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Report to the Chairman, Subcommittee on Oversight and Investigations, Committee on Energy and Commerce, House of Representatives

March 1991

HYDROELECTRIC DAMS

Costs and Alternatives for Restoring Fisheries in the Elwha River

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GAO

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Resources, Community, and
Economic Development Division

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March 27, 1991

The Honorable John D. Dingell
Chairman, Subcommittee on Oversight
and Investigations
Committee on Energy and Commerce
House of Representatives

Dear Mr. Chairman:

You asked us to review a number of issues related to the effects of the Elwha and Glines Canyon dams on fisheries in the Elwha River in the state of Washington. We addressed legal issues on the Federal Energy Regulatory Commission's (FERC) authority to license these dams in our February 16 and August 16, 1990, letters to you. This report addresses three other issues you asked us to review concerning the dams: (1) the potential costs of removing the dams to restore the fisheries, (2) the potential costs of restoring the fisheries without removing the dams, and (3) the effectiveness of both dam removal and dam retention coupled with mitigation measures in restoring fish to the Elwha River.

Results in Brief

FERC's preliminary cost estimate for the removal of both dams under the most likely option is about $61 million.[1] This cost could increase to about $124.6 million if FERC requires that the large amount of sediment that has accumulated in the reservoirs behind the dams be hauled to a disposal site several miles away rather than stabilized in place.

FERC's preliminary cost estimates for constructing fish passage facilities with the dams in place range from $20 million to $40.4 million, depending on the facilities selected. FERC estimated the annual cost of operating and maintaining such facilities at $160,000 to $260,000 ($4.1 million to $6.7 million over a 50-year period).[2]

Under both dam removal and dam retention with fish passage facilities, FERC staff believe that new fish hatchery facilities will be needed to restore fish upriver from the dams. FERC estimated that these facilities would cost $3.1 million to construct and $240,000 a year ($2 million over 10 years) to operate.

[1]Costs are in 1990 dollars unless otherwise noted.

[2]The total is the present value of future payments discounted over 50 years at a 3-percent interest rate.

According to FERC, dam removal would provide the best prospects for restoring the fisheries. However, dam removal would result in the loss of nearly 40 percent of a local pulp and paper mill's power that is supplied by the dams' hydroelectric generators. Replacement power could be purchased from the local utility that provides most of the mill's electricity. Although dam retention with mitigation measures would allow the mill to continue using power produced by the dams to meet part of its energy requirements, FERC's analysis showed that the mitigation measures would increase the cost of dam-generated electricity to about the rate charged by the local utility.

Background

The Elwha dam near the mouth of the Elwha River was built between 1911 and 1913, and the Glines Canyon dam about 7 miles further upstream was built in 1927. The sole purpose of these dams is to provide part of the electricity used by a local pulp and paper mill in Port Angeles, Washington. The dams together generate about 172 gigawatt hours of electricity annually, or about 40 percent of the mill's power. Most of the mill's energy is provided by the Bonneville Power Administration through the local utility.

FERC is considering whether to issue licenses for the continued operation of these hydroelectric projects. A major concern is whether fisheries above the dams can be restored without removing the dams.

The Elwha River has historically supported large populations of wild anadromous fish, which hatch in freshwater rivers and streams, migrate to the ocean to mature, and return to the freshwater rivers and streams of their origin to spawn. The river was renowned for its production of four species of Pacific salmon (chinook, coho, pink, and chum) and three species of trout (steelhead, cutthroat, and Dolly Varden char). Since the construction of the Elwha dam, these native fish have been unable to migrate upstream to spawn and have been eliminated from the river above the dam. However, some of these species still spawn in the 5 miles of habitat below the Elwha dam.

The pristine quality of the water in the Elwha River continues to make the 65 miles of river above the Elwha dam exceptional habitat for anadromous fish. All but a small part of this habitat is within the boundaries of the Olympic National Park and is protected from development.

The Glines Canyon dam's original 50-year license to provide hydroelectric power expired in 1976, and since then FERC has renewed the license

annually. The Elwha dam has never been licensed. The owner of the two dams has applied to FERC for a new long-term license for the Glines Canyon project and an original long-term license for the Elwha project.[3] The owner has also proposed to provide fish passage facilities. In considering the applications, FERC has prepared a draft environmental impact statement (EIS) for the projects.

Cost of Dam Removal

In preparing its draft EIS, FERC considered several approaches for dam removal. The major difference in the cost of the approaches is the method of managing the large amount of sediment that has collected in the reservoirs behind the dams. According to FERC staff estimates, if the sediment is stabilized as the reservoirs are drained (FERC's preferred approach), the cost of dam removal would be about $61 million. But, if the sediment is removed and transported to an off-site disposal location, the cost of dam removal would increase to about $124.6 million.[4]

Dam Removal Phases and Associated Costs

The selection of a specific dam removal plan will depend on engineering judgment regarding safety, environmental impact, and costs. However, regardless of the plan chosen, dam removal would most likely proceed in three phases: (1) river control, (2) sediment management, and (3) structure removal. Table 1 shows the estimated costs of these phases.

Table 1: Estimated Costs to Remove the Two Dams

Dollars in Millions

Phase	Elwha dam	Glines Canyon dam	Total
River control	$5.0	$7.3	$12.3
Sediment management	17.1	28.6	45.7
Structure removal	1.8	1.2	3.0
Total	**$23.9**	**$37.1**	**$61.0**[a]

[a]FERC staff estimated that sediment management costs would increase to about $109.3 million, and total dam removal costs to about $124.6 million, if the sediment has to be removed and trucked to an off-site disposal location. According to FERC staff, an additional $75,000 a year ($1.9 million over 50 years) would be needed to control soil erosion, and an additional $180,000 would be required in adjustments to the local mill's electrical power system to enable the mill to rely solely on power from the local utility.

[3]GAO has taken the position that when the Congress created the Olympic National Park, it effectively prohibited the relicensing of Glines Canyon dam. FERC disagrees with our position and issued a declaratory order on October 19, 1990, asserting its authority to relicense the dam. For a more extensive discussion of the issues raised in this case, see our legal opinions of February 16, 1990 (B-236481) and August 16, 1990 (B-236481.2).

[4]These costs include all construction costs and a 25-percent contingency for uncertainty. They do not include the cost of replacement power, which is discussed later.

River Control

The river flow must be controlled during all phases of decommissioning the projects to facilitate construction and demolition and to ensure safety. Under FERC's preferred approach, the river would be diverted through tunnels constructed around the dams. These diversion tunnels would be tapped into the reservoirs. The reservoirs would then be drained under controlled conditions.

Excavation of the diversion tunnels is considered a low-risk operation using proven engineering procedures. The method envisioned for tapping into the reservoirs is a complex but proven engineering technique used to drain lakes or other impoundments. A diversion canal would also be constructed at the Glines Canyon project to control water quality downstream. Clear water from above the dam would be channeled through the canal and used to dilute the turbid water from the diversion tunnel. FERC staff estimated that the cost of river control would be about $12.3 million.

Sediment Management

Sediment management presents the greatest concern in removing the dams and would comprise about three-fourths of the cost. About 4.2 million cubic yards and 10.9 million cubic yards of sediment has built up in the reservoirs and deltas behind the Elwha and Glines Canyon dams, respectively. If the release of the trapped sediment is not controlled, material washed downstream may raise the level of the river bed and cause flooding in some areas. The discharged sediment would also increase water turbidity, adversely affecting fish habitat and water users. The only practical alternative to removing and disposing the sediment off site is to stabilize the sediment in or around the reservoirs as they are drained. This would greatly reduce the total cost of dam removal by eliminating the need to transport large volumes of sediment off site.

FERC staff has estimated the cost of sediment management at about $45.7 million if the preferred approach of stabilizing the sediment in or around the reservoirs is adopted. Under this approach the sediment would be moved as the reservoirs are drained and placed in terraces within the reservoir areas. These areas would then be revegetated to control erosion. FERC staff estimated that it would cost about $109.3 million, or about $63.6 million more, if the sediment had to be loaded on trucks as the reservoirs are drained and hauled to an upland disposal site several miles away.

Structure Removal

The dams and other project structures would be removed after the reservoirs are drained and the sediment is either sufficiently stabilized or

removed. Dam removal would be accomplished by demolition using conventional drill and blast techniques. Because these techniques are widely used and the volume of material to be removed is fairly well defined, structure removal is not considered a major engineering problem. FERC staff estimated that the cost of completely removing all structures would be about $3 million.

Value of Power Lost Due to Dam Removal

FERC staff estimated that the value of foregone power as a result of dam removal would be about $16.5 million a year in 1996 dollars. This estimate is based on assumptions about the future need for power in the Northwest (over a 50-year period beginning in 1996) and the cost of new facilities to provide that power. For example, the estimate assumes that replacement power would be valued at the higher rate for new source power in the Northwest (9.6 cents per kilowatt hour), rather than at the rate currently being charged to the mill by the local utility (2.4 cents per kilowatt hour, which totaled $3.4 million in 1989).[5]

Liability for Dam Removal Costs

Determining who is liable for the cost of dam removal is tied to the dam licensing process. If the federal government wants to remove a licensed dam, the government would have to pay the owner to acquire the dam and then pay the cost of the dam's removal.

The Glines Canyon dam was licensed in 1926. As a result, should the government decide that this dam ought to be removed, the government would be obligated to acquire the dam and pay any removal costs.

The Elwha dam, on the other hand, has never been licensed. Therefore, if FERC decides not to issue a license, the owner could be required to pay removal costs. It should be noted, however, that if FERC should license the Elwha dam, it would be subject to the same rules as other licensed dams. Should the government then decide that the Elwha dam ought to be removed, it would have to acquire the dam and pay for any removal costs.

[5]The current cost to the mill of power produced by the dams is 1 cent per kilowatt hour.

Cost of Alternatives for Restoring Fisheries Without Dam Removal

The owner of the two dams has proposed to retain the dams and construct fish passage facilities to accommodate the movement of some species upstream and downstream past the dams. The owner's plan targets the restoration of two species of anadromous salmon (chinook and coho) and one species of anadromous trout (steelhead). The owner would construct a fish ladder at the Elwha dam and a trap and haul facility at the Glines Canyon dam to assist fish in upstream passage and make spillway improvements and use experimental screens at the Elwha dam to facilitate downstream passage and protect fish from the turbines.[6] FERC staff agreed with the owner's estimate that it would cost about $20 million to construct the fish passage facilities the owner proposed (including $9 million for long-term repair and replacement costs).[7] FERC staff estimated that it would cost about $260,000 a year ($6.7 million over 50 years) to operate and maintain the facilities.

In evaluating fish passage mitigation measures, FERC considered both the owner's proposal and the most effective fish passage facilities available. According to FERC staff, the most effective measures would be to construct a fish ladder and install conventional turbine screens at both dams. FERC staff estimated that the cost to construct the most effective fish passage facilities at the two dams would be about $40.4 million and that the cost to operate and maintain the facilities would be about $160,000 a year ($4.1 million over 50 years).

However, FERC staff did not recommend that the most effective measures be used at the Glines Canyon dam because of their high cost relative to the potential increased fish survival rate. FERC staff also accepted the owner's proposal to use the less-expensive experimental turbine screens at the Elwha dam on the condition that the screens are proven effective. If they are not effective and conventional screens are needed, the cost for screens would increase by about $5.6 million. FERC staff, however, recommended that the most effective type of fish ladder be used at the Elwha dam, which would cost about $1 million more than the type proposed by the owner. (App. I contains additional details on fish passage facilities and other mitigation measures.)

[6]Fish ladders consist of a series of elevated pools of water that allow fish to move upstream past a dam by jumping or swimming from one pool to the next. With trap and haul facilities, fish are trapped below a dam, sorted, loaded on trucks, and transported around the dam.

[7]Additional costs may be incurred for habitat protection, recreation facilities, and project improvements.

Value of Power Lost Due to Construction and Operation of Fish Passage Facilities

FERC staff estimated that it would cost the dams' owner about $1.2 million in 1994 dollars to replace the power that would be foregone while the generators are shut down during construction of the fish passage facilities that the owner proposed and about $376,000 a year in 1996 dollars to replace the power lost as water is diverted to operate the facilities. FERC's estimate used 1994 as the midpoint of the construction period and assumed the facilities would be operational in 1996. FERC staff estimated that the cost of replacing the power that would be foregone from operating the most effective fish passage facilities would be about $1.2 million a year in 1996 dollars.

Effectiveness of Dam Removal Versus Retention in Restoring Fisheries and Meeting Other Objectives

In evaluating dam removal versus dam retention with fisheries mitigation measures, FERC identified three principal resource objectives: (1) the restoration of wild, self-sustaining runs of anadromous fish; (2) the restoration of natural environmental conditions within the Olympic National Park (primarily through reintroduction of anadromous fish to the food chain in the upper watershed and restoration of the lowland habitat in the areas inundated by the reservoirs); and (3) the provision of renewable hydroelectric energy. Because of the absence of generally accepted methodologies, FERC staff did not attempt to assign dollar estimates to nondevelopmental values such as fish production, recreation use, terrestrial resources, or aesthetics. Therefore, a cost/benefit analysis was not done by FERC. The following discussion addresses the effectiveness of the various alternatives in meeting the above objectives.

According to FERC staff, dam removal would provide the best potential for meeting the first two objectives. In addition to restoring chinook and coho salmon and steelhead trout—which also could be restored to some degree with fisheries mitigation measures—this alternative would provide restoration potential for other native fish, such as pink and chum salmon along with cutthroat and Dolly Varden trout. Although all of these species are expected to be restored with some certainty if the dams are removed, as shown in table 2, only fall chinook and winter steelhead trout are considered to have excellent restoration potential, according to the FERC staff assessment.

Table 2: Comparison of the Overall Outlook for Restoring Fish With the Dams Removed and With Fish Passage Facilities

Species	Dams removed	FERC staff approach/ owner's proposal	Most effective facilities
Chinook:			
Fall	Excellent	Good/fair[a]	Good
Spring	Good	Poor	Poor
Coho	Good	Fair	Good
Steelhead:			
Winter	Excellent	Good	Excellent
Summer	Good	Fair	Good
Pink	Good	Poor	Poor
Chum	Good	Poor	Poor
Sockeye	Poor	Poor	Poor
Cutthroat	Good	Poor	Poor
Dolly Varden	Good	Poor	Poor

[a]The restoration outlook for fall chinook is "good" under the FERC approach and "fair" under the owner's proposal.

In addition, if the dams are removed, food sources for wildlife provided by anadromous fish would be increased upriver from the dams considerably more than by using mitigation measures, and the water level would return to pre-dam conditions, which would provide the opportunity for restoration of 715 inundated acres in Olympic National Park. However, dam removal would result in the loss of nearly 40 percent of the power used by a local pulp and paper mill. This power is provided at a lower cost than commercially procured power used to meet the mill's energy requirements. But a FERC staff analysis indicates that the cost of constructing and operating fish passage facilities under the dam retention alternative would increase the cost of producing electricity and would essentially eliminate the mill's current cost advantage over purchasing replacement power from other sources.

Dam retention using the owner's proposed mitigation measures would result in increased restoration potential for the three species the owner targeted—chinook and coho salmon and steelhead trout. However, as shown in table 2, other native species of salmon and trout would not likely be restored because of the inability of these fish to move up or down the river even with mitigation measures in place. Mitigation measures are more effective for some species than others, but for certain species, no mitigation measures are likely to work. For example, pink and chum salmon are generally unable to pass through reservoirs when migrating downstream.

As previously mentioned, FERC staff recommended some additional mitigation measures to enhance the owner's proposal, but these measures would only slightly improve the potential for restoring one of the three targeted species (fall chinook). Although the most effective mitigation measures would remove some of the uncertainty in restoring the three species, FERC staff believe these measures are too costly relative to the expected increased survival rate. Mitigation measures would allow the continued generation of hydroelectric power but would reduce the output by about 2 percent below the current average annual output.

The National Park Service and other organizations that constitute the Joint Fish and Wildlife Agencies have taken the position that full restoration of the Elwha River will require self-sustaining wild runs of all of the anadromous fish stocks that existed before the dams were built.[8] On the basis of the results of cooperative research, these organizations believe that full restoration of all of these stocks cannot occur with the dams remaining in place.

Little information is available on the genetic composition of the original and present stocks of anadromous fish in the Elwha River. A National Park Service official told us that the Service would prefer to use native fish (descendants of the original stocks with the same or similar genetic make-up) for reintroduction into the upper river. He pointed out, however, that many of the native stocks are at low or very low levels. He indicated that the Service would attempt to capture as many of these fish as possible and raise them in a hatchery until they are placed in the upper river, or crossbreed them with the closest stock available (geographically and genetically) and use the hybrid fish in restoration.

Conclusions

Dam removal offers the best prospects for fish restoration. The cost is high, however—about $61 million under the most likely option—and could reach as high as $124.6 million if the sediment behind the dams has to be removed and transported off site for disposal. Also, dam removal would require the pulp and paper mill to purchase replacement power from another source.

It is less costly, at least initially, to retain the dams with construction of fish passageways and use of other mitigation measures, at a cost of

[8]The Joint Fish and Wildlife Agencies include the National Marine Fisheries Service, National Park Service, U.S. Fish and Wildlife Service, Bureau of Indian Affairs, Washington Department of Wildlife, Lower Elwha Klallam Tribe, and Point No Point Treaty Council.

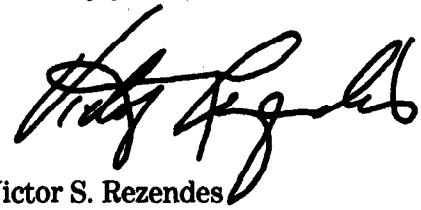
about $20 million if the dams' owner's proposal is adopted or $40.4 million if the most effective measures are used. But this alternative is much less effective than dam removal in restoring fish to the river above the dams. It also entails some foregone power generation. Costs associated with mitigation measures would lessen the cost-effectiveness of the dams in generating electricity and, according to the FERC staff analysis, would essentially eliminate any future cost advantage that the mill would otherwise have from using energy generated by the dams over purchasing power from other sources.

Given that the costs and benefits of various alternatives could not be fully quantified, we believe that the selection of one alternative over another is essentially a public policy decision in which value judgments must be made about the costs, benefits, and any trade-offs.

We discussed the information in this report with FERC officials. However, at the request of your office, we did not obtain official agency comments on a draft of the report. Our work was performed between June 1990 and January 1991 in accordance with generally accepted government auditing standards. The scope and methodology of our review are discussed in appendix II.

Unless you publicly announce its contents earlier, we plan no further distribution of this report for 30 days from the date of this letter. At that time we will send copies to the appropriate congressional committees; the Chairman of FERC; and the Director, Office of Management and Budget. We will also make copies available to others upon request. Should you need further information, please contact me at (202) 275-1441. Major contributors to the report are listed in appendix III.

Sincerely yours,



Victor S. Rezendes
Director, Energy Issues

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Abbreviations

EIS	environmental impact statement
FERC	Federal Energy Regulatory Commission
GAO	General Accounting Office

Fish Passage Facilities and Other Mitigation Measures Under Consideration

Fish passage facilities include various ways of getting anadromous fish past barriers such as dams. The resource managers we spoke with said that the success of fish passage facilities varies from site to site even for the same species. They also said that the effectiveness of a particular type of facility cannot be determined until years after it has been in operation.

For a fish passage facility to be successful, it must move fish both upstream and downstream safely without undue delay. Some methods of moving fish are preferred by resource managers because they result in fewer fish being injured or killed or they reduce the risks associated with human intervention. The survival rate of migrating fish is critical to the successful restoration of anadromous fish in rivers with dams.

Mitigation Measures for Upstream Passage

Upstream fish passage will require either fish ladders or trap and haul facilities. A typical state-of-the-art fish ladder (referred to as a pool and weir ladder) consists of a series of connected pools of water in a stair step configuration that allows anadromous fish to ascend in a relatively natural manner by jumping from one pool to the next at their own pace. Under the trap and haul method, fish are trapped below a dam and transported by truck for release upstream.

Resource managers prefer facilities that most closely simulate natural conditions. Fish ladders are preferred over trap and haul facilities for fish migration upstream because they allow fish to move according to their individual biological clock without human assistance. The economics of trap and haul facilities can delay migration until a sufficient number of fish are available for transport. Trap and haul facilities also increase the risk of injury to fish from handling and transport. We were told that there are instances where trap and haul facilities have been successful and other instances where such facilities have been unsuccessful.

Elwha Dam

For upstream passage around the Elwha dam, the owner has proposed to construct a fish ladder on the east bank of the dam at an estimated cost of about $3.2 million. This ladder (referred to as a denil fish ladder) is less expensive than a pool and weir ladder to construct because it can be prefabricated. The owner estimated that the cost of operating and maintaining a denil ladder would be about $100,000 a year ($2.6 million over 50 years).

However, the FERC staff has recommended that the more effective pool and weir type fish ladder be used at the Elwha dam. The staff estimated that it would cost about $4.2 million to construct and about $25,000 a year ($.6 million over 50 years) to operate and maintain.

Glines Canyon Dam

The owner has proposed to construct a trap and haul facility for upstream passage at the Glines Canyon dam, at an estimated cost of about $2.4 million. The steep canyon slope would require a major effort to build a fish ladder around the dam. The owner estimated that a trap and haul facility would cost about $100,000 a year ($2.6 million over 50 years) to operate and maintain.

Although resource managers indicated that a fish ladder at this dam would provide a better opportunity for fish restoration than a trap and haul facility, the FERC staff is not recommending a ladder because of the high cost relative to the potential benefits. The staff estimated that a pool and weir fish ladder would cost about $5.3 million to construct and about $25,000 a year ($.6 million over 50 years) to operate and maintain.

Engineers who were familiar with fish ladders told us that they would not expect any major problems in constructing a fish ladder at the Glines Canyon dam. They indicated, however, that it would involve a major construction effort because of the elevation (about 200 feet) and the rough terrain. We were also told that a fish ladder at this dam would be one of the longest ever built (about 2,200 feet at a 10-percent slope).

Mitigation Measures for Downstream Passage

Mitigation measures under consideration for downstream migration include screens to keep the fish from being killed by the power generating turbines, release of water at the dams to facilitate timely migration, and modification of spillways to minimize injuries to fish. However, because of the lack of conclusive test data on fish mortality for some species, resource managers question many of the specific measures, such as the type of screens to be used and the amount of water needed to be released to facilitate fish migration. Most of the controversy involves measures that would increase costs for the dams' owner.

Elwha Dam

For downstream passage the owner has proposed to install an experimental fish screen for the turbine intakes at the Elwha dam at an estimated cost of $3.7 million. These screens will be tested and evaluated

over several years to determine their effectiveness. In addition, the owner has proposed modifications (totaling about $1.3 million) to reduce fish mortality from passage over the spillway, automate project equipment to better control spill, and install a gage to monitor river flow. The owner has estimated that the cost of operating and maintaining these facilities would be about $60,000 a year ($1.5 million over 50 years).

Based on preliminary test results, the FERC staff has tentatively accepted the owner's proposal to use the experimental fish screen at this dam. However, the staff has recommended that if further testing shows that the screen is not effective, the owner should be required to install conventional fish screens. According to the FERC staff, conventional screens would cost about $9.3 million (or about $5.6 million more than the experimental screens).

Glines Canyon Dam

The owner's proposal would release water at a spill rate of 100 cubic feet per second at the Glines Canyon dam to facilitate fish passage over the spillway and would automate project equipment (at an estimated cost of about $400,000) to better control the release of spill. The owner does not plan to take any additional mitigation measures to facilitate downstream fish passage at this site. However, FERC staff has recommended placing greater restrictions on drawdown of the reservoir for power generation.

The FERC staff had considered recommending the installation of conventional fish screens at this dam but decided that the expected reduction in fish mortality from using these proven screens was not sufficient to justify the high installation cost. The staff estimated that it would cost about $10.9 million to relocate the turbine intake and install the screens and about $50,000 a year ($1.3 million over 50 years) to operate and maintain them. The experimental fish screen that may be used at the Elwha dam was not considered practical for the Glines Canyon dam.

Scope and Methodology

In obtaining information on the potential costs of removing the dams to restore the Elwha River fisheries and restoring the fisheries without removing the dams, we reviewed available federal, state, and private studies, reports, and correspondence on the alternatives under consideration. We also reviewed the FERC staff assessment of the potential costs, feasibility, limitations, environmental effects, trade-offs, and outlook for fish restoration under the alternatives as discussed in the draft EIS. In addition, we reviewed the underlying assumptions on which the costs were based.

We discussed dam removal approaches and costs with representatives of the dams' owner, interested private engineering firms, the Seattle District Army Corps of Engineers, FERC's contractor, and FERC staff. We discussed fish passage facilities and other mitigation measures, and their estimated costs and potential effectiveness in restoring the Elwha River fisheries, with representatives of the dams' owner, federal regional and state of Washington natural resource management agencies, local interest groups, FERC's contractor, and FERC staff. We also discussed the potential outlook for restoring the fisheries under the dam removal alternative with these agencies and groups. In addition, we toured the projects to obtain a better understanding of the dams and their impact. The organizations we contacted follow.

Organizations Contacted

Federal Agencies

Federal Energy Regulatory Commission
National Marine Fisheries Service
National Park Service
U.S. Army Corps of Engineers
U.S. Fish and Wildlife Service

State Agencies

Washington Department of Ecology
Washington Department of Fisheries
Washington Department of Wildlife

Other Organizations

EBASCO Environmental
Friends of the Earth

Hosey & Associates Engineering Company
James River II, Inc.
Lower Elwha Klallam Tribe
Point No Point Treaty Council
Summit Technology Consulting Engineers, Inc.

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