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BRIEFLY

The Corps of Engineers calculates that breaching the four lower Snake River dams would cost the economy an average of nearly $300 million per year over 100 years.

It Would Be A Dam Expensive Shame

Four Snake River salmon populations are listed as threatened under the Endangered Species Act. Based on this, environmental activists have called for the removal of four dams on the lower Snake River in Washington State.

The governors of Washington, Oregon, Idaho, and Montana have rejected this call, arguing that the benefits of dam removal are too tenuous to justify the costs. Eleven key Federal agencies agree with the governors. These agencies have adopted a unified strategy for attacking the salmon problem throughout the Columbia Basin that promotes actions they believe to be more cost effective than dam removal.

After a decade of very low salmon runs, ocean conditions have turned favorable and Columbia River salmon returns are setting modern records. This resurgence has bolstered the case of those who argue that there are multiple factors at work in the decline of the salmon and that dam removal is not the silver bullet that will save the salmon. A recent court decision, however, has reopened the question as to whether the four dams on the lower Snake River should be removed.

Although a controversial report issued by the RAND Corporation seems to show that the dams could be removed with minimal economic consequences, the U.S. Army Corps of Engineers' more careful study demonstrates that the costs would be substantial.

Among the consequences of dam removal would be a $300 million annual increase in electricity bills, a $40 million dollar annual increase in transportation expenses, and the loss of 37,000 acres of prime irrigated cropland. On balance, the Corps calculates that, over a 100-year timeframe, the costs of removal would exceed the benefits by about $300 million dollars annually.

Endangered Salmon

As of May 2003, 26 distinct populations of Pacific Coast salmon (including steelhead) have been listed as threatened or endangered under the Endangered Species Act. Each of these populations constitutes what the National Marine Fisheries Service (MNFS) terms an Evolutionarily Significant Unit (ESU), "a group of salmon runs that is reproductively isolated . . . and possesses unique characteristics that reflect evolutionary adaptation to particular stream conditions."[1] Twelve of these ESUs are in the Columbia River and its tributaries, including four in the Snake River.

Blame for the decline in salmon is generally assigned to four factors, collectively referred to as "the four Hs": habitat degradation, harvesting, hatchery misuse, and hydropower dams. The relative impor-

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tance of each factor, however, is subject to considerable scientific dispute, and this lack of scientific consensus has stoked the public debate on what can and should be done to save the salmon.[2]

Much public attention has focused on hydropower, and in particular on four dams on the lower Snake River operated by the Corp of Engineers. Environmental activists have demanded that these four dams, Ice Harbor, Lower Monumental, Little Goose, and Lower Granite, be breached to re-create a free flowing river. Many people who live in the Columbia Basin, however, fear that breaching the dams would seriously damage local economies.

Scientists at the National Marine Fisheries Service (NMFS), working on a project called the Cumulative Risk Initiative (CRI), have tried to develop an integrated understanding of the effects of the four Hs on salmon. The NMFS scientists find that relatively small improvements in the survival of salmon in the phase before they migrate down the river or in the phase where they transition from river to ocean would benefit the species more than would near total elimination of mortality during in-river migration. These scientists also find that the actions already taken to mitigate the impact of the lower Snake River dams on salmon have had significant benefits.[3]

In recent years the number of salmon returning to the Columbia River has increased dramatically; improvements in ocean conditions are the reason for this rebound. Decade-scale oscillations in ocean currents and temperatures significantly affect ocean biological productivity and the percent of salmon that survive their stay in the ocean. From 1977 to 1998, ocean conditions were bad for salmon from Washington, Oregon, and California rivers and good for salmon from Alaskan rivers. Beginning in 1999 the pattern reversed. The effects of the ocean cycles are so strong that they masked the positive impacts on salmon of improvements made to the Columbia Basin hydro-system during the 1980s and 1990s.

Basinwide Recovery Strategy

Under the Endangered Species Act, federal agencies must consult with NMFS and the U.S. Fish and Wildlife Service concerning activities that might adversely affect endangered or threatened species. As a result, nine federal agencies active in the Columbia Basin (the Corps of Engineers, the Bonneville Power Administration, the Bureau of Indian Affairs, the Bureau of Land Management, the Bureau of Reclamation, the Environmental Protection Agency, the Fish and Wildlife Service, the Forest Service, and the National Marine Fisheries Service) working together as the "Federal Caucus" have developed a unified salmon recovery strategy.

The Federal Caucus's "Basinwide Recovery Strategy" is a comprehensive strategy that extends across the Columbia Basin. Embracing the conclusions of NMFS's Cumulative Risk Initiative, the strategy looks for improvements in all four Hs and at every stage of the salmon life cycle, giving the highest priority to the most cost-effective actions. It promotes actions that will have quick and relatively certain payoffs:

> *The Caucus agencies also recognize that, even while the region has devoted considerable resources to restoring Columbia Ba-*

> *sin fish, there are limits to those resources. The combination of near-term biological risks and resource limitations led the agencies to focus on actions that give the greatest "bang for the buck" – that have predictable benefits and that will benefit the greatest number of species. Getting the biggest bang for the buck can mean focusing on those life stages where improvements will yield the biggest survival increase, or on those actions that are more certain to result in improvements, regardless of the life stage. . . . Because there are limits to improving survival at any life stage, it is likely that improvements in all life stages will have a greater effect on overall ESU productivity than focusing improvements on just one life stage.*[4]

The strategy eschews breaching the dams, at least until it is shown that the adopted approach is not succeeding. The Federal Caucus finds that the scientific case that removing the dams is necessary for the survival of the salmon has not been made. Moreover, the Caucus believes that the high cost of dam removal would crowd out other more cost-effective actions. Removal would take a considerable length of time to implement and could not take place without congressional approval. Removal would help the four listed salmon species of the Snake River but would do nothing for the other eight listed Columbia Basin species.

The Basinwide Recovery Strategy was endorsed by NMPS in a biological opinion issued in December 2002 regarding the Federal Columbia River Power System. In that opinion NMPS concluded that it was "reasonable and prudent" to preserve the four lower Snake River dams until it was demonstrated that the other actions contemplated were insufficient to preserve the Snake River salmon.

In February 2002, the Corps of Engineers further advanced the Basinwide Recovery Strategy when it concluded a six-year study of lower Snake River salmon and issued the massive *Final Lower Snake River Juvenile Salmon Migration Feasibility Report/Environmental Impact Statement* (Feasibility Report).[5] The Feasibility Report examined four alternatives for the lower Snake River, one of which would have breached the lower Snake River dams. The study rejected breaching in favor of an alternative (described below) that would make major improvements to the dams and the fish transportation system. The Corps formally accepted this recommendation in September 2002.

The whole issue was thrown back up in the air in May of this year, however, by a decision issued by Judge James A. Redden of the U.S. District Court. Ruling in a case brought by the National Wildlife Federation, Judge Redden found NMFS's December 2000 biological opinion to be arbitrary and capricious. He remanded the opinion back to NMPS for a period of one year with instructions to either correct the deficiencies or recommend other strategies (possibly including dam breaching).

Because of the costs that breaching would impose on regional economic vitality, the governors of Idaho, Montana, Oregon, and Washington have strongly endorsed saving dams. Though a recent report by the RAND Corporation downplays the economic effects of removing the dams, the Corps of Engineers's much more thorough study of the issue demonstrates that the costs would be substantial.

The Costs of Dam Removal

The Corps's Feasibility Report documents the costs of dam removal. The Corps examined four alternatives for the lower Snake River:

Alternative 1—Existing Conditions

The Corps would operate the four dams in the current manner, continuing the existing fish passage programs, and implementing already-planned improvements to the dams to aid fish passage.

Alternative 2—Maximum Transport of Juvenile Salmon

The Corps would make most of the already-planned improvements to the dams. The maximum number of juvenile salmon would be collected for transportation downriver by barge or truck, minimizing the number spilled over the dams or passed through their turbines.

Alternative 3—Major System Improvements (Adaptive Migration)

The Corps would balance barge and truck transport of juvenile fish with in-river passage. This alternative would include all of the system improvements identified for Alternative 1 and most identified for Alternative 2. In addition, the Corps would experiment with new technologies including surface bypass collectors, behavioral guidance structures, and removable spillway weirs.

Alternative 4—Dam Breaching

The Corps would remove the earthen embankments of the four lower Snake River dams. The concrete powerhouse, spillway, and navigational lock structures would remain. Breaching would eliminate the reservoirs and lead to a river with near natural flow.

Alternative 3 was recommended by the Feasibility Report and ultimately adopted by the Corps.

The Corps prepared economic analyses of the alternatives on two levels, through two "accounts." The higher-level national economic development account measures the economic costs and benefits of each alternative without regard to where those effects were located geographically. The lower-level regional economic development account measures how the four alternatives would affect the geographic distribution of economic activity.

National Economic Development

Table 1 shows the overall economic effects of Alternatives 2, 3 and 4, relative to Alternative 1, which serves as baseline. The effects are calculated over a 100-year period, from 2005 to 2104, and are expressed as an annual average in 2003 dollars.[6] The economic effects are

Table 1: Summary of Estimated Net Average Annual Economic Effects (millions of 2003 dollars; 6.875 percent discount rate)

	Alternative 2	Alternative 3	Alternative 4
Costs	-	-	-
Implementation	-	(25.12)	(53.57)
Power	-	-	(297.57)
Transportation	-	-	(41.52)
Water Supply	-	-	(16.94)
Avoided Costs	-	(10.98)	-
Total costs	-	(36.10)	(409.61)
Benefits	-	-	-
Avoided Costs	-	-	36.86
Recreation	1.54	1.58	78.24
Commercial Fishing	0.18	0.17	1.63
Implementation	3.80	-	-
Power	9.33	9.33	-
Total benefits	14.85	11.08	116.74
Net Benefits	14.85	(25.02)	(292.87)

Source: U.S. Army Corps of Engineers

grouped as costs and benefits and fall in 7 broad categories: power, transportation, water supply, recreation, commercial fishing, implementation cost, and avoided costs.

Power

The maximum output of the four dams' generating units is 3,486 megawatts. This represents 7 percent of the peaking capacity of the total Pacific Northwest system. The dams, however, are "run-of-the-river facilities." That is, each dam has limited storage capacity, so the flow through its turbines and over its spillway must roughly balance the flow into its reservoir. The annual average output of the dams is 1,246 megawatts. This represents about 5 percent of the total Pacific Northwest system.

Under both Alternative 2 and Alternative 3, less water would be spilled over the dams than under Alternative 1, and therefore more water would be available for power generation. As a result, the value of power generated would increase by an average of $9.33 million per year.

Under Alternative 4, the dams would be breached and their generating capacity would be unusable. The Corps believes that natural gas-fired combined cycle combustion turbines would be the most cost-effective technology to replace the power provided by the four dams. Besides the additional capital and operating expenses to replace the power, the region would incur costs to maintain transmission reliability and to replace certain ancillary services that the dams provide to the power system. The total estimated annual power cost associated with breaching the dams is $298 million.[7]

Transportation

The reservoirs created by the four lower Snake River dams allow commercial barge traffic to extend 141 miles up the Snake River, from the Columbia River to Lewiston Idaho. While Alternative 2 and Alternative 3 would have no effect on transportation, dam breaching would impose significant costs.

Based on counts at the Ice Harbor Dam navigation lock, grain comprises 78 percent of the tonnage moved on the river; logs and wood chips, 16 percent; and petroleum products, 3 percent. Annual tonnage through the lock averaged 3.8 million tons between 1987 and 1996.

Were the dams to be breached, this traffic would need to be diverted to trucks or trains, which are more costly than barges. Also, accommodating the diversion would require infrastructure improvements including upgrades to the area's mainline and short line railroad tracks, additional railcars, highway improvements, and additional grain elevator capacity at the McNary pool on the Columbia River. In total, the costs of transportation are expected to increase by an average $41.5 million per year.

Water Supply

Breaching the four dams also would affect water supply in the adjacent counties.

Approximately 37,000 acres of farmland in Franklin and Benton counties are irrigated with water pumped from the reservoir behind the Ice Harbor Dam. This is about 12 percent of the total irrigated farmland in the two counties. If the Ice Harbor Dam is breached, the existing system of pumps will no longer be functional. The Corps estimates that the costs of reconfiguring the irrigation system to allow continued operation would exceed $300 million dollars, and that this is more than twice the $148 million added to the value of the land by irrigation. Thus, if the dams are breached it would be most cost-effective to simply leave the land unirrigated.

Water is pumped for municipal and industrial uses from the reservoir behind Lower Granite Dam. The estimated cost of reconfiguring these pumping stations if lower Granite Dam is breached ranges from $13 million to $61 million.

There are 180 privately owned functioning wells located within one mile of the Snake River. Breaching the dams would compromise the operation of some of these wells. Necessary modifications to compensate include installing larger pumps and increasing well depth. The estimated cost of these modifications is $62 million.

Combining the effects on agricultural, municipal and industrial withdrawals, and private wells gives an average annual cost of $16.9 million over the 100-year planning horizon.

Implementation Cost

Implementation costs include various capital expenditures for acquisition and construction as well as ongoing maintenance, repair and operation costs. For the case of breaching the dams, the capital costs total $943 million.[8] This translates to an annual average of $61 million over the 100-year planning horizon. In addition, the annual maintenance, repair and operation cost averages $9 million. Subtracting the implementation cost associated with the baseline Alternative 1, the net annual average implementation cost associated with dam breaching is $54 million.

Recreation

The four alternatives provide varying recreational benefits, which balance against some of the costs.

Recreation benefits are valued by the "willingness-to-pay" of users, which is maximum dollar amount that the users would be willing to pay for access to the recreational opportunities, above and beyond the amount they must normally spend to get them.

Based on user surveys, the annual value of the existing recreational opportunities on the reservoirs and of fishing on the Snake River above the reservoirs is $57 million.[9]

More fish would be available to anglers under Alternatives 2 and 3, compared to Alternative 1, with values of $1.5 and $1.6 million respectively.

Breaching the dams would extensively change recreational opportunities. The flat-water activities currently enjoyed on the reservoirs would no longer be possible, but new opportunities for activities such as rafting, kayaking, fishing, and hiking would be available.

Valuing these new opportunities is difficult.

The workgroup that prepared recreational values for the Feasibility Report used a mail survey of 9,000 potential visitors to the Snake River area to help gauge the value of the recreational opportunities that would be created by breaching the dams. The analysis projected that the free flowing river would generate approximately 2.5 million visitor-days of recreational use per year, with an estimated value of $135 million. (Californians account for 43.4 percent of the projected visitors.) The net increase in recreational value accompanying dam breaching would then be $78 million per year.

After the recreational workgroup had substantially completed these estimates, the Northwest Power Planning Council's Independent Economic Analysis Board raised questions about the analysis. As a result, the Corps commissioned an outside evaluation of the results by Charles C. Harris, Jr. of the University of Idaho. Professor Harris identified a number of potential problems with the workgroups methods, which together suggest that the recreational opportunities created by breaching the dams might be quite a bit less than the $135 million estimated by the workgroup.[10]

Commercial Fishing

Alternatives 2, 3 and 4 all provide greater salmon runs than the baseline. As a result commercial salmon harvests will be higher under all three. The net average annual effect for Alternative 2 is $175,000; the effect for Alternative 3 is $173,000, while the effect for Alternative 4 is $1.6 million.

Avoided Costs

An additional benefit to breaching the dams is that certain costs associated with the continued operation of the dams would not be required. These avoided costs include rehabilitation of the turbines and annual maintenance, repair and operation costs. The average annual value of these avoided costs is $36.9 million.

Adding It Up

By the Corps analysis, then, the costs associated with dam breaching total $410 million per year over a 100-year time horizon. These costs are in part offset by benefits that total $117 million per year, giving a net cost of $293 million per year. Two-third of the benefits, however, result from the questionable analysis of the recreational opportunities that breaching the dams would create.

Most of the costs and benefits identified in the national analysis will be borne within the Pacific Northwest. The value of the combined economies of Washington, Oregon, Idaho, and Montana is about $400 billion.[11] Thus, the estimated annual net cost of breaching the dams is on the order of one tenth of a percent of the regional economy.

Regional Economic Development

To determine how breaching would impact the geographic distribution of economic activity, the Corps developed separate input-output models for the four states, a 24-county study area within the Columbia Basin and 3 subregions of the study area. (See Table 2). This allows the analysis to capture effects that are localized in the vicinity of the dams as well as those that are felt broadly across the four-state region.

The Corps stresses the importance of the disaggregation allowed by the local models:

Table 2: Regional Economic Development Study Area by State and County

Downriver Subregion	Reservoir Subregion	Upriver Subregion
Oregon	**Washington**	**Idaho**
Gilliam	Adams	Clearwater
Hood River	Asotin	Custer
Morrow	Columbia	Idaho
Sherman	Garfield	Latah
Umatilla	Walla Walla	Lemhi
Wasco	Whitman	Lewis
		Nez Perce
Washington		Valley
Benton		
Franklin		**Oregon**
Klickitat		Wallowa

It should be noted that combining state and subregional impacts tends to obscure the potential significance of local impacts. The loss of 1,105 jobs in the reservoir subregion, for example, appears less significant when viewed in terms of total employment in Washington or the Pacific Northwest than it does when viewed at a more local level. Further, the loss of these jobs in a relatively localized area has different implications than if it were to occur throughout Washington State.[12]

The Corps's regional analysis distinguishes between the short run, when dam breaching generates considerable construction spending, and the long run, when higher power and transportation cost and the loss of irrigated cropland permanently reduce employment and income.

The Short Run

Dam breaching would generate a number of temporary jobs over a five-year period: constructing power plants, electrical transmission lines, roads, and transportation facilities; upgrading railroad track; modifying wells and pumping facilities; and reconfiguring the dams. Most of these jobs will be in the 24-county study area. In the overall peak year it is expected that breaching-related work would add 14,871 jobs in the 24-county study area.

Employment in the various categories will not all peak in the same year. In the peak year for constructing power plants, there would be 5,572 such jobs in the study area. Transmission line construction would provide 2,080 jobs in its peak year. Transportation facility construction would provide 6,982 peak jobs. Road construction would provide 1,972 peak jobs.

Outside of the study area, the major short-term impact would be felt in the Puget Sound Region, where the Corps projects three power plants will be constructed, providing, at the peak, 2,786 jobs.

The Long Run

Using input-output analysis, the Corps was able to quantify certain long-run effects of breaching the dams, resulting in a permanent loss of jobs and personal income. The long-run analysis of employment is summarized in Tables 3 and 4.

The largest single impact stems from higher electricity prices. Because they must spend more for electricity, households reduce their purchases of other goods and services. The reduction in purchases cascades through the regional economy through the multiplier process, eliminating 2,382 jobs all together in the four states (Table 4).

The reduction in household purchases is partially offset by the maintenance and operation expenditures of the new power plants. These expenditures (directly and via the multiplier) would support 884 jobs in the Snake River Study Area (Table 3) and 876 jobs in the Puget Sound region (Table 4).

Table 3: Long-Run Subregion Employment Impacts under Alternative 4--Dam Breaching

	Upriver	Reservoir	Downriver	Total
Replacement Power	0	0	884	884
Recreation	156	691	0	847
Implementation	6	11	11	28
Total	245	702	895	1,842
Reduction In Irrigated Lands	0	(1,105)	(474)	(1,579)
Reduction in Corps Spending	(283)	(566)	(566)	(1,415)
Loss of Barge Transportation	(221)	(407)	491	(137)
Total Decrease	(587)	(2,078)	(549)	(3,214)
Net	(342)	(1,376)	346	(1,372)

Source: U.S. Army Corps of Engineers

The loss of irrigation to 37,000 acres of cropland eliminates 1,579 jobs in the Snake River study area, while reductions in Corps of Engineers spending eliminates 1,415 jobs. The loss of barge transportation decreases employment by 628 in the reservoir and upriver subregions, but increases employment by 901 elsewhere. It is estimated that there will be 847 additional jobs due to recreation in the study area, and 171 jobs in commercial fishing.

Overall, the analysis shows that breaching the dams will decrease employment by 2,290 jobs and reduce annual personal income by $278 million.[13] The reservoir sub region would experience a net loss of 1,376 jobs, which is more than one-half of the four-state total.

Additional job losses are possible if businesses close or relocate due to increased costs for power or transportation or decreased availability of raw materials. The Corps, however, lacked sufficient information to project the number of businesses or jobs that would be so affected:

> *Increases in costs for electric power and transportation, decreases in the availability of irrigated farm output, and removal of the reservoirs and locks could cause significant cost increases for energy and transport intensive industries or industries requiring reservoirs or inputs from agriculture. In some cases, it is possible that these cost increases could be large enough to cause affected plants or firms to close down or relocate to another region. Substantial proprietary information about each firm or plant, such as the cost and profit structure, would be required to allow prediction of those businesses that would close or relocate. It would also be necessary to forecast market prices for the potentially affected products into the future. These types of information are not publicly available and, therefore, it was not possible to identify those firms or plants that would be likely to close or relocate if dam breaching were to occur.*[14]

The Corps study did identify three manufacturing industries most likely to suffer closings or relocations: primary aluminum, forest products, and food processing. Primary aluminum manufacturing would be hurt by the higher electricity rates that would accompany dam breaching. Wood products producers would be hurt by higher costs to transport logs, wood chips, pulp paper and lumber. Food processors would be hurt by the loss of crops grown on lands irrigated from the lower Snake River.

To summarize, the impact analysis shows a long-run net loss of 2,290 jobs due to breaching the lower Snake River dams. Additional jobs would be lost if higher electricity prices and transportation costs or the reduced availability of inputs from agriculture caused any businesses to close or

Table 4: Annual State Level Employment Effects for Alternative 4--Dam Breaching Excluding those Effects Modeled for the Subregions

	Washington	Oregon	Idaho	Montana	Total
Increased Electricity Bills	(1,136)	(810)	(366)	(70)	(2,382)
O&M Spending on New Power Plants	876	0	0	0	876
Loss of Barge Transportation	224	210	(24)	0	410
Commercial Fishing	*	*	*	*	171
Ocean Recreational Fishing	*	*	*	*	7
Total	(36)	(600)	(390)	(70)	(918)

*Fishing jobs were not allocated among the states.
Source: U.S. Army Corps of Engineers

relocate. The job loss is concentrated in the 24-county study area, particularly in the reservoir subregion.

RAND's Analysis

A recent controversial study by the RAND Corporation examined the effects on the Pacific Northwest economy of different energy generation options. Among the scenarios studied were several that involved breaching the four lower Snake River dams.[15] Under these scenarios, the dams' generating capacity was replaced alternatively by either natural gas-fired combined cycle turbines, investments in energy efficiency, or a combination of wind power and investments in efficiency.

RAND prepared this study in response to an RFP issued by the Northwest Energy Coalition, whose board has endorsed breaching the lower Snake River dams, and with funding from the Pew Memorial Trusts.[16]

The study touts diversification as a factor to consider in choosing how to generate electricity and notes that:

> *Hydroelectricity in the Pacific Northwest has significant capacity uncertainties. The amount of hydroelectric power generated in any one year depends on the amount of rainfall in the region."*[17]

The implication is that replacing the cheap power generated by the lower Snake River dams with more expensive power from other sources could be justified by the reduction in risk.

However, the appeal to diversification is a red herring.

The RAND study's discussions of the benefits of risk reduction are both confused and confusing. The study provides neither a formal analysis of the extent to which ending power generation at these four dams in the Snake River drainage would change the risk profile of the overall power system nor a formal analysis of the value that should be placed on any risk reduction.[18]

Citing the statistic that hydropower represents 66 percent of the Pacific Northwest's firm energy resources, the study overstates the reliance on hydropower. Diversification should be gauged in terms of the whole Pacific Coast, which is becoming a single market. As the Northwest Power Planning Council (NWPPC) has noted,:

> *Because transmission costs are low relative to plant operating costs, loads will increasingly be served by plants having low variable operating costs, wherever these may be located on the western interconnected system. The westwide resource base is roughly four times as large, and much more diverse than that of the Northwest alone.*[19]

(The Northwest Power Planning Council was recently renamed the Northwest Power and Conservation Council.)

Terry Morlan of the NWPPC staff concludes,

> *The RAND study is placed in the context of diversifying the electricity supply of the Pacific Northwest. However, the actual value of diversity is not directly analyzed . . . . It is difficult to see how eliminating a nearly costless resource, even though it depends on uncertain water conditions, could reduce expected system cost through risk diversification.*[20]

The RAND study made use of a modeling package prepared by Regional Economic Modeling, Incorporated (REMI), a consulting firm based in Amherst Massachusetts. The REMI Policy Insight model combines elements of the econometric, input-output, and computable general equilibrium approaches to create a structural model of the economy. As such, the REMI model represents a broader approach than the pure input-output analysis employed by the Corps of Engineers. However, the validity of the results that the model produces depends critically on the ability of the analysts to fit the many effects that dam breaching will have into the model's framework.

The study focuses on two measures of economic performance, gross regional product for the four-state region and aggregate employment.

As implemented for the RAND study, the REMI model treated the states of Montana, Idaho, Washington and Oregon as a single aggregated economy. This sacrifices important detail that the Corps was able to capture by separately modeled various subregions.

Terry Morlan offers a general warning about interpreting the results:

> *One of the dangers of this type of impact analysis is that increasing the cost of providing electricity services can also appear as an increase in regional production and employment.*[21]

(That is to say, a sloppy economic impact analysis can show that it would be a good thing to shoot oneself in the foot, because the resulting purchases of medical services would raise the measured value of regional production.)

For each scenario simulated, the study presents the results in two charts. One chart graphs the percentage deviation in gross regional product from a baseline scenario for the years 2005 through 2019. The second chart graphs the corresponding deviation in the number of regional jobs. (It is frustrating that the report does not present numerical values for the results of the simulations.)

According to RAND's simulations, breaching the dams and replacing their generating capacity with gas-fired combined-cycle plants would give a slight boost to gross regional product in the short run, while construction

activity is stimulated, and no discernable effect in the long run. There is a "modest" increase in net employment. (It appears from the graph that employment is boosted by about 10,000 during the construction phase and by 2,000 in the long run.) This implies, though RAND does not make the point, that labor productivity (that is output per worker) would decrease modestly were the dams to be breached.

It is a bit surprising that RAND's analysis with the REMI model shows a *gain* in employment from breaching the dams when the Corps's input-output analysis shows a *loss*.

Perhaps the explanation is that the RAND study understates the cost of electricity in the event that the dams are breached. A portion of the price paid to the Bonneville Power Administration for electricity goes to repay debt incurred in constructing the hydroelectric dams of the Federal Columbia River Power System. Breaching the dams will not extinguish Bonneville's obligation to repay this debt. The RAND study ignores this cost, biasing upward their estimates of employment and gross regional product.

Perhaps there are other errors. It is unclear from the documentation how RAND's analysts accounted for the many complex consequences of dam breaching, particularly in the areas of agriculture and recreation.

The study also presents scenarios where the lower Snake River dams' generating capacity is replaced with conservation and wind power. When conservation replaces the dams, gross regional product is either up slightly or down slightly depending on the assumptions made regarding the cost of conservation, and employment is modestly increased. When the dams are replaced by a combination of wind and conservation, gross regional product is 0.1 percent to 0.2 percent lower while employment is only slightly affected.

At a meeting of the NWPPC, RAND's Mark Bernstein summarized the study as showing that breaching the dams would only have minimal overall regional impact when viewed against the total regional economy.[22] But as the Corps of Engineers stressed, gauging the effects of dam breaching against the $400 billion four-state economy obscures the significant impacts felt by local communities.

NWPPC Chair Frank L. Cassady echoed that point in a letter to RAND:

> *We believe a much more useful analysis of regional and sub-regional issues would have resulted had RAND adopted a more detailed approach to assessing the regional economic effects, while also utilizing the best available regional and sub-regional information involving a broad spectrum of interests. This last point -- public input and involvement -- is of no small moment to the Council, as our governing statute, the Northwest Power Act, requires such an approach. We are concerned that because the RAND analysis did not sufficiently involve northwest stakeholders and was not adequately vetted with knowledgeable regional entities, it lacks important northwest-specific information and perspectives and thus is not as informative as it could be.*[23]

The NWPPC's frustration with the RAND study is even clearer in the press release issued following the meeting at which Bernstein spoke, which concludes:

> *RAND has been used, perhaps unwittingly, to advance special-*

interest policies in the Pacific Northwest. This can only harm RAND's reputation as an objective research institution.[24]

Spend It Wisely

The Corps of Engineers's Feasibility Report calculates that the cost of breaching the four Snake River dams is equal to an average of nearly $300 million per year over 100 years. This is a lot of money, even if it is only a tiny share of the region's gross regional product. The four governors characterize the issue of dam removal as "polarizing and divisive." One of the reasons the issue is so divisive is that the costs will fall disproportionately on a relatively small segment of the region's population.

Research by NMFS indicates that improvements already made to the hydro system have benefited the Snake River salmon and that further reducing salmon mortality during in-river migration would have less benefit than improvements at other life stages. The agencies that comprise the Federal Caucus have sensibly adopted a strategy that targets salmon recovery money towards actions that promise to be more cost effective than dam breaching.

The Federal Caucus was correct when it said that there are limits to the resources that the region will devote to recovery. It is imperative that what we spend be spent wisely, for if we don't, the salmon will suffer, as well as the people.

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ENDNOTES

[1] Daniel D. Huppert, "Columbia River Salmon Recovery: Where Are We Going? And How do We Get There?" http://faculty.washington.edu/huppert/SMAWorkingPaper-00-5.pdf,

[2] Charles C. Mann and Mark L. Plummer, "Can Science Rescue Salmon?" Science, Aug. 4, 2000. pp. 716-719.

[3] Peter Kareiva, Michelle Marvier, and Michelle McClure, "Recovery and Management Options for

Spring/Summer Chinook Salmon in the Columbia River Basin," Science, Nov. 3, 2000, p. 977-979.

[4] The Federal Caucus, Conservation of Columbia Basin Fish: Final Basinwide Salmon Recovery Strategy, Volume 1, December 2000, p. 24.

[5] U.S. Army Corps of Engineers, Final Lower Snake River Juvenile Salmon Migration Feasibility Report/Environmental Impact Statement, February 2002, http://www.nww.usace.army.mil/lsr/final_fseis/study_kit/studypage.htm.

[6] Calculated using the Corps's preferred 6.875% discount rate. The Feasibility Report also presents Costs and benefits calculated with 4.75% and 0.0% discount rates. The Feasibility Report expresses cost and benefits in 1998 dollars. We have adjusted to 2003 dollars using the Implicit Price Deflator for Personal Consumption Expenditures.

[7] The Corps prepared this estimate in the late 1990s, when natural gas prices were lower than they are today. Incorporating current forecasts of natural gas prices would increase the estimated cost by at least $100 mil-

lion.

[8] Feasibility Report, Appendix D Annex X, Table X-1, adjusted to 2003 dollars.

[9] Feasibility Report, Appendix I Table 3.2-10, converted to 2003 dollars.

[10] Foster Wheeler Environmental Corporation and Charles C. Harris, Jr, "Assessment and Evaluation of the Drawdown Regional Economic Workgroup (DREW) Recreation Analysis Findings," July 2001 http://www.nww.usace.army.mil/lsr/reports/recreation/drew/default.htm

[11] The Gross Regional Product of the 4-state region was $402.5 billion in 2001. Personal income for the four states was $355.9 billion in 2002.

[12] Feasibility Report, Appendix I, p. I6-5.

[13] Feasibility Report, Appendix I Table ES-17, converted to 2003 dollars.

[14] Feasibility Report, p. I6-45.

[15] Christopher G. Pernin, Mark A. Bernstein, Andrea Mejia, Howard Shih, Fred Rueter and Wilber Steger, Generating Electric Power in the Pacific Northwest: Implications of Alternative Technologies, RAND, 2002.

[16] Northwest Power Planning Council, "Minutes of Council Meeting", October 15-17, 2002, p. 13. http://www.nwcouncil.org/news/2002_10/minutes.pdf

[17] Pernin et al, p. xii.

[18] The meteorological risks associated with hydropower are likely to be uncorrelated with the business cycle. If so, financial contracts would provide better tools than dam breaching for mitigating the risk.

[19] NWPPC, Draft Fourth Northwest Conservation and Electric Power Plan, Document 98-22, 1998, p. A-3. http://www.nwcouncil.org/library/1998/98-22/Default.htm

[20] Terry Morlan, "RAND Analysis on Generating Electric Power in the Pacific Northwest," Memorandum to the Members of the Northwest Power Planning Council, Oct. 9, 2002. http://www.nwcouncil.org/news/2002_10/6.pdf

[21] Morlan, p. 2.

[22] NWPPC, "Minutes of Council Meeting," October 15-17, 2002, P. 13.

[23] Frank L. Cassady, Letter to Steve Rattien, Nov. 12, 2002. http://www.nwcouncil.org/library/2002/rand.pdf

[24] Northwest Power Planning Council, "RAND report on region's energy future lacks Northwest Information, Council says," Press Release, October 17,2002: http://www.nwcouncil.org/library/releases/2002/1017.htm

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