Policy and Factual Considerations for Breaching the Four Lower Snake River Dams Now

The past four decades establish that ESA-listed lower Snake River salmon cannot co-exist with the four lower Snake River dams. Either salmon or dams must go.

The Snake River was once one of the greatest salmon producers in the world, that for millennia supported a rich ecosystem, sustaining hundreds of species from humans to orcas. This is no longer the case. Snake River salmon runs have dropped to below 3 percent of historical estimates. And four Lower Snake River dams, with their warm slack water reservoirs, are killing what is left of the salmon and the river. The travesty of the dams is that scientists, economists, engineers, and politicians knew when these dams were proposed that they were a bad investment and would eliminate some of the largest wild salmon runs in the country. Nevertheless, construction of the pork barrel dams went ahead. The continuing travesty is that scientists, economists, engineers and politicians knew in 2002, and probably well before, that breaching the dams provides the only chance at Snake River wild salmon recovery. Research shows that these salmon will disappear in the next few years.

For the better part of three decades, the best available science has established that dam breaching presents the greatest biological potential for recovering endangered and threatened Snake River salmon and steelhead.[1] By 1999 the National Marine Fisheries Service (NMFS), now NOAA Fisheries, had determined that to recover ESA-listed Snake River spring/summer Chinook, the ***most risk averse action*** would include dam breaching, a harvest moratorium, and vigorous improvements in habitat and hatcheries.[2] By 1999 NMFS' results demonstrated that for the ESA-listed Snake River fall Chinook and steelhead, ***dam breaching by itself would likely lead to recovery***.[3] After conducting an exhaustive $33 million 5-year plus study that narrowed salmon survival through the four lower Snake River dams to four "reasonable" alternatives, the Army Corps of Engineers knew that it was necessary to breach the four dams to recover the ESA-listed lower Snake River salmon runs. *USACE, February 2002, Summary, Improving Salmon Passage, FINAL Lower Snake River Juvenile Salmon Migration Feasibility Report/ Environmental Impact Statement* (FR/EIS), p. 25. The Corps' analysis showed that ***breaching the dams had the highest probability of meeting the government's salmon survival and recovery criteria***, while employing ***the other so-called "reasonable" alternatives would be slightly worse than doing nothing***. Nevertheless, the Corps implemented the "***slightly worse than doing nothing***" alternatives and has been on a spending spree since, wasting approximately $1 billion of ratepayer and taxpayer money on hardware improvements and juvenile transportation around the dams over the last 14 years. Predictably, the ESA-listed runs are in worse shape today than in 2002.

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[1] Budy, P., *Analytical Approaches to Assessing Recovery Options for Snake River Chinook Salmon* (2001), p. 4, UTCFWRU 2001(1): 1-86, https://www.fws.gov/columbiariver/publications/recopt.pdf; *Lower Snake River Juvenile Salmon Migration Feasibility Report* (2002), *Appendix A, Anadromous Fish Modeling*, p. A ES-8, http://www.nww.usace.army.mil/portals/28/docs/environmental/lsrstudy/Appendix_A.pdf.

[2] *Analytical Approaches to Assessing Recovery Options for Snake River Chinook Salmon*, *Id*. pp. 5-6.

[3] *Id*., p. 6.

ESA-Listed Snake River Salmon

For the Snake River in particular, both old and new research consistently points in one direction - the dams are a major cause of decline of the salmon runs.[4] The four lower Snake River dams are obstructing 140 miles of prime salmon migration waterways. This is particularly harmful to lower Snake River fall Chinook runs, since historically they spawned in the mainstem of the lower Snake River. The four dams inundated that spawning and rearing habitat. Without the mainstem habitat, the fall Chinook population declined dramatically from pre-dam levels. In 1992, NOAA Fisheries listed both fall run and spring/summer-run Snake River Chinook as threatened under the ESA.

Most people are unaware of how close to extinction the wild salmon stocks are, since the Northwest Regional offices of the Corps, Bonneville Power Administration, and NOAA Fisheries Service have been making claims of "record runs" the last several years. They do this by shifting the baseline to create a new "normal" that fails to account for the long term depletion of wild genetic stocks. For example, the runs were terrible in the 1990s, so the federal agencies often use that period for comparison to current runs. The agencies count hatchery fish in the returns – fish that not only do not contribute to wild stocks and their hardier genetics, but actually harm them. For fall Chinook salmon, hatchery fish are 85 percent of the total run, which is not what the taxpayers are spending billions of dollars trying to recover. The court rulings requiring salmon recovery are all focused on wild stocks. By disingenuously claiming record salmon runs for the last several years, the federal agencies then can argue that their massive investments are paying off. The "record" salmon runs have far more to do with research projects (that have now ended) inflating runs, favorable ocean conditions over the last 15 years (that have now ended), and the fact that ever more hatchery fish are dumped into the Snake River, even though their survival rates are lower than wild stocks.

Federal fisheries biologists and reports show that lower Snake River wild salmon runs are within a few years of collapse, due to the near complete elimination of their wild genetics. The genetics that have evolved over tens of thousands of years are now being nearly wiped out by dilution from breeding with hatchery fish. This is important because hatchery fish cannot sustain more than a few generations before they collapse and require extensive human intervention. Further, hatchery stocks are not far behind in completely collapsing due to their dependency on wild salmon genetic input for survival.

There is a practical way to recover these fish without further studies. The FR/EIS is the current operative EIS for fish passage through the Snake River dams. It authorizes dam breaching through channel bypass to halt the decline of the wild salmon runs. This is the only remaining permitted measure yet to be tried and the one that even the Corps believes will recover the wild salmon runs.

For more information see:
Snake River Endangered Salmon White Paper 11.4.2015
Fall Chinook Surrogates 11.4.2015
Lower Snake River Juvenile Salmon Migration Feasibility Study—Record of Decision, Sept. 2002

[4] See e.g., *Nat'l Wildlife Fed'n v. Nat'l Marine Fisheries Serv.*, 839 F. Supp. 2d 1117, 1131 (D. Or. 2011) ("[T]here is ample evidence in the record that indicates that the operation of the FCRPS causes substantial harm to listed salmonids. . . . NOAA Fisheries acknowledges that the existence and operation of the dams accounts for most of the mortality of juveniles migrating through the FCRPS.")

Endangered Puget Sound Orcas

In 2005 the remaining 87 Puget Sound orcas were listed under the Endangered Species Act as "endangered" species. This is the highest and worst listing possible. The designation has not helped them. By late December 2014, only 76 endangered orcas survived. *In May, 2015 NOAA Fisheries, the agency in charge of their recovery, designated these whales as one of the eight endangered species most likely to go extinct in the immediate future*. Between September 2012 and late December 2014, no new calves had survived. At least seven endangered orcas had died during that period, due to cumulative pressures tied to nutritional stress. Approximately 80% of the orcas' summer diet is Chinook salmon. Recent research shows that in winter the orcas also have a strong feeding preference for Chinook salmon. To survive and recover, the endangered orcas need a substantially larger Chinook salmon population on which to feed, as shown in multiple studies by both governmental and non-governmental researchers. Significantly, after nearly a decade on the endangered species list, these endangered killer whales are not recovering.

The orcas' current situation is perhaps explained best and most succinctly in an April 28, 2016 email from renowned orca expert Kenneth Balcomb, who has been researching the Puget Sound endangered orcas for 40 years.

> I have to keep returning to what I know from the field work and my observations for truth. I do not need more data and spin-doctoring to see and document that these whales are skinny and that they are dying way before they should be - fetal, neonatal, juvenile, and in their prime reproductive years. I am concerned that they do not have the prey resources within their travel range to sustain a viable population, while people who should be responsible for them proclaim "record years" of salmon, more detailed measurements and samples are needed, and more whales must be biopsied and harpoon-tagged before management decisions 'based on science' can be made. That is fiddling while Rome is burning.
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> The [Puget Sound] Partnership cannot restore Puget Sound to anything like its condition of forty years ago when I began studying these whales, much less to its condition prior to then. The human harvest of Chinook salmon from the Salish Sea in those early years was 1.5 to 3+ million adult fish per year, with 500,000 from Puget Sound alone; and, the whales were here almost daily from May through September for the Chinook salmon spawning runs. They also hung around a little in the fall for Chum runs, but these fish are not as nutritious. During other months the SRKW's foraged in coastal waters and visited the Salish Sea about twice per month. We should not give up attempts to restore the quality of the Puget Sound ecosystem to a level that can recover some of these salmon stocks, but the whale population will not last that long at the rate we are going. That is why I have looked to the Snake River wild Chinook to be their savior because the remedy there is relatively simple - get rid of the expensive and wasteful dams that block passage and kill salmon. Get rid of the hatcheries that are genetically destroying wild runs and competing with them to oblivion. The obstacles to such remedy, as usual, are political and inertial but the time is now.
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> * * *

Attached is a photo from yesterday [4/27/16], beautiful whale grotesquely skinny.

[End of email excerpt.]

Within the United States, the Columbia-Snake River watershed is the most important source of salmon for the endangered Puget Sound orcas. For thousands of years, the orcas have depended on Chinook salmon from this watershed, which once produced millions of Chinook annually. The Snake River is the largest tributary to the Columbia River. It historically produced about half the salmon coming out of the basin. NOAA Fisheries has underscored the importance of this watershed to the orcas, stating that, *"[p]erhaps the single greatest change in food availability for resident killer whales since the late 1800s has been the decline of salmon from the Columbia River basin*." *2008 Recovery Plan for Southern Resident Killer Whales*, p. II-82.

Even though the Columbia-Snake River prey resource is greatly reduced, the endangered orcas rely on it. Research conducted over the last decade shows that Columbia-Snake River Chinook remain crucial to the orcas' continued existence. They forage in the coastal waters of the Northeast Pacific Ocean more than half the year.[5] The whales appear to be especially reliant on the Snake River's nutrient rich, high fat content early spring-run Chinook.[6] Significantly, recent NOAA Fisheries acoustic and satellite tag studies indicate that the Southern Residents' visits to the coastal waters off Westport, Washington and the mouth of the Columbia River coincide with high concentrations of spring Chinook salmon.[7] In fact according to the satellite tags, the orcas' travels often center around the mouth of the Columbia River when Snake River Chinook are returning to the Columbia.

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[5] See 134 J. Acoust. Soc. Am. 5, Hanson et al., Assessing the Coastal Occurrence of Endangered Killer Whales Using Autonomous Passive Acoustic Recorders (November 2013), 3486, http://oceanwidescience.org/cms/wp-content/uploads/2014/12/Hanson-et-al-2013.pdf (on average the Southern Residents occur in inland waters less than half of the days each year.)

[6] Ayres KL, et al., *supra*, http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0036842.

[7] Northwest Fisheries Science Center, NOAA Fisheries. 2013 Southern Resident Killer Whale Satellite Tagging, http://www.nwfsc.noaa.gov/research/divisions/cb/ecosystem/marinemammal/satellite_tagging/blog.cfm; 2015

Although the orca situation is dire, recently the population has taken a slightly hopeful turn. Since late December 2014 the endangered orcas have celebrated the birth of nine calves. According to the last census from January 2016, eight survive. Although this is good news, this means there are eight more mouths to feed with a declining number of salmon. Orcas are not light eaters. The population will need between 30,000 and 50,000 additional Chinook salmon annually to sustain the calves as juveniles, and many more as they grow to adults. Breaching the Snake River dams would provide many of the additional fish the orcas need to survive and recover. As the lower Snake River is restored, it would support the growing needs of the endangered orca population.

The recent orca "baby boom" is not a mere coincidence. The gestation period for orcas is approximately 17 months. That means the nine births coincided with the larger Snake River hatchery salmon runs that occurred in 2013 through 2015. The runs were pumped up by hundreds of thousands of large fall Chinook salmon that had been specially bred as juveniles in a hatchery program for a lower Snake River fish transport research project. Many of the calves were conceived in the year 2013 when the endangered orcas largely were absent from the Salish Sea inland waters, presumably feeding on coastal Chinook, a number of which likely were the larger specially bred Chinook. The lower Snake River research project last released fish in 2012, which means the inflated fall Chinook runs will not continue. The fish were expensive to produce and the research project will not be resumed. Nonetheless, it is good evidence that when there are plentiful Snake River Chinook, the endangered orcas can conceive, reproduce, survive and recover.

Despite the "baby boom," the orca population is in decline. Since the beginning of this year, at least three calves have been born, but did not survive. In mid-January J55 disappeared a few days after s/he was first seen. The same day J55 was seen, a dead neonate was observed being carried around on the rostrum of a 20 year old J pod female. On March 25, 2016 another J pod calf, a female, washed up on shore near Sooke, B.C., never having been seen alive. To make matters worse, on April 1, 2016 the badly decomposed body of L95/Nigel, a young adult male born in 1996, washed up off the west coast of Vancouver Island. NOAA had satellite tagged him on February 24, 2016, south of La Push, Washington, in an effort to study the winter habits and habitat of the Southern Residents. L95's death points to the increasing fragility of the Southern Resident orca population.

Due to the poor Chinook runs this summer, the endangered orca pods have been fragmented and have spent little time in their summer core area, the Salish Sea. As a result, the annual orca census that is normally done by July 1st each year has not been completed. It is likely that the population will be smaller when the census is completed.

Breaching the four lower Snake River dams would open the gateway to 5500 miles of intact, high elevation cold water salmon spawning and rearing streams that are the most resistant to global warming in the lower 48 states. These streams have a huge potential to once again produce large amounts of salmon. Moreover, if the past ability of the Snake River watershed to produce enormous salmon runs can be used as an indicator of its future ability as a free flowing river to produce salmon, breaching the dams is the single measure most likely to recover abundant salmon and steelhead in time to enable the endangered Puget Sound orcas to survive.

Southern Resident Killer Whale Satellite Tagging, http://www.nwfsc.noaa.gov/research/divisions/cb/ecosystem/marinemammal/satellite_tagging/blog2015.cfm; 2016 Southern Resident Killer Whale Satellite Tagging, https://www.nwfsc.noaa.gov/research/divisions/cb/ecosystem/marinemammal/satellite_tagging/blog2016.cfm.

For more information on the endangered orcas see:
Center for Whale Research, http://www.whaleresearch.com/about-salmon
White Paper Southern Resident Killer Whales, updated February 2016.

Dam Breaching Mechanics

In the FR/EIS the Corps listed breaching the dams through channel bypass as one of four reasonable measures to achieve fish survival and recovery through the lower Snake River. Channel bypass is a relatively simple method of breaching. It would remove the dams' earthen embankments to draw down the four Lower Snake River reservoirs to create a free flowing 140 mile stretch of river. Two private engineers, one retired from the Corps, in collaboration with field personnel in the Corps Walla Walla District and the EPA, have updated the Corps' breach plan. The revised channel bypass plan has been designed to cost 70% less than the Corps' near-billion dollar proposal set forth in the FR/EIS. Through hydraulic breaching, it can be accomplished in half the time. Since channel bypass keeps costs to a minimum and little design is required, dam breaching is fiscally responsible.

The breach has three basic phases: mechanical removal of the top 60 feet of material by dozer to the downstream side of the embankment, while dewatering over the spillway and turbines; controlled (via turbine wicket gates) hydraulic breaching of the remaining 40 feet; and channel alignment and armoring around the structure and bridge piers/road embankments, if necessary. Thus, the contract is little more than a time and materials or rental contract for four to five pieces of equipment. This approach is essentially the same as in the FR/EIS.

Drawdown must be scheduled as soon as possible to fit into the next fish window. Drawdown of the Lower Granite pool should begin between November 1 and December 15 of this year, with the hydraulic breach to begin no later than January 15, 2017. Drawdown this year is made easier because the Corps has scheduled a 100 day lock outage at Lower Granite for repairs to dam structures, beginning in early December 2016. Farmers already are preparing to redirect their fall grain harvest to rail or ship.

The keys to accomplishing a cost and time efficient breaching of each dam are as follows:

- *Very little modification to the powerhouse is needed*. The Corps' proposal involved significant alterations to the six turbines that even their own data showed was unnecessary to safely draw down the reservoir.
- *Allow the river to do the majority of the embankment removal*. The Corps' proposal mechanically excavates the entire earthen embankment and allows the river to breach only the cofferdams, although it appears that more hydraulic removal of material is required than assumed. Since 2002 hydraulic breaching has been used successfully numerous times in the Pacific Northwest. Also new technology exists to model hydraulic breaching in a safe and predictable manner, as was done in this updated plan.
- *River channelization can be accomplished using materials already in place at the dam*. During dam construction, the Corps successfully routed the natural river channel around the concrete structure, without the levees proposed in the FR/EIS.
- *Fish handling is unnecessary*. Dam breaching will take place at a time when few anadromous fish are present in the river. To keep costs down, only one dam will be breached per year. Hydraulic conditions through the breached embankments will be favorable to fish passage, just as they were during dam construction.

- *Minimal reservoir embankment actions are necessary for road/railroad protection and repairs*. The Corps Walla Walla District proved this during their 1992 drawdown test. The FR/EIS planned to spend one hundred times more money on repairing damages to roads and railroads than drawdown actually caused. Drawing the reservoir down at a slower initial rate as this reevaluation recommends will further reduce damage.
- *Lyons Ferry Hatchery should not be modified as the Corps plan proposes*. Due to the negative impacts that hatchery fish have on wild salmon stocks, Lyons Hatchery should be immediately decommissioned.
- *The Corps selected channel bypass as the means to breach. This revised plan simply improves channel bypass at lower cost, this plan is consistent with the existing Environmental Impact Statement for the overall project*.

Revised Channel Bypass Plan, Executive Summary, p. 5.

While the Corps' breaching proposal was created with a pre-determined conclusion that breaching is an unjustifiably expensive and lengthy process, this revised breaching plan was designed with efficiency and safety in mind, using innovative means. With the breaching of each successive dam, year by year, the salmon would take another step towards recovery.

Revised Breaching Costs

The costs of breaching all four lower Snake River dams have been reevaluated to ***$255 million. This saves $604 million*** from an original estimate of $859 million in 1999. *Revised Channel Bypass Plan*, Table 8, p. 28. ***In 2016 dollars the costs of breaching is $340 million.***

The following tables contain a breakdown of the reevaluated costs. *Revised Channel Bypass Plan*, at pp. 24-28. The reevaluated costs are explained in the *Revised Channel Bypass Plan*, at pp. 28-46.

Table 4: Lower Granite Dam Totals
(Costs shown in the tables are in thousands of 1999 dollars)

	Original Cost	Corrected Cost	Difference
Grand Totals (thousands of dollars)	**$286,882**	**$42,880**	**$244,002**
Power House Turbine Modifications	$8,130	$1,626	$6,504
Dam Embankment Removal	$28,376	$1,500	$26,876
River Channelization	$27,544	$10,000	$17,544
Temporary Fish Handling Facilities	$0	$0	$0
Project Dam Decommissioning	$1,522	$1,522	$0
Railroad Relocations	$0	$0	$0
Bridge Pier & Abutment Protection	$32,672	$7,534	$25,138
Reservoir Embankment Protection	$56,092	$2,804	$53,288
Railroad/Roadway Damage Repair	$109,420	$1,000	$108,420
Recreation Access Modification	$7,973	$6,378	$1,595
HMU Modification	$1,745	$1,745	$0
Reservoir Revegetation	$7,729	$3,092	$4,637
Cultural Resource Protection	$1,538	$1,538	$0
Cattle Watering Facilities	$1,037	$1,037	$0
Excess Property Disposal	$266	$266	$0

Table 5: Little Goose Dam Totals
(Costs shown in the tables are in thousands of 1999 dollars)

	Original Cost	Corrected Cost	Difference
Grand Totals (thousands of dollars)	**$192,134**	**$37,180**	**$154,954**
Power House Turbine Modifications	$7,863	$1,573	$6,290
Dam Embankment Removal	$26,589	$1,500	$25,089
River Channelization	$53,462	$10,000	$43,462
Temporary Fish Handling Facilities	$18,052	$0	$18,052
Project Dam Decommissioning	$1,471	$1,471	$0
Railroad Relocations	$0	$0	$0
Bridge Pier & Abutment Protection	$12,772	$2,554	$10,218
Reservoir Embankment Protection	$39,718	$4,000	$35,718
Drainage Structure Protection	$1,789	$1,789	$0
Railroad/Roadway Damage Repair	$9,814	$1,000	$8,814
Recreation Access Modification	$3,257	$2,606	$651
HMU Modification	$2,643	$2,643	$0
Reservoir Revegetation	$11,100	$4,440	$6,660
Cultural Resource Protection	$1,435	$1,435	$0
Cattle Watering Facilities	$1,973	$1,973	$0
Excess Property Disposal	$196	$196	$0

Table 6: Lower Monumental Dam Totals
(Costs shown in the tables are in thousands of 1999 dollars)

	Original Cost	Corrected Cost	Difference
Grand Totals (thousands of dollars)	**$173,021**	**$82,545**	**$90,476**
Power House Turbine Modifications	$7,857	$1,571	$6,286
Dam Embankment Removal	$41,441	$30,000	$11,441
River Channelization	$31,847	$16,000	$15,847
Temporary Fish Handling Facilities	$0	$0	$0
Project Dam Decommissioning	$1,539	$1,539	$0
Railroad Relocations	$13,921	$16,705	-$2,784
Bridge Pier & Abutment Protection	$6,414	$1,283	$5,131
Reservoir Embankment Protection	$38,113	$3,811	$34,302
Drainage Structure Protection	$2,062	$2,062	$0
Railroad/Roadway Damage Repair	$4,753	$500	$4,253
Recreation Access Modification	$2,043	$1,634	$409
HMU Modification	$2,434	$0	$2,434
Reservoir Revegetation	$6,578	$2,631	$3,947
Cultural Resource Protection	$1,578	$1,578	$0
Cattle Watering Facilities	$2,459	$2,459	$0
Excess Property Disposal	$272	$272	$0
Lyons Ferry Hatchery Modifications	$9,710	$500	$9,210

Table 7: Ice Harbor Dam Totals
(Costs shown in the tables are in thousands of 1999 dollars)

	Original Cost	Corrected Cost	Difference
Grand Totals (thousands of dollars)	**$206,902**	**$92,421**	**$114,481**
Power House Turbine Modifications	$7,857	$1,571	$6,286
Dam Embankment Removal	$65,524	$50,000	$15,524
River Channelization	$35,349	$18,000	$17,349
Temporary Fish Handling Facilities	$19,702	$0	$19,702
Project Dam Decommissioning	$1,477	$1,477	$0
Railroad Relocations	$6,261	$2,000	$4,261
Bridge Pier & Abutment Protection	$0	$0	$0
Reservoir Embankment Protection	$44,892	$4,489	$40,403
Drainage Structure Protection	$1,867	$1,867	$0
Railroad/Roadway Damage Repair	$6,020	$500	$5,520
Recreation Access Modification	$2,470	$1,976	$494
HMU Modification	$3,238	$3,238	$0
Reservoir Revegetation	$8,237	$3,295	$4,942
Cultural Resource Protection	$2,275	$2,275	$0
Cattle Watering Facilities	$1,392	$1,392	$0
Excess Property Disposal	$341	$341	$0

Table 8: Four Dam Totals
(Costs shown in the tables are in thousands of 1999 dollars)

	Original Cost	Corrected Cost	Difference
Grand Totals (thousands of dollars)	**$858,939**	**$255,026**	**$603,913**
Power House Turbine Modifications	$31,707	$6,341	$25,366
Dam Embankment Removal	$161,930	$83,000	$78,930
River Channelization	$148,202	$54,000	$94,202
Temporary Fish Handling Facilities	$37,754	$0	$37,754
Project Dam Decommissioning	$6,009	$6,009	$0
Railroad Relocations	$20,182	$18,705	$1,477
Bridge Pier & Abutment Protection	$51,858	$11,371	$40,487
Reservoir Embankment Protection	$178,815	$15,104	$163,711
Drainage Structure Protection	$8,556	$8,556	$0
Railroad/Roadway Damage Repair	$130,007	$3,000	$127,007
Recreation Access Modification	$15,743	$12,594	$3,149
HMU Modification	$10,060	$7,626	$2,434
Reservoir Revegetation	$33,644	$13,458	$20,186
Cultural Resource Protection	$6,826	$6,826	$0
Cattle Watering Facilities	$6,861	$6,861	$0
Excess Property Disposal	$1,075	$1,075	$0
Lyons Ferry Hatchery Modifications	$9,710	$500	$9,210

For comparative information on the costs of retaining v. breaching the dams see:
The Costs of Keeping the Four Lower Snake River Dams, January 2015
Graph Comparing Costs

Breach Funding Mechanisms

If and when breaching takes place, the Bonneville Power Administration, and perhaps the Corps, will be responsible for the costs of breaching, not Washington State. The Bonneville Power Administration (BPA) is obligated by law to repay to the Federal Treasury all costs allocated to hydropower from the four lower Snake River dams, while the Corps is obligated to pay the navigation costs. The average costs allocation to BPA for hydropower is 91%, while the average cost allocation to the Corps for navigation is 9%. Each dam, however, has a different rate. The allocation percentages for Corps' navigation costs set forth in the 2002 FR/EIS are 1.6% for Lower Granite, 6.7% for Little Goose, 5.9% for Lower Monumental and 21.4% percent for Ice Harbor. FR/EIS, Appendix I, section 11, Table 11-2, and section 11.3.

A good business case can be made for Bonneville Power Administration to pay the full cost of breaching as a cheaper way to accomplish fish mitigation, although a portion of each project has non-hydropower benefits that may need to be financed elsewhere. The *Revised Channel Bypass Plan* sets forth an estimate of approximately $50 million (in 2017 dollars) for Lower Granite Dam. The navigation portion of costs at 1.6% for Lower Granite would be $800,000 in non-BPA funding. The Corps' Columbia River Fish Mitigation Program (CRFM) is authorized to pay the cost of fish passage improvements. The Corps could use CRFM funds to pay this portion of the breach cost. In addition, as noted above, CRFM has expended roughly $1 billion for fish passage improvements, with no increase in wild fish recovery. Note that 91% of the CRFM expenditures should be paid back to the US treasury by BPA, under the BPA/Corps allocation set forth above, so immediate full funding by the Corps is also a possible option.

Policy reasons BPA and the Corps should fund dam breaching:

- Given the failed economics reflected in the .15 BC ratio over the project life, and when all current annual costs from BPA and the Corps are considered, the dams likely already are operating in the "red." Thus, the Corps has an inherent responsibility to stop spending money on these projects and decommission them. Note, NWW claims an annual cost of $62 million, but this is only operation and maintenance costs.
- As noted above, the Corps' expenditures under the Columbia River Fish Mitigation (CRFM) program for the four Lower Snake dams to date are ***roughly $1 billion*** for implementing the two non-breach alternatives in the 2002 FR/EIS, ***that the Corps admitted in 2002 would have a worse chance at recovering ESA-listed salmon than doing nothing***. The only remaining approved alternative for salmon recovery in the 2002 FR/EIS is breaching via channel bypass. Remaining CRFM budgets could cover any breaching costs not covered by the BPA under the Fish Mitigation authority it derives from the 1980 Northwest Power and Conservation Act.

BPA budget for Turbine Replacement

The Bonneville Power Administration currently is in the process of rehabilitating three turbines at Ice Harbor Dam. That leaves 21 turbines that should to be replaced within the next 10 to 15 years. The 21 turbines do not appear to be included in BPA's budget based on a review of the budget through 2030.

Taxpayer and Ratepayer Investment Return on the Lower Snake River Dams
The Corps' purported overriding consideration for concluding that breaching was not necessary in 2002 was the alleged low cost of maintaining the dams. This was compared to the alleged high costs of breaching, and the alleged significant loss of economic output that breaching would deliver.

Today, an accounting by an economic firm using the 2002 FR/EIS, Planning & Guidance for Water Resource Projects, and the Corps' own planning guidance shows the reverse to be the case then and today. The costs of keeping the dams far outweigh the costs of breaching. It is clear that in reaching its conclusion NWW cherry picked the guidance and data to come up with a positive economic argument. Indeed the benefits/cost ratio (BC ratio) for keeping the dams is .15 to 1. That is 15¢ on the dollar. *National Economic Analysis of the Four Lower Snake River Dams*, pp. 2, 5-6. The dams are a bad investment. Breaching the dams will save money for taxpayers and ratepayers.

Washington State School Budgets
At the same time as Lower Granite Dam breaching occurs, the Corps should use its Section 216 Authority, Study of Existing Projects, to determine the disposition of project lands. Significant additional economic activity can be gained if just 4000-5000 acres of the 40,000 acres of project land that would be exposed by breaching would be reclaimed as vineyards and orchards, with ancillary business such as wineries, restaurants, and hotels. ***If some of this reclaimed land were conveyed to the State of Washington, proceeds from the sale or lease of such land could go into state school budgets, where it is greatly needed.***

Surplus Energy in Region
The regional power grid currently produces a 16 percent annual surplus. The median electricity production of the four lower Snake River dams is about 795 aMW. This accounts for less than 3 percent of the energy on the grid, and has been replaced nearly three times over by greener solar and wind energy. For example, in 2013, the lower Snake River dams contributed 2.9% of the power to the regional grid, while wind contributed 7.6%.[8]

The Northwest region power supply is overbuilt. This has resulted in paying wind generators to not produce power, in giving utilities energy for free, and in "negative pricing"—the practice of paying utilities to take power off the grid. For years BPA has been forced to deal with periods of over-generation of hydropower, often because of heavy rains or runoff from snow pack in the spring and early summer. When possible, the oversupply is sold into short-term markets, much of it leaving the region.[9] In 2012 BPA projected the costs of energy oversupply to range from zero to more than $50 million based on water, wind and market conditions.[10] BPA projected the average value to be $12 million, and also projected that it would need to compensate wind generators for only two in

[8] EIA, 2015. Table 5. Electric power industry generation by primary energy source, 1990-2013. Available at: http://www.eia.gov/electricity/state/washington/

[9] Northwest Power and Conservation Council, 2016. Seventh Northwest Conservation and Electric Power Plan. Chapter 1, p 13. Available at: http://www.nwcouncil.org/media/7149940/7thplanfinal_allchapters.pdf

[10] *Fact Sheet—BPA proposes resolution to electricity oversupply*, February 2012, https://www.bpa.gov/news/pubs/FactSheets/fs-201202-bpa-proposes-resolution-to-electricity-oversupply.pdf.

every three years. In fact, the extra generation costs associated with high levels of wind and water reached $2.7 million in 2012.[11]

According to the Northwest Power & Conservation Council, increases in energy efficiency are projected to meet all load growth for the next 20 years. Since the power is already on the system, new power generating facilities are not projected to be needed at least through 2035. Future demand can be met by conservation, e.g., LED lighting, energy star appliances, and agriculture efficiency. [12] Decreasing power consumption through conservation means people will use less power. Less power used means less money paid for power. Additionally, because these dams cost more to operate than they generate in revenue, it is not likely that there will be an increase in power rates.

A common misconception is that hydropower is clean energy, free of greenhouse gas (GHG) emissions. This is untrue. The dams are destroying the lower Snake River ecosystem. Further, GHG emissions are known to come from both reservoirs and water outgassing while passing through the dams. Hydroelectric, photovoltaic (solar), wind, nuclear, and biomass all emit under 100 $_{g}CO_2eq/kWh_e$.[13] For context, natural gas and coal emit 500 and 1000 $_{g}CO_2eq/kWh_e$, respectively. The reservoirs behind the four lower Snake River dams produce at least 46,000 metric tons of CO2 equivalent.[14] This equals the methane emissions of 4000 dairy cows. Unlike hydropower, wind and solar energy do not emit methane or destroy entire river ecosystems.

For more information see:
Rocky Mountain Econometrics, *Lower Snake River Dam Alternative Power Costs*, June 2015
Seventh Northwest Conservation and Electric Power Plan, Executive Summary, February 2016

Navigation

The navigation channel opened by the dams has outlived its expense. Container shipping largely ceased on the Snake River in April 2015 when the last major shipping line, Hapag-Lloyd, pulled out of the Port of Portland. To add to navigation's demise, shipping by barge has decreased greatly over the past 20 years.[15] Petroleum transport on the lower Snake River has declined substantially since 2008, in large part because a pipeline has moved petroleum to a refinery in Salt Lake City. Further, Snake River barge traffic is being replaced by rail transport at a lower overall cost and a similar carbon footprint. Farmers are building their own unit train grain loaders, while the State of Washington has invested in rail upgrades and grain shuttle services that use rail to get grain to Wallula, where it is put on a barge for transit down the Columbia. This shows that shipping grain on the Snake River is going to further decline as more rail upgrades in the area are made.

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[11] Energy & Environment, *Generators to Pay Bill for Excess Powe*r, 4/2/14, http://www.ect.coop/public-policy-watch/energy-environment/generators-to-foot-bill-for-excess-nw-power/68347.

[12] *Id*.

[13] Weisser, D., 2007. A guide to life-cycle greenhouse gas (GHG) emissions from electric supply technologies. Energy 32, 1543–1559. Available at: https://www.iaea.org/OurWork/ST/NE/Pess/assets/GHG_manuscript_pre-print_versionDanielWeisser.pdf

[14] This amount was derived from the DOE, PNNL report *Evaluating Greenhouse Gas Emissions from Hydropower on Large Rivers in Eastern Washington*, March 2013, available at: http://www.pnl.gov/main/publications/external/technical_reports/PNNL-22297.pdf.

[15] Mapes, L. 2013. Snake River barging drop: new factor in dams debate. The Seattle Times. Available at: http://www.seattletimes.com/seattle-news/snake-river-barging-drop-new-factor-in-dams-debate/

Economic analysis has shown that barge transportation provides an economic edge of just $7.6 million.[16] Moreover, the real economic value of barge shipping is not currently known because taxpayers subsidize it. Which transportation modes governments choose to subsidize is a policy question. If the public were willing to invest in more rail infrastructure, grain growers are among the people most easily made whole. As noted, a better rail system, partly financed with public dollars, is transitioning grain growers who currently depend on barges. Improved rail systems vastly improve transportation for grain growers who do not depend on barges. Directly subsidizing affected nonindustrial farms or expanding rail capacity within the region also could minimize economic impacts.[17]

Recreation

Outdoor recreation spending supports an estimated 200,000 jobs in Washington.[18] With a free flowing lower Snake River, recreation benefits would skyrocket in many Washington counties. Recreation is one of the top industries in the state. Southeastern Washington is one of the poorest performers in terms of recreation expenditures. A free flowing Lower Snake River offers an amenity that is not currently available in the region. People desire high quality recreation experiences and are willing to travel for them. A well conducted survey found that there would be an immense increase in visitation with a free flowing river.[19]

Economists value the recreational benefits of a free flowing lower Snake River at $1.4 billion dollars per year. Earth Economics, *Regional Economic Analysis of the Four Lower Snake River Dams*, February 2016. Just the additional expenditures associated with recreation on the river are estimated to be about $400 million per year in the six counties adjacent to the lower Snake River. The visitor spending effects would support between 3,000 and 4,000 jobs within the counties surrounding the Lower Snake annually.[20] More jobs will be supported within the Pacific Northwest through multiplier effects.

Flood Control

The four Lower Snake River dams are run of the river dams and do not provide flood control. Flood control comes from bigger dams in Canada for the Columbia River, and from Dworshak Dam for both the lower Snake and Columbia rivers.

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[16] Jones, Anthony 2015 Lower Snake River Dam Navigation Study, p 9-23, available at: www.wildsalmon.org/images/stories/PDFs/Fact_Sheets/LSD.Navigation.Study.2015.Final.pdf.

[17] US Army Corps of Engineers, 2002 Lower Snake River Juvenile Salmon Migration Feasibility Report / Environmental Impact Statement, Appendix I: Economics, p I7-9. Available at: http://www.nww.usace.army.mil/Library/2002-LSR-Study/.

[18] Briceno, T., Schundler, G. 2015. *Economic Analysis of Outdoor Recreation in Washington State*. *Earth Economics*, Tacoma, WA.

[19] Loomis, J. 1999. *Recreation and Passive Use Values from Removing the Dams on the Lower Snake River to Increase Salmon*. AEI. Masonville, CO. Print.

[20] Mojica, J., et al. 2016. *National Economic Analysis of the Four Lower Snake River Dams: A Review of the 2002 Lower Snake Feasibility Report/Environmental Impact Statement*. *Economic Appendix (I)*. Earth Economics, Tacoma, WA. Available at: https://drive.google.com/file/d/0B_8s5T-LzCzod3lEeXczams1bk0/view

In fact, Lower Granite Dam has increased the flood risk to Lewiston, Idaho, since part of downtown now lies below the river water level. Lower Granite Dam causes this. The city stands at the confluence of the Snake and Clearwater rivers. Lower Granite Dam created the reservoir that made Lewiston a deep water port. The pool elevation required to allow inland barge traffic to travel to Lewiston, Idaho is made possible by 30 foot levies at Lewiston. The levies are the only thing that keeps the river water from flowing into downtown Lewiston. Lower Granite traps silt that the Clearwater washes down from 37,000 square miles of central Idaho. As the silt builds up, the river water level rises. The surface of the dam pool now stands higher than the land. The sediment raises the water to an elevation that could over top the levees with just a 50 year storm event. The risk increases each year as more sediment is deposited. Dam breaching will remove this flood risk.

Irrigation

There are an estimated 37,000 acres of industrial farmland irrigated by the reservoir behind one dam, Ice Harbor. Irrigation pumps can be replaced and pipes extended to the free flowing Snake River, or the land could be converted to either non-irrigated farmland or pasture. The economic effect was not estimated to be large in comparison to other impact categories when the Corps released their 2002 Lower Snake River Feasibility Report.[21] The Corps' work is currently being reviewed by Earth Economics, an economic consulting group located in Tacoma, WA.

Tribes

Recently in *United States v. Washington*, No. 13-35474, 2016 U.S. App. LEXIS 11709 (9th Cir. June 27, 2016), the Ninth Circuit held that both Washington State and the United States governments are liable to signatory tribes for violating the 1855 Stevens Treaties. According to the court, those treaties guarantee undiminished salmon runs to the tribes, in return for the tribes ceding essentially much of what is now Washington State to the European settlers. The Court's opinion was clear. By building and maintaining barriers (in this case culverts) to salmon in Washington, the State diminished the supply of salmon available to the tribes. This violates Washington State's obligation to the tribes under the Stevens Treaties. The ruling applies to the United States, as well.

As a result of this decision, not only do the tribes have a right to injunctive relief to have barriers to salmon migration removed, they also have a right to damages for the diminished salmon runs. In other words, the decision green lights the tribes to enforce their treaty rights against both the State of Washington and the United States.

The Snake River dams are far greater barriers to salmon migration than the culverts. Were the tribes to enforce their treaty rights to Snake River salmon, the likely result would be court ordered breaching of the four lower Snake River dams, and a judgment in the billions of dollars, possibly against both Washington State and the United States. At this point, it would be fiscally irresponsible not to heed the Ninth Circuit's decision and act on it. The liability is too great not to take affirmative action as soon as possible, and that is now, since breaching can be accomplished this year.

Conclusion

[21] US Army Corps of Engineers, 2002. Lower Snake River Juvenile Salmon Migration Feasibility Report / Environmental Impact Statement, Appendix I: Economics. Available at: http://www.nww.usace.army.mil/Library/2002LSRStudy.aspx.

Dam advocates have long argued that the dams' alleged benefits – the hydropower they produce, as well as the transportation corridor they create by forming a long passage for grain-bearing barges all the way into Idaho – outweigh whatever benefits the salmon provide to the region. But those claims no longer hold water. Most grain farmers in the region now ship by rail because of the rising costs of barging. The dams are not needed. They are low-head "run of the river" dams that produce little energy – less than 3 percent of a regional power grid that currently produces an annual surplus of 16 percent. The dams have no flood control function (and in fact create flooding conditions at times), and their irrigation benefits have been nullified by modern water-pumping technology.

In the end, the lower Snake River dams are really nothing more than a massive boondoggle – one that has been sustained by their status as a political football in Washington State's "culture wars." When breaching the dams was first proposed in the 1990s, conservative eastern Washingtonians erupted in anger, claiming that urban liberals were blithely attacking their way of life. Now the tables have turned; and a whale-watching industry that brings in millions of dollars to western Washington's economy is at stake, as well as a salmon industry that produces millions more.