Exploring the Elwha River Restoration

An interpretive overview created by the Juan de Fuca Scenic Byway Association

The Juan de Fuca Scenic Byway Association sincerely thanks its partners on this project:

Clallam County

The Elwha Klallam Tribe

Olympic National Park

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Exploring the Elwha River Restoration

For thousands of years, the Elwha River ran freely from its headwaters high in the Olympic Mountains to its mouth on the Strait of Juan de Fuca. In December 1913, the first fruit of an ambitious project to bring electricity to the region came online, the Elwha Dam. This, and the subsequent 1927 upstream construction of the Glines Canyon Dam brought many changes to the ecosystems and people of the north Olympic Peninsula.

The Elwha River Restoration Project is the largest dam removal and river restoration in United States history.

The project is vast, much more than just deconstructing two dams. Teams of highly qualified personnel have been tasked with giving nature a hand up in habitat restoration, facilitating a return of the river to its natural processes, revegetation of the drained reservoirs, and opening areas of the watershed blocked for a century to migrating salmon. This booklet is an overview of the history of the river, the dams, and how this historic project is and will be bringing new and exciting natural and cultural changes to this part of the Olympic Peninsula.

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Beginnings

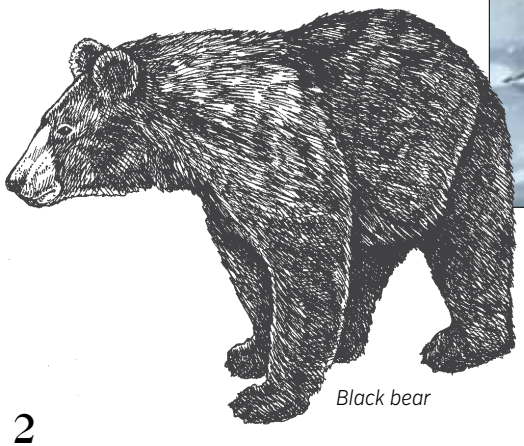
During the last Ice Age,

between 25,000 and 10,000 years ago, this region was covered with glaciers. As this cold period ended and the climate warmed, the huge sheets of ice melted, exposing the terrain over which the Elwha River runs.

The warming trend supported varied species of plants and animals, many of which are still here. Forests of Douglas-fir, spruce, hemlock, cedar, alder, and maple trees cover large areas of the watershed. Black bears, cougars, eagles, deer, elk, and many other animals live and forage in the area. Historically, some of the largest migratory fish runs outside Alaska used the Elwha River as their spawning ground. Coho, chum, sockeye, pink, and Chinook salmon, along with cutthroat trout, native char, and steelhead, depended upon the Elwha to shelter and nurture their eggs and young.

Roosevelt Elk

River otter



Black bear

Map showing locations of the dams on the Elwha River prior to their removal.

The Elwha River flows generally north for 45 miles from its headwaters high in the Olympic Mountains to its mouth on the Strait of Juan de Fuca. The watershed encompasses 321 square miles and over 75 miles of migratory fish habitat. It is one of the largest watersheds on the Olympic Peninsula, and the largest in Olympic National Park.

The Elwha snow finger, where the Elwha River begins.

The People


Early Klallam village

Elwha Klallam oral history tells of a sacred place on the Elwha River where Klallams were created, bathed and blessed.

"There are two holes in the river bed that contain water called "spčúʔ", [pronounced: "spcho"] which means "coiled basket." These holes are the places from which dirt was scooped, out of which the Creator formed humans. Throughout time, this is the place where people went to get information about their future. For example, if you reached into the water and pulled out a deer hair, you would be a good hunter. If you pulled out a fish bone it meant you would be a good fisherman. Before visiting this site the people would first cleanse and prepare their minds and bodies by fasting, meditating, and bathing."

Against the fertile backdrop of the Olympic Peninsula comes the first evidence of humans living in the area, approximately 13,800 years ago.

Since time immemorial, the Strong People or "nəxʷsƛ̓áy̓əm" [pronounced "Klallam"], resided near beaches and rivers along the north and east coasts of the Olympic Peninsula.

The Elwha Klallam people were and are particularly bound to the Elwha River and its watershed. They used the river as a crucial source of food, water, and as a route into the mountains and forests, establishing villages from which they hunted game and gathered plants. Shellfish in abundance were found in the river's estuary and nearby beaches. An old tribal saying is, "When the tide is out, the table is set." Central to their culture, however, and the core of their food supply, was the river's abundant salmon.


Members of the Klallam Drum and Dance Group celebrate the beginning of dam removal at the September 2011 official ceremony.

In the book *Native Peoples of the Olympic Peninsula,* Jamie Valadez tells this story: "Thunderbird lived in a cave and chased the salmon upriver by sending thunder and lightning toward the mouth of the Elwha. When the lightning hit the water it turned into a two-headed serpent . . . . Then the Klallam prepared to fish, because they knew a good run of fish was coming."

The Elwha Klallams continue to live along the river today, holding it in deep reverence and regarding it as a part of their tribe's soul.


Early logging on the Olympic Peninsula.

In the mid-1800s European-Americans started arriving in earnest and settling on the Olympic Peninsula.

Founded in 1862 a few miles east of the Elwha River, Port Angeles grew from a frontier outpost into a small town. The population increased rapidly when booming resource-based industries drew an influx of newcomers.

In 1890 the city incorporated and became the county seat, positioning it as the region's civic, commercial, and economic center.

The first decade of the 1900s was a time of rapid industrial and scientific advancement. Progress in producing and harnessing electricity during the last decades of the 1800s had made it possible to power many tasks previously accomplished only mechanically or by hand.

Electricity meant a huge leap forward in increased production and efficiency for anyone who could gain access. Some towns and cities were developing electrical grids that could supply power to businesses and residences. Many civic leaders in Port Angeles felt that a readily available source of electricity would enhance development of the harbor and local industries, bringing prosperity to the region.

Port Angeles downtown and harbor, circa 1895.

It's not just about taking the dams out, or even just putting the fish back. It's about the whole picture, the human population, marine predators, overfishing, the works. If the whole system is addressed, then maybe restoration will work.

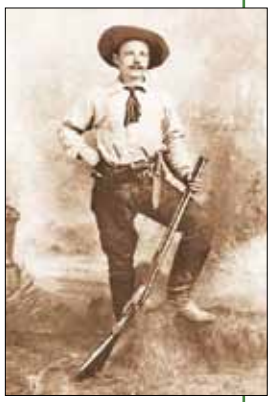
— George Bolstrom, Elwha Klallam Tribal Elder, 1929-2000

Our Creator gave us this fish to live on . . . and we cherished it, and we respected it . . . we didn't waste it, we used every bit of it . . . I may not see the abundance of fish come back in my lifetime, but I would like to see it come back for my grandchildren, my great-grandchildren, and the rest of my people, the generations to come. It was a gift from our Creator; it was our culture and heritage.

— Beatrice Charles, Elwha Klallam Tribal Elder, 1919-2009

The Dams

The Elwha Dam and construction camp, circa 1912.



Thomas Aldwell, real estate developer and founder of the Olympic Power and Development Company, circa early 1900s.

Real estate developer Thomas T. Aldwell believed that hydro electric power generated by a dam on the Elwha River could support development in the region. He sold his vision to a group of investors and formed the Olympic Power and Development Company in 1910. Construction of the dam started five miles upstream from the river's mouth and in 1914 the 105 foot Elwha Dam was producing and distributing electricity to customers in the region.

The success of the project coupled with a growing demand for more electricity fueled the construction of another dam. By 1927 the 210 foot Glines Canyon Dam was producing hydroelectric power eight miles upriver from the Elwha Dam.

Electricity allowed Port Angeles to become a center for the pulp and paper industry, which grew rapidly in the 1920s as new ways of processing pulpwood into paper and cellulose were discovered. Thomas Aldwell played a leading role in recruiting mills to the city, with power from the dams an important factor.

Construction of the Glines Canyon Dam, circa 1925.

Although the two dams were a crucial source of electricity for the region, the passage of fish had been blocked by the construction of the first dam. In fact, both dams were built without providing a way for fish to pass. Salmon returning to spawn were only able to access the first five miles of the river, whereas previously there was over 75 miles of river and tributaries available. The river had few spawning grounds remaining, and inevitably fewer and fewer salmon returned.

The river and its watershed had provided rich resources for the Elwha Klallam people. The water rising behind the newly built dams inundated villages, fish camps, medicinal plants, food gathering areas, and sites sacred to the tribe. Changes in sediment and woody debris runoff drastically altered the river's mouth and estuary, severely reducing shellfish populations. These changes left the Elwha Klallam tribe struggling to feed their people and maintain their self-sufficient lifestyle.

The Hatcheries

Hatchery broodstock harvest

Several projects designed to preserve the Elwha River salmon population have been initiated since the first dam was built.

Construction of the Elwha Dam had begun in 1910. Even before completion, it was clear that salmon were being blocked. This was prohibited by state law. The Washington State fish commissioner proposed a mitigation program designed to preserve both the dam and the salmon. State law allowed barriers to salmon migration if they were used to collect fish from which eggs could be harvested for a hatchery program. The Commissioner proposed that the state make use of the Elwha Dam as such a barrier. The resulting hatchery went into operation in 1915. It was found to be ineffective and was abandoned in 1922.

Salmon eggs hatching

A hatchery program for Chinook operated from the mid-1930s to the present, although a facility was not located on the river until the 1970s. Until then, Elwha Chinook eggs were reared at the nearby Dungeness hatchery, and then smolts [young fish] were released back into the Elwha.

A rearing channel was built by the Washington State Department of Fish and Wildlife to mitigate fishery losses to the state.

In the 1970s, a tribal hatchery was built on the river and started operating in 1978. It produced coho and chum salmon, as well as steelhead.

An aerial view of the new Elwha River hatchery, 2011.

Sediment released by removing the dams would change the river and render the hatchery unusable, so in 2011, a new one was built on higher ground.

The Fish

Chinook salmon fry

Leroy Black, Elwha Klallam tribal member, and a Chinook salmon.

Fish of many varieties depended on the pristine Elwha River and its tributaries for food and shelter. Most of these fish were anadromous. Born in fresh water, anadromous fish migrate to salt water, grow into adulthood, and then return to fresh water to spawn (produce fertilized eggs). Chinook, chum, coho, pink, and sockeye salmon, sea-run cutthroat, steelhead, and bull trout were all present in the Elwha River. It was the only river on the Olympic Peninsula that supported all species of Pacific salmon.

Year-round, the Elwha would swarm with adult fish returning from the sea to their birthplace. Some journeyed many miles upstream to spawn.

Prior to 1910, when dam construction began, estimates are that the river supported as many as 400,000 salmon in a year. In 2011, just prior to the start of dam removal, that number was approximately 3,000.

Driven by instinct even after a century, salmon were still gathering at the base of the Elwha Dam which blocked their upriver migration.

SALMON LIFE CYCLE

Salmon eggs *in a redd (nest).*

In addition to blocking access to about 70 miles of spawning habitat, the dams also degraded the five miles still accessible to salmon. Spawning beds became fewer and of lower quality because gravelly sediment became trapped above the dams. Woody debris was also held back, resulting in less shelter for young fish and the forage they depend on.

Prior to dam construction, Chinook salmon weighing 100 pounds were seen in the Elwha River. It is thought that removal of the dams and habitat restoration efforts may provide the environment needed for some individuals to again reach this remarkable size.

As much as the fish depended upon the river and its watershed, this same ecosystem and the people living in it depended on the fish.

After migrating into a river system and spawning, most salmon die. Many animals, birds, and other fish eat the highly nutritious carcasses and eggs.

The absence of fish carcasses above the dams changed the chemistry of the river and the surrounding soil, reducing the availability of carbon, nitrogen, and phosphorus to terrestrial and aquatic plant life. The loss of these crucial nutrients changed the numbers, types, and distribution of plants and animals living along the upper river.

In essence, the elimination of anadromous fish in the upper river fundamentally affected all life, human and otherwise, in the entire watershed.

Adults *spend from one to as many as eight years at sea before returning to their home river to spawn and die.*

Alevins *hatch and live on their yolk sacs, hiding in gravel beds.*

Smolts *undergo physical adaptations that allow them to leave fresh water and survive in the ocean.*

Fry *swim about, learning to feed, school, and develop survival skills.*

Parr *feed mainly on insects and continue to live in fresh water.*

A New Direction for the River

Fall colors along the Elwha River

Glines Canyon Dam

Returning Chinook salmon

Removal of the dams had long been advocated by the Elwha Klallam people.

In 1968, the owners of the Elwha Dam filed an application for a license and in 1973 a re-licensing application was submitted for Glines Canyon. Hydroelectric projects in the United States are licensed through the Federal Energy Regulatory Commission (FERC), and the process includes public hearings. The licensing process was a clear opportunity to reexamine the pros and cons of the two hydroelectric projects.

Environmental groups started aligning with the tribe, supporting dam removal and the restoration of the Elwha River. Because of the growing support for removing the dams, the FERC licensing process became delayed and contentious. There were challenges made by conservation groups. Some factions filed to intervene in the licensing process, one challenged jurisdiction in the courts.

The issues, greatly condensed, were:

- what agency, if any, had jurisdiction to license or re-license the dams,
- whether or not licenses should be granted,
- if substantive fish mitigation could be achieved without removing the dams, and
- if the dams could or should be removed in an effort to restore migratory fish populations and the associated ecosystem.

As part of the licensing process, FERC drafted an Environmental Impact Statement to explore the different fish mitigation options. The draft, released in February 1991, concluded that:

- dam removal is feasible,
- only removal of both dams would result in the potential for full restoration of the Elwha River ecosystem and anadromous fish runs, and
- the cost of power produced by the dams would equal or exceed the cost of power from the Bonneville Power Administration (by this time the main supplier of electricity to the region).

Many years passed after the licensing applications had been submitted. Conflict among competing interests needed a final resolution. Federal legislation, in essence a negotiated settlement, was drafted to mandate restoration.

In 1992, Public Law 102-495, the "Elwha River Ecosystem and Fisheries Restoration Act" was enacted, ordering "full restoration of the Elwha River ecosystem and native anadromous fisheries."

Elwha Dam, circa 2010

Orville Campbell,
Retired Mill Manager,
James River
Corporation

Many people think the dams were a mistake. In 1910, the culture and values of the people of Port Angeles were very different. Life was difficult, it was tough making a living, commerce was limited, and there was no electrical energy. The story of the dams is lacking if we pass judgment using only our modern day values.

There is no doubt that the Native Americans were mistreated. The original owners of the project were focused on bringing a source of energy to the region and did not consider the damage being done to the lifestyle of the local Native Americans.

The process of eliminating the dams began in the 1960s as tribes and environmentalists came together and began to criticize the entire hydro industry. This heralded a cultural change: even though energy brought a huge change in improving American lives, there was a degree of arrogance that had driven dam development.

In 1991, the staffs of US Senators Brock Adams and Bill Bradley came to meet with the dam owners. They were going to draft legislation to remove the dams from FERC's jurisdiction, buy them back and remove them. The owners could help draft the act or not.

Planning the Restoration

USGS surveying a section of the lower Elwha River and coastal zone.

Once it was final that the dams would be removed, the complex process of planning started. The National Park Service was put in charge of the project. Decisions had to be made regarding federal acquisition of the dams.

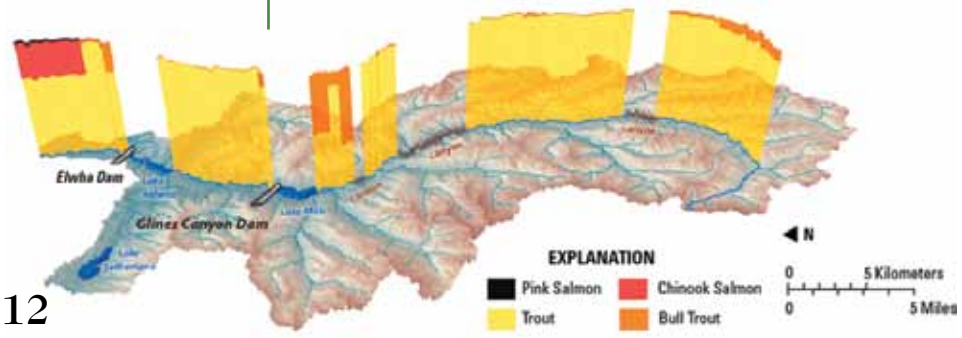
As the reservoirs drained, their dry bottoms would be devoid of vegetation. Should they be allowed to revegetate naturally, or would that process require assistance?

Millions of cubic yards of sediments had accumulated in the reservoirs behind the dams. When the dams were removed they would wash uncontrolled into the river making the water silty and smother aquatic life. Some of the surrounding communities which had water supplies dependent upon the Elwha might also experience problems with the sediment runoff. How would these assets be protected as the removal process progressed?

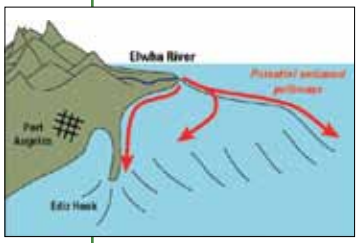
The power houses and their machinery had to be dismantled and removed. Additionally, there were thousands of cubic yards of concrete that had to be dealt with when the dams were dismantled.

Measuring and monitoring changes to the river, its watershed, the estuary, and the nearshore habitat, created a unique opportunity to enhance understanding of river systems and fisheries. This complex series of tasks needed to start early in the restoration to establish baselines and then continue on for decades. Qualified teams of personnel were needed to do the work.

In 2007, relative proportions of adult fish in the Elwha River were counted during summer snorkel surveys. Anadromous salmon could not pass the Elwha Dam. The fish community is dominated by resident bull trout and trout.

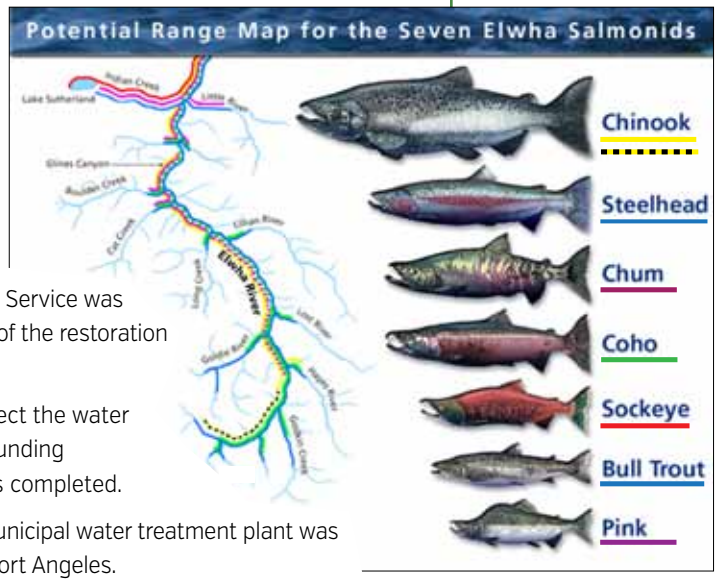


Sediment released from the two reservoirs will resupply coastal habitats and nearby beaches.



From 1992 to 2011, these and many other issues were resolved, and although not a single cubic inch of dam concrete had been removed, many preparatory projects were completed.

- In early 2000, the federal government purchased both the Elwha and the Glines Canyon Dams.
- The Bureau of Reclamation began operation of both hydroelectric projects.



- The National Park Service was placed in charge of the restoration project.
- Mitigation to protect the water supplies of surrounding communities was completed.
- A replacement municipal water treatment plant was constructed for Port Angeles.
- The Elwha Water Facilities were built and included a new river diversion, industrial water treatment plant, and flood protection.
- A greenhouse and plant propagation facility was built to grow native plants for revegetation projects.
- A replacement hatchery was built on the Elwha River.
- "Fish windows" were established as periods when altering the river's flow or allowing the release of sediments into the river could be harmful to fish. During a fish window, dam removal would stop and other parts of the project would be worked on.
- A strategy was developed to deal with the millions of cubic yards of sediments that had accumulated behind both dams. Each would be demolished from the top down in gradual increments, exercising some control over the amount of sediment washed downstream. These increments would be adjusted as needed and alternated with "fish windows."
- In September 2011, six webcams were installed along the river. They will help monitor sediment movement and allow online access by individuals interested in viewing the restoration project as it progresses.

Removing the Elwha Dam

Removing the base of the dam.

In 2011, a cofferdam was constructed upstream, diverting the river so crews could work in a drier environment. Contractors prepared an operations center next to the dam and upgraded the access road to accommodate heavy truck and equipment traffic.

Working below the safety of the log boom.

In June, the dam's power plant was shut down and disconnected from the electrical grid. The machinery from the power plant was taken apart and sorted for recycling. Some tools and pieces of machinery were loaned to historical societies and museums.

The original water level of the reservoir behind the 105-foot dam was about 200 feet above sea level. This was first lowered by opening the spillways. In mid-September, a large backhoe took out the first chunk of concrete from the top of the dam.

Elwha gravity dam removal.

November and December had been designated a fish window, so contractors temporarily stopped demolishing the dam and shifted to removing the powerhouse and penstocks. Penstocks are the huge pipes that direct water flow from the reservoir to the dam's power-producing turbines.

While demolishing the dam, crews continually moved the river between previously constructed left and right diversion channels, working in areas protected from the river's flow. The dam's height and the reservoir's water level were lowered slowly to manage the release of accumulated sediments from behind the dam.

By the end of 2011, all of the poles and lines that had connected the power plant to the electrical grid were gone.

Elwha Powerhouse demolition, 2011.

In January 2012, the reservoir's water level was down to about 152 feet above sea level and about half of the Elwha Dam's original height had been removed. Work on the dam then stopped for a few weeks while sediments washed downstream.

The demolition of the powerhouse was completed and the last remnants were removed. Crews excavated the bed of the left diversion channel down to about 140 feet above sea level, then shifted the river back into it. The reservoir was then drawn down more, to about 145 feet.

Removal of penstocks.

On January 30, 2012, a 14-day hold on dam demolition began, providing some control over the amount of dislodged sediments being washed downstream. Demolition then resumed, this time to excavate the remaining dam down to the original river bed.

In February, final grading and placement of rip-rap began along the river at the powerhouse site.

On March 16th, the concrete walls on both the left and right sides of the dam site were removed. Workers took the cofferdam out and the Elwha once again flowed in its original channel, approximately 100 feet above sea level.

By April 23rd, 2012, the Elwha Dam was gone.

Former site of the Elwha Dam, circa May 2012.

Removing the Glines Canyon Dam

Lake MIlls reservoir bed above Glines Canyon Dam site.

Removal of the dam began on September 15, 2011 and employed a strategy similar to that used on the Elwha Dam, but the scale of the process was much larger. Standing about 210 feet, this dam was approximately twice as tall as the Elwha Dam. Sediments had to be released gradually, as in the case of the Elwha Dam, but being upstream and much larger, the Glines Canyon Dam had many more millions of cubic yards of sediment trapped behind it.

Glines Canyon Dam demolition begins.

The reservoir's water level was about 600 feet above sea level. With the dam gone, the river channel here is now approximately 400 feet above sea level.

Demolition began by opening the spillgates and lowering the water level. Perched on a barge floating along the back of the dam, a large hydraulic hammer made notches in the top of the dam allowing water to flow through. When the water dropped below the bottom of the notches, the material in between was removed.

Notching Glines Canyon Dam.

By the end of February 2012, the level of the water in the reservoir was about 530 feet above sea level.

Between March and May 2012, crews started dismantling the powerhouse, gatehouse, and sections of the dam above the water.

During the May and June fish window, demolition of the powerhouse and gatehouse continued. Contractors used explosives to remove sections of dam that were above the water level.

In July, the hydraulic hammer could no longer reach the work from the floating barge, so crews used controlled blasting to lower the height of the dam. By the end of July, the reservoir's level was about 490 feet above sea level.

The August-September 15th fish window was used to remove the intake tower and a log jam.

Between September 15th and the end of the month, the reservoir's level had dropped to approximately 473 feet. Crews started removing natural and demolition debris that had piled up behind the dam.

By the end of October, blasting had lowered the dam enough for the river level to reach about 450 feet. Only 65 feet above sea level of the dam's original 210 foot height remained.

During the November-December 2012 fish window, crews hauled away rubble.

In February 2013, engineers put a temporary hold on continuing dam removal while the Elwha Water Treatment Plant downriver was upgraded.

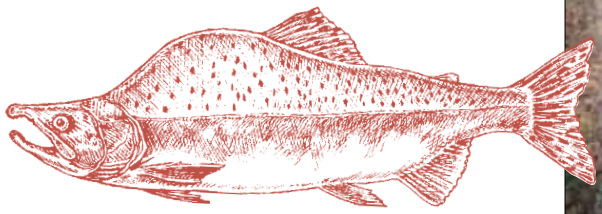
By July of 2013, only 50 feet of the dam remained, and by October, 40 feet.

In January 2014, 1,478 cubic yards of concrete were blasted into rubble, leaving only 30 feet of the 210 foot tall dam.

A 200 foot crane at the Glines Canyon Dam site.

Glines Canyon Dam removal progresses.

The final removal of the last bit of Glines Canyon Dam occurred on Tuesday, August 26, 2014, eliminating the last barrier between returning salmon and the entire Elwha River watershed.



Male pink salmon develop hooked jaws and a large lump on their back during spawning season.

Revegetation

Helicopter transporting woody debris to reservoir bed.

Approximately 800 acres of riparian and lowland forest habitat were flooded by water when the Elwha and Glines Canyon Dams were built. When their reservoirs were drained, fern rhizomes and stumps of 500-year-old cedar trees were exposed, remnants of the ancient forests that once covered the valley.

The river continues to erode sediments which in some places are 30 feet thick. It is carving a new main channel, leaving most of the remaining sediments as a base for the plants being reintroduced.

Revegetation is important for many reasons. It starts a new cycle of soil building and stabilization encouraging the return of plant life to the bare reservoir bottoms, providing vital habitat for fish, birds, and other animals. Since 2001, Elwha Klallam crews have been treating and removing noxious weeds to prepare for revegetating the area with native plants.

Tribal revegetation crew planting saplings on the newly exposed reservoir bed.

While some areas will revegetate almost immediately from seed that is blown or floated in, much of the newly exposed sediments would not be covered with regrowth quickly enough to prevent serious erosion. Thousands of pounds of grass and wildflower seed have been sown in these areas. The seeds are from plants native to the Elwha watershed, a mix of eight different species all proven to be successful colonizers of fine sediments. The seeds were collected in the Elwha watershed by Olympic National Park staff, volunteers, and members of the Elwha Klallam Tribe.

Covering the newly dry land also requires hundreds of thousands of native tree and shrub seedlings. A nursery facility had been built early on as part of the restoration project. Over 50 different native species are being fostered, including Douglas-fir, grand fir, big-leaf maple, red alder, black cottonwood, thimbleberry, Scouler's willow, snowberry, salmonberry, baldhip rose, Nootka rose, gooseberry, cottonwood, willow, Indian plum, and oceanspray.

The planting of these seedlings started as soon as bare ground was exposed.

After the Elwha Dam's structures were removed, the bare hillside was prepped and seeded to minimize erosion and runoff. Straw blankets were laid over the seed. Green shoots quickly started growing through the blankets. In the fall of 2013, over 1,000 seedlings were planted on the slope, accelerating forest development and slope stabilization.

Over the next several years, crews from both the Elwha Klallam Tribe and the National Park Service will plant up to 400,000 seedlings on the drained reservoir bottoms to augment the natural revegetation process.

Early results are encouraging. Birds and frogs moved in, and larger animals followed. River otters adjusted to the new surroundings. Deer forage on the newly exposed land.

In the drained reservoir behind Glines Canyon, revegetation efforts included modifying the environment for seedlings by adding large piles of woody debris. In October 2012, a "heavy lift" helicopter transformed nine acres into a sheltered environment by moving hundreds of logs from the former reservoir shoreline to an open sandy terrace.

Large piles of wood create safe sites for young plants as they get established, protecting them from wind, excessive heat, and drought. The wood helps minimize erosion, traps seeds and other particles blown in by the wind, and nourishes the poor sediments with much-needed nutrients. Woody debris also creates barriers that protect young seedlings from being eaten by large herbivores such as deer and elk.

The revegetation process will continue for several more years.

Reservoir bed before revegetation.

Reservoir bed after revegetation.

Returning Fish Runs

A pair of Chinook salmon

The dams were removed to restore an ecosystem and open approximately 70 additional miles of the Elwha River and its tributaries to salmon. The river is carrying tons of accumulated sediment out of the dry reservoir beds, and will be for some time.

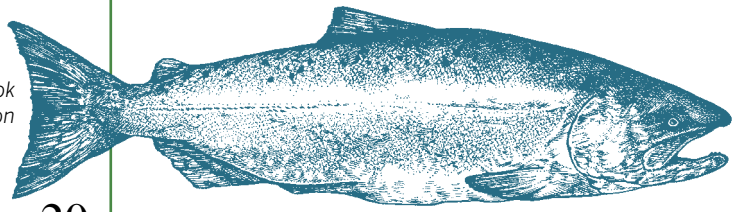
Sediment plume at mouth of the Elwha River.

Sediment suspended in water creates challenging conditions for most fish native to the Elwha. The multiple impacts of sediment transport were carefully considered throughout the restoration project planning.

Fish windows were one tool used to help clear the river channel of suspended sediments during salmon runs. This form of control ended once both dams were removed. Revegetation is now the best available tool to mitigate the entry of accumulated sediments into the river. Even with all aspects of the restoration project in place, it will be many years before the Elwha River returns to a natural state.

Sediment monitoring

Part of the project includes monitoring the impacts of the dams' removal on the river's fish. Many strategies are being used to document the numbers, size, and location of the various species as the stages of their life cycles are played out in the river. Surveys are conducted using fish traps, boats, snorkels, scuba gear, sonar, redd (nest) counting, radio tagging, and other techniques. Genetic testing is also being conducted to broaden understanding of how the project has affected the salmon.



Adult Chinook salmon

Before the Elwha Dam was completely removed, biologists transported adult salmon above the dam and released them. As hoped, their fry (newly hatched fish) were found in the tributaries above the dam site.

Chinook salmon juveniles

Chinook are the largest of the salmon that come to the Elwha, ranging between 20 and 60 pounds, with historical accounts of some weighing as much as 100 pounds.

In August and early September of 2013, the largest run of Chinook salmon since 1992 returned to the river. Some of these Chinook swam upstream of the former Elwha Dam site, taking advantage of new access to clear-running tributaries. There, biologists mapped over 600 redds (nests).

Ongoing monitoring

After the removal of the last few feet of the Glines Canyon Dam on August 26, 2014, a snorkel survey was conducted during the week of September 12th. Upstream from the former dam site three Chinook were counted, and 432 were found just downstream.

Young salmon that leave the Elwha River for the adult phase of their life in the ocean will now return free to explore the entire river system and find their former spawning grounds.

Projections are that the river will eventually support the return of fish to their "pre-dam" numbers in the hundreds of thousands.

In 2010, a 60+ pound male Chinook salmon documents a century of survival and a future of hope.

Progress of the Restoration

The expanding Elwha River delta.

Public Law 102-495 is the road map for the Elwha River Restoration Project, mandating full restoration of the Elwha River and its native anadromous fisheries.

Salmon alevin

Has all the hard work paid off? By what measures could this project be called a success? The only way to answer these questions is to keep monitoring, measuring, and analyzing data on every possible aspect of the environmental processes taking place in the watershed.

Dam removal set the stage for the recovery of an environment that historically supported hundreds of thousands of salmon. The success of the work will only be fully evaluated after many years and generations of salmon.

Changes in the watershed show that natural processes are returning. The dams are gone. Willow and alder are taking root in the drained reservoirs. The river is transporting excess sediments downstream. The estuary at the river's mouth is expanding and fine grained beaches are forming along the nearshore.

Returning pink salmon

Returning salmon now have access to about 75 miles of river and tributaries. Chinook and coho salmon and steelhead trout traditionally swam many miles up the river to spawn. In 2013, hundreds of Chinook found their way past the old Elwha Dam site and spawned in three tributaries not accessible for a century. In 2014, a survey counted salmon upriver from the former Glines Canyon Dam site. Future generations are now free to explore the upper river and their former spawning grounds.

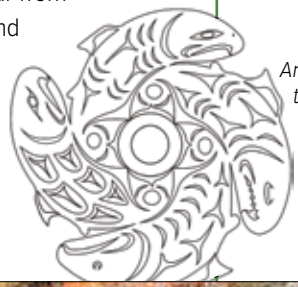
The estuary at the mouth of the Elwha had been "starved" of sediments for a century. It is now being replenished. Habitat for freshwater invertebrates and nearshore species, such as clams, crabs, and smelt are improving. Most salmon spend part of their early life in the estuary at a river's mouth where they forage for food and find shelter from predators.

Salmon eggs in a redd (nest).

Removing the dams to expose formerly dry land has validated oral histories and revived cultural practices that had been carefully preserved and passed down through generations of Elwha Klallam tribal members.

Juvenile Chinook salmon

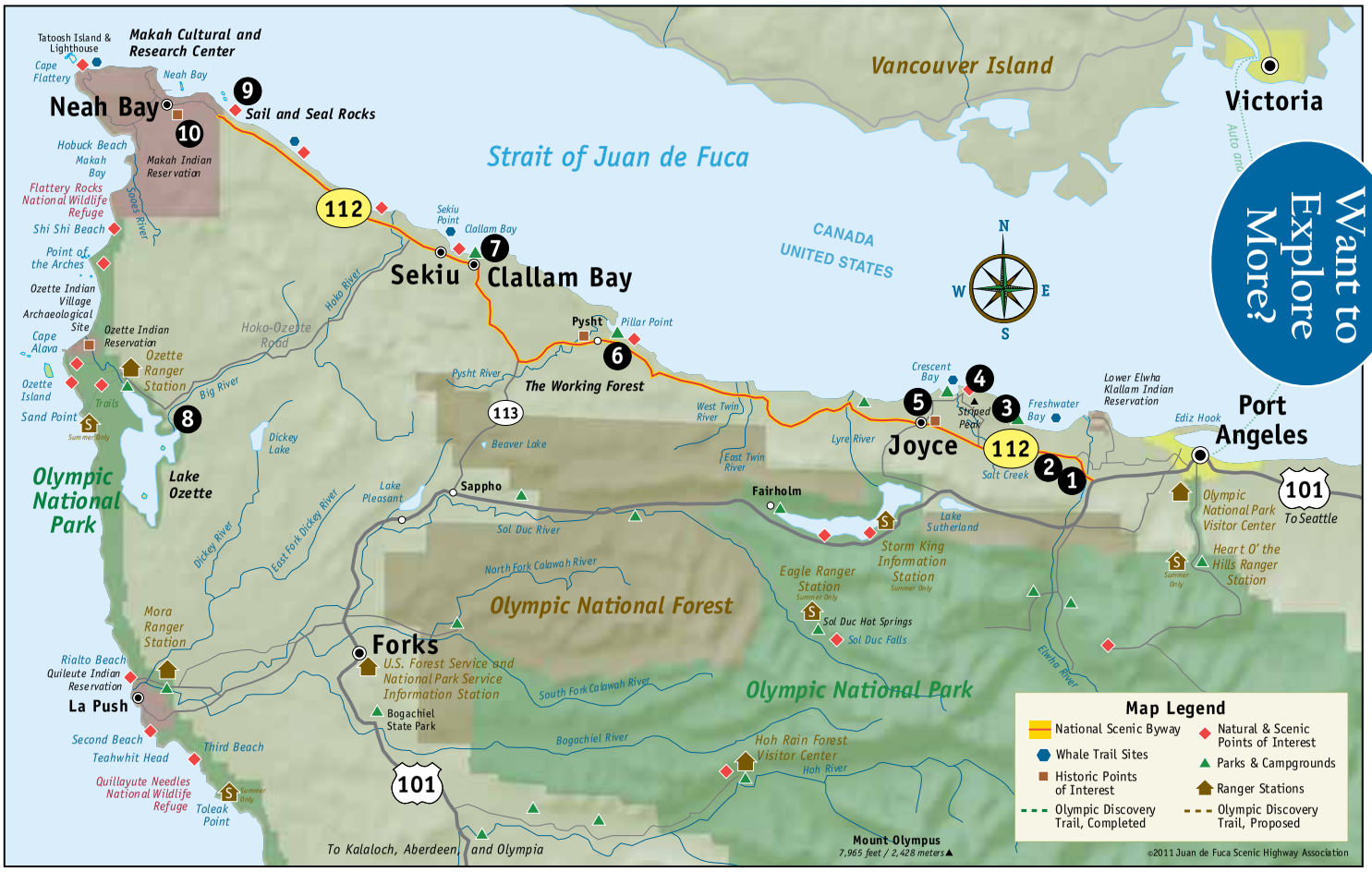
The Elwha River will continue to change as long as it flows. The project is far from over; many years will be spent watching and analyzing the changes wrought by the restoration. So far, indications are that natural processes are returning and the Elwha River is, once again, an environment which welcomes its salmon.



An Elwha Klallam traditional spindle-whorl design depicts sockeye, Chinook, coho, and chum salmon which run in the Elwha River.

The Elwha River flows freely once again.

The Strait of Juan de Fuca Scenic Byway • *Washington State Route 112*



MP = Highway mile post

1. Elwha River Restoration Interpretive Center

A self-guided center housing an overview of the largest dam removal project in the United States occurring on the adjacent Elwha River. There are picnic tables, parking and toilets, all with ADA access. A nature trail leads to views of the Elwha River gorge, and the former Elwha Dam site can be walked to using Lower Dam Road. Information on the outer walls of the center highlights other points of interest along the scenic byway. *[Turn off SR112 at Milepost 60/Lower Dam Road and turn right at the first gate]*

2. Olympic Adventure Trail

The Olympic Discovery Trail (ODT) is a non-motorized, multiuser transportation/recreation system that will eventually span the Olympic Peninsula. One portion, connecting SR112 at the Elwha River with Lake Crescent, is the Adventure Trail. It is three feet wide with a dirt and gravel surface and intended for use by equestrians, hikers, and mountain bikers. *(MP 59.5)*

3. Freshwater Bay County Park

The launch ramp for small boats, saltwater beach access and lower picnic area are open year round. The 17-acre day-use park has an upper picnic area located in a natural cedar forest, with covered picnic shelters. This area is open from May to Sept. *(Turn off SR 112 at MP 56.5)*

4. Salt Creek Recreation Area

Salt Creek includes the Tongue Point Marine Life Sanctuary, diving sites, a saltwater beach, playground, tidepools and hiking trails to Striped Peak. Originally a World War II harbor defense site, the remnants of Fort Hayden are preserved on the 196-acre site. The park has 90 campsites, accessible showers and rest rooms, and an RV dump station. *(Turn off SR112 at MP 53.8)*

5. Joyce General Store & Depot Museum

This historic landmark is a favorite supply stop for locals and tourists. It still has many original fixtures from back in the day. It continues its service as a U.S. Post Office, with many of the features from its beginnings a century ago. Open seven days a week year round. Call **(360) 928-3568** for more information. The Joyce Depot Museum is east of the store in a former railroad station. It exhibits items from the 1920s through the 1940s. The museum is open every Saturday year round (extended days in summer). *(MP 50-51)*

6. Pillar Point County Park

This wooded 4-acre day-use park has a sandy beach with a concrete launch ramp for small boats. Check tides before launching. Great area for crabbing, shell fishing and photography. Enjoy scenic views of the Strait, the Pysht River estuary and the imposing profile of Pillar Point. *(MP 29-30)*

7. Clallam Bay Spit County Park

With 33 acres on a saltwater beach, this day-use park includes public access to the Clallam Spit with a mile-long sand and gravel beach, access to the Clallam River, picnic sites, accessible rest rooms, an interpretive display and room to roam. *(MP 16-17)*

8. Lake Ozette

The area around Lake Ozette is part of Olympic National Park and can only be reached by car from SR112. The lake is the third-largest and second-deepest in the state of Washington. It offers boating, hiking and camping and is also the trailhead to a 9-mile cedar boardwalk loop to the Pacific shoreline, up the coast and back to the lake. Reservations are required for backpacking along the Ozette Coast from May through September. Check with the ONP Wilderness Information Center in Port Angeles for permits, tips and tide schedules. *(Turn at MP 12-13 and drive to the end of Hoko-Ozette Road.)*

9. Sail and Seal Rocks (Sea Stacks)

These twin offshore rocks are feeding grounds for gray whales; sea birds can also be seen. The Strait of Juan de Fuca connects Puget Sound to the Pacific Ocean. Exceptionally scenic, with complex rocky shorelines, and soft northwest light and water. *(MP 1)*

10. Neah Bay and the Makah Nation

Travel through Neah Bay as Highway 112 becomes the Cape Flattery Tribal Scenic Byway. Discover the ancient Makah heritage at the Makah Cultural and Research Center or continue along the byway to explore camping, sports fishing, sightseeing and hiking the pristine coast to Shi Shi Beach in Olympic National Park. Take the Cape Flattery trail on a 3/4-mile cedar-planked boardwalk to a magnificent view of the Tatoosh Island Lighthouse. A recreational permit is required and can be purchased at several outlets in Neah Bay. *(MP 0)*

Exploring the Elwha River Restoration **is an interpretive project created by the Juan de Fuca Scenic Byway Association.**

THE STRAIT OF

JUAN DE FUCA SCENIC BYWAY

Washington State Route 112

Mission Statement

To promote the Strait of Juan de Fuca Highway 112 Scenic Byway.

The Juan de Fuca Scenic Byway Association (JFSBA)

is a grassroots, volunteer organization formed for the purpose of promoting awareness of and sharing the history, culture, natural beauty, and recreational opportunities along the Strait of Juan de Fuca Scenic Byway. The Association is a Washington State non-profit organization with 501[c]3 charitable organization status.

The Strait of Juan de Fuca Scenic Byway

– Washington State Route 112 is located on the Olympic Peninsula just west of Port Angeles. The 61-mile highway meanders along the Strait through a remote and beautiful landscape of forests and coastline to the westernmost lands of the Pacific Northwest. Cultures and traditions on the peninsula today reflect the rich history of its people and environment. The highway has played a key part in that story.

Highway 112 is a National Scenic Byway, part of the collection of America's Byways.

In 2011, the Association received a generous grant from the Federal Highway Administration Scenic Byway Program to design and construct an interpretive visitor center near the eastern entrance to Highway 112. With the largest dam removal and river restoration effort in US history taking place within sight, the timing was just right. The center tells the story of the Elwha River and its restoration, both in the interpretive center and this accompanying commemorative booklet.

We are pleased and honored to have had this opportunity to offer an informative and welcoming experience for those who come to visit and explore.

AMERICA'S BYWAYS™

Learn more about the Strait of Juan de Fuca Scenic Byway at ***www.highway112.org***