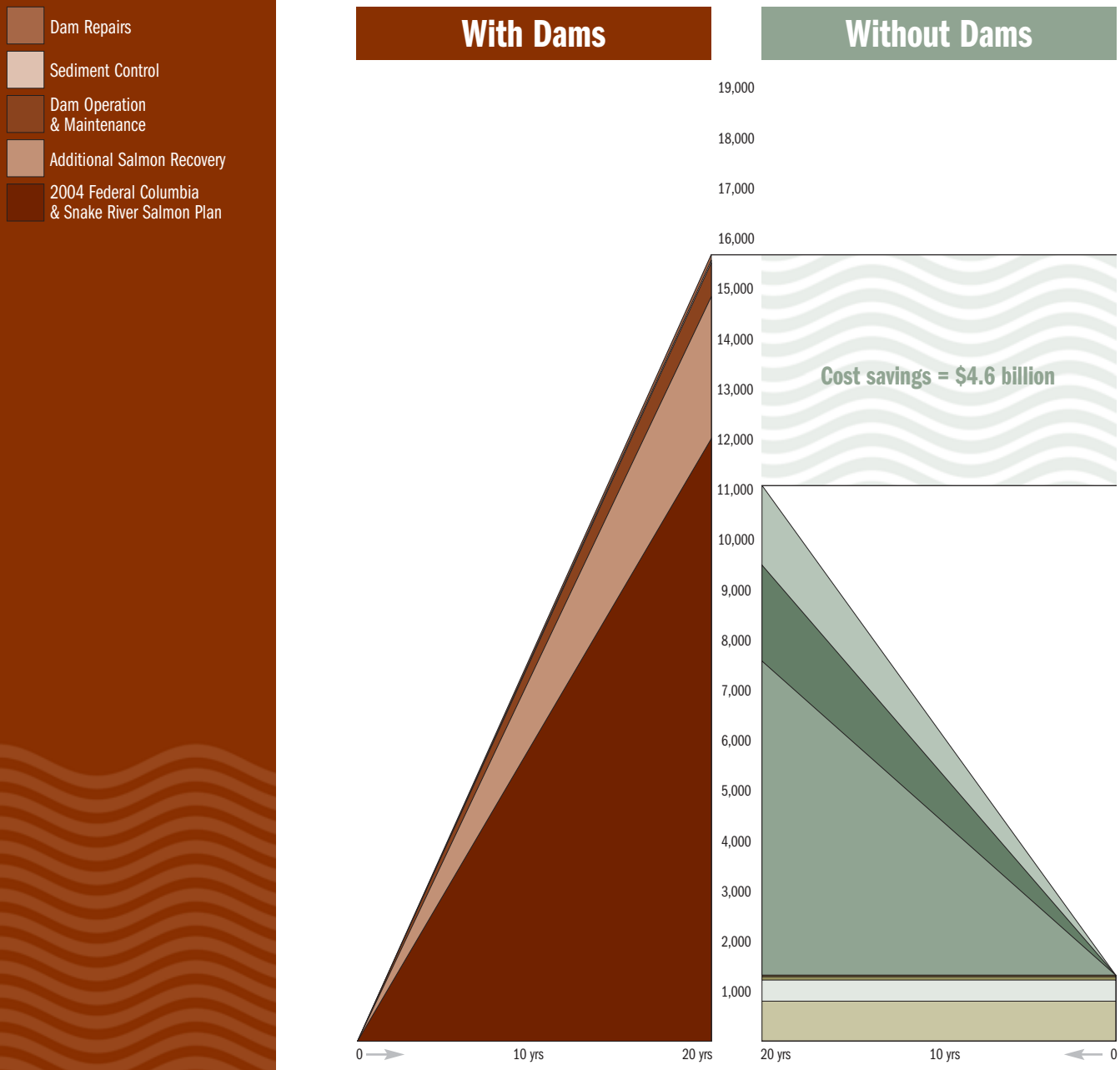
Summary of Federal Expenses:

($ mil

Low Estimate

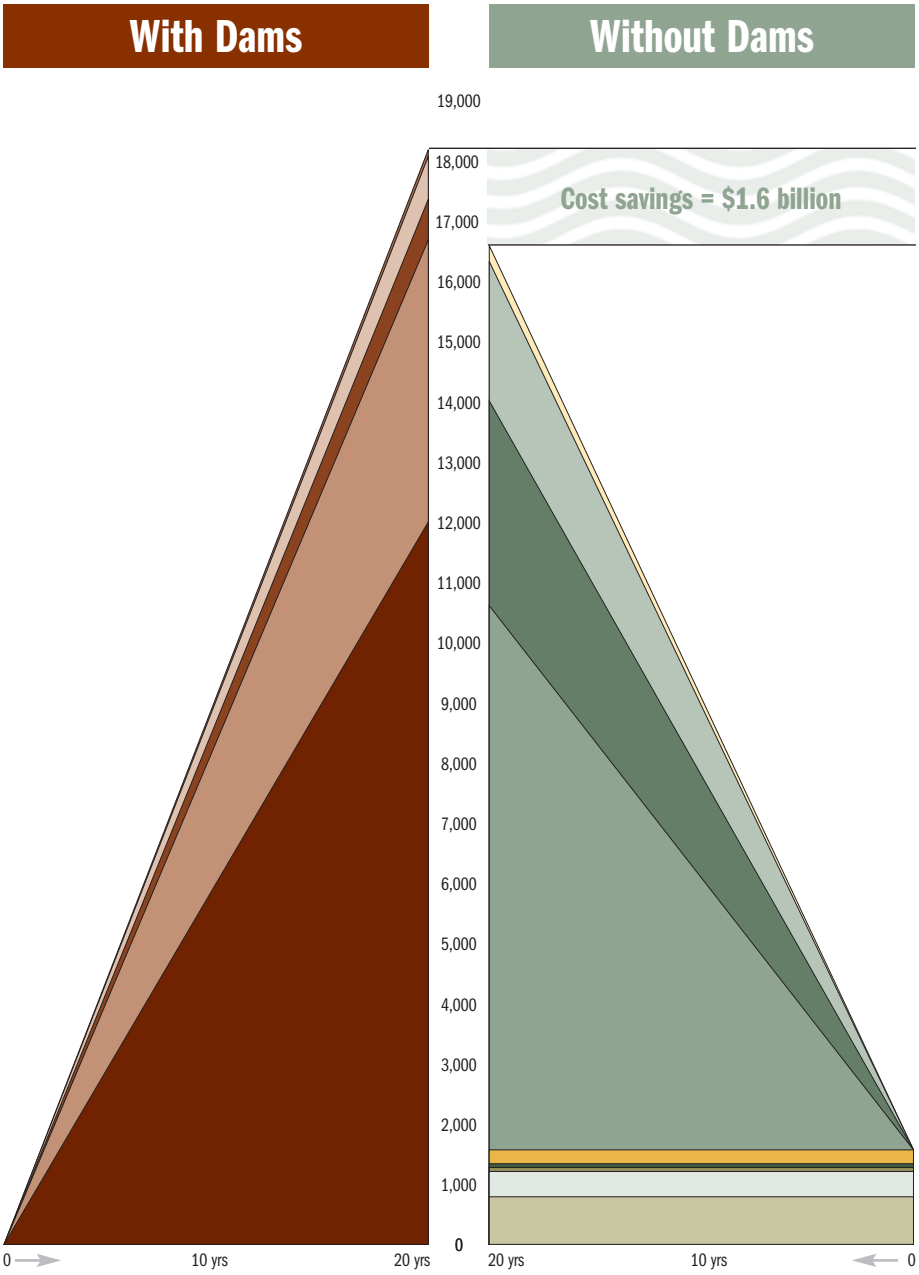


Federal Savings (10 years) = $1.65 billion
Federal Savings (20 years) = $4.61 billion

With Dams vs. Without Dams

lions)

High Estimate



Federal Savings (10 years) = $11.9 million

Federal Savings (20 years) = $1.59 billion

- Municipal & Industrial Wells
- Private Wells
- Irrigation
- Shipping Rates
- Transportation Infrastructure
- Power Replacement
- Dam Removal & River Restoration
- Additional Salmon Recovery
- New Federal Columbia & Snake River Salmon Plan

COST:
$65.5 million one-time cost

Private Well Modifications

Removing the four lower Snake River dams would lower the water table near the river and could require modifying privately owned wells located within one mile of the lower Snake River. The modifications, which would involve deepening 71 wells and improving water-pumping systems, would require a one-time expenditure estimated at $65.5 million.[33]

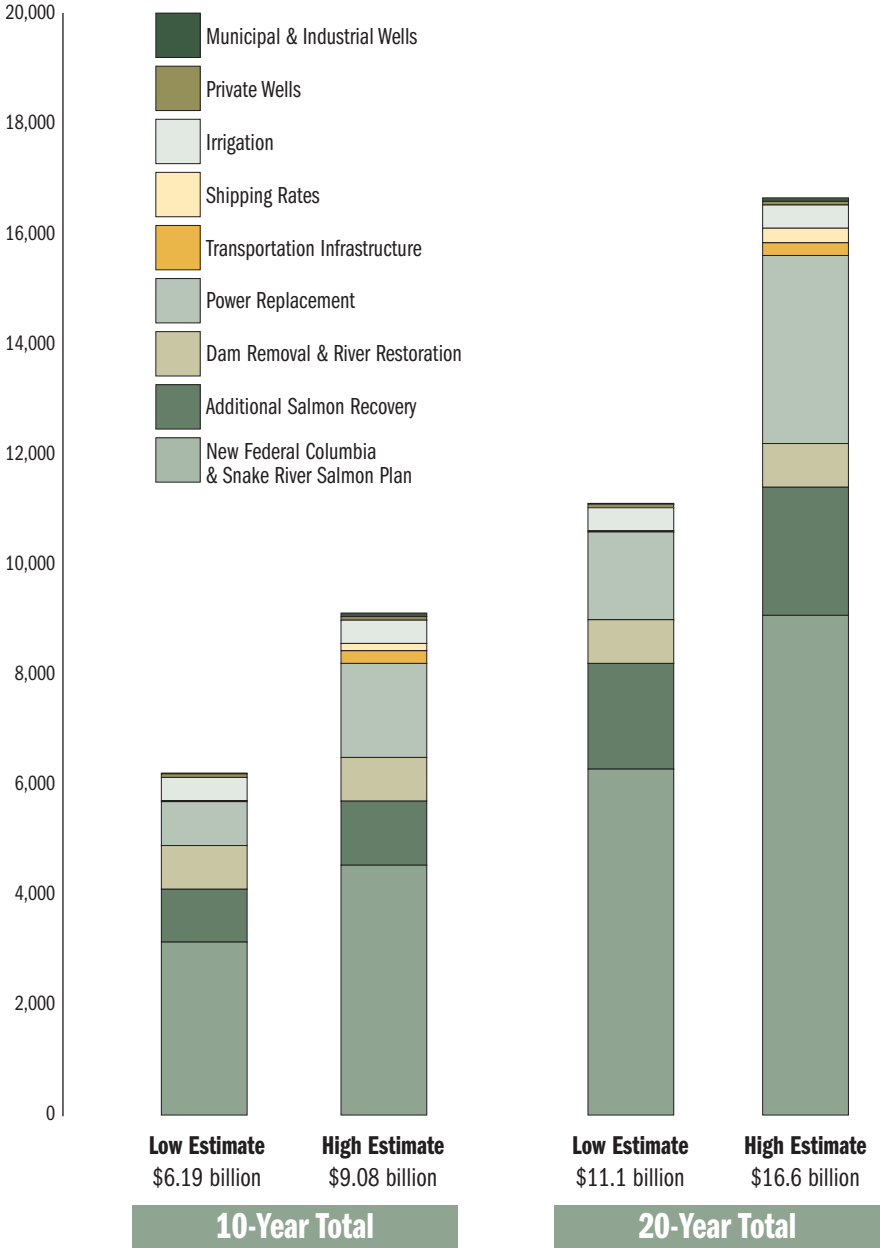
COST:
$13.3-63.9 million one-time cost

Municipal and Industrial Water Use Modifications

Removing the lower Snake River dams would require modifications to some municipal and industrial pumps. The Army Corps estimates the one-time cost of these modifications, which would be necessary at only one of the four lower Snake River reservoirs, at $13.3 million to $63.9 million.[34] Well over 90 percent of these costs (or all but $700,000) would go toward modifying the water-cooling system at a Potlatch Corporation pulp mill in Lewiston, Idaho, to ensure its compliance with the Clean Water Act. Depending on the cooling system built at the mill, the estimated cost would be either $12.5 million or $63.2 million. The remaining municipal and industrial pump changes would go toward two Public Utility District pumps used by two local golf courses and a concrete aggregate washing company.

Summary of Federal Expenses: Removing the Lower Snake River Dams and Investing in Communities

($/millions over 10 years)



The cost of salmon recovery without the four dams ranges from $6-9 billion over the next 10 years to $11-17 billion over the next 20 years.

Summary: Comparing the Scenarios

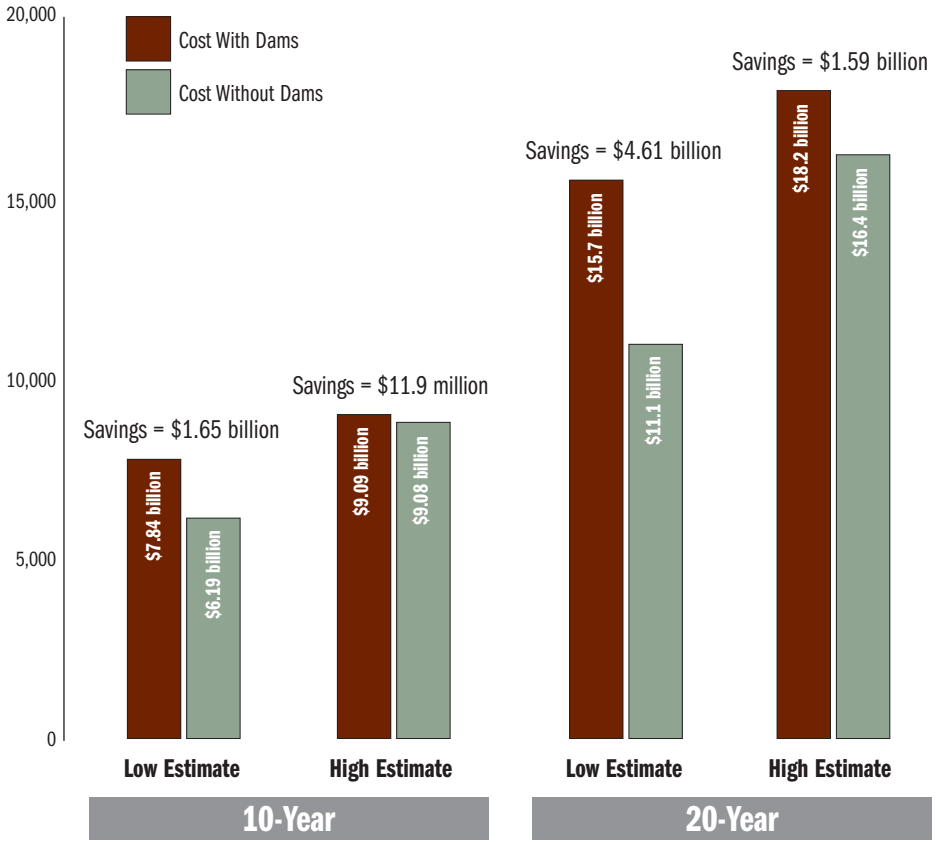
Taxpayers and Northwest electricity ratepayers could save almost $5 billion, and restore Columbia and Snake River salmon in the process, by removing the four lower Snake River dams and completing the other tasks necessary for overall recovery. This includes the cost of replacing the current benefits of those dams; it does not include the costs or benefits associated with job gains and losses.

The status quo has already cost taxpayers more than $7 billion, and has produced few tangible results. The chart below shows future federal savings from removal of the four lower Snake River dams. In summary, taxpayers could save approximately $2 billion to $5 billion over a 20-year period.

Dam removal could save Northwest ratepayers and American taxpayers almost $5 billion.

Comparing the Costs of Salmon Recovery with Dams and without Dams

($/millions)



Regional Economic Benefits of Lower Snake River Dam Removal

Lower Snake River dam removal will bring considerable savings to American taxpayers and Northwest ratepayers. It will also provide significant local and regional economic benefits. Removing these four dams will create a "revenue stream" of expanded sport and commercial salmon industries, restore 140 miles of river for recreation activities, and unlock the major earnings potential of the Snake River Basin.

Non-fishing Recreation

With lower Snake River dams: $36.6 million per year

Without lower Snake River dams: $223-$360 million per year

Net benefit with removal: $186.4-$323.4 million

Removing the four lower Snake River dams will draw hikers, birders, boaters, campers, and other visitors from across the nation and around the world. Interest in the restored river will generate diverse recreation-based economic activity, especially in inland Northwest communities from Lewiston, Idaho, to Pasco, Washington, and many spots in between. An economic study commissioned by the Army Corps concluded that removing the lower Snake River dams would generate between $223 million and $360 million per year in non-fishing recreation.[35] That is nearly ten times the $36.6 million per year in economic activity now generated by reservoir-based recreation on the lower Snake River.[36]

Fishing: Recreational and Commercial

Removal of the four lower Snake River dams and subsequent recovery of Snake River salmon and steelhead populations will increase fishing opportunities throughout the Columbia and Snake River Basin and in five states: California, Oregon, Washington, Idaho, and Alaska. Recreational and commercial salmon fishing opportunities in the Columbia and Snake rivers and Pacific Ocean currently are limited in order to protect imperiled populations, such as those returning to the Snake River. The restoration of wild Snake River salmon and steelhead will open new fishing opportunities not only for currently protected species, but also for healthy salmon populations.

However, given available information, accurately predicting the economic value of fishing-related benefits is a difficult task. A more comprehensive and consistent economic analysis is necessary to confidently assess dam removal's full economic benefit for recreational and commercial fisheries. The following are estimates based on the best available information to identify the economic activity from expanded commercial and recreational fishing after removing the four lower Snake River dams.

With lower Snake River dams:
$86-562 million per year

Without lower Snake River dams:
$556 million per year

Net benefit with removal:
At least $470 million per year

Sportfishing

Recreational fishing for salmon and steelhead in the Columbia and Snake River Basin currently supports a vital economy in the Northwest. Recreational fishing involves spending on boats and related fishing gear (rods, reels, tackle, etc.), as well as travel expenses (food, gas, lodging, etc.) in and around river and coastal communities. This economic output ripples through local communities, helping to foster jobs, economic stability, and growth.

A 2005 economic study finds that fully restored salmon and steelhead fishing in Idaho alone could provide economic activity in excess of $556 million annually statewide.[37] Much of that activity ($300 million) would be realized in small rural communities. This total is an increase of almost 300 percent over the economic activity Idaho experienced from salmon fishing in 2001 and steelhead fishing in 1992-93.[38]

Since it does not account for Oregon and Washington economic activity, the $556 million per year estimate for Idaho can be viewed as a conservative estimate of sportfishing economic activity throughout the Northwest after dam removal. That still represents $470 million more each year than the Northwest states generate with the four lower Snake River dams in place.[39]

With lower Snake River dams:
$55.7 million per year

Without lower Snake River dams:
$127.4 million per year

Net benefit with removal:
At least $71.7 million per year

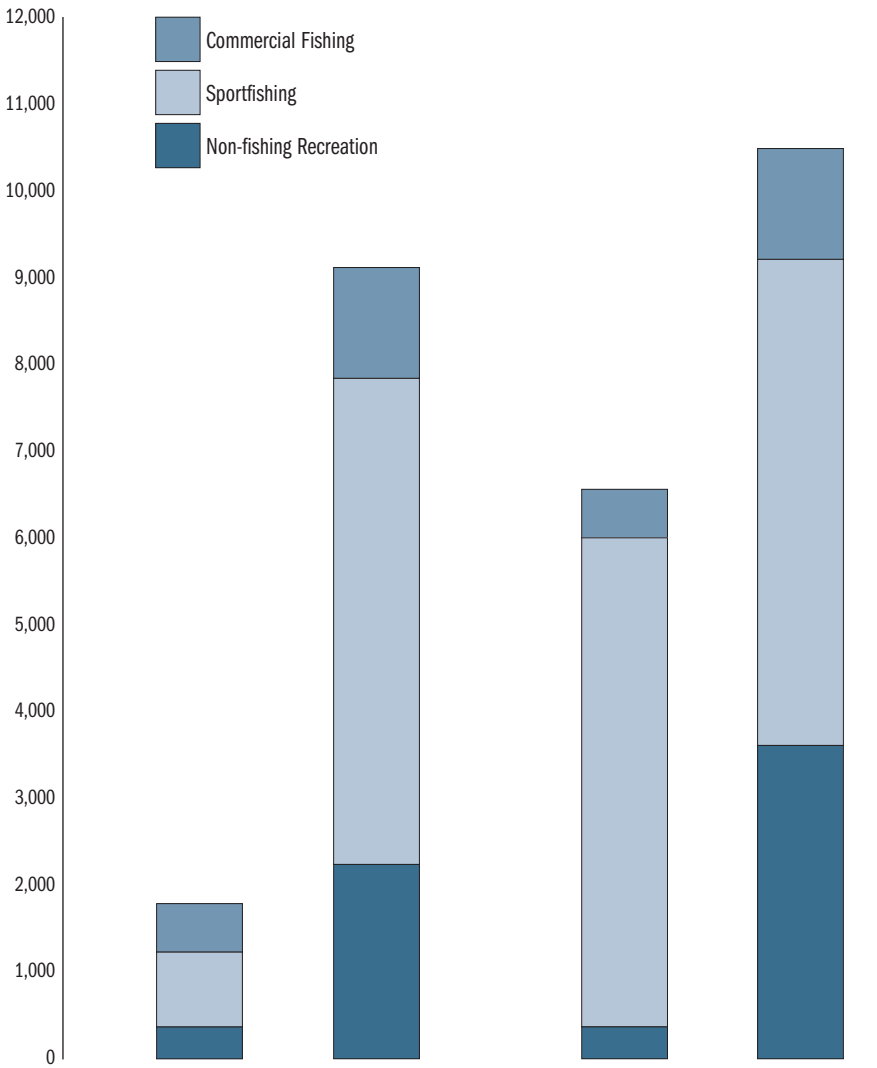
Commercial Fishing[40]

Available data indicate that Snake River salmon restoration will bring considerable economic benefits to commercial fishing communities. A recent study by an economic advisory board to the Northwest Power and Conservation Council finds that with the four lower Snake River dams in place, the average value of commercial fishing for Columbia and Snake River salmon over the past 30 years has been $55.7 million per year.[41] The study includes no estimate of the additional value of restored Columbia and Snake salmon and steelhead runs.

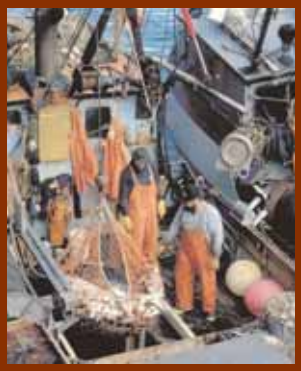
A report by the Institute for Fisheries Resources estimates that recovery of all Columbia River Basin stocks to historic levels could generate $637 million per year for the commercial fishing industry over and above current levels.[42] According to commercial fishing industry experts, at least one-fifth of the increased economic activity — that is, $127.4 million per year — would come from restoring Snake River stocks alone.

Summary of Regional Economic Benefits After Lower Snake River Dam Removal

($/millions)



	Low Estimate with Dams	Low Estimate without Dams	High Estimate with Dams	High Estimate without Dams
10-Year Total	$1.78 billion	$9.09 billion	$6.54 billion	$10.5 billion
20-Year Total	$3.57 billion	$18.2 billion	$13.1 billion	$20.9 billion



Dam removal unlocks the major earnings potential of the Snake River Basin, creating a "revenue stream" of expanded salmon industries equaling at least $9 billion.

Conclusion

Federal laws and treaties require the protection and restoration of wild Columbia and Snake River salmon. Two options — retaining four dams on the lower Snake River in Washington state and removing those same dams — are now under discussion, each with its own costs and benefits. A side-by-side comparison of the options shows that removing the four lower Snake River dams is less costly for taxpayers, and generates greater economic benefits.

Restoring wild salmon with the lower Snake River dams in place would cost taxpayers $7.8 billion to $9.1 billion over 10 years, and generate non-fishing recreation and sport and commercial fishing benefits of $1.8 billion to $6.5 billion over the same time period. Conversely, restoring wild salmon by removing these four dams should be the cheaper of the two options for taxpayers, costing between $6.2 billion and $9.08 billion over 10 years. That is $12 million to $1.7 billion less than the costs of keeping the dams in place. Additionally, removing the dams results in economic activity from non-fishing recreation and sport and commercial fishing equaling as much as almost five times today's benefits (with the dams in place), ranging from $9.1 billion to $10.5 billion over 10 years.

Removing the dams saves both taxpayer and Northwest electricity ratepayer dollars and at the same time provides significant new revenue to the Northwest. Keeping the dams in place is clearly the more expensive option and brings the fewest benefits while falling far short of guaranteeing restoration of Columbia and Snake River Basin salmon. The expenses associated with retaining the four lower Snake River dams could accrue without actually meeting the requirements of federal law. Removing the dams is less expensive and is more certain to meet federal law.

Revenue Stream also identifies areas in which additional independent economic assessments of the true costs and benefits of dam removal are needed. In particular, economic analyses of the potential benefits of a restored fishery in the Columbia River Basin are sorely needed. *Revenue Stream* shows the need for Congress to demand and ensure the completion of these studies. Without independent analyses, it is likely that the nation will continue to waste precious resources – both economic and natural.

Revenue Stream demonstrates that removing the four lower Snake River dams is a serious salmon-recovery option that would both save money and provide economic benefits. Consequently, national and Northwest leaders should closely examine this option rather than continuing to spend taxpayer dollars on less-beneficial measures. Taxpayers and Northwest electricity ratepayers deserve this thorough examination.

Total Federal Savings Over Ten Years

	Low Case	High Case
Total Costs WITH Four Lower Snake River Dams	$7,835,867,382	$9,093,026,064
Total Costs WITHOUT Four Lower Snake River Dams	$6,185,846,545	$9,081,145,776
FEDERAL SAVINGS WITHOUT DAMS	**$1,650,020,837**	**$11,880,288**

Total Regional Economic Benefits Over Ten Years, Without Lower Snake River Dams

	Low Case	High Case
Non-fishing Recreation	$2,232,908,459	$3,600,231,750
Sportfishing	$5,585,215,606	$5,585,215,606
Commercial Fishing	$1,273,885,350	$1,273,885,350
10-YEAR TOTAL BENEFITS	**$9,092,009,415**	**$10,459,332,706**

Notes

[1] In this report, the "removal" of the four lower Snake River dams refers to the act of removing just the earthen portion of each of these four dams and keeping the rest of the dam in place. This partial removal is what the U.S. Army Corps of Engineers examined in its 2002 Environmental Impact Statement.

[2] U.S. Army Corps of Engineers, Final Lower Snake River Juvenile Salmon Migration Feasibility Report/Environmental Impact Statement (February 2002) [*hereinafter* "EIS"].

[3] The costs and benefits discussed in this section may be realized over different periods of time. Some costs, such as actual dam removal, are one-time costs. Others, such as operation and maintenance of the dams, are ongoing annual costs. To allow comparison, we compare costs at 10 and 20 years, given that the biological opinions, or salmon plans, have been and will likely continue to be 10-year plans. To be more conservative, we assume that those one-time costs will accrue within the first 10 years and in fact are likely to accrue in the first several years. All costs are rough estimates from federal agencies or other studies and have been converted into 2004 dollars. For analytic consistency, this report compares like case to like case, e.g., the high case with dams to the high case without dams, and the low case with dams to the low case without dams.

[4] Pernin, Christopher G., Mark A. Bernstein, et al., *Generating Electric Power in the Pacific Northwest: Implications of Alternative Technologies*. Santa Monica, Calif.: RAND, MR-1604-PCT, 2002.

[5] Cost of 2004 Federal Salmon Plan is a NOAA Fisheries estimate. Of this $600 million, more than half consists of taxpayer dollars appropriated by Congress to various federal agencies (Army Corps of Engineers, Bureau of Reclamation, etc.). The rest is payment by the Bonneville Power Administration using revenue from Pacific Northwest electricity ratepayers.

[6] http://www.salmonrecovery.gov/about%5Fus/esa/recovery/

[7] Yakama Indian Nation, *Can BPA Afford Salmon Recovery?* (August 9, 2006). This estimate reflects the potential cost of fully implementing "subbasin plans" or locally crafted salmon restoration plans. The cost of subbasin planning can serve as a suitable surrogate for additional recovery costs in the absence of more specific estimates.

[8] E-mail communications with Witt Anderson, U.S. Army Corps of Engineers, Northwest District. In FY07, O&M costs for the lower Snake River dams total $48 million, but about $12.8 million of that total is not included in this section because it goes toward fish and wildlife measures, such as operating and maintaining fish passage and fish collection/transportation facilities, which are accounted for in the $600 million budget for the FCRPS biological opinion discussed above.

[9] U.S. Army Corps of Engineers, Dredged Material Management Plan and Environmental Impact Statement: McNary Reservoir and Lower Snake River Reservoirs, 1-8 (July 2002).

[10] *Id.*

[11] *Id.* at Appendix B, B-I to B-VI.

[12] *Id.* at 2-23 to 2-26.

[13] EIS at Appendix I, I3-213.

[14] EIS at Appendix E, Annex D, E-D-31.

[15] Not including the costs of removing the dams themselves or replacing their benefits, which are accounted for below.

[16] The Northwest Power and Conservation Council is a regional entity created by Congress partly to ensure that the harm caused to salmon by the federal dams is minimized and mitigated.

[17] CH2M Hill, *Human Effects Analysis of the Multi-Species Framework Alternatives* (for the Northwest Power Planning Council), February 2000. Available upon request. This study estimates that habitat costs required after lower Snake River dam removal outside the Snake River Basin at $145 million - $262.6 million per year over 10 years (see table 1-1). The report also analyzes which hydropower system costs (largely for lower Columbia River dams) would still be needed to help these fish after lower Snake River dam removal ($129.1 million per year over 10 years), not including the cost of removing the lower four Snake River dams and replacing their benefits, which is addressed elsewhere in this report (see table 4-9).

[18] A salmon plan that includes removing these dams is cheaper for taxpayers and ratepayers than a plan that includes the status quo for two main reasons: First, removing the lower Snake River dams would eliminate the need to spend money on the dams themselves. For example, the $600 million per year for the federal salmon plan costs includes about $80 million per year for operating, maintaining, and installing technological "fixes" for salmon passage at the four lower Snake dams. Such spending would be unnecessary were the dams removed. Second, removing the four lower Snake River dams would significantly reduce habitat preservation and restoration expenditures. Substantially improved salmon survival rates would require less costly and more targeted and effective recovery investments. The Snake River Basin upriver from the dams contains about 70 percent of the recovery potential for all Columbia Basin spring/summer chinook salmon and summer steelhead, due to abundant, high quality habitat (including several federally protected areas). The lower Snake River dams prevent salmon from returning to this habitat in the abundant numbers it would otherwise support. Removing the lower Snake River dams would allow future habitat restoration dollars to flow where they are needed most, primarily along the Columbia River and its smaller tributaries.

[19] This assumes a 45% reduction in expenditures from projected recovery costs with the dams in place. Forty-five percent represents the average of what the CH2M Hill study found in terms of reduced federal salmon plan/biological opinion costs after lower Snake River dam removal (*see supra*, note 17, 35-55% reduction). It is also consistent with an American Rivers analysis of habitat recovery potential in the Snake Basin based on data from the National Marine Fisheries Service (available upon request). The simplified assumption that the reduction in recovery costs would be analogous to the reduction in biological opinion costs is likely conservative because any biological opinion that includes dam removal will likely also call for many of the actions necessary to restore the relatively few areas in the Snake River basin with habitat so degraded that it significantly limits salmon and steelhead recovery.

[20] EIS at Appendix I: Economics at I3-208, 209.

[21] Each of the four dams is constructed of both a concrete and an earthen portion. The Army Corps' analysis examined the costs of simply removing the earthen portion of the dam and leaving the concrete portion in place. Other engineers have suggested that the cost of removing the four lower Snake River dams could be significantly less – up to 50% less - than the Corps' estimate if a different removal technique were used. There are no published studies on such an approach, however. Nevertheless, the costs shown here could be 50% greater than actual removal costs.

[22] EIS at Appendix D, Natural River Drawdown Engineering.

[23] *Id.* at Appendix I: Economics at I3-3.

[24] Save Our Wild Salmon, *Myths vs. Facts – Salmon and Energy* (May 2003).

[25] In 2002, the Corps recommended gas-fired combustion turbines (along with some transmission upgrades to accommodate them) as replacement power sources if the dams came out. Natural gas prices have more than doubled since then, making clean, climate-friendly power sources and energy efficiency even more appropriate for replacing the power from the lower Snake dams. A 2002 study by the Tellus Institute shows that the Northwest has more than enough cost-competitive clean energy potential (through energy efficiency, wind power, combined heat and power, and geothermal energy) to meet new energy demand through 2020 *and* replace the power from the lower Snake River dams. Lazarus, Michael et al., *An Assessment of Efficiency and Renewable Potentials Through the Year 2020: A Report to the Northwest Energy Coalition,* Tellus Institute, 2002. Available at: http://www.nwenergy.org/outreach/docs/Tellus_PNW_Oct15.pdf. Regarding the region's energy efficiency potential, the Northwest Power and Conservation Council and the Tellus Institute agree that more than 2,500 aMW of cost-effective efficiency improvements can be achieved by 2025. For the Northwest Power and Conservation Council's conclusions on energy efficiency potential, see www.nwcouncil.org/library/releases/2003/0408.htm.

[26] Pernin, Christopher G., Mark A. Bernstein, et al., *Generating Electric Power in the Pacific Northwest: Implications of Alternative Technologies.* Santa Monica, Calif.: RAND, MR-1604-PCT, 2002. Available at http://www.rand.org/pubs/monograph_reports/2005/MR1604.pdf.

[27] Low Cost: NW Energy Coalition (NWEC) and Natural Resources Defense Council, *Going with the Flow: Replacing Energy from Four Snake River Dams* (April 2000). High Cost: Analysis (by NWEC) based on updated information in "*Going with the Flow.*" NWEC assumed that 82% of this energy would come from conservation (3 cents/kilowatt-hour) and 18% from wind (5.5 cents/kwh). The conservation cost assumption is conservatively higher than estimates from the Northwest Power and Conservation Council.

[28] "Firm customers" refers to public utility customers serviced by BPA.

[29] These figures are based on "Grain Transportation After Snake River Dam Removal," an analysis by American Rivers and Save Our Wild Salmon, available at www.AmericanRivers.org/SnakeRiverEcon. They are based on data from BST Associates' 2003 Lower Snake River Transportation Study, data on planned and funded shortline rail improvements from the Washington State Department of Transportation, and conversations with Dr. Ken Casavant, a transportation economist at Washington State University.

[30] Burlington Northern Santa Fe Railway, "Washington Wheat Analysis" (February 27, 2003). Available upon request.

[31] BST Associates, *Lower Snake River Transportation Study*, Table 2 (June 2003). Available at http://www.AmericanRivers.org/site/DocServer/lsr_transportation_study_final_report.pdf?docID=661.

[32] EIS at Appendix I, I3-126, I3-143. This figure includes $291,481,000 in construction costs and 20 years of operation and maintenance costs at $3,573,000 per year. The total was then converted into 2004 dollars.

[33] *Id.* at I3-145 to I3-146.

[34] *Id.* at I3-143.

[35] Dr. John Loomis, *Quantifying Recreation Use Values From Removing Dams and Restoring Free-Flowing Rivers: A Contingent Behavior Travel Cost Demand Model for the Lower Snake River*, p. 22 (November 2000).

[36] EIS at Appendix I, I3-54

[37] Ben Johnson Associates, Inc., *Potential Economic Impacts of Restored Salmon and Steelhead Fishing in Idaho* (February 2005).

[38] *Id.*

[39] Additional explanation of existing economic impact for Columbia and Snake River Basin salmon and steelhead fishing is available upon request.

[40] The economic figures in this section are shown in terms of personal income because it was the best available estimate. This differs from other regional economic impact sections of this report in that personal income as an output does not include broader direct or indirect economic activity associated with commercial fishing, e.g., money changing hands and its multiplier effect on the local economy. As such it is likely a conservative estimate of the true economic impact of commercial fishing. Since this report is both regional and national in scope, it is appropriate to account for broader economic effects where available.

[41] Independent Economic Advisory Board to the Northwest Power and Conservation Council, *Economic Effects from Columbia Basin Anadromous Salmonid Fish Production* (January 2005).

[42] Institute for Fisheries Resources, *The Cost of Doing Nothing: The Economic Burden of Salmon Declines in the Columbia River Basin.*

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