May 8, 2018

Dear Educators:

We are happy to share the following electronic binder of lesson plans for grades 4-12 for your use in both formal and informal settings. This curriculum is part of a larger interpretive plan for the Condit Hydroelectric Project. PacifiCorp tasked Cascade Mountain School, a program of the Mt. Adams Institute, to collect existing and develop new curricular resources to educate students in a variety of classroom scenarios that could also be adaptable to river guides and outfitters. The curriculum included here mostly focuses on the history of Condit Dam and dams more generally, current and historical use of the White Salmon River by native people and others, salmon and watershed health, and stakeholder involvement during the decommissioning process.

We've also included a spreadsheet of local resources, including speakers and field trips, to allow you to dive further into this topic with your students. The binder is filled with photos, maps, presentations, and articles that may be of use to you as you teach your students. Our hope is that we've compiled useful, relevant, and exciting information here that can be used in a variety of different ways.

Many thanks to many individuals who shared their resources with us for this project.

Sincerely,

Emily Martin and Heather Kowalewski

Condit Hydroelectric Project Overview: The Condit Hydroelectric Project was located on the White Salmon River in south-central Washington, approximately three river miles upstream from its confluence with the Columbia River. PacifiCorp agreed to decommission and remove the project dam and water conveyance system in accordance with the 1999 Condit Hydroelectric Project Settlement Agreement and the related Federal Energy Regulatory Commission (FERC) Surrender Order issued in December 2010.

Work began in June of 2011, the dam was breached on October 26, 2011, and dam removal was completed on September 14, 2012. The former reservoir area was revegetated in March of 2013.

Steps involved in decommissioning the Condit project included constructing new bridge piers for the Northwestern Lake Road bridge which provides public access across the White Salmon River, relocation of a City of White Salmon waterline and removing the dam, intake structure, wood stave flowline from dam to surge tank, surge tank, penstocks from surge tank to powerhouse, and powerhouse tailrace wall. The powerhouse remains. The penstock entrances into the powerhouse turbines have been blocked as well as the exit to the tailrace. Environmentally sensitive materials such as hydraulic oils and batteries have been removed from the powerhouse.

Per regulatory permits, PacifiCorp is monitoring the establishment of newly planted vegetation, slope stability within the former reservoir area, water quality within the former project area and the extent of the newly formed delta at the mouth of the White Salmon River. --PacifiCorp (http://www.pacificorp.com/es/hydro/hl/condit.html)

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- ❑ What is a Dam?
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- ❑ Balancing Act

Lesson: What is a Dam?
Grades: 4-5
Learning Objectives: Students understand what a dam is and why they're built. Students understand the history of the Condit Dam on the White Salmon River. Students get to explore materials and dam building by building small dams using sand, popsicle sticks, rocks, and water.
Contributor: Emily Martin, Cascade Mountain School
Logistics:

What is a Dam & Why Do We Build Them? A dam is a barrier constructed to hold back water and raise its level, the resulting reservoir being used in the generation of electricity, flood protection, or as water supply.

A few facts about dams:

- Dams generate 16% of the world's electricity and irrigate food crops for 12-15% of the world's population
- Dams produce renewable energy by taking advantage of natural evaporation and precipitation (the hydrologic cycle) to generate electricity.
- Large dams belong to the most expensive investments many governments have ever made. An estimated 2 trillion dollars has been spent on dams since 1950.
- Dams block the migration of fish, deplete rivers of oxygen, and interfere with the biological triggers that guide fish. They also reduce the ability of rivers to clean themselves.
- There are fourteen dams on the mainstem of the Columbia River and over 450 dams throughout the entire Columbia Basin. The dams on the Columbia River and its tributaries produce half of the electricity consumed in the Pacific Northwest.
- Dam development has displaced wildlife habitat, agricultural lands and homes worldwide.
---Sources: www.internationalrivers.org and www.columbiariverkeeper.org

Brief History. *Information from Condit Hydroelectric Project Interpretive Plan & PacifiCorp Final Slides:* Condit Dam was built in 1913 by the Northwestern Electric Company. The dam was built in order to generate hydroelectric power for the Crown Columbia Paper Mill, located in Camas, Washington. The 125- foot dam and powerhouse took about a year to construct. Due to the construction of the dam, a lake was formed behind the dam known as Northwestern Lake which was about 2 miles long. 900 people worked on the dam everyday. In order to build the dam, the workers had to divert the water around the dam site so they could build the dam up from bedrock. The finished dam created 12 MW (megawatts) of electricity, about enough to power 9,000 modern homes. Bonneville Dam, on the other hand, produces 526 MW, enough to power close to 400,000 homes. Condit represents about 2% of power generating capacity as compared to Bonneville.

However, along with the construction of the dam came impacts to the salmon runs in the area, salmon which were protected by treaty. In 1855, heads of many of the tribes in the area signed a treaty with the U.S. government and were united as one nation under the name "Yakama." The treaty set aside exclusive reservation land for Yakama Nation and acknowledged the right for Yakama Nation to take fish in all of the streams bordering the reservation, the ceded area (larger area used by the tribes prior to the treaty), and in all their usual and accustomed places. With continued development in the area by

White homesteaders, ranches, orchards, and cities overtook wild places, wildlife, and foraging areas used by the Nation.

Even though the original dam did feature a fish ladder. It was destroyed in 1914 by a flood. The ladder was rebuilt the same year, but also washed out by a flood in 1918. According to the Condit Hydroelectric Project Interpretative Plan, "from 1918 to 2011 the natural migration of fish past the dam both upstream and downstream all but ceased. Instead, in 1919, a fish hatchery was constructed on the lower Columbia River, funded in part by Northwestern Electric Company as mitigation for the loss of the fish ladder." The White Salmon River before the dam was constructed had a tremendous Tule Chinook Salmon run every fall.

In the 1970s several federal court decisions (*U.S. v Oregon and U.S. v Washington*) established Yakama Nation as a sovereign co-manager of fishery resources, and there became more recognition of the need to stand by original treaties especially in regards to protecting usual and accustomed places to fish. In addition, many species of salmon were listed as endangered species under the Endangered Species Act, requiring legal protection. With these legal victories, federal hydropower relicensing requirements for safe fish passage increased.

In 1996 the Federal Energy Regulatory Commission (FERC) issued an Environmental Impact Statement (EIS) that required PacifiCorp to install $30 million worth of fish ladders and screens for fish passage. With these additional costs, PacifiCorp understood it would be too expensive to keep operating the dam. Removal of the dam was believed to be the most cost-effective way to allow adult salmon to migrate upstream and juveniles to migrate downstream and would return the river to more natural conditions. In 2011, Condit Dam was dynamited and removed.

In this case, the decision-makers were PacifiCorp and FERC. However, there were many stakeholders who may have helped to move the decommissioning process along such as tribes and environmental groups and those who may have contributed to additional time and expense of the project such as local landowners. The Yakama people currently participate in the co-management of shared resources, such as salmon and lamprey management, along the White Salmon River.

Videos:

- **Energy 101: Hydropower Video:** https://www.youtube.com/watch?v=tpigNNTQix8
- (produced by U.S. Department of Energy, 4 minutes)
- **Video of Explosive Breach of Condit Dam:** https://vimeo.com/31305629 (produced by Maser Films, 2 minutes)

Build A Dam Activity: We're going to use sand and popsicle sticks to see if we can build effective dams.

Materials:

- long, shallow, clear Tupperware container
- sand
- small rocks (like aquarium gravel)

- popsicle sticks
- bucket full of water

Instructions:

1. Fill the Tupperware container with sand.
2. Dig the path of a river in the sand.
3. Choose a spot somewhere along the river to build your dam. Where is the easiest place to build your dam? Where is the safest place to build your dam? What accommodations can you make for fish passage?
4. Use popsicle sticks and small rocks to construct a dam that will let only a little bit of water come through, but not too much. Keep in mind that the deeper the water, the greater the water pressure. So, the bottom of your dam will need to support more pressure than the top of your dam. If you built your dam in a triangular shape, then the bottom will be wider and will be able to support more pressure.
5. Test your dam by pouring water from a bucket down the river path.

Wrap-Up: Let's talk about the pros and cons of building dams in our rivers. Teacher starts a list on the whiteboard.

Pros: power generation, flood control, irrigation, water storage, recreation (on lakes formed behind dams), navigation

Cons: fish and other freshwater species decline, loss of river sediment downstream, displacement of human communities along the river, loss of cultural experience of the river

Extensions: Field trip visit to old dam site, including powerhouse, flowlines, and native plant restoration efforts. Compare and contrast beaver dams vs. man-made dams in size, scale, impact, and ecological repercussions.

7. Next, the teacher asks students to move to one side of the room or the other if they believe the dam should come down or stay up (students should stay in character as their stakeholder as they make this decision)

8. The teacher notes the new, larger groupings and then has the students return to their original groups.

9. Students return back to their original groups and make a compelling final statement for their group. The case must include:

- a statement of whether they think the dam should stay or go
- a thoughtful explanation of why they believe what they do

10. If the teacher thinks the students can handle a more open-ended discussion, then open the floor up to debate, students can respond to other stakeholder opinions (respectfully, of course).

11. Teacher wraps up the conversation with some final remarks, thanking the participants.

12. (optional) Teacher has students answer the questions provided.

Wrap-Up:
Ask students to answer this question: What do you personally believe about the removal of Condit Dam? Did you find yourself representing an opinion you actually didn't believe? If so, what was challenging about that for you?

Video of Explosive Breach of Condit Dam: https://vimeo.com/31305629 (produced by Maser Films, 2 minutes)

Lesson: Stakeholder Community Meeting
Grades: 4-5
Learning Objectives: Students gain a broader perspective than one's own about the decision to remove the Condit Dam. Students recognize the diversity of stakeholder perspectives around the Condit Dam removal. Students start to understand the complexity of public process and natural resource management. Note: names of people and organizations have been changed to be fictional.
Contributor: Emily Martin, Cascade Mountain School
Definitions:

- **Decision-Maker:** a person who has the authority to make a decision
- **Stakeholder:** a person or group of people who have a stake (interest or concern) in the outcome of the decision

Logistics: 1 class period, full class participation
Materials:

- Stakeholder Information & Question Sheet
- Video of Dam Breach: https://vimeo.com/31305629

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However, along with the construction of the dam came impacts to the salmon runs in the area, salmon which were protected by treaty. In 1855, heads of many of the tribes in the area signed a treaty with the U.S. government and were united as one nation under the name "Yakama." The treaty set aside exclusive reservation land for Yakama Nation and acknowledged the right for Yakama Nation to take fish in all of the streams bordering the reservation, the ceded area (larger area used by the tribes prior to the treaty), and in all their usual and accustomed places. With continued development in the area by White homesteaders, ranches, orchards, and cities overtook wild places, wildlife, and foraging areas used by the Nation.

Even though the original dam did feature a fish ladder. It was destroyed in 1914 by a flood. The ladder was rebuilt the same year, but also washed out by a flood in 1918. According to the Condit Hydroelectric Project Interpretative Plan, "from 1918 to 2011 the natural migration of fish past the dam both upstream and downstream all but ceased. Instead, in 1919, a fish hatchery was constructed on the lower Columbia River, funded in part by Northwestern Electric Company as mitigation for the loss of the fish ladder." The White Salmon River before the dam was constructed had a tremendous Tule Chinook Salmon run every fall.

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In this case, the decision-makers were PacifiCorp and FERC. However, there were many stakeholders who may have helped to move the decommissioning process along such as tribes and environmental groups and those who may have contributed to additional time and expense of the project such as local landowners. The Yakama people currently participate in the co-management of shared resources, such as salmon and lamprey management, along the White Salmon River.

Activity: Community Meeting

Instructions:
1. The teacher divides the class into groups of 2-3 students. Each group represents one stakeholder in the White Salmon watershed/greater area.

2. Each group receives a few copies of the information about the stakeholder (such as a kayaker, fish biologist, or dam operator) and each student reads the information provided.

3. As a group they discuss the information and come up with an opening statement to make at the community meeting. Their statement must including the following information:
- Their name
- One sentence about who they are (their job or some other defining characteristic)
- What they most care about in relationship to the river (is it fish health, recreation, culture?)

Please make sure students don't just read from their paper. They need to *create* their own opening statement.

4. The teacher acts as a representative of PacifiCorp, the operator of the dam. PacifiCorp has to decide whether to upgrade the dam to add expensive modern fish passage or decommission the dam. S/he wants to hear from the stakeholders around the region about their opinions.

5. Round 1: Each student group picks one representative to present their opening statement to the class, the class listens to all of the statements.

6. At this point, the teacher can ask clarifying questions about the stakeholders and their values.

7. Next, the teacher asks students to move to one side of the room or the other if they believe the dam should come down or stay up (students should stay in character as their stakeholder as they make this decision)

8. The teacher notes the new, larger groupings and then has the students return to their original groups.

9. Students return back to their original groups and make a compelling final statement for their group. The case must include:
- a statement of whether they think the dam should stay or go
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10. If the teacher thinks the students can handle a more open-ended discussion, then open the floor up to debate, students can respond to other stakeholder opinions (respectfully, of course).

11. Teacher wraps up the conversation with some final remarks, thanking the participants.

12. (optional) Teacher has students answer the questions provided.

Wrap-Up:
Ask students to answer this question: What do you personally believe about the removal of Condit Dam? Did you find yourself representing an opinion you actually didn't believe? If so, what was challenging about that for you?

Video of Explosive Breach of Condit Dam: https://vimeo.com/31305629 (produced by Maser Films, 2 minutes)

Kirstin Martin
Kayaker and Raft Guide for Local Rafting Company
Husum, WA

I moved to the Gorge in 2009 because I love to kayak. I was living in Portland and drove all the way out here on weekends just to get in my boat. When I am on the river, nothing else matters. I feel so alive as I paddle and play through the rapids.

When I heard that there might be the possibility of the Condit Dam coming down, I was right away all for it. Five more river miles downstream of Northwestern Lake would be open to kayak and raft. Over 25,000 people raft the White Salmon every year—it is a tremendous recreational resource. By opening more river miles, we will increase the access to this beautiful river, a river that is designated as a Wild and Scenic in the upper stretches.

Also, it's great for the rafting companies around here. They'll be able to offer additional river miles to their customers and fill more river trips. This means a healthy river economy for the rafting guides.

If the dam comes out, the kayaking and rafting community will be happy. We'll get an incredible run down one of the most spectacular rivers in the Gorge.

Stephanie Springs
Fish Biologist
Klickitat, WA

I'm fairly new to the Hood River area, but my husband and I love it out here. We both went to college in Walla Walla, WA at Whitman and studied natural resource management. I took that path in college because I knew I loved being outside, and I wanted to find a job that allowed me to enjoy nature and protect our natural resources.

Even though I am not a tribal member, my job is with a local tribe based in Klickitat, Washington. The mission of my organization is to honor, protect, and restore the Columbia River. The fish of the Columbia River and its tributaries are of paramount importance to our people, our diet, and our health. We advocate for the fish because they cannot speak for themselves. Specifically, we are trying to restore populations of salmon, steelhead, lamprey, and White Sturgeon.

In my job, I survey fish populations by going out into the rivers to count adult and juvenile salmon. I also monitor habitat and look for areas that might support salmon redds (nests). I love my job because I get to be outside while contributing to the scientific information the tribe uses to make harvest and management decisions.

I believe getting rid of the dam is a really smart decision. It will improve the health of the salmon and lamprey fishery and contribute to better natural resource management of this precious resource. By taking out the dam, 33 miles of steelhead habitat will open up and 14 miles of chinook habitat will open up for migration and spawning in the upper reaches of the watershed.

Joe Lewis
Tribal Council Chairman
Toppenish, WA

Most people living in Hood River are too young to remember or understand the history of salmon fishing and our people in the Columbia River Gorge. They see the Columbia and think, “how beautiful.” I see the Columbia and think, “where are the bountiful runs of salmon and the deafening sound of the great falls?” The last of the big dams went in in 1957, drowning Celilo Falls, our cherished gathering place and fishing spot.

One by one these dams have choked our river and starved our fish of their homes. Now the salmon rely on engineered structures, such as fish ladders to get up stream, and the small fry rely on trucks! to get back downstream around the dams.

I am the chairman of a local Tribal Council. For the fish and for our people, I am in favor of removing the Condit Dam. Fishing is a way of life for our people. The removal of this dam is a good step toward the recovery of the fishery, so that this fundamental part of our culture will not be lost to future generations.

Barbara Swift
Conservation Advocate

Few things have such a fundamental impact on a river as a dam. Dams block a river's flow and can harm clean water, fish and wildlife, and recreation opportunities.

My organization plays a leadership role in working to reform dam operations to more closely approximate natural river flows and benefit fish, wildlife and communities. There are pros and cons to hydroelectric power. We can get clean energy from hydropower, but it must be sited, operated, and mitigated responsibly in order to earn this distinction. However, many dams fail to meet this standard and hydropower generation can damage rivers. The Condit Dam needs to be dramatically updated to provide adequate fish passage and to meet today's environmental standards for "clean" hydropower.

In general, dams damage rivers in the following ways (not all of these are applicable to the Condit Dam)

- **Dams block fish passage** (preventing migration for spawning and growth)
- **Dams slow rivers** (stagnant reservoir pools disorient migrating fish and significantly increase the duration of their migration)
- **Dams alter water temperatures** (by slowing water flow, most dams increase water temperatures. Other dams decrease temperatures by releasing cooled water from the reservoir bottom. Fish and other species are sensitive to these temperature irregularities, which often destroy native populations.)
- **Dams alter timing of flows (**by withholding and then releasing water to generate power for peak demand periods, dams cause downstream stretches to alternate between no water and powerful surges that erode soil and vegetation, and flood or strand wildlife. These irregular releases destroy natural seasonal flow variations that trigger natural growth and reproduction cycles in many species.)
- **Dam turbines hurt fish (**following currents downstream, fish can be injured or killed by turbines. When fish are trucked or barged around the dams, they experience increased stress and disease and decreased homing instincts.)

Our expertise and advocacy have directly contributed to the removal of more than 200 dams across the country!

I am 100% behind the removal of the Condit Dam. Let's see this river free again!!

Bob Childs
Condit Dam Operations Manager
United Electric Company
Husum, WA

Condit was first put into service in 1913. It produces 13.7 megawatts of power--enough local, clean hydropower for 7,000 residents. I've been working at the Condit Dam for the last twenty years. I moved to Husum for the job from another small town in Washington where I was servicing a similar dam. I'm one of the only people in the region that knows how these dams work and operate. I am very proud of my work and my ability to keep this dam generating power. I'm the guy everyone calls if something goes wrong, which is inevitable.

I'm proud of the company I work for, United Electric Company. We serve 1.5 million customers in six western states. The company operates an 8,200-megawatt power system consisting of hydro, thermal, wind and geothermal generation.

If this dam comes out, I'll lose my job. I'll also have to let go of the three other techs that work here under me. All of us will have to relocate to another city or state because there are no other low-head dams to operate in this area. I don't want to relocate my family. My daughter is entering her sophomore at Columbia High School. She wants to graduate with all of her friends. If I lose this job, I won't be able to send her to the college of her dreams.

I understand that we don't need the 15 MW from this dam anymore now that we have Grand Coulee, The Dalles, and Bonneville Dams. Bonneville alone generates 5 million megawatts of power! But I still like these little dams. They make sense to me. They employ local people. They have made my life possible here.

Stephanie Andrews
Federal Bureau for Energy and the Environment (FBEE) Staff
Washington, DC

I work for the Federal Bureau for Energy and the Environment (FBEE) based in Washington, DC. Our role is to regulate interstate transmission of electricity, natural gas, and oil. We also license hydroelectric facilities through the United States. Every 30-50 years, hydroelectric facilities (dams) are up for re-licensing. I oversee this process for a number of dams, including Condit.

I don't have an opinion either way about removing the Condit Dam. However, I do have an obligation to the public of the United States to make sure any new licensed dams are up to snuff on their safety, operations, and environmental considerations.

Condit's federal operating license expired in 1996, and it was up to the company to apply for re-licensing. When they looked into what it would take to meet our standards, they saw that the dam would have to upgrade its fish screens and ladders to protect migrating salmon and steelhead. This is an expensive upgrade! They estimated it would cost close to $30 million dollars to upgrade when they were only bringing in about $5 million a year in electricity sales. Decommissioning was estimated at $10 million.

Rather than accepting a new license, United Electric decided they would rather remove the dam than spend the money upgrading the dam.

If United Electric had chosen to accept a new operating license, Condit's future economic viability was doubtful. A new license would have come with more-restrictive operating conditions, and the plant would have also required a considerable amount of new capital investment to keep it operating for the next 30 to 50 years.

Robbie Nelson
Fisherman
White Salmon, WA

I come to the mouth of the White Salmon River for peace and quiet. I love the serenity I feel when I fish for salmon and find myself in the same rhythm as nature. I really love the White Salmon for it's glacial melt, the bald eagles I see soaring, and the real possibility of snagging a big one.

I fish for spring and fall chinook, and steelhead and keep hoping to find some native spring chinook. The US Fish and Wildlife Service raise hatchery fish to release into the Columbia, and I can tell the difference by whether or not the fin is clipped. If it is, then it's hatchery raised, and I can keep it. The challenge is catching the native chinook. That's the real prize! They're harder to catch because there are fewer of them—and they're better adapted to this river because they're wild.

The big dams on the Columbia prevent fish migration and spawning upstream.[1] All native runs of salmon and steelhead on the river are listed under the Endangered Species Act.

If we take out the Condit Dam, it might really help restore native populations of fish, so I'm all for it. That means better fishing for me…

[1] The dams on the Columbia allow for fish passage until Chief Joseph Dam located at river mile 545.

Terry Labon
United Electric Company Project Manager
Portland, OR

It really all came down to economics. I work for United Electric Company. We want to provide cheap, reliable clean energy to our customers. The issue of Condit Dam is an economic decision. We would rather take the money and devote it to some other source of generating that would produce power at less cost for our customers.

Every 30-50 years, hydroelectric facilities (dams) are up for re-licensing. I oversee this process for a number of dams, including Condit.

Condit's federal operating license expired in 1996, and it was up to us to apply for re-licensing. When we looked into what it would take to meet the environmental and safety standards, we saw that we would have to upgrade the fish screens and ladders to protect migrating salmon and steelhead. This is an expensive upgrade! It was estimated to cost around $30 million to make the necessary upgrades. We only generate about $5 million annually in power, so it would have taken many years to recoup the costs of upgrading. And who knows what additional upgrades and capital investments would be needed in the future beyond those required today.

Rather than re-applying for a new license, we decided to close the dam rather than spend the money upgrading the dam.

Jeff Owens, Local Landowner
Northwestern Lake
Husum, WA

I've been living in Husum all of my life. My grandparents settled in this valley and our family has been apple and pear orchardists for generations. I bought my lakeside cabin along Northwestern Lake back in 1950. United Electric of course owns the land on which my house sits, but I own my house, and I love my lakefront view! I love how quiet and still the lake always is. I love sitting on my deck watching the mallard ducks swim by. I get out fishing and swimming on the lake all the time. My family and I love this oasis.

If dam comes down, I'll lose my beautiful lakefront property. My kids won't be able to swim or fish anymore because it will be a swift river instead of the calm lake. The banks will be all barren when the lake is drained. It will be a complete eye-sore! Also, I know everyone is talking about restoring salmon and lamprey populations, but what about all the plants and animal species that have adapted to a lake environment. Where will they go?

I'd prefer to keep everything the way it is. I'm sure the value of my house will plummet if I don't have lakeside property anymore. I hope I'll be compensated for property loss if the dam comes down.

Peggy Green
Chair of Northwestern Lake Homeowners Association

We must consider the wellbeing of the cabin owners along Northwestern Lake. As cabin owners, we have invested our time and money in our cabins along the lake. If the dam comes down, our property value will drastically decrease.

I am not only worried about loss of property value, but also the erosion that will occur if the dam is breached. Think about the volume of water that will rush through! Water is a powerful force and will certainly carve out the canyon deeper and increase erosion of the soil. Our cabins could be in danger of landslides or erosion that could damage our foundations, septic systems, and water lines. As the soil shifts, trees could fall on our homes. You wouldn’t want your septic tank to crack, your floor to cave in, or a tree to crash down on you while you sleep, would you?

Dam Removal Party

1. Find someone who believes they will be hurt from the dam being removed. Who is the person? How has or might, this individual be hurt?

2. Find someone who believes they will benefit from the dam being removed? Who is the person? How might the person benefit?

3. Find someone who cares about the health of the salmon. Who is this person? How do they feel about the dam?

4. Find someone who can tell you how dams hurt salmon. Who is this person? How do dams hurt salmon?

5. Find someone who can explain why the dam removal process came down to an economic decision for United Electric. Who is this person? What did you learn from them?

6. Find someone who is struggling with how to best restore the new landscape at the old lake site. Who is this person? What kinds of issues are they struggling with?

Sources:

White Salmon Time Lapse Website: http://whitesalmontimelapse.wordpress.com/

American Rivers Website: http://www.americanrivers.org/initiatives/dams/hydropower/

http://www.columbian.com/news/2012/sep/15/crews-complete-removal-condit-dam-white-salmon-riv/

Columbia Land Trust Website: http://www.columbialandtrust.org/

FERC website: http://www.ferc.gov/

Yakama Nation Fisheries Website: http://yakamafish-nsn.gov

News Articles:

- "Exploring the Undammed White Salmon River at Last" (OPB, Nov 2012) http://www.opb.org/news/article/undamed-white-salmon-river-opens-to-paddlers/
- "Northwestern Lake sees its last summer…" (Oregonian, Aug 2011) http://www.oregonlive.com/environment/index.ssf/2011/08/when_the_condit_dam_is_breache.html
- "White Salmon River evolves amid mixed feelings" (The Columbian, May 2015) http://www.columbian.com/news/2015/may/03/after-dam-white-salmon-river-evolves-mixed-feeling/

Lesson: Take A Stand (SHARE video and activities)
Grade Level: All
Learning Objectives: Students understand current important issues on the White Salmon River, students confront their own values and belief systems around protecting the White Salmon River, students learn to communicate information visually and orally.
Contributor: Emily Martin, Cascade Mountain School
Logistics: 1-2 class periods to complete

Materials:

- 3-minute SHARE video (https://vimeo.com/174849822)
- SHARE educational handout pdf
- Leave No Trace, Aquatic Invasives, and Wood In River Documents
- 4 blank poster boards and markers
- 4 sheets of paper with the words: Strongly Agree, Strongly Disagree, Agree, Disagree

Instructions: The teacher shares the following background information with his/her students and tells them that we'll be talking about current ecological issues unfolding on the White Salmon River.

Background Information: We're talking about current important issues unfolding along the White Salmon River in the wake of the Condit Dam removal. In a few minutes, we're going to watch a video put out by SHARE, a committee of residents, recreationists, agencies, and others working together on important issues on the White Salmon River. SHARE stands for:

S: Salmon, Safety, and Stewardship
H: Habitat
A: Awareness, Aquatic, and Access
R: Recreation, Respect, and Resources
E: Ethics, Ecology, Etiquette, Engagement and Education

SHARE Committee members include:

- Yakama Nation Fisheries
- Mid-Columbia Fisheries Enhancement Group
- US Forest Service — Wild & Scenic River
- Friends of the White Salmon River
- Underwood Conservation District
- Wet Planet Whitewater
- All Adventures Rafting
- American Whitewater
- Cabin-Owners of Northwestern Lake Association (CONLA)
- Washington State Dept. of Fish & Wildlife
- US Fish & Wildlife Service
- Klickitat River Guides

Watch SHARE video and **ask** the students to pay attention to different ways river users can take responsibility for the river and keep it clean and healthy for future generations.
After the video, ask the students the following questions:
1. How do you currently interact/use the White Salmon River? For example, when do you go, how often do you visit, and what do you do when you're there?
2. Write down a list of different types of river users
3. What are 2-4 **specific** actions you (or another type of river user) can take to protect the White Salmon?

Divide into 4 groups, each group will be assigned one of the four focus areas of SHARE's education campaign:

- Wood is Good!
- Invasive Aquatic Species.
- Protecting Salmon Redds and Spawning Salmon.
- Leave No Trace Ethic

Hand out information from SHARE on each of the four topics listed above.

Have students **develop & present back to the class a poster** about their topic that includes:

- Drawings depicting the issue/topic
- Key messages for river users describing the issue
- Clear action or actions river users can take to mitigate the issue

Wrap-Up: Take A Stand Activity. Teacher posts 4 pieces of paper, one in each corner of the room. On each sheet of paper is one of the possible choices: strongly agree, strongly disagree, agree, and disagree. After the teacher makes a statement (listed below), the students must choose which corner of the room they want to go to and go there. The teacher can open the floor up for discussion/rationale/why they are in the corner they are in or why they're having trouble deciding where to go.

Statements:
1. I feel responsible for the health of the White Salmon River even if I hardly visit, play, boat, or fish in it.
2. Large logs that fall into the river should be removed so as to prevent hazards to boaters and improve river safety.
3. Large logs that fall into the river should be left in place because they provide important habitat for a number of aquatic species.
4. I support protecting the water quality of the White Salmon River even if it means restricting access to some locations, curtailing fishing, and imposing stricter land use laws adjacent to the river.
5. I believe the White Salmon River benefits from concerned citizens banding together to educate and protect water quality.
6. Leave No Trace is a great tool for teaching young and old people about picking up after themselves.

7. Leave No Trace principles impedes my freedom to do what I want along the river.
8. If I go boating on the Deshutes River and then plan to take a trip down the White Salmon River, I'm not going to take the time to clean my boat off. I'm just one boat and it doesn't matter if I bring in a few invasive mud snails.
9. You just discovered a new swimming hole and you tell your friends about it. Just as you're about to jump in, you notice that you're right above a gravel bed/cobble bar where you know salmon could spawn. You decide to jump in that area anyway and tell your friends to jump, too.
10. I plan to get involved in a local group (or start a club at my school) to protect the White Salmon River.

Lesson: Condit Dam Balancing Act
Grade Level: All
Learning Objectives: Use this activity with any resource management controversy. Students practice identifying stakeholders, imagining consequences, making decisions, and defending their decisions.
Contributor: Caitlin Cray, White Salmon Schools
Logistics: (30 minutes, half or whole class)

Materials:

- Wooden blocks (i.e. child's set of various sizes)
- Masking tap + pens for labeling wooden blocks
- Balance beam: e.g. a playground see-saw or substitute a wooden board (6 foot length of 2"X4") centered on an automobile tire with two chock blocks to keep it from rolling
- Washable marker (to label the blocks)
- A list of relevant stakeholders. If possible, have students make a list in classroom beforehand. In the case of Condit Dam removal and riparian restoration the list would include: cabin owners, salmon, whitewater boaters, sport fishermen, commercial fishermen, tribal fisherman, local residents, barge pilots, power company, energy users, Native Americans, hatchery operators, tax payers, contractors, etc.

Procedure:
Set up balance beam in an open area where entire group can gather and see. Ask students to imagine they were responsible for deciding what to do about a problem, for example, whether or not to remove Condit Dam. Divide group into two teams. One team will label blocks with stakeholders who may benefit from dam removal. Other team will label blocks with stakeholders who may be harmed by dam removal. Each team member must be prepared to explain aloud to the whole group why his or her stakeholder is important
Tell them to use big blocks to represent the most important stakeholders, and smaller blocks to represent less important stakeholders. When both teams have finished labeling their blocks, have students take turns speaking for their stakeholder and placing their blocks on the balance beam. Alternate sides (facilitator must remain in middle holding the beam in balance until all blocks have been placed). When all blocks have been placed, get your camera ready, stand back, and release the beam to see which side 'wins'.

Ask open-ended questions such as….

- How do you know whether dam removal will benefit or harm your stakeholder?
- Are all stakeholders equally important? How would you decide who 'wins' and who 'loses'?
- What may happen to the stakeholders in the next 10 years? How about 40 years from now? How about 100 years from now?

Assessment:
Formative: Observe and listen to students throughout the activity. Pay attention to level of engagement, who is doing most of the talking, quality of the discussion.

Summative: In their field journals, each student writes one thing they learned or think about decision making when the decision will affect many lives.

Grades 6-8 Condit Dam Lesson Plans

- ❑ Condit Dam History Jigsaw
- ❑ Condit Dam Tea Party (Stakeholder Perspectives)
- ❑ Take A Stand (SHARE video and activities)
- ❑ Balancing Act

Lesson: Condit Dam History Lesson JigSaw
Grades: 6-8
Learning Objectives: Students gain an understanding of:

- White Salmon River Ecology,
- Native History/Cultural Use of the White Salmon River,
- Hydroelectric perspective of the Dam & History of Building Dam,
- Ecological Impacts of the Dam, and
- The Decommissioning Process

Contributors: Emily Martin, Cascade Mountain School and Heather Kowalewski
Logistics: 1-2 class periods; whole class
Materials:

- PDF of resources, divided by group
- Print out of group questions
- 5 empty poster boards and markers

Instructions: Divide the class into 5 groups. Give each group a packet of information to read and the questions below to answer. In Round 1, give the group 20-25 minutes to complete the answers. In Round 2, reconfigure the group into 5 new groups, but each new group has one "expert" representative from each of the previous groups. In their new groups, the students have to draw a colorful poster according to round 2 instructions. Students then present their posters to the class.

ROUND 1:

Group 1: White Salmon Watershed Ecology
Resources

- ❑ Map (s) of WS watershed, including USGS White Salmon Watershed, Columbia River Basin Watershed, White Salmon & Rattlesnake relief, and WA State Ecozone Map
- ❑ White Salmon Subbasin Description document
- ❑ The White Salmon River Subbasin_YKFP document
- ❑ Wildlife in the White Salmon Subbasin document
- ❑ Land Use in the White Salmon Subbasin document
- ❑ Terrestrial and Aquatic Resources of the White Salmon document
- ❑ Historical photos of salmon

Answer these questions:
1. Describe in your own words what a watershed is
2. Draw the White Salmon watershed. Be sure to include: the source/headwaters of the White Salmon River, where the White Salmon River flows, and how/where it reaches the Pacific Ocean.
3. What is the land use surrounding the White Salmon River and what counties border the White Salmon River?
4. What are some key ecological features of the White Salmon River, like lava tubes and springs? Also, what animal species live here? In your opinion, what makes this river special?

Group 2: Native History/Cultural Use of the White Salmon River
Resources:

- ❑ Yakama Nation History document
- ❑ Yakama Nation information document
- ❑ Native American use of Jewett Creek document
- ❑ Columbia River Indian Traditional Foods document

- ❑ Seasonal Gathering Rounds Sustained Columbia River Peoples document
- ❑ Seasonal Round Diagram
- ❑ Anthropogenic Disturbances in White Salmon Subbasin document
- ❑ Basic Condit Dam History document
- ❑ Lamprey found on the White Salmon River Yakima Herald article
- ❑ Lamprey - a cultural resource document
- ❑ Photos of Tribes along the White Salmon River
- ❑ Maps (2) of Reservation and Ceded Lands

Answer these questions:
1. How has the White Salmon River been important to humans since time immemorial? What species of plants and animals were harvested in the White Salmon watershed?
2. What is the difference between the ceded lands and the Yakama reservation?
3. Describe the current tribal rights for fishing.
4. Look at your life and draw a personal seasonal round, using events and interactions with nature and family, using as a guide/model the seasonal round of the Yakama.

Group 3: Hydroelectric perspective of the Dam & History of Building Dam
Resources:
- ❑ Condit Dam Background document
- ❑ History of Condit document
- ❑ Basic Condit Dam History document
- ❑ PacifiCorp Condit Info document
- ❑ Condit Dam History and Decommissioning document
- ❑ Condit FAQ document
- ❑ Impacts on Habitats in White Salmon Subbasin document
- ❑ White Salmon Restored: A Timelapse Project document
- ❑ Condit Dam Powerpoint Presentation
- ❑ Maps (2) including PacifiCorp Condit Dam map and PNW dams & salmon spawning map
- ❑ Photos of Condit Dam 3-D Model

Answer these questions:
1. Why was Condit Dam built?
2. How much power did Condit Dam generate? How does this compare to other dams in the area? How many modern homes would be powered by Condit if it were still running?
3. What were the hardest engineering challenges faced by the dam builders?
4. Describe what was happening along the Columbia River during the early 1900s. How did Condit Dam represent the zeitgeist of the era? Zeitgeist is the defining spirit or mood of a particular period of history as shown by the ideas and beliefs of the time.

Group 4: Ecological Impacts of the Dam
Resources:
- ❑ Ecological Impacts of Condit Dam document
- ❑ Ecological Impacts of Dams document
- ❑ Beneficial & Adverse Effects of Dam Removal document
- ❑ American Dipper Study article
- ❑ Lamprey found on White Salmon River Yakima Herald article
- ❑ Terrestrial and Aquatic Resources of the White Salmon document
- ❑ Tule Salmon Capture & Transfer document
- ❑ PacifiCorp Newsletter Condit Summer 2012
- ❑ How Dams Harm Rivers document

- ❑ American Rivers Dam Removal article
- ❑ Why Trees Need Salmon article
- ❑ Salmon Keystone Species diagram
- ❑ Maps (2) including White Salmon River Salmon Habitat map & White Salmon Fish Recolonization map

Answer these questions:

1. Describe how dams impact both out-migrating and in-migrating salmon. How does the health of salmon impact other species and the overall ecosystem health of the watershed?
2. Describe the importance of water temperature on ecological processes and how dams influence temperature.
3. Describe the importance of sediment input into rivers and how dams influence sediment flow through a watershed.
4. Given the dramatic impacts to the ecology of building dams, why do you think people built Condit and continue to build dams today?
5. How do you think the ecosystem will respond with the dam removal?

Group 5: Decommissioning Process

Resources:

- ❑ History of Condit document
- ❑ Access Restored to White Salmon River PacifiCorp article
- ❑ Condit Dam Breach PacifiCorp article
- ❑ Condit FAQ document
- ❑ PacifiCorp Condit Info document
- ❑ PacifiCorp newsletter Condit Summer 2012
- ❑ Condit Settlement & Decommissioning Overview document
- ❑ Condit Dam History and Decommissioning document
- ❑ Condit Decommissioning Overview document

Answer these questions:

1. What does decommissioning mean?
2. What factors influenced PacifiCorp to make the decision to decommission the dam? What wound up being the most compelling reason?
3. How long did the decommissioning process take?
4. What decision-makers and stakeholders got involved in the settlement process? List all decision-makers and stakeholders and their influence/role in the process.

ROUND 2:

In your new group, draw a poster which includes:

1. a map of the WS river and watershed with major towns and land features noted
2. the placement of Condit dam in the watershed
3. a one-sentence rationale for building the dam in 1913
4. a list of ecological impacts of the dam on the watershed
5. a one-sentence rationale for taking the dam out in 2011

Lesson: Condit Dam Tea Party (Stakeholder Perspectives)

Grades: 6-8

Learning Objectives: Students gain a broader perspective than one's own about the decision to remove the Condit Dam. Students recognize the diversity of stakeholder perspectives around the Condit Dam removal. Students start to understand the complexity of public process and natural resource management. Note: names of people and organizations have been changed to be fictional.

Contributors: Emily Martin, Cascade Mountain School and Caitlin Cray, White Salmon Schools

Logistics: 1 class period; whole class

Materials:

- Condit Dam Background/History (see below)
- Stakeholder Information & Question Sheets (3 copies)
- White board on which to list names of panelists and cost/benefits of dam removal
- Video of Dam Breach: https://vimeo.com/31305629

Brief History: *Information from Condit Hydroelectric Project Interpretive Plan & PacifiCorp Final Slides.* Condit Dam was built in 1913 by the Northwestern Electric Company. The dam was built in order to generate hydroelectric power for the Crown Columbia Paper Mill, located in Camas, Washington. The 125-foot dam and powerhouse took about a year to construct. Due to the construction of the dam, a lake was formed behind the dam known as Northwestern Lake which was about 2 miles long. 900 people worked on the dam everyday. In order to build the dam, the workers had to divert the water around the dam site so they could build the dam up from bedrock. The finished dam created 12 MW (megawatts) of electricity, about enough to power 9,000 modern homes. Bonneville Dam, on the other hand, produces 526 MW, enough to power close to 400,000 homes. Condit represents about 2% of power generating capacity as compared to Bonneville.

However, along with the construction of the dam came impacts to the salmon runs in the area, salmon which were protected by treaty. In 1855, heads of many of the tribes in the area signed a treaty with the U.S. government and were united as one nation under the name "Yakama." The treaty set aside exclusive reservation land for Yakama Nation and acknowledged the right for Yakama Nation to take fish in all of the streams bordering the reservation, the ceded area (larger area used by the tribes prior to the treaty), and in all their usual and accustomed places. With continued development in the area by White homesteaders, ranches, orchards, and cities overtook wild places, wildlife, and foraging areas used by the Nation.

Even though the original dam did feature a fish ladder. It was destroyed in 1914 by a flood. The ladder was rebuilt the same year, but also washed out by a flood in 1918. According to the Condit Hydroelectric Project Interpretative Plan, "from 1918 to 2011 the natural migration of fish past the dam both upstream and downstream all but ceased. Instead, in 1919, a fish hatchery was constructed on the lower Columbia River, funded in part by Northwestern Electric Company as mitigation for the loss of the fish ladder." The White Salmon River before the dam was constructed had a tremendous Tule Chinook Salmon run every fall.

In the 1970s several federal court decisions (*U.S. v Oregon and U.S. v Washington*) established Yakama Nation as a sovereign co-manager of fishery resources, and there became more recognition of the need to stand by original treaties especially in regards to protecting usual and accustomed places to fish. In addition, many species of salmon were listed as endangered species under the Endangered Species Act, requiring legal protection. With these legal victories, federal hydropower relicensing requirements for safe fish passage increased.

In 1996 the Federal Energy Regulatory Commission (FERC) issued an Environmental Impact Statement (EIS) that required PacifiCorp to install $30 million worth of fish ladders and screens for fish passage. With these additional costs, PacifiCorp understood it would be too expensive to keep operating the dam. Removal of the dam was believed to be the most cost-effective way to allow adult salmon to migrate upstream and juveniles to migrate downstream and would return the river to more natural conditions. In 2011, Condit Dam was dynamited and removed.

In this case, the decision-makers were PacifiCorp and FERC. However, there were many stakeholders who may have helped to move the decommissioning process along such as tribes and environmental groups and those who may have contributed to additional time and expense of the project such as local landowners. The Yakama people currently participate in the co-management of shared resources, such as salmon and lamprey management, along the White Salmon River.

Activity: Community Meeting

Instructions:
1. The teacher divides the class into groups of 2-3 students. Each group represents one stakeholder in the White Salmon watershed/greater area.

2. Each group receives a few copies of the information about the stakeholder (such as a kayaker, fish biologist, or dam operator) and each student reads the information provided.

3. As a group they discuss the information and come up with an opening statement to make at the community meeting. Their statement must including the following information:
- Their name
- One sentence about who they are (their job or some other defining characteristic)
- What they most care about in relationship to the river (is it fish health, recreation, culture?)

Please make sure students don't just read from their paper. They need to *create* their own opening statement.

4. The teacher acts as a representative of United Electric, the operator of the dam. United Electric has to decide whether to upgrade the dam to add expensive modern fish passage or decommission the dam. S/he wants to hear from the stakeholders around the region about their opinions.

5. Round 1: Each student group picks one representative to present their opening statement to the class, the class listens to all of the statements.

6. At this point, the teacher can ask clarifying questions about the stakeholders and their values.

7. Next, the teacher asks students to move to one side of the room or the other if they believe the dam should come down or stay up (students should stay in character as their stakeholder as they make this decision)

8. The teacher notes the new, larger groupings and then has the students return to their original groups.

9. Students return back to their original groups and make a compelling final statement for their group. The case must include:

- a statement of whether they think the dam should stay or go
- a thoughtful explanation of why they believe what they do

10. If the teacher thinks the students can handle a more open-ended discussion, then open the floor up to debate, students can respond to other stakeholder opinions (respectfully, of course).

11. Teacher wraps up the conversation with some final remarks, thanking the participants.

12. (optional) Teacher has students answer the questions provided.

Wrap-Up:
Ask students to answer this question: What do you personally believe about the removal of Condit Dam? Did you find yourself representing an opinion you actually didn't believe? If so, what was challenging about that for you?

Video of Explosive Breach of Condit Dam: https://vimeo.com/31305629 (produced by Maser Films, 2 minutes)

Kirstin Martin
Kayaker and Raft Guide for Local Rafting Company
Husum, WA

I moved to the Gorge in 2009 because I love to kayak. I was living in Portland and drove all the way out here on weekends just to get in my boat. When I am on the river, nothing else matters. I feel so alive as I paddle and play through the rapids.

When I heard that there might be the possibility of the Condit Dam coming down, I was right away all for it. Five more river miles downstream of Northwestern Lake would be open to kayak and raft. Over 25,000 people raft the White Salmon every year—it is a tremendous recreational resource. By opening more river miles, we will increase the access to this beautiful river, a river that is designated as a Wild and Scenic in the upper stretches.

Also, it’s great for the rafting companies around here. They’ll be able to offer additional river miles to their customers and fill more river trips. This means a healthy river economy for the rafting guides.

If the dam comes out, the kayaking and rafting community will be happy. We’ll get an incredible run down one of the most spectacular rivers in the Gorge.

Stephanie Springs
Fish Biologist
Klickitat, WA

I'm fairly new to the Hood River area, but my husband and I love it out here. We both went to college in Walla Walla, WA at Whitman and studied natural resource management. I took that path in college because I knew I loved being outside, and I wanted to find a job that allowed me to enjoy nature and protect our natural resources.

Even though I am not a tribal member, my job is with a local tribe based in Klickitat, Washington. The mission of my organization is to honor, protect, and restore the Columbia River. The fish of the Columbia River and its tributaries are of paramount importance to our people, our diet, and our health. We advocate for the fish because they cannot speak for themselves. Specifically, we are trying to restore populations of salmon, steelhead, lamprey, and White Sturgeon.

In my job, I survey fish populations by going out into the rivers to count adult and juvenile salmon. I also monitor habitat and look for areas that might support salmon redds (nests). I love my job because I get to be outside while contributing to the scientific information the tribe uses to make harvest and management decisions.

I believe getting rid of the dam is a really smart decision. It will improve the health of the salmon and lamprey fishery and contribute to better natural resource management of this precious resource. By taking out the dam, 33 miles of steelhead habitat will open up and 14 miles of chinook habitat will open up for migration and spawning in the upper reaches of the watershed.

Joe Lewis
Tribal Council Chairman
Toppenish, WA

Most people living in Hood River are too young to remember or understand the history of salmon fishing and our people in the Columbia River Gorge. They see the Columbia and think, “how beautiful.” I see the Columbia and think, “where are the bountiful runs of salmon and the deafening sound of the great falls?” The last of the big dams went in in 1957, drowning Celilo Falls, our cherished gathering place and fishing spot.

One by one these dams have choked our river and starved our fish of their homes. Now the salmon rely on engineered structures, such as fish ladders to get up stream, and the small fry rely on trucks! to get back downstream around the dams.

I am the chairman of a local Tribal Council. For the fish and for our people, I am in favor of removing the Condit Dam. Fishing is a way of life for our people. The removal of this dam is a good step toward the recovery of the fishery, so that this fundamental part of our culture will not be lost to future generations.

Barbara Swift
Conservation Advocate

Few things have such a fundamental impact on a river as a dam. Dams block a river's flow and can harm clean water, fish and wildlife, and recreation opportunities.

My organization plays a leadership role in working to reform dam operations to more closely approximate natural river flows and benefit fish, wildlife and communities. There are pros and cons to hydroelectric power. We can get clean energy from hydropower, but it must be sited, operated, and mitigated responsibly in order to earn this distinction. However, many dams fail to meet this standard and hydropower generation can damage rivers. The Condit Dam needs to be dramatically updated to provide adequate fish passage and to meet today's environmental standards for "clean" hydropower.

In general, dams damage rivers in the following ways (not all of these are applicable to the Condit Dam)

- **Dams block fish passage** (preventing migration for spawning and growth)
- **Dams slow rivers** (stagnant reservoir pools disorient migrating fish and significantly increase the duration of their migration)
- **Dams alter water temperatures** (by slowing water flow, most dams increase water temperatures. Other dams decrease temperatures by releasing cooled water from the reservoir bottom. Fish and other species are sensitive to these temperature irregularities, which often destroy native populations.)
- **Dams alter timing of flows (**by withholding and then releasing water to generate power for peak demand periods, dams cause downstream stretches to alternate between no water and powerful surges that erode soil and vegetation, and flood or strand wildlife. These irregular releases destroy natural seasonal flow variations that trigger natural growth and reproduction cycles in many species.)
- **Dam turbines hurt fish (**following currents downstream, fish can be injured or killed by turbines. When fish are trucked or barged around the dams, they experience increased stress and disease and decreased homing instincts.)

Our expertise and advocacy have directly contributed to the removal of more than 200 dams across the country!

I am 100% behind the removal of the Condit Dam. Let's see this river free again!!

Bob Childs
Condit Dam Operations Manager
United Electric Company
Husum, WA

Condit was first put into service in 1913. It produces 13.7 megawatts of power--enough local, clean hydropower for 7,000 residents. I've been working at the Condit Dam for the last twenty years. I moved to Husum for the job from another small town in Washington where I was servicing a similar dam. I'm one of the only people in the region that knows how these dams work and operate. I am very proud of my work and my ability to keep this dam generating power. I'm the guy everyone calls if something goes wrong, which is inevitable.

I'm proud of the company I work for, United Electric Company. We serve 1.5 million customers in six western states. The company operates an 8,200-megawatt power system consisting of hydro, thermal, wind and geothermal generation.

If this dam comes out, I'll lose my job. I'll also have to let go of the three other techs that work here under me. All of us will have to relocate to another city or state because there are no other low-head dams to operate in this area. I don't want to relocate my family. My daughter is entering her sophomore at Columbia High School. She wants to graduate with all of her friends. If I lose this job, I won't be able to send her to the college of her dreams.

I understand that we don't need the 15 MW from this dam anymore now that we have Grand Coulee, The Dalles, and Bonneville Dams. Bonneville alone generates 5 million megawatts of power! But I still like these little dams. They make sense to me. They employ local people. They have made my life possible here.

Stephanie Andrews
Federal Bureau for Energy and the Environment (FBEE) Staff
Washington, DC

I work for the Federal Bureau for Energy and the Environment (FBEE) based in Washington, DC. Our role is to regulate interstate transmission of electricity, natural gas, and oil. We also license hydroelectric facilities through the United States. Every 30-50 years, hydroelectric facilities (dams) are up for re-licensing. I oversee this process for a number of dams, including Condit.

I don't have an opinion either way about removing the Condit Dam. However, I do have an obligation to the public of the United States to make sure any new licensed dams are up to snuff on their safety, operations, and environmental considerations.

Condit's federal operating license expired in 1996, and it was up to the company to apply for re-licensing. When they looked into what it would take to meet our standards, they saw that the dam would have to upgrade its fish screens and ladders to protect migrating salmon and steelhead. This is an expensive upgrade! They estimated it would cost close to $30 million dollars to upgrade when they were only bringing in about $5 million a year in electricity sales. Decommissioning was estimated at $10 million.

Rather than accepting a new license, United Electric decided they would rather remove the dam than spend the money upgrading the dam.

If United Electric had chosen to accept a new operating license, Condit's future economic viability was doubtful. A new license would have come with more-restrictive operating conditions, and the plant would have also required a considerable amount of new capital investment to keep it operating for the next 30 to 50 years.

Robbie Nelson
Fisherman
White Salmon, WA

I come to the mouth of the White Salmon River for peace and quiet. I love the serenity I feel when I fish for salmon and find myself in the same rhythm as nature. I really love the White Salmon for it's glacial melt, the bald eagles I see soaring, and the real possibility of snagging a big one.

I fish for spring and fall chinook, and steelhead and keep hoping to find some native spring chinook. The US Fish and Wildlife Service raise hatchery fish to release into the Columbia, and I can tell the difference by whether or not the fin is clipped. If it is, then it's hatchery raised, and I can keep it. The challenge is catching the native chinook. That's the real prize! They're harder to catch because there are fewer of them—and they're better adapted to this river because they're wild.

The big dams on the Columbia prevent fish migration and spawning upstream.[1] All native runs of salmon and steelhead on the river are listed under the Endangered Species Act.

If we take out the Condit Dam, it might really help restore native populations of fish, so I'm all for it. That means better fishing for me…

[1] The dams on the Columbia allow for fish passage until Chief Joseph Dam located at river mile 545.

Terry Labon
United Electric Company Project Manager
Portland, OR

It really all came down to economics. I work for United Electric Company. We want to provide cheap, reliable clean energy to our customers. The issue of Condit Dam is an economic decision. We would rather take the money and devote it to some other source of generating that would produce power at less cost for our customers.

Every 30-50 years, hydroelectric facilities (dams) are up for re-licensing. I oversee this process for a number of dams, including Condit.

Condit's federal operating license expired in 1996, and it was up to us to apply for re-licensing. When we looked into what it would take to meet the environmental and safety standards, we saw that we would have to upgrade the fish screens and ladders to protect migrating salmon and steelhead. This is an expensive upgrade! It was estimated to cost around $30 million to make the necessary upgrades. We only generate about $5 million annually in power, so it would have taken many years to recoup the costs of upgrading. And who knows what additional upgrades and capital investments would be needed in the future beyond those required today.

Rather than re-applying for a new license, we decided to close the dam rather than spend the money upgrading the dam.

Jeff Owens, Local Landowner
Northwestern Lake
Husum, WA

I’ve been living in Husum all of my life. My grandparents settled in this valley and our family has been apple and pear orchardists for generations. I bought my lakeside cabin along Northwestern Lake back in 1950. United Electric of course owns the land on which my house sits, but I own my house, and I love my lakefront view! I love how quiet and still the lake always is. I love sitting on my deck watching the mallard ducks swim by. I get out fishing and swimming on the lake all the time. My family and I love this oasis.

If dam comes down, I’ll lose my beautiful lakefront property. My kids won’t be able to swim or fish anymore because it will be a swift river instead of the calm lake. The banks will be all barren when the lake is drained. It will be a complete eye-sore! Also, I know everyone is talking about restoring salmon and lamprey populations, but what about all the plants and animal species that have adapted to a lake environment. Where will they go?

I’d prefer to keep everything the way it is. I’m sure the value of my house will plummet if I don’t have lakeside property anymore. I hope I’ll be compensated for property loss if the dam comes down.

Peggy Green
Chair of Northwestern Lake Homeowners Association

We must consider the wellbeing of the cabin owners along Northwestern Lake. As cabin owners, we have invested our time and money in our cabins along the lake. If the dam comes down, our property value will drastically decrease.

I am not only worried about loss of property value, but also the erosion that will occur if the dam is breached. Think about the volume of water that will rush through! Water is a powerful force and will certainly carve out the canyon deeper and increase erosion of the soil. Our cabins could be in danger of landslides or erosion that could damage our foundations, septic systems, and water lines. As the soil shifts, trees could fall on our homes. You wouldn’t want your septic tank to crack, your floor to cave in, or a tree to crash down on you while you sleep, would you?

Dam Removal Party

1. Find someone who believes they will be hurt from the dam being removed. Who is the person? How has or might, this individual be hurt?

2. Find someone who believes they will benefit from the dam being removed? Who is the person? How might the person benefit?

3. Find someone who cares about the health of the salmon. Who is this person? How do they feel about the dam?

4. Find someone who can tell you how dams hurt salmon. Who is this person? How do dams hurt salmon?

5. Find someone who can explain why the dam removal process came down to an economic decision for United Electric. Who is this person? What did you learn from them?

6. Find someone who is struggling with how to best restore the new landscape at the old lake site. Who is this person? What kinds of issues are they struggling with?

Sources:

White Salmon Time Lapse Website: http://whitesalmontimelapse.wordpress.com/

American Rivers Website: http://www.americanrivers.org/initiatives/dams/hydropower/

http://www.columbian.com/news/2012/sep/15/crews-complete-removal-condit-dam-white-salmon-riv/

Columbia Land Trust Website: http://www.columbialandtrust.org/

FERC website: http://www.ferc.gov/

Yakama Nation Fisheries Website: http://yakamafish-nsn.gov

News Articles:

- "Exploring the Undammed White Salmon River at Last" (OPB, Nov 2012) http://www.opb.org/news/article/undamed-white-salmon-river-opens-to-paddlers/
- "Northwestern Lake sees its last summer…" (Oregonian, Aug 2011) http://www.oregonlive.com/environment/index.ssf/2011/08/when_the_condit_dam_is_breache.html
- "White Salmon River evolves amid mixed feelings" (The Columbian, May 2015) http://www.columbian.com/news/2015/may/03/after-dam-white-salmon-river-evolves-mixed-feeling/

Lesson: Take A Stand (SHARE video and activities)
Grade Level: All
Learning Objectives: Students understand current important issues on the White Salmon River, students confront their own values and belief systems around protecting the White Salmon River, students learn to communicate information visually and orally.
Contributor: Emily Martin, Cascade Mountain School
Logistics: 1-2 class periods to complete

Materials:

- 3-minute SHARE video (https://vimeo.com/174849822)
- SHARE educational handout pdf
- Leave No Trace, Aquatic Invasives, and Wood In River Documents
- 4 blank poster boards and markers
- 4 sheets of paper with the words: Strongly Agree, Strongly Disagree, Agree, Disagree

Instructions: The teacher shares the following background information with his/her students and tells them that we'll be talking about current ecological issues unfolding on the White Salmon River.

Background Information: We're talking about current important issues unfolding along the White Salmon River in the wake of the Condit Dam removal. In a few minutes, we're going to watch a video put out by SHARE, a committee of residents, recreationists, agencies, and others working together on important issues on the White Salmon River. SHARE stands for:

S: Salmon, Safety, and Stewardship
H: Habitat
A: Awareness, Aquatic, and Access
R: Recreation, Respect, and Resources
E: Ethics, Ecology, Etiquette, Engagement and Education

SHARE Committee members include:

- Yakama Nation Fisheries
- Mid-Columbia Fisheries Enhancement Group
- US Forest Service — Wild & Scenic River
- Friends of the White Salmon River
- Underwood Conservation District
- Wet Planet Whitewater
- All Adventures Rafting
- American Whitewater
- Cabin-Owners of Northwestern Lake Association (CONLA)
- Washington State Dept. of Fish & Wildlife
- US Fish & Wildlife Service
- Klickitat River Guides

Watch SHARE video and **ask** the students to pay attention to different ways river users can take responsibility for the river and keep it clean and healthy for future generations.
After the video, ask the students the following questions:
1. How do you currently interact/use the White Salmon River? For example, when do you go, how often do you visit, and what do you do when you're there?
2. Write down a list of different types of river users
3. What are 2-4 **specific** actions you (or another type of river user) can take to protect the White Salmon?

Divide into 4 groups, each group will be assigned one of the four focus areas of SHARE's education campaign:
- Wood is Good!
- Invasive Aquatic Species.
- Protecting Salmon Redds and Spawning Salmon.
- Leave No Trace Ethic

Hand out information from SHARE on each of the four topics listed above.

Have students **develop & present back to the class a poster** about their topic that includes:
- Drawings depicting the issue/topic
- Key messages for river users describing the issue
- Clear action or actions river users can take to mitigate the issue

Wrap-Up: Take A Stand Activity. Teacher posts 4 pieces of paper, one in each corner of the room. On each sheet of paper is one of the possible choices: strongly agree, strongly disagree, agree, and disagree. After the teacher makes a statement (listed below), the students must choose which corner of the room they want to go to and go there. The teacher can open the floor up for discussion/rationale/why they are in the corner they are in or why they're having trouble deciding where to go.

Statements:
1. I feel responsible for the health of the White Salmon River even if I hardly visit, play, boat, or fish in it.
2. Large logs that fall into the river should be removed so as to prevent hazards to boaters and improve river safety.
3. Large logs that fall into the river should be left in place because they provide important habitat for a number of aquatic species.
4. I support protecting the water quality of the White Salmon River even if it means restricting access to some locations, curtailing fishing, and imposing stricter land use laws adjacent to the river.
5. I believe the White Salmon River benefits from concerned citizens banding together to educate and protect water quality.
6. Leave No Trace is a great tool for teaching young and old people about picking up after themselves.

7. Leave No Trace principles impedes my freedom to do what I want along the river.
8. If I go boating on the Deshutes River and then plan to take a trip down the White Salmon River, I'm not going to take the time to clean my boat off. I'm just one boat and it doesn't matter if I bring in a few invasive mud snails.
9. You just discovered a new swimming hole and you tell your friends about it. Just as you're about to jump in, you notice that you're right above a gravel bed/cobble bar where you know salmon could spawn. You decide to jump in that area anyway and tell your friends to jump, too.
10. I plan to get involved in a local group (or start a club at my school) to protect the White Salmon River.

Lesson: Condit Dam Balancing Act
Grade Level: All
Learning Objectives: Use this activity with any resource management controversy. Students practice identifying stakeholders, imagining consequences, making decisions, and defending their decisions.
Contributor: Caitlin Cray, White Salmon Schools
Logistics: (30 minutes, half or whole class)

Materials:

- Wooden blocks (i.e. child's set of various sizes)
- Masking tap + pens for labeling wooden blocks
- Balance beam: e.g. a playground see-saw or substitute a wooden board (6 foot length of 2"X4") centered on an automobile tire with two chock blocks to keep it from rolling
- Washable marker (to label the blocks)
- A list of relevant stakeholders. If possible, have students make a list in classroom before-hand. In the case of Condit Dam removal and riparian restoration the list would include: cabin owners, salmon, whitewater boaters, sport fishermen, commercial fishermen, tribal fisherman, local residents, barge pilots, power company, energy users, Native Americans, hatchery operators, tax payers, contractors, etc.

Procedure:
Set up balance beam in an open area where entire group can gather and see. Ask students to imagine they were responsible for deciding what to do about a problem, for example, whether or not to remove Condit Dam. Divide group into two teams. One team will label blocks with stakeholders who may benefit from dam removal. Other team will label blocks with stakeholders who may be harmed by dam removal. Each team member must be prepared to explain aloud to the whole group why his or her stakeholder is important
Tell them to use big blocks to represent the most important stakeholders, and smaller blocks to represent less important stakeholders. When both teams have finished labeling their blocks, have students take turns speaking for their stakeholder and placing their blocks on the balance beam. Alternate sides (facilitator must remain in middle holding the beam in balance until all blocks have been placed). When all blocks have been placed, get your camera ready, stand back, and release the beam to see which side 'wins'.

Ask open-ended questions such as….

- How do you know whether dam removal will benefit or harm your stakeholder?
- Are all stakeholders equally important? How would you decide who 'wins' and who 'loses'?
- What may happen to the stakeholders in the next 10 years? How about 40 years from now? How about 100 years from now?

Assessment:

Formative: Observe and listen to students throughout the activity. Pay attention to level of engagement, who is doing most of the talking, quality of the discussion.

Summative: In their field journals, each student writes one thing they learned or think about decision making when the decision will affect many lives.

Grades 9-12 Condit Dam Lesson Plans

- ❑ Condit Dam History Jigsaw
- ❑ Condit Dam Tea Party (Stakeholder Perspectives)
- ❑ Take A Stand (SHARE video and activities)
- ❑ Balancing Act

Lesson: Condit Dam History Lesson JigSaw
Grades: 9-12
Learning Objectives: Students gain an understanding of:

- White Salmon River Ecology,
- Native History/Cultural Use of the White Salmon River,
- Hydroelectric perspective of the Dam & History of Building Dam,
- Ecological Impacts of the Dam, and
- The Decommissioning Process

Contributors: Emily Martin, Cascade Mountain School and Heather Kowalewski
Logistics: 1-2 class periods; whole class
Materials:

- PDF of resources, divided by group
- Print out of group questions
- 5 empty poster boards and markers

Instructions: Divide the class into 5 groups. Give each group a packet of information to read and the questions below to answer. In Round 1, give the group 20-25 minutes to complete the answers. In Round 2, reconfigure the group into 5 new groups, but each new group has one "expert" representative from each of the previous groups. In their new groups, the students have to draw a colorful poster according to round 2 instructions. Students then present their posters to the class.

ROUND 1:

Group 1: White Salmon Watershed Ecology
Resources

- ❑ Map (s) of WS watershed, including USGS White Salmon Watershed, Columbia River Basin Watershed, White Salmon & Rattlesnake relief, and WA State Ecozone Map
- ❑ White Salmon Subbasin Description document
- ❑ The White Salmon River Subbasin_YKFP document
- ❑ Wildlife in the White Salmon Subbasin document
- ❑ Land Use in the White Salmon Subbasin document
- ❑ Terrestrial and Aquatic Resources of the White Salmon document
- ❑ Historical photos of salmon

Answer these questions:
1. Describe in your own words what a watershed is
2. Draw the White Salmon watershed. Be sure to include: the source/headwaters of the White Salmon River, where the White Salmon River flows, and how/where it reaches the Pacific Ocean.
3. What is the land use surrounding the White Salmon River and what counties border the White Salmon River?
4. What are some key ecological features of the White Salmon River, like lava tubes and springs? Also, what animal species live here? In your opinion, what makes this river special?

Group 2: Native History/Cultural Use of the White Salmon River
Resources:

- ❑ Yakama Nation History document
- ❑ Yakama Nation information document
- ❑ Native American use of Jewett Creek document
- ❑ Columbia River Indian Traditional Foods document

- ❑ Seasonal Gathering Rounds Sustained Columbia River Peoples document
- ❑ Seasonal Round Diagram
- ❑ Anthropogenic Disturbances in White Salmon Subbasin document
- ❑ Basic Condit Dam History document
- ❑ Lamprey found on the White Salmon River Yakima Herald article
- ❑ Lamprey - a cultural resource document
- ❑ Photos of Tribes along the White Salmon River
- ❑ Maps (2) of Reservation and Ceded Lands

Answer these questions:
1. How has the White Salmon River been important to humans since time immemorial? What species of plants and animals were harvested in the White Salmon watershed?
2. What is the difference between the ceded lands and the Yakama reservation?
3. Describe the current tribal rights for fishing.
4. Look at your life and draw a personal seasonal round, using events and interactions with nature and family, using as a guide/model the seasonal round of the Yakama.

Group 3: Hydroelectric perspective of the Dam & History of Building Dam
Resources:
- ❑ Condit Dam Background document
- ❑ History of Condit document
- ❑ Basic Condit Dam History document
- ❑ PacifiCorp Condit Info document
- ❑ Condit Dam History and Decommissioning document
- ❑ Condit FAQ document
- ❑ Impacts on Habitats in White Salmon Subbasin document
- ❑ White Salmon Restored: A Timelapse Project document
- ❑ Condit Dam Powerpoint Presentation
- ❑ Maps (2) including PacifiCorp Condit Dam map and PNW dams & salmon spawning map
- ❑ Photos of Condit Dam 3-D Model

Answer these questions:
1. Why was Condit Dam built?
2. How much power did Condit Dam generate? How does this compare to other dams in the area? How many modern homes would be powered by Condit if it were still running?
3. What were the hardest engineering challenges faced by the dam builders?
4. Describe what was happening along the Columbia River during the early 1900s. How did Condit Dam represent the zeitgeist of the era? Zeitgeist is the defining spirit or mood of a particular period of history as shown by the ideas and beliefs of the time.

Group 4: Ecological Impacts of the Dam
Resources:
- ❑ Ecological Impacts of Condit Dam document
- ❑ Ecological Impacts of Dams document
- ❑ Beneficial & Adverse Effects of Dam Removal document
- ❑ American Dipper Study article
- ❑ Lamprey found on White Salmon River Yakima Herald article
- ❑ Terrestrial and Aquatic Resources of the White Salmon document
- ❑ Tule Salmon Capture & Transfer document
- ❑ PacifiCorp Newsletter Condit Summer 2012
- ❑ How Dams Harm Rivers document

- ❑ American Rivers Dam Removal article
- ❑ Why Trees Need Salmon article
- ❑ Salmon Keystone Species diagram
- ❑ Maps (2) including White Salmon River Salmon Habitat map & White Salmon Fish Recolonization map

Answer these questions:
1. Describe how dams impact both out-migrating and in-migrating salmon. How does the health of salmon impact other species and the overall ecosystem health of the watershed?
2. Describe the importance of water temperature on ecological processes and how dams influence temperature.
3. Describe the importance of sediment input into rivers and how dams influence sediment flow through a watershed.
4. Given the dramatic impacts to the ecology of building dams, why do you think people built Condit and continue to build dams today?
5. How do you think the ecosystem will respond with the dam removal?

Group 5: Decommissioning Process
Resources:
- ❑ History of Condit document
- ❑ Access Restored to White Salmon River PacifiCorp article
- ❑ Condit Dam Breach PacifiCorp article
- ❑ Condit FAQ document
- ❑ PacifiCorp Condit Info document
- ❑ PacifiCorp newsletter Condit Summer 2012
- ❑ Condit Settlement & Decommissioning Overview document
- ❑ Condit Dam History and Decommissioning document
- ❑ Condit Decommissioning Overview document

Answer these questions:
1. What does decommissioning mean?
2. What factors influenced PacifiCorp to make the decision to decommission the dam? What wound up being the most compelling reason?
3. How long did the decommissioning process take?
4. What decision-makers and stakeholders got involved in the settlement process? List all decision-makers and stakeholders and their influence/role in the process.

ROUND 2:
In your new group, draw a poster which includes:

1. a map of the WS river and watershed with major towns and land features noted
2. the placement of Condit dam in the watershed
3. a one-sentence rationale for building the dam in 1913
4. a list of ecological impacts of the dam on the watershed
5. a one-sentence rationale for taking the dam out in 2011

Lesson: Condit Dam Tea Party (Stakeholder Perspectives)
Grades: 9-12
Learning Objectives: Students gain a broader perspective than one's own about the decision to remove the Condit Dam. Students recognize the diversity of stakeholder perspectives around the Condit Dam removal. Students start to understand the complexity of public process and natural resource management.
Contributors: Emily Martin, Cascade Mountain School and Caitlin Cray, White Salmon Schools
Logistics: 1 class period; whole class
Materials:

- Condit Dam Background/History (see below)
- Stakeholder Information & Question Sheets (3 copies)
- White board on which to list names of panelists and cost/benefits of dam removal
- Video of Dam Breach: https://vimeo.com/31305629

Brief History: *Information from Condit Hydroelectric Project Interpretive Plan & PacifiCorp Final Slides.* Condit Dam was built in 1913 by the Northwestern Electric Company. The dam was built in order to generate hydro-electrical power for the Crown Columbia Paper Mill, located in Camas, Washington. The 125- foot dam and powerhouse took about a year to construct. Due to the construction of the dam, a lake was formed behind the dam known as Northwestern Lake which was about 2 miles long. 900 people worked on the dam everyday. In order to build the dam, the workers had to divert the water around the dam site so they could build the dam up from bedrock. The finished dam created 12 MG (mega watts) of electricity, about enough to power 9,000 modern homes. Bonneville Dam, on the other hand, produces 526 MW, enough to power close to 400,000 homes. Condit represents about 2% of power generating capacity as compared to Bonneville.

However, along with the construction of the dam came impacts to the salmon runs in the area, salmon which were protected by treaty. In 1855, heads of many of the tribes in the area signed a treaty with the U.S. government and were united as one nation under the name "Yakama." The treaty set aside exclusive reservation land for Yakama Nation and acknowledged the right for Yakama Nation to take fish in the all of the streams bordering the reservation, the ceded area (larger area used by the tribes prior to the treaty), and in all their usual and accustomed places. With continued development in the area by White homesteaders, ranches, orchards, and cities overtook wild places, wildlife, and foraging areas used by the Nation.

Even though the original dam did feature a fish ladder. It was destroyed in 1914 by a flood. The ladder was rebuilt the same year, but also washed out by a flood in 1918. According to the Condit Hydroelectric Project Interpretative Plan, "from 1918 to 2011 the natural migration of fish past the dam both upstream and downstream all but ceased. Instead, in 1919, a fish hatchery was constructed on the lower Columbia River, funded in part by Northwestern Electric Company as mitigation for the loss of the fish ladder." The White Salmon River before the dam was constructed had a tremendous Tule Chinook Salmon run every fall.

In the 1970s several federal court decisions (*U.S. v Oregon and U.S. v Washington*) established Yakama Nation as a sovereign co-manager of fishery resources, and there became more recognition of the need to stand by original treaties especially in regards to protecting usual and accustomed places to fish. In addition, many species of salmon were listed as endangered species under the Endangered Species Act, requiring legal protection. With these legal victories, federal hydropower re-licensing requirements for safe fish passage increased.

In 1996 the Federal Energy Regulatory Commission (FERC) issued an Environmental Impact Statement (EIS) that required PacificCorp to install $30 million worth of fish ladders and screens for fish passage. With these additional costs, PacifiCorp understood it would be too expensive to keep operating the dam. Removal of the dam was believed to be the most cost-effective way to allow adult salmon to migrate upstream and juveniles to migrate downstream and would return the river to more natural conditions. In 2011, Condit Dam was dynamited and removed.

In this case, the decision-makers were PacifiCorp and FERC. However, there were many stakeholders who may have helped to move the decommissioning process along such as tribes and environmental groups and those who may have contributed to additional time and expense of the project such as local landowners. The Yakama people currently participate in the co-management of shared resources, such as salmon and lamprey management, along the White Salmon River.

Instructions:

1. The teacher hands each student a stakeholder perspective information sheet (such as a kayaker, fish biologist, or dam operator) and each student reads the information provided.

2. Convene a panel of stakeholders (cabin owner, paddler, Yakima Nation, fish bio, Pacificorps, etc). Each student briefly introduces self and their perspective on the dam (need to summarize information provided). In a class of 30, there will be 3 of each stakeholder represented.

3. Each student embodies that stakeholder (think acting class!) and walks around meeting the other stakeholders, like they were attending a tea party. Everyone stays in character as they mingle. Students mull around and ask each other questions, keeping Dam Removal Party questions in mind

4. Then have the students divide into "Pro Removal" and "Against Removal" groups to formulate an argument to present to the judge for why the dam should or should not be removed

5. Reconvene for "City Council" meeting. Teacher is the judge. Each side of argument presents its case, representatives speak on behalf of their side to share their judgment. Judge makes final call on whether or not to remove Condit Dam.

Wrap-Up:
Ask students to answer this question: What do you personally believe about the removal of Condit Dam? Did you find yourself representing an opinion you actually didn't believe? If so, what was challenging about that for you?

Optional Video of Explosive Breach of Condit Dam: https://vimeo.com/31305629 (produced by Maser Films, 2 minutes)

Dave Martin
Kayaker and Raft Guide for Wet Planet Rafting Company
Husum, WA

I moved to the Gorge in 2009 because I love to kayak. I was living in Portland and drove all the way out here on weekends just to get in my boat. When I am on the river, nothing else matters. I feel so alive as I paddle and play through the rapids.

When I heard that there might be the possibility of the Condit Dam coming down, I was right away all for it. Five more river miles downstream of Northwestern Lake would be open to kayak and raft. Over 25,000 people raft the White Salmon every year—it is a tremendous recreational resource. By opening more river miles, we will increase the access to this beautiful river, a river that is designated as a Wild and Scenic in the upper stretches.

Also, it's great for the rafting companies around here. They'll be able to offer additional river miles to their customers and fill more river trips. This means a healthy river economy for the rafting guides.

If the dam comes out, the kayaking and rafting community will be happy. We'll get an incredible run down one of the most spectacular rivers in the Gorge.

Stephanie Springs
Fish Biologist for Yakama Fisheries
Klickitat, WA

I'm fairly new to the Hood River area, but my husband and I love it out here. We both went to college in Walla Walla, WA at Whitman and studied natural resource management. I took that path in college because I knew I loved being outside, and I wanted to find a job that allowed me to enjoy nature and protect our natural resources.

Even though I am not a tribal member, my job is with Yakama Nation Fisheries based in Klickitat, Washington. The mission of my organization is to honor, protect, and restore the Columbia River. The fish of the Columbia River and its tributaries are of paramount importance to our people, our diet, and our health. We advocate for the fish because they cannot speak for themselves. Specifically, we are trying to restore populations of salmon, steelhead, lamprey, and White Sturgeon.

In my job, I survey fish populations by going out into the rivers to count adult and juvenile salmon. I also monitor habitat and look for areas that might support salmon redds (nests). I love my job because I get to be outside while contributing to the scientific information the tribe uses to make harvest and management decisions.

I believe getting rid of the dam is a really smart decision. It will improve the health of the salmon and lamprey fishery and contribute to better natural resource management of this precious resource. By taking out the dam, 33 miles of steelhead habitat will open up and 14 miles of chinook habitat will open up for migration and spawning in the upper reaches of the watershed.

Joe Lewis
Yakama Tribal Council Chairman
Toppenish, WA

Most people living in Hood River are too young to remember or understand the history of salmon fishing and our people in the Columbia River Gorge. They see the Columbia and think, "how beautiful." I see the Columbia and think, "where are the bountiful runs of salmon and the deafening sound of the great falls?" The last of the big dams went in in 1957, drowning Celilo Falls, our cherished gathering place and fishing spot.

One by one these dams have choked our river and starved our fish of their homes. Now the salmon rely on engineered structures, such as fish ladders to get up stream, and the small fry rely on trucks! to get back downstream around the dams.

I am the chairman of the Yakama Tribal Council. For the fish and for our people, I am in favor of removing the Condit Dam. Fishing is a way of life for our people. The removal of this dam is a good step toward the recovery of the fishery, so that this fundamental part of our culture will not be lost to future generations.

Barbara Swift
American Rivers Conservation Advocate

Few things have such a fundamental impact on a river as a dam. Dams block a river's flow and can harm clean water, fish and wildlife, and recreation opportunities.

American Rivers plays a leadership role in working to reform dam operations to more closely approximate natural river flows and benefit fish, wildlife and communities. There are pros and cons to hydroelectric power. We can get clean energy from hydropower, but it must be sited, operated, and mitigated responsibly in order to earn this distinction. However, many dams fail to meet this standard and hydropower generation can damage rivers. The Condit Dam needs to be dramatically updated to provide adequate fish passage and to meet today's environmental standards for "clean" hydropower.

In general, dams damage rivers in the following ways (not all of these are applicable to the Condit Dam)

- **Dams block fish passage** (preventing migration for spawning and growth)
- **Dams slow rivers** (stagnant reservoir pools disorient migrating fish and significantly increase the duration of their migration)
- **Dams alter water temperatures** (by slowing water flow, most dams increase water temperatures. Other dams decrease temperatures by releasing cooled water from the reservoir bottom. Fish and other species are sensitive to these temperature irregularities, which often destroy native populations.)
- **Dams alter timing of flows (**by withholding and then releasing water to generate power for peak demand periods, dams cause downstream stretches to alternate between no water and powerful surges that erode soil and vegetation, and flood or strand wildlife. These irregular releases destroy natural seasonal flow variations that trigger natural growth and reproduction cycles in many species.)
- **Dam turbines hurt fish (**following currents downstream, fish can be injured or killed by turbines. When fish are trucked or barged around the dams, they experience increased stress and disease and decreased homing instincts.)

Our expertise and advocacy have directly contributed to the removal of more than 200 dams across the country!

I am 100% behind the removal of the Condit Dam. Let's see this river free again!!

Bob Childs
Condit Dam Operations Manager
PacifiCorp
Husum, WA

Condit was first put into service in 1913. It produces 13.7 megawatts of power--enough local, clean hydropower for 7,000 residents. I've been working at the Condit Dam for the last twenty years. I moved to Husum for the job from another small town in Washington where I was servicing a similar dam. I'm one of the only people in the region that knows how these dams work and operate. I am very proud of my work and my ability to keep this dam generating power. I'm the guy everyone calls if something goes wrong, which is inevitable.

I'm proud of the company I work for, PacifiCorp. We serve 1.5 million customers in six western states as Pacific Power and Utah Power. The company operates an 8,200-megawatt power system consisting of hydro, thermal, wind and geothermal generation.

If this dam comes out, I'll lose my job. I'll also have to let go of the three other techs that work here under me. All of us will have to relocate to another city or state because there are no other low-head dams to operate in this area. I don't want to relocate my family. My daughter is entering her sophomore at Columbia High School. She wants to graduate with all of her friends. If I lose this job, I won't be able to send her to the college of her dreams.

I understand that we don't need the 15 MW from this dam anymore now that we have Grand Coulee, The Dalles, and Bonneville Dams. Bonneville alone generates 5 million megawatts of power! But I still like these little dams. They make sense to me. They employ local people. They have made my life possible here.

Stephanie Andrews
Federal Energy Regulatory Commission (FERC) Staff
Washington, DC

I work for the Federal Energy Regulatory Commission (FERC) based in Washington, DC. Our role is to regulate interstate transmission of electricity, natural gas, and oil. We also license hydroelectric facilities through the United States. Every 30-50 years, hydroelectric facilities (dams) are up for re-licensing. I oversee this process for a number of dams, including Condit.

I don't have an opinion either way about removing the Condit Dam. However, I do have an obligation to the public of the United States to make sure any re-licensed dams are up to snuff on their safety, operations, and environmental considerations.

Condit's federal operating license expired in 1996, and it was up to the company to apply for re-licensing. When they looked into what it would take to meet our standards, they saw that the dam would have to upgrade its fish screens and ladders to protect migrating salmon and steelhead. This is an expensive upgrade! They estimated it would cost close to $50 million dollars to upgrade when they were only bringing in about $5 million a year in electricity sales. Decommissioning was estimated at $10 million.

Rather than accepting a new license, PacifiCorp decided they would rather close the dam down than spend the money upgrading the dam.

If PacifiCorp had chosen to accept a new operating license, Condit's future economic viability was doubtful. A new license would have come with more-restrictive operating conditions, and the plant would have also required a considerable amount of new capital investment to keep it operating for the next 30 to 50 years.

Robbie Nelson
Fisherman
White Salmon, WA

I come to the mouth of the White Salmon River for peace and quiet. I love the serenity I feel when I fish for salmon and find myself in the same rhythm as nature. I really love the White Salmon for it's glacial melt, the bald eagles I see soaring, and the real possibility of snagging a big one.

I fish for spring and fall chinook, and steelhead and keep hoping to find some native spring chinook. The US Fish and Wildlife Service raise hatchery fish to release into the Columbia, and I can tell the difference by whether or not the fin is clipped. If it is, then it's hatchery raised, and I can keep it. The challenge is catching the native chinook. That's the real prize! They're harder to catch because there are fewer of them—and they're better adapted to this river because they're wild.

The big dams on the Columbia prevent fish migration and spawning upstream. All native runs of salmon and steelhead on the river are listed under the Endangered Species Act.

If we take out the Condit Dam, it might really help restore native populations of fish, so I'm all for it. That means better fishing for me…

Terry Labon
PacifiCorp Project Manager
Portland, OR

It really all came down to economics. I work for PacifiCorp. We want to provide cheap, reliable clean energy to our customers. The issue of Condit Dam is an economic decision. We would rather take the money and devote it to some other source of generating that would produce power at less cost for our customers.

Every 30-50 years, hydroelectric facilities (dams) are up for re-licensing. I oversee this process for a number of dams, including Condit.

Condit's federal operating license expired in 1996, and it was up to us to apply for re-licensing. When we looked into what it would take to meet the environmental and safety standards, we saw that we would have to upgrade the fish screens and ladders to protect migrating salmon and steelhead. This is an expensive upgrade! It was estimated to cost around $50 million to make the necessary upgrades. We only generate about $5 million annually in power, so it would have taken many years to recoup the costs of upgrading. And who knows what additional upgrades and capital investments would be needed in the future beyond those required today.

Rather than re-applying for a new license, we decided to close the dam down rather than spend the money upgrading the dam.

Jeff Owens, Local Landowner
Northwestern Lake
Husum, WA

I've been living in Husum all of my life. My grandparents settled in this valley and our family has been apple and pear orchardists for generations. I bought my lakeside cabin along Northwestern Lake back in 1950. PacifiCorp of course owns the land on which my house sits, but I own my house, and I love my lakefront view! I love how quiet and still the lake always is. I love sitting on my deck watching the mallard ducks swim by. I get out fishing and swimming on the lake all the time. My family and I love this oasis.

If dam comes down, I'll lose my beautiful lakefront property. My kids won't be able to swim or fish anymore because it will be a swift river instead of the calm lake. The banks will be all barren when the lake is drained. It will be a complete eye-sore! Also, I know everyone is talking about restoring salmon and lamprey populations, but what about all the plants and animal species that have adapted to a lake environment. Where will they go?

I'd prefer to keep everything the way it is. I'm sure the value of my house will plummet if I don't have lakeside property anymore. I hope I'll be compensated for property loss if the dam comes down.

Peggy Green
Chair of Cabin Owners of Northwestern Lake Association

We must consider the wellbeing of the cabin owners along Northwestern Lake. As cabin owners, we have invested our time and money in our cabins along the lake. If the dam comes down, our property value will drastically decrease.

I am not only worried about loss of property value, but also the erosion that will occur if the dam is breached. Think about the volume of water that will rush through! Water is a powerful force and will certainly carve out the canyon deeper and increase erosion of the soil. Our cabins could be in danger of landslides or erosion that could damage our foundations, septic systems, and water lines. As the soil shifts, trees could fall on our homes. You wouldn't want your septic tank to crack, your floor to cave in, or a tree to crash down on you while you sleep, would you?

Dam Removal Party

1. Find someone who believes they will be hurt from the dam being removed. Who is the person? How has or might, this individual be hurt?

2. Find someone who believes they will benefit from the dam being removed? Who is the person? How might the person benefit?

3. Find someone who cares about the health of the salmon. Who is this person? How do they feel about the dam?

4. Find someone who can tell you how dams hurt salmon. Who is this person? How do dams hurt salmon?

5. Find someone who can explain why the dam removal process came down to an economic decision for PacifiCorp. Who is this person? What did you learn from them?

6. Find someone who is struggling with how to best restore the new landscape at the old lake site. Who is this person? What kinds of issues are they struggling with?

Sources:

White Salmon Time Lapse Website: http://whitesalmontimelapse.wordpress.com/

American Rivers Website: http://www.americanrivers.org/initiatives/dams/hydropower/

http://www.columbian.com/news/2012/sep/15/crews-complete-removal-condit-dam-white-salmon-riv/

Columbia Land Trust Website: http://www.columbialandtrust.org/

FERC website: http://www.ferc.gov/

Yakama Nation Fisheries Website: http://yakamafish-nsn.gov

News Articles:

- "Exploring the Undammed White Salmon River at Last" (OPB, Nov 2012) http://www.opb.org/news/article/undamed-white-salmon-river-opens-to-paddlers/
- "Northwestern Lake sees its last summer…" (Oregonian, Aug 2011) http://www.oregonlive.com/environment/index.ssf/2011/08/when_the_condit_dam_is_breache.html
- "White Salmon River evolves amid mixed feelings" (The Columbian, May 2015) http://www.columbian.com/news/2015/may/03/after-dam-white-salmon-river-evolves-mixed-feeling/

Lesson: Take A Stand (SHARE video and activities)
Grade Level: All
Learning Objectives: Students understand current important issues on the White Salmon River, students confront their own values and belief systems around protecting the White Salmon River, students learn to communicate information visually and orally.
Contributor: Emily Martin, Cascade Mountain School
Logistics: 1-2 class periods to complete

Materials:
- 3-minute SHARE video (https://vimeo.com/174849822)
- SHARE educational handout pdf
- Leave No Trace, Aquatic Invasives, and Wood In River Documents
- 4 blank poster boards and markers
- 4 sheets of paper with the words: Strongly Agree, Strongly Disagree, Agree, Disagree

Instructions: The teacher shares the following background information with his/her students and tells them that we'll be talking about current ecological issues unfolding on the White Salmon River.

Background Information: We're talking about current important issues unfolding along the White Salmon River in the wake of the Condit Dam removal. In a few minutes, we're going to watch a video put out by SHARE, a committee of residents, recreationists, agencies, and others working together on important issues on the White Salmon River. SHARE stands for:

S: Salmon, Safety, and Stewardship
H: Habitat
A: Awareness, Aquatic, and Access
R: Recreation, Respect, and Resources
E: Ethics, Ecology, Etiquette, Engagement and Education

SHARE Committee members include:

- Yakama Nation Fisheries
- Mid-Columbia Fisheries Enhancement Group
- US Forest Service — Wild & Scenic River
- Friends of the White Salmon River
- Underwood Conservation District
- Wet Planet Whitewater
- All Adventures Rafting
- American Whitewater
- Cabin-Owners of Northwestern Lake Association (CONLA)
- Washington State Dept. of Fish & Wildlife
- US Fish & Wildlife Service
- Klickitat River Guides

Watch SHARE video and **ask** the students to pay attention to different ways river users can take responsibility for the river and keep it clean and healthy for future generations.
After the video, ask the students the following questions:
1. How do you currently interact/use the White Salmon River? For example, when do you go, how often do you visit, and what do you do when you're there?
2. Write down a list of different types of river users
3. What are 2-4 **specific** actions you (or another type of river user) can take to protect the White Salmon?

Divide into 4 groups, each group will be assigned one of the four focus areas of SHARE's education campaign:
- Wood is Good!
- Invasive Aquatic Species.
- Protecting Salmon Redds and Spawning Salmon.
- Leave No Trace Ethic

Hand out information from SHARE on each of the four topics listed above.

Have students **develop & present back to the class a poster** about their topic that includes:
- Drawings depicting the issue/topic
- Key messages for river users describing the issue
- Clear action or actions river users can take to mitigate the issue

Wrap-Up: Take A Stand Activity. Teacher posts 4 pieces of paper, one in each corner of the room. On each sheet of paper is one of the possible choices: strongly agree, strongly disagree, agree, and disagree. After the teacher makes a statement (listed below), the students must choose which corner of the room they want to go to and go there. The teacher can open the floor up for discussion/rationale/why they are in the corner they are in or why they're having trouble deciding where to go.

Statements:
1. I feel responsible for the health of the White Salmon River even if I hardly visit, play, boat, or fish in it.
2. Large logs that fall into the river should be removed so as to prevent hazards to boaters and improve river safety.
3. Large logs that fall into the river should be left in place because they provide important habitat for a number of aquatic species.
4. I support protecting the water quality of the White Salmon River even if it means restricting access to some locations, curtailing fishing, and imposing stricter land use laws adjacent to the river.
5. I believe the White Salmon River benefits from concerned citizens banding together to educate and protect water quality.
6. Leave No Trace is a great tool for teaching young and old people about picking up after themselves.

7. Leave No Trace principles impedes my freedom to do what I want along the river.
8. If I go boating on the Deshutes River and then plan to take a trip down the White Salmon River, I'm not going to take the time to clean my boat off. I'm just one boat and it doesn't matter if I bring in a few invasive mud snails.
9. You just discovered a new swimming hole and you tell your friends about it. Just as you're about to jump in, you notice that you're right above a gravel bed/cobble bar where you know salmon could spawn. You decide to jump in that area anyway and tell your friends to jump, too.
10. I plan to get involved in a local group (or start a club at my school) to protect the White Salmon River.

Lesson: Condit Dam Balancing Act
Grade Level: All
Learning Objectives: Use this activity with any resource management controversy. Students practice identifying stakeholders, imagining consequences, making decisions, and defending their decisions.
Contributor: Caitlin Cray, White Salmon Schools
Logistics: (30 minutes, half or whole class)

Materials:

- Wooden blocks (i.e. child's set of various sizes)
- Masking tap + pens for labeling wooden blocks
- Balance beam: e.g. a playground see-saw or substitute a wooden board (6 foot length of 2"X4") centered on an automobile tire with two chock blocks to keep it from rolling
- Washable marker (to label the blocks)
- A list of relevant stakeholders. If possible, have students make a list in classroom before-hand. In the case of Condit Dam removal and riparian restoration the list would include: cabin owners, salmon, whitewater boaters, sport fishermen, commercial fishermen, tribal fisherman, local residents, barge pilots, power company, energy users, Native Americans, hatchery operators, tax payers, contractors, etc.

Procedure:
Set up balance beam in an open area where entire group can gather and see. Ask students to imagine they were responsible for deciding what to do about a problem, for example, whether or not to remove Condit Dam. Divide group into two teams. One team will label blocks with stakeholders who may benefit from dam removal. Other team will label blocks with stakeholders who may be harmed by dam removal. Each team member must be prepared to explain aloud to the whole group why his or her stakeholder is important
Tell them to use big blocks to represent the most important stakeholders, and smaller blocks to represent less important stakeholders. When both teams have finished labeling their blocks, have students take turns speaking for their stakeholder and placing their blocks on the balance beam. Alternate sides (facilitator must remain in middle holding the beam in balance until all blocks have been placed). When all blocks have been placed, get your camera ready, stand back, and release the beam to see which side 'wins'.

Ask open-ended questions such as….

- How do you know whether dam removal will benefit or harm your stakeholder?
- Are all stakeholders equally important? How would you decide who 'wins' and who 'loses'?
- What may happen to the stakeholders in the next 10 years? How about 40 years from now? How about 100 years from now?

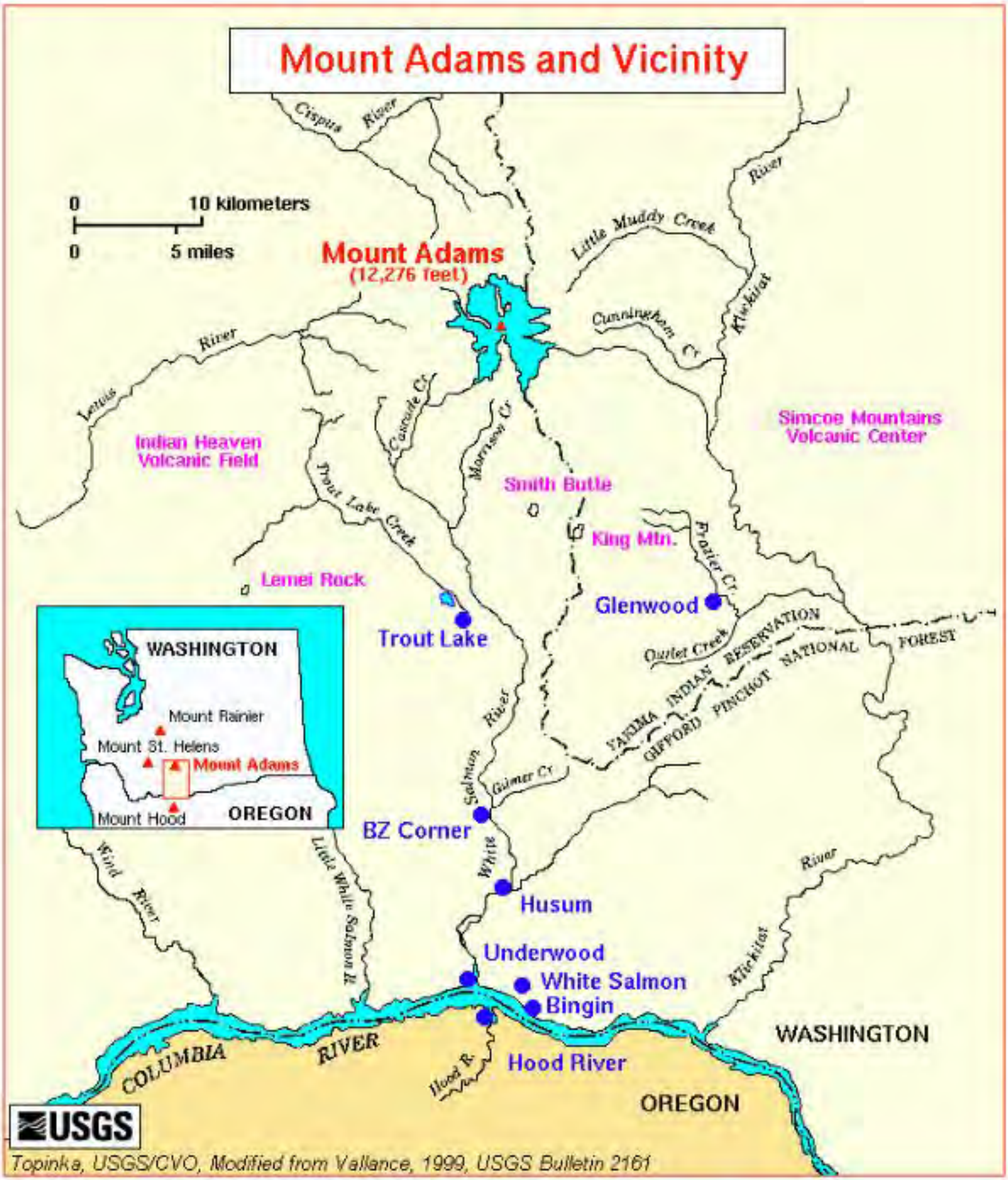
Assessment:

Formative: Observe and listen to students throughout the activity. Pay attention to level of engagement, who is doing most of the talking, quality of the discussion.

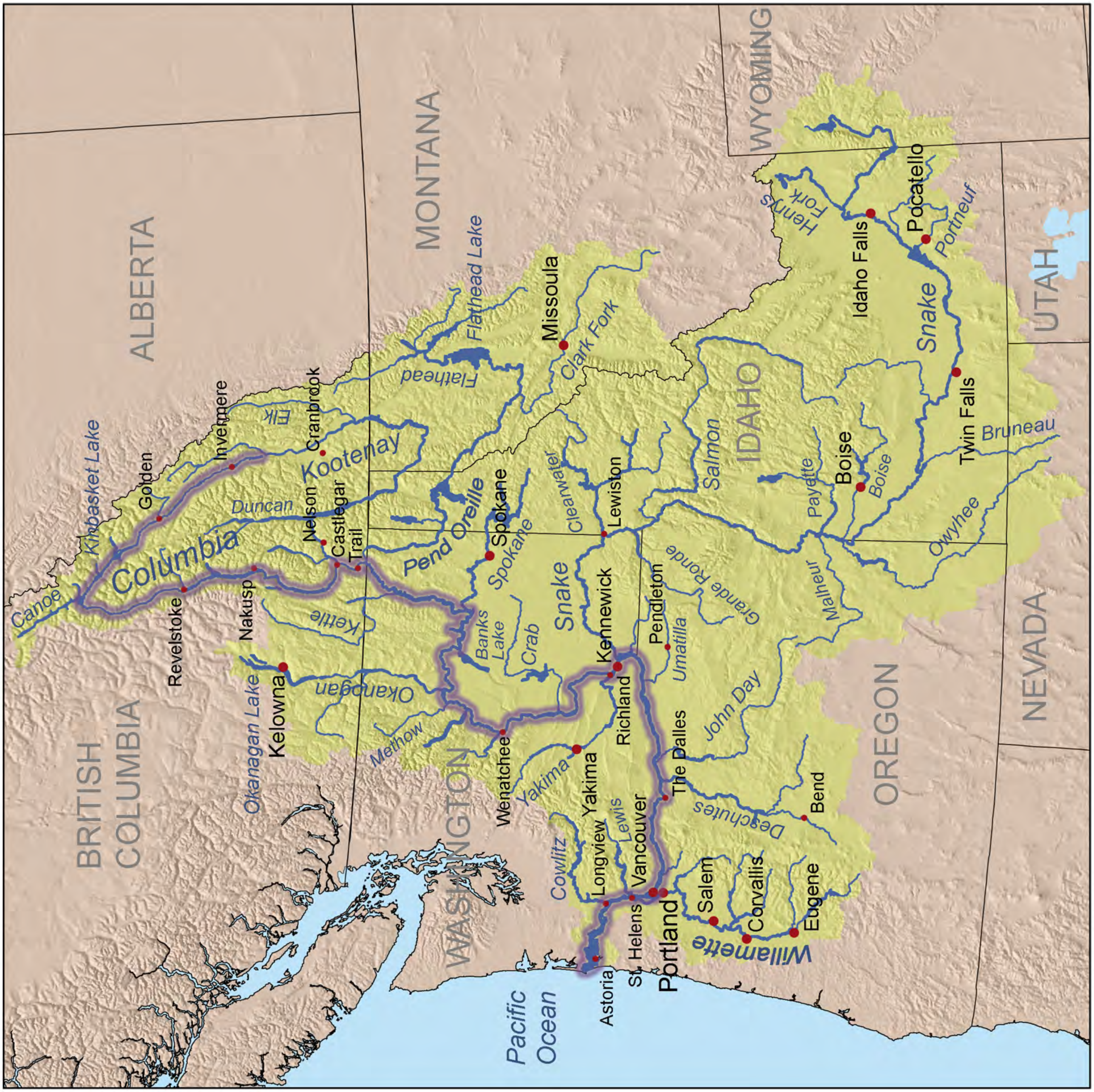
Summative: In their field journals, each student writes one thing they learned or think about decision making when the decision will affect many lives.

Resources For Condit Dam Lesson Plans

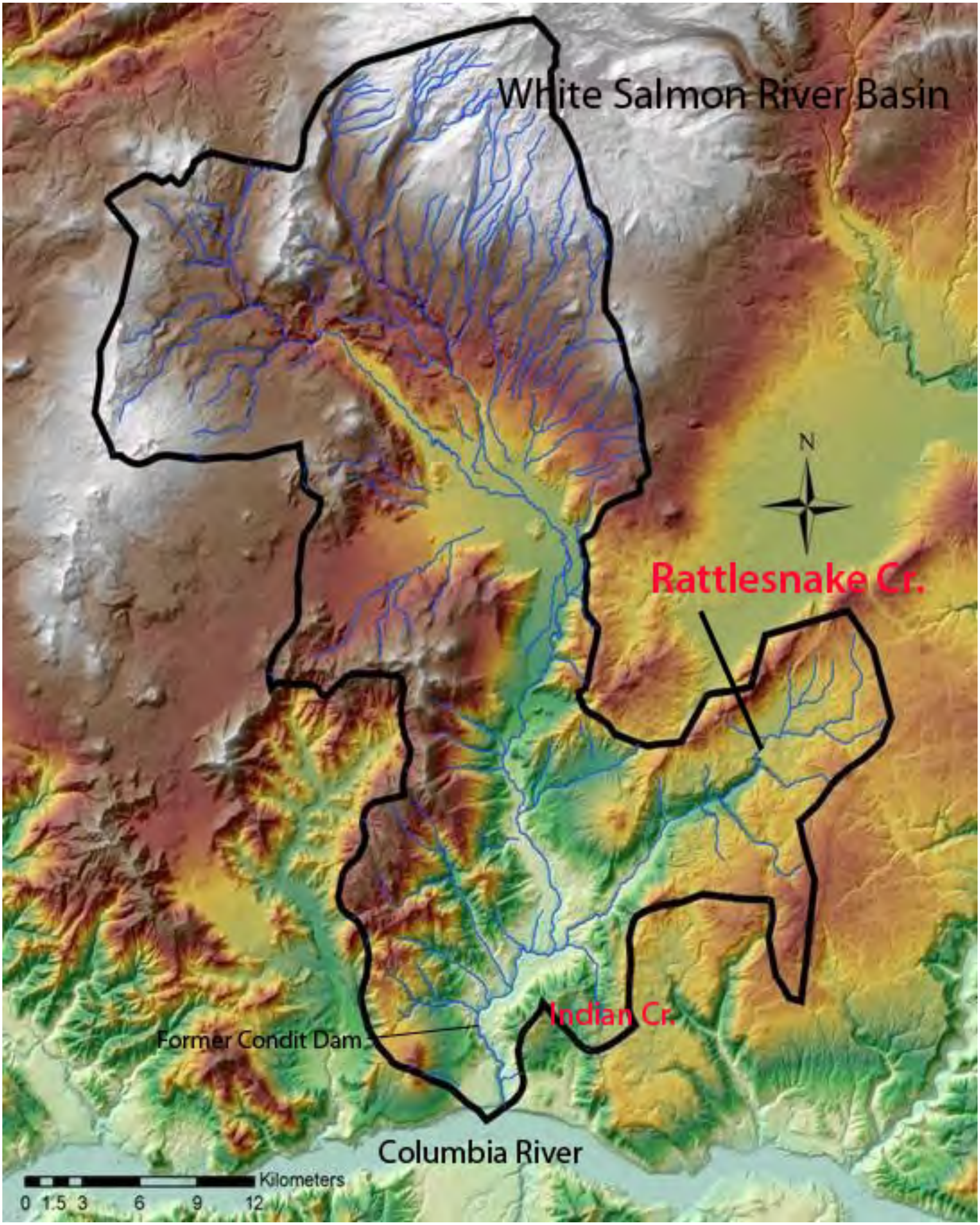
- ❑ Condit Dam History Jigsaw Grades 6-8 & 9-12
    - ❑ Watershed Ecology
        - ❑ Map (s) of WS watershed, including USGS White Salmon Watershed, Columbia River Basin Watershed, White Salmon & Rattlesnake relief, and WA State Ecozone Map
        - ❑ White Salmon Subbasin Description document
        - ❑ The White Salmon River Subbasin_YKFP document
        - ❑ Wildlife in the White Salmon Subbasin document
        - ❑ Land Use in the White Salmon Subbasin document
        - ❑ Terrestrial and Aquatic Resources of the White Salmon document
        - ❑ Historical photos of salmon



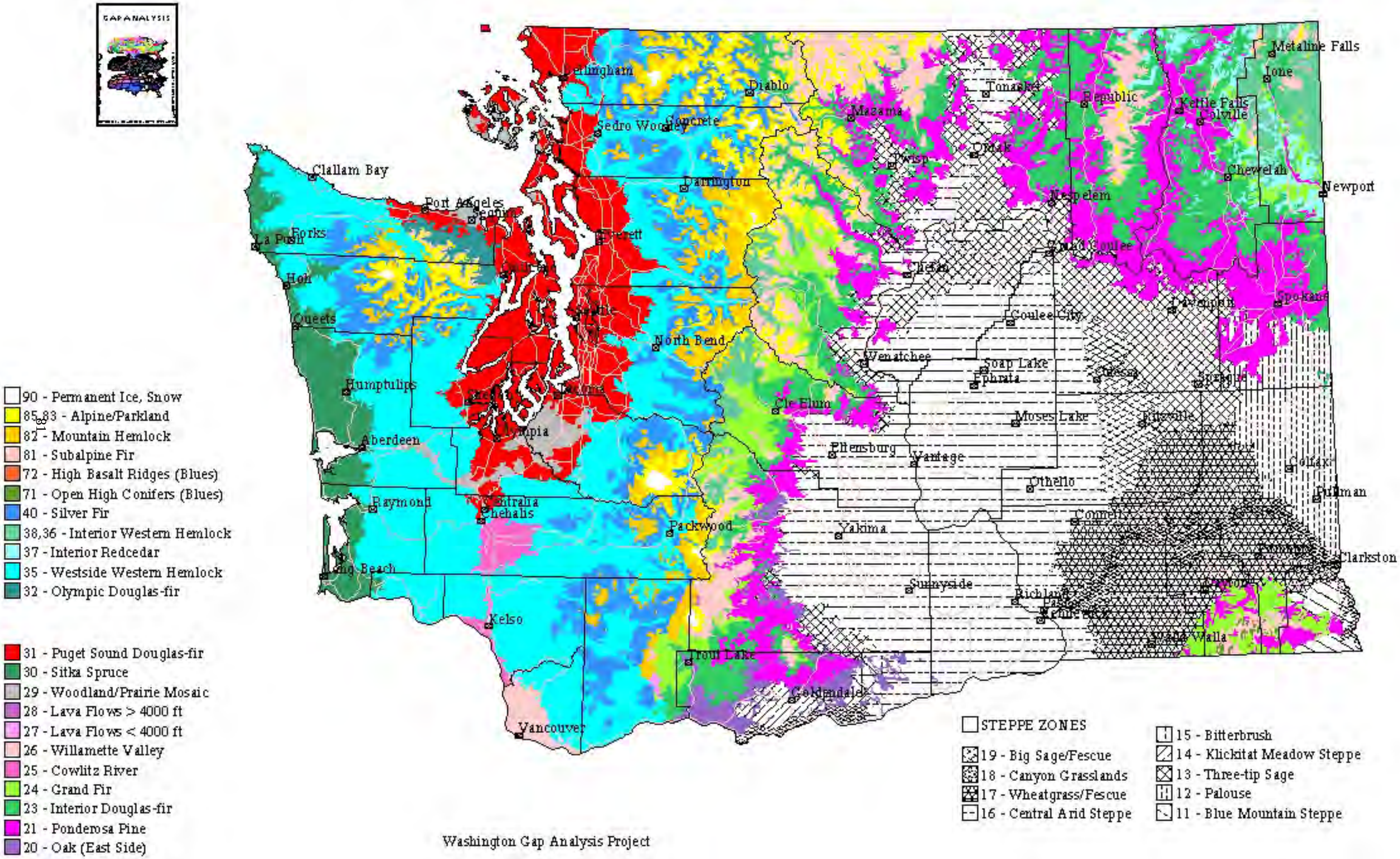
Mount Adams and Vicinity
0 10 kilometers
0 5 miles
Mount Adams
(12,276 feet)
Cispus River
Little Muddy Creek
River
Klickitat
Cunningham Cr
Lewis River
Cascade Cr
Morrison Cr
Indian Heaven
Volcanic Field
Simcoe Mountains
Volcanic Center
Smith Butte
King Mtn.
Trout Lake Creek
Frazier Cr
Lemei Rock
Glenwood
Trout Lake
Outlet Creek
YAKIMA INDIAN RESERVATION
GIFFORD PINCHOT NATIONAL FOREST
WASHINGTON
Mount Rainier
Mount St. Helens
Mount Adams
Mount Hood
OREGON
Salmon River
Gilmer Cr
BZ Corner
White
Wind River
Little White Salmon R.
Husum
River
Underwood
White Salmon
Bingin
Klickitat
COLUMBIA RIVER
Hood R.
Hood River
WASHINGTON
OREGON
USGS
Topinka, USGS/CVO, Modified from Vallance, 1999, USGS Bulletin 2161



ALBERTA
BRITISH COLUMBIA
MONTANA
WYOMING
IDAHO
UTAH
NEVADA
OREGON
WASHINGTON
Pacific Ocean
Columbia
Canoe
Kinbasket Lake
Golden
Invermere
Elk
Cranbrook
Kootenay
Duncan
Nelson
Castlegar
Trail
Revelstoke
Nakusp
Kettle
Okanagan Lake
Kelowna
Okanogan
Methow
Wenatchee
Flathead Lake
Flathead
Missoula
Clark Fork
Pend Oreille
Spokane
Banks Lake
Crab
Clearwater
Lewiston
Snake
Kennewick
Richland
Pendleton
Umatilla
Grande Ronde
Salmon
Payette
Boise
Malheur
Owyhee
Bruneau
Twin Falls
Idaho Falls
Pocatello
Portneuf
Henrys Fork
John Day
Yakima
The Dalles
Deschutes
Bend
Cowlitz
Lewis
Longview
Vancouver
St. Helens
Astoria
Portland
Salem
Corvallis
Eugene
Willamette


White Salmon River Basin
N
Rattlesnake Cr.
Indian Cr.
Former Condit Dam
Columbia River
Kilometers
0 1.5 3 6 9 12

Washington Vegetation Zones, Version 6, August 1996



Washington Gap Analysis Project

White Salmon Subbasin Description

Excerpts from White Salmon Subbasin Plan, pages xx-xxvii

Source: Northwest Power &Conservation Council, https://www.nwcouncil.org/media/116771/EntirePlan_screen.pdf

3.1.2 White Salmon Subbasin

The White Salmon River originates in the Gifford Pinchot National Forest in south central Washington along the south slope of Mt. Adams in Skamania and Klickitat counties. It drains approximately 386 square miles and flows south for 45 miles before entering the Columbia River (Bonneville reservoir) in Underwood, Washington at RM 167. Elevation in the subbasin ranges from the 12,307 foot Mount Adams to 72 feet at the mouth. Condit dam is located at RM 3.25, the resultant reservoir extends to approximately RM 5.0 (Haring 2003).

A settlement agreement entered into between PacifiCorp, state and federal agencies, tribes and environmental groups, was finalized on Sept. 22, 1999. The settlement documents agreement on a proposed removal plan for Condit Dam and demolition and removal of all Condit Hydroelectric Project facilities with the exception of the project's powerhouse. The settlement calls for the removal in 2006.

The settlement agreement is now pending before the Federal Energy Regulatory Commission (FERC) while awaiting a decision regarding a Clean Water Act Section 401 Water Quality Certification that, if issued, would describe the actions required to mitigate for water quality effects, such as increased sedimentation, resulting from dam breaching.

The Washington Department of Ecology (Ecology) is the delegated entity authorized to issue or deny the 401 permit. Ecology has also determined that a stormwater NPDES permit under the Clean Water Act, which Ecology has state jurisdiction to issue, will likely be required for the project. At the time of this writing Ecology has gathered the scientific information necessary to begin preparation of a State Environmental Policy Act (SEPA) Supplemental Environmental Impact Statement (SEIS) to support its permitting activities. The SEIS will supplement the National Environmental Policy Act (NEPA) Final SEIS issued by FERC in June 2002. Ecology anticipates the SEIS will be complete in mid-2005; with the 401 permit following shortly thereafter. There will be opportunities for public comment during development of the EIS.

In comparison to other subbasins in the Columbia Basin, the White Salmon watershed is lightly to moderately developed. However, historical logging practices and associated road building, unscreened irrigation diversions, and inappropriate riparian grazing have resulted in increased sedimentation, reduced riparian vegetation, loss of large woody debris, and increased summer temperature in some areas.

3.2 Subbasin Description

3.2.1 Topographic/Physio-geographic Environment

White Salmon Subbasin Description

Excerpts from White Salmon Subbasin Plan, pages xx-xxvii

Source: Northwest Power &Conservation Council, https://www.nwcouncil.org/media/116771/EntirePlan_screen.pdf

The White Salmon subbasin is located in south central Washington in Klickitat and Skamania counties. The river begins on the southwest slope of Mount Adams and flows south about 45 miles into Bonneville Pool on the Columbia River (RM 168.3). Drainage area is approximately 386 square miles. Subbasin elevation ranges from 72 feet to 12,300 feet, and topography varies from rugged mountains to rolling hills to river valleys. Consolidated sediments are overlain with basaltic lava flows. Subsequent erosion, mud flows, and glaciation have resulted in precipitous cliffs, deeply incised canyons, and relatively flat valley floors. Several peaks and buttes reach elevations above 4,000 feet, but most prominent is 12,307-foot Mount Adams. Trout Lake Valley is the major subbasin valley and is bordered by hills to the west and rolling plateaus to the east (WDF 1990).

Geology

The geology of the subbasin is dominated by past volcanic activity. Subbasin soils are the result of volcanism and glaciation. Soils in the valley are deep and coarse with moderate fertility. In the hilly areas the deep and well drained soils are derived from weathered volcanic ash and lava underlain with olivine basalt (Haring 2003). The lava flows were often confined within ancient river valleys. For example, Quaternary basalt lavas flowed down the ancient Wind River, Little White Salmon River, and White Salmon River valleys to the Columbia River. In general, these Quarternary volcanics are more permeable than older rocks as the original permeability related to fractures has not been reduced by weathering (Envirovision 2003). In the lower portion of the basin, the soils are generally shallow and less porous (Haring 2003).

Climate

Climatic patterns of the White Salmon subbasin are controlled by marine-influenced air masses from the Pacific Ocean and continental air masses from eastern Washington. Winters are usually wet and mild, while summers are warm and dry. Approximate 75% of the precipitation is delivered in the form of rainfall or snow between October and March. The average precipitation along the eastern most portion of the watershed equals 40 inches a year, increasing to as much as 95 inches in the west and north (Haring 2003). Temperatures vary considerably because of the large range in elevation, but are tempered by prevailing westerly winds. Typically, temperatures range from 29o F in January to 65oF in July (WDW 1990).

Land Cover and Vegetation

The subbasin vegetation is a mixture of east and west Cascade forests. Of the 247,039 acres that compose the watershed, 233, 698 acres (94.6 %) are forested. The other 5.4% which was composed of grassland and shrub-steppe has been converted to agricultural use (Haring 2003).

3.2.5 Hydrology

Hydrologic regimes

White Salmon Subbasin Description

Excerpts from White Salmon Subbasin Plan, pages xx-xxvii

Source: Northwest Power &Conservation Council, https://www.nwcouncil.org/media/116771/EntirePlan_screen.pdf

The mainstem White Salmon River has excellent flows and water temperatures year-round. The majority of flow is from glacial melt runoff and/or from springs and seeps from the porous basalts that are present through much of the watershed. Coupled with the location of much of the White Salmon River in a deeply incised canyon, water temperatures in the mainstem remain cold throughout the year (Haring 2003).

Streamflows in the tributaries in the watershed range from summer low flows to peak flows in the winter. Some tributaries only flow during high flow events and are dry the remainder of the year. Peak flows in the mainstem are generated by snowmelt runoff and occur in the spring, increasing from an average daily flow of 644 cubic feet per second (cfs) in the fall to flows of 1,538 cfs during the spring (Haring 2003). However, peak discharges are associated with rain on-snow events (USFS 1998)

The flow pattern on the White Salmon River mainstem is relatively constant due to its glacial origin, large water recharge potential, and storage capacity. Recharged water is released mostly in the middle portion of the mainstem canyon between Trout Lake Valley and Husum. The largest stream flows typically occur in response to Chinooks – rain-on-snow events when heavy rains combine with high air temperatures and high winds to cause widespread snowmelt. Low flows are maintained on the mainstem by late season snowmelt and areas of water retention or recharge (Haring 2003).

Large woody debris (LWD) is a critical habitat element, as it provides cover and instream habitat diversity, reduces peak flow energy, and retains substrate gravels. These key pieces could then form the foundation for collection of smaller LWD pieces and formation of logjams. The potential supply of large key-piece LWD in the watershed is severely impaired by past and ongoing land uses. Much of the limited recruitment of LWD that currently occurs is actively cut up or removed by river rafters (Bair) (Haring 2003).

Water Quality

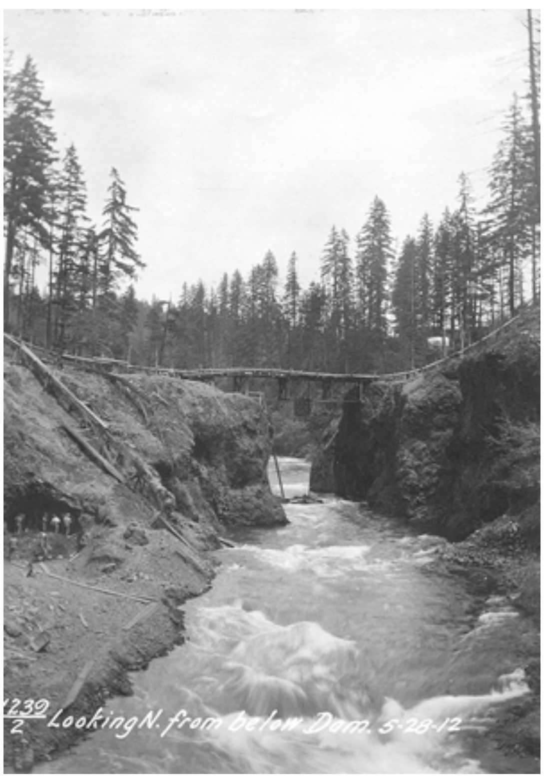
Water quality in the subbasin is good, although the river suffers from a yearly high sediment discharge due to glacial-melt in the headwaters. Cascade Creek enters the river at RM 36.9 and is heavily laden with glacial flour. Substantial quantities of sediment are delivered downstream, which can reduce the quality of spawning gravel (WDW 1990).

The White Salmon River Subbasin

The White Salmon River subbasin is part of the area ceded by the Yakama Nation to the U.S. Government by treaty in 1855, and contains usual and accustomed hunting, fishing and gathering grounds, as well as archaeological and cultural sites of tribal and national significance. The Rattlesnake Creek site was added to the National Register of Historic Places in 1978.

The river is home to historical populations of Middle Columbia River steelhead, Lower Columbia River Chinook, Lower Columbia River coho, Columbia River chum, Pacific and brook lamprey, bull trout, rainbow and coastal cutthroat trout. Currently the historical spring Chinook population is considered extirpated, the historical steelhead, chum, fall Chinook and coho populations are listed as threatened for protection under the Endangered Species Act.

The White Salmon River drains approximately 386 square miles in southwestern Washington and joins the Columbia River at Underwood, Washington at river mile (RM) 163. Abundance of the subbasin's salmon and steelhead populations dropped significantly after 1913 when construction of Condit Dam at RM 3.3 on the White Salmon River blocked all anadromous fish migration to, and most outmigration from, historical spawning and rearing grounds in the upper watershed. The Yakama Nation, along with several other organizations and agencies, is party to a settlement agreement with PacifiCorp for the removal of Condit Dam. The dam was breached in October 2011 (see Pacificorp's press release from June 14, 2011) and decommissioning, including removal of the dam structure, flow line and coffer dam, is expected to be completed in September 2012. Restoration activities, such as sediment stabilization and revegetation of the former reservoir will be conducted in the year after breach.



SOURCE: Yakama Nation Fisheries Project website, http://www.ykfp.org/klickitat/WS.htm

Wildlife in the White Salmon Subbasin

Excerpts from White Salmon Subbasin Plan, pages xx-xxiii

Source: Northwest Power &Conservation Council, https://www.nwcouncil.org/media/116771/EntirePlan_screen.pdf

3.1.3 Terrestrial/Wildlife Relationships

The different habitats found in the Big White Salmon subbasin support a varied array of wildlife. Our Oregon white oak and ponderosa pine habitats support a diversity of species, including western gray squirrels (Sciurus griseus). Klickitat County has the healthiest and most stable population of western gray squirrels in Washington State. This population, which is located in the lower Klickitat River Subbasin, may play an important role in the recolonization or reintroduction of squirrels into habitats they were formally found but are depleted. Despite some land conversion of oak and pine habitat in Klickitat County, a habitat vital to western gray squirrels, there are still large amounts of suitable and unfragmented habitat available.

Klickitat County supports many neotropical migratory birds. Many of them breed in the White Salmon subbasin. Lewis' woodpecker (Melanerpes lewis) is a migratory bird that breeds in Washington State, including our subbasin. The wintering grounds consist of the southern portion of the breeding grounds from Oregon, Utah, and Colorado south to the U.S.-Mexican border and into northern Baja California (Audubon 2002).

3.1.4 Fish & Aquatic / Wildlife & Terrestrial Relationships

Riparian areas are a unique habitat that connects aquatic and terrestrial ecosystems providing an important link between fish, wildlife and wildlife habitat. Riparian areas perform a number of functions vital to the watershed and water quality. These functions are important to salmon habitat and wildlife that are dependent on salmon for food and nutrients.

Anadromous salmon provide a rich, seasonal food and nutrient resource that directly impacts the ecology of both aquatic and terrestrial consumers and the vegetative landscape. There is also an important indirect effect on the entire food-web linking water and land resources (Cederholm et al. 2000). This food-web has likely always included this co-evolutionary relationship between salmon, wildlife and habitat in the Pacific Northwest.

The life stages of salmon (i.e., eggs, fry, smolts, adults, and carcasses) all provide direct or indirect foraging opportunities for terrestrial, freshwater, and marine wildlife (Cederholm et al. 2000). The relationship between pacific salmon and wildlife was examined by Johnson et al.

Wildlife in the White Salmon Subbasin

Excerpts from White Salmon Subbasin Plan, pages xx-xxiii

Source: Northwest Power &Conservation Council, https://www.nwcouncil.org/media/116771/EntirePlan_screen.pdf

(2001). A total of 605 species terrestrial and marine mammals, birds, reptiles, and amphibians currently or historically common to Washington and Oregon were examined for their relationship to pacific salmon. They found a positive relationship between salmon and 137 species of wildlife. See Appendix C, table C.6.A,h.s. for a full list of the wildlife species in our subbasin identified as having a relationship with salmon.

There are several predators in the Pacific Northwest ecosystem that benefit from the important ecological contribution that pacific salmon make as prey during their anadromous life history. Pacific salmon contribute nutrients during several stages of their life, regardless of whether particular individual salmon complete all life history stages or not (Cederholm et al. 2000). Six wildlife species present in our subbasin are identified as having a strong, consistent relationship with salmon: Common merganser (Mergus merganser), harlequin duck (Histrionicus histrionicus), osprey (Pandion haliaethus), bald eagle (Haliaeetus leucocephalus), black bear (Ursus americanus) and northern river otter (Lontra canadensis).

Fish, and their habitat, also benefit from the presence of particular wildlife species. American beavers (Castor canadensis) are extremely important in contributing to large woody debris, which is a critical structural component in Pacific Northwest streams. Large woody debris provides important structural complexity as well as vital nutrients to streams. Large woody debris and beaver dams decreases stream velocity and temperature. It also provides refugia to migrating fish.

There are many human activities that, if conducted improperly, can have significant impact on both terrestrial and aquatic species and habitat. Some examples include timber activities, urbanization, and cattle grazing. Timber activities can fragment and decrease quantity and quality of wildlife habitat. It can also decrease woody debris available to streams and increase sedimentation. High amounts of sediment can increase water temperature, making streams unsuitable for fish, amphibian and aquatic macroinvertebrate species. Urbanization and associated road building can impact terrestrial wildlife by fragmenting habitat and creating barriers to migrating species. Roads can also cause sediment increase and edge degradation. Grazing can degrade both terrestrial and aquatic vegetation, impacting both wildlife and fish.

Wildlife in the White Salmon Subbasin

Excerpts from White Salmon Subbasin Plan, pages xx-xxiii

Source: Northwest Power &Conservation Council, https://www.nwcouncil.org/media/116771/EntirePlan_screen.pdf

The White Salmon subbasin chum salmon and chinook salmon are listed within the Lower Columbia Evolutionary Significant Unit (ESU) or distinctive group of Pacific salmon or steelhead established by NOAA Fisheries. Steelhead are listed within the Middle Columbia River ESU. Steelhead in the subbasin were listed as threatened under the ESA in 1998, and fall and spring chinook salmon along with chum salmon , also designated threatened, were added to the list in 1999 (NOAA Fisheries 2004). Steelhead and salmon migrating to upper river tributaries of the Columbia and Snake Rivers typically dip in to the cooler waters of the White Salmon (Yakama nd).

Land Use in the White Salmon Subbasin

Our Watershed:

Source: Friends of the White Salmon River, http://friendsofthewhitesalmon.org/our-watershe/

Ninety-five percent (95%) of the White Salmon watershed is classified as forestland, amounting to 236,963 of the total 250,459 acres. Roughly half of this is managed by the US Forest Service as Gifford Pinchot National Forest Mount Adams Ranger District. The remainder is managed by WA Department of Natural Resources or as private forestland. Pasture and hay land rank a distant second to forestland in White Salmon River watershed land use. Approximately 9,000 acres are utilized for this purpose, accounting for only 4% of the watershed area. The third largest land use in the watershed is orchard fruit production, accounting for 1,585 acres, or 0.6% of the total watershed area.

Excerpts from White Salmon Subbasin Plan, pages xxiii-xxiv

Source: Northwest Power and Conservation Council, https://www.nwcouncil.org/media/116771/EntirePlan_screen.pdf

3.2.2 Jurisdictions and Land Ownership

The White Salmon subbasin totals 33,437 acres, of which 22,298 acres are located on federal land with the Gifford Pinchot National Forest (GPNF). Planning and management jurisdictions form an overlapping mosaic that includes the U.S. Forest Service (USFS), Confederated Tribes of the Yakama Nation, State of Washington, Klickitat County, Skamania County, Underwood Conservation District (UCD), and Columbia River Gorge Commission.

The upper portion of the basin and its tributaries are located within the legislated boundary of the GPNF. Federal ownership accounts for 50% of the watershed. The Washington Department of Natural Resources (DNR) manages approximately 20% of the basin, corporate timber holdings account for 20%, while the remaining 10% consists of small private timber lands, irrigated cropland, orchards, and residential area. The White Salmon River subbasin is part of the Yakama Nation lands ceded to the United States in the Treaty of June 9, 1855. Within this area the tribe reserves the right to hunt and fish at all usual and accustomed places in common with citizens of the territory.

The 8-mile segment of the White Salmon River upstream of Northwestern Lake to BZ Corner (RM 5.0-12.7) is included within the federal Wild and Scenic River system. The river downstream of Condit Dam (RM 3.3-mouth) is within the boundaries of the Gorge Scenic Area.

3.2.3 Land Use and Demographics

The principal uses of land are timber production, forest range, and agriculture. The area is rural with unincorporated towns and scattered residences along the river. Highway 141 generally parallels the river and provides primary access (WDW 1990).

The White Salmon River drainage has been managed for timber and agricultural production since white settlement. Pasture and hayland rank a distant second to forestland in watershed land use dominance, approximately 9,880 acres are utilized for this purpose, accounting for only 4% of the watershed area. The third largest land use in the watershed is orchard fruit production, accounting for 1,482 acres, or 0.6% of the total watershed area Animal husbandry includes approximately 1,140 range cattle, 500 pasture cattle, 2,050 dairy cattle, 800 sheep, 300 horses, and 60 llamas (Haring 2003). Additionally, all lands within the Gorge Scenic Area fall under land use regulations administered by Skamania County and the Gorge Commission. Land outside the Gorge Scenic Area is regulated under Washington State Forest Practices Act. Also, under the USFS Northwest Forest Plan initiated in 1997, much of the drainage has been designated as riparian reserves, or reserved through other means (Rawding 2000). Most of the land area outside of the GPNF is subject to Klickitat County land use ordinances.

Most of the 3,000 rural residents in the White Salmon subbasin live in the in the vicinity of Trout Lake, BZ Corner, and Husum. Other significant population centers within the watershed include the rural western outskirts of White Salmon, and the east side of Underwood Mountain in and around Underwood Heights. Urban development has been concentrated in White Salmon and the unincorporated towns of Husum, BZ Corner, and Trout Lake. Large scale industrial activities are limited by lack of available land outside the National Forest and Gorge Scenic Area. The river's proximity to the Portland/Vancouver area makes it a popular recreation destination for whitewater boating, winter sports, fishing, golfing, wildflower viewing, camping, hiking, picnicking, sightseeing, hunting, and berry picking (Rawding 2000). River recreational activities such as windsurfing has increased tourism in Klickitat and Skamania counties dramatically, likely leading to continued growth in these rural areas (WDW 1990).

Terrestrial and Aquatic Resources (From Laura Wallace's Thesis, 2009, "Condit Dam Removal: a decision-making comparison with removal of Elwha River Dams", pages 38-39)

The White Salmon River watershed supports a wide variety of terrestrial wildlife species native to the area. Mammals found in the area include black-tailed deer (Odocoileus hemionus), beaver (Castor canadensis), mink (Mustela vison), river otter (L. canadensis), and the western grey squirrel (Sciurus griscus) which is listed as "threatened" under the Washington State Endangered Species Act (FERC 1996, 3-39 – 3-40). Several bird species found in the Project area include the bald eagle (H. leucocephalus), pileated woodpecker (Dryocopus pileatus), Vaux's swift (Chaetura vauxi), tern species (Podicipedidae spp.), great blue heron (Ardea herodias), and osprey (Pandion haliaetus) (FERC 1996, F- 3; PacifiCorp 2009, 23-25).

While the dam was still in place, fish species diversity was decidedly greater in the river below the dam than it was in Northwestern Lake and further upstream. A total of 16 species have been found downstream of the dam, including spring and fall Chinook (king) salmon (Oncorhynchus tshawytsch), Coho (silver) salmon (O. kisutch), winter and summer steelhead (O. mykiss), and bull trout (Salvelinus confluentus). Upstream of the dam were significantly fewer species. These included cutthroat trout (O. clarkii), rainbow trout (O. mykiss), non-native brook trout (S. fontinalis), and sculpin (Cottus bairdii) (Rawding 2000, 5). Endangered species include several subspecies of lower Columbia River Chinook salmon (O. tshawytscha), middle Columbia steelhead (O. mykiss), lower Columbia coho salmon (O. keta), Columbia bull trout (S. confluentus), and others (Wellner 2007; Silver, Hudson, and Whitesel 2011). A list of salmon and steelhead species of concern may be found summarized in the table below (Table 3.1).

Salmon and Condit Dam

Before the dam's placement, the White Salmon River supported large populations of wild fish. This natural resource was so abundant that the river was able to support two native fishing villages (Becker 2006). Due to the absence of any kind of fish passage at the dam, however, one hundred years later most of the river's wild salmon runs are endangered, and its spring Chinook salmon population is already extinct, "due in large part to Condit Dam" (Bonham 1999, 2). In an attempt to mitigate the impact of the dam on the White Salmon River's native fish stocks, the U.S. Fish and Wildlife Service installed a fish hatchery for spring Chinook salmon nearby. While it operated with some success, it has not resulted in self-sustaining populations, at least when the dam was still in place (Haring 2003). Now that the dam has been removed, this is expected to change. Salmon now have 14 miles of river habitat restored to them, and steelhead are reconnected to 33 miles of their original habitat. The hope is that this will result in the restoration of pre-dam abundance and diversity (Wellner 2007; Susewind 2010).

Resources For Condit Dam Lesson Plans

- ❑ Native History/Cultural Use of the River
    - ❑ Yakama Nation History document
    - ❑ Yakama Nation information document
    - ❑ Native American use of Jewett Creek document
    - ❑ Columbia River Indian Traditional Foods document
    - ❑ Seasonal Gathering Rounds Sustained Columbia River Peoples document
    - ❑ Seasonal Round Diagram
    - ❑ Anthropogenic Disturbances in White Salmon Subbasin document
    - ❑ Basic Condit Dam History document
    - ❑ Lamprey found on the White Salmon River Yakima Herald article
    - ❑ Lamprey - a cultural resource document
    - ❑ Photos of Tribes along the White Salmon River
    - ❑ Maps (2) of Reservation and Ceded Lands

Yakama Nation History

SOURCE: Yakama Nation official website, http://www.yakamanation-nsn.gov/history.php

First Chief of the Yakama Nation 1856-1861

Chief Spencer's tribal name was "Tah pa shah" and interpreted to Sharp Shooter. He was Chief of the Klickitats and appointed at the original Yakama Agency in White Swan, Washington. He was confirmed by J.W. Nesmith, Superintendent of Indian Affairs for the Washington-Oregon Territory in 1856.

He was also appointed by U.S. officials since Chief Kamiakin refused to come onto the reservation. Chief Spencer was paid $500 per year and at the end of his appointment was given an officer's sword.

The Land

Upon central Washington's plateau and along the Columbia River reside tribal people called the Yakama's. The Cascade mountains shelter this central portion from marine showers. The rolling foothills and Yakima River are the eastern border.

Due west in majestic glory is Pahto, 12,307 feet high. It is one of five Cascade volcanoes that dot the landscape from California to Washington. Her snow melts through canyons, forests, meadows and valleys to provide gifts to our people.

The tribal people comprising the Yakama Nation have lived in this area since the beginning of time. They used the entire land base, from the lowlands around the Columbia River to the snow-peaked Cascade Mountains.

Yakama people spent the coldest months in winter villages generally located on the valley floor, a place with a relatively moderate climate. A reliable source of wood and water, and protection from cold winds could be found there. Villages were located on or near waterways, in places where a variety of resources could be obtained including deer, elk, fish, riparian and desert plants, and animal resources.

In the springtime, as soon as the first edible greens appeared above the ground, tribal people began moving across the countryside for fresh food resources. The melting snows would be followed upland, and edible roots collected as they matured. Some tribal people would go to the rivers to fish. Others would remain in the mountains, following the maturing plants upslope, ending with the huckleberry harvest in the fall. At that time, foods would be either stored or transported back to the winter village from both the mountains and the rivers, and people would settle in, once more living on stored foods and occasional fresh meat until the next spring. Bordering the reservation, the Yakima River flows southward from the Cascade Mountains to the Columbia River. Along the river there is a pass, a gap in Ahtanum Ridge called Union Gap. The Yakima River flowed through this area before the ridges existed. The Toppenish Basin is shaped like a scoop that is open to the east. The higher sides of the scoop are Ahtanum Ridge to the North, Toppenish ridge to the south and the Lost Horse Plateau to the west. Located along the eastern slopes of the Cascade Mountain Range, the Yakama Nation forest consists of 600,000 acres of timbered lands.

All this for future generations yet unborn according to teachings by our elders.

Yakama Nation History

SOURCE: Yakama Nation official website, http://www.yakamanation-nsn.gov/history.php

Map of Ceded Area & Reservation

Lands ceded to the federal government during the 1855 Treaty signing included over 12 million acres of land. But tribal elders have said that their distance of travel sometimes took them as far north as Canada and as far south as California.

The reserved portion of the tribal people's original home land is where the tribes and bands were moved to. Tribal leaders reserved the right to fish, hunt and gather all of the tribe's traditional foods on the reservation as well as the ceded area. Although the Treaty was signed on June 9, 1855 it did not become valid until ratified March 8, 1859 by the U.S. Senate and proclaimed law by the President on April 18, 1859. And just one month after the treaty was signed Governor Stevens through northwest newspapers declared all ceded lands open and available for white settlement.

Located in southwestern Washington State is the 1,130,000 acres reservation that is home to the Yakima or Yakama Indian Nation (AID, 39). That reservation was granted to the Yakama in a treaty signed in 1855 by Gov. Isaac Stevens of the Washington Territory and representatives of the Cayuse, Umatilla, Wallawalla, Nez Perce and Yakama tribes.

Although the treaty called for a period of two years to allow the various tribes to migrate to and resettle on, their new reservations, Gov. Stevens declared Indian lands open for white settlers a mere twelve days after the treaty was signed (ENAT 253-254). A Yakama chief, Kamiakin called upon the tribes that had been duped to forcefully oppose this declaration, but not before they had built up their strength to oppose the military. Things move too quickly and shortly thereafter a series of raids, counter raids and reciprocal atrocities began. This uprising became known as the Yakima War. The war continued until 1859, when the last phase, known as the Couer d'Alene War ended. The Yakama accepted their reservation and still dwell there today. In addition to the Yakima, some Paiutes and a few members of other tribes reside on the Yakama Reservation.

Yakama Nation Information

Compiled & written by Jeanette Burkhardt, Yakama Nation Fisheries

By 1854, Skamania County was formed west of the White Salmon. During the late 19th century, local tribes were still a military threat and the United States began entering into a treaty to avoid costly wars over resources.

In 1855, the Confederated Tribes and Bands of the Yakama Nation signed a treaty with the U.S. government. The treaty reserved an area of land for the Yakama Nation, known as a reservation, for the exclusive use of its people. The treaty also set aside a larger area, known as ceded lands, which includes the White Salmon River.

The relationship between the Yakama, the salmon and the White Salmon River is the foundation of time-honored laws to protect the resources for those not yet born.

Today, the Yakama people continue to utilize the White Salmon River and the lands around it, maintaining a relationship with their traditional homeland. Federal court decisions in the 1970s (*U.S. v Oregon and U.S. v Washington*) established Yakamas as a sovereign co-manager of fishery resources. The Yakama people participate in the co-management of shared resources along the White Salmon River.

Ceded Area: In the Treaty of 1855 (12 stat. 951) with the United States of America, the Yakama Nation reserved the right to take fish in all streams bordering the reservation, the ceded area and in all usual and accustomed places. Article VI, the Supremacy Clause of the U.S. Constitution, reaffirms the Treaty as the Supreme Law of the land.

Native American use of Jewett Creek

Compiled & written by Jeanette Burkhardt, Yakama Nation Fisheries

Rich archaeological deposits throughout the Columbia Plateau suggest that the area has been occupied by human beings for up to 11,000 years before present. The Plateau Indian way of life appears to have remained fundamentally unchanged for 10,000 years. Human use of Jewett Creek and its surroundings has been documented by various sources since the Euro-American settlement of the Northwest. Lewis and Clark, on their travels through the Columbia Gorge, commented on the Indian villages they encountered along the north bank of the Columbia River, among them a Chinookan village they called *We-ock-sock willacum*.

William Clark, April 14, 1806:
"at 1 P. M. we arrived at a large village situated in a narrow bottom on the N. side a little above the entrance of canoe creek [White Salmon River]. their houses are rather detatched and extent for several miles. they are about 20 in number. These people call themselves We-ock-sock, Wil-la-cum [...] we halted at this village and dined [...] here I observed several habitations entirely under grownd; they were sunk about 8 feet deep and covered with strong timber and several feet of earth in a conic form. these habitations were evacuated at present. they are about 16 feet in diameter, nearly circular, and are entered through a hole at the top which appears to answer the double purpose of a chimney and a door. from this entrance you decend to the floor by a ladder. the present habitations of these people were on the surface of the ground and do not differ from those of the tribes of the rapids. their language is the same with that of the Chilluckkittequaws [now identified as "White Salmon people"]. these people appeared very friendly" --Capt. Lewis

"*I walked on Shore with Shabono on the N. Side through a handsom bottom [Bingen area]. met Several parties of women and boys in Serch of herbs & roots to Subsist on maney of them had parcels of the Stems of the Sun flower[likely the roots of the balsamroot, Balsamorhiza sagittata]*." –Clark

The people inhabiting the villages from just above the White Salmon River to the Klickitat River were an Upper Chinookan-language group referred to in later historical literature as the White Salmon people. They were closely related and spoke the same dialect as the Wishrams at The Dalles (The Long Narrows). The village referred to by Lewis and Clark may be *iɬk'i'lak*, ("dried pulverized salmon"), a mixed village of White Salmon people and Klickitats. The village by lower Jewett Creek that is now Bingen was once a Chinook village, Clemiaksuc (*ɬmiyaqsáq in Chinookan*), whose population swelled during salmon season. [The name may have been anglicized to "We-ock-sock". The second form, "Wil-la-cum", is the Chinookan term *wílxam*, "village."] The presence of circular semi-subterranean pit-houses with conical roofs at this settlement suggests that it was a winter village, as this was prevalent style for winter houses among peoples on the Columbia Plateau to the east. The surface structures were plank houses.

Between 1856-1859, an area which included the Jewett Creek watershed and surrounding lands was administered as the White Salmon Reservation. About 800 Indians were removed there from the Vancouver reservation during the Indian Wars in order to prevent added hostilities between them and white settlers. The reservation spanned 15 miles along the Columbia, bounded by the White Salmon on the west, The Klickitat on the east, and back about 20 miles to La Camas Prairie (Glenwood Valley) on the north. Agency headquarters were located about 4 mi. upstream of the White Salmon River at the steamboat landing (Warner's Landing, then White Salmon Landing) on land claimed by early Bingen and White Salmon pioneer, E. J. Joslyn. The agency office location was also chosen because it was at the intersection of Indian trails from the interior.

After epidemic disease decimated the Chinookan people in the mid to late 1800's, it became a jointly occupied Chinookan/Klickitat village, and then a Klickitat village. Local Indians from Husum interviewed in the early 1900s referred to a "Klikitat" village between the White Salmon River and Jewett Creek, the largest of the Klikitat settlements, having about 500 residents throughout the year. It was also the home of the Klikitat chief, the last of whom was *tau'uwita kc*. The village was called *la'uli pa mi' (*or *lawlípaámi')* in Sahaptin.

Ethnographic researchers place a village named *lmie'qsoq* or *lmuyaqso'q* (also *Clemiaksuc*) a half-mile above White Salmon Landing around 1905 by at the site of the Byrkett Ranch (formerly Joslyn's property) which included the mouth of Jewett Creek. This village was home to 100 White Salmon (i.e. Chinookan-speaking) Indians. (Byrkett had converted in 1895 the old government blockhouse into a dairy barn).

Coho salmon run in the lower part of Jewett Creek in the fall to spawn. It is likely that Indians living in the vicinity drew water and fished for salmon in the creek.

General history:
Jewett Creek extends 4 miles through White Salmon, and Bingen Washington. The Creek is home to forests, orchards, cattle grazing, and commercial and private land owners. It is an important component to Whitson Elementary's outdoor classroom, and stream surveys. Jewett Creek is home to the White Salmon Steelheaders Fishing Derby. Coho salmon also run in the lower part of Jewett Creek in the fall.

Fish species:
Lower river (below barriers): coho and steelhead strays from other tributaries
Upper river: Resident coastal cutthroat. Other resident fish species unknown.

Chilluckittequaw. Significance unknown.

Connections. The Chilluckittequaw belonged to the Chinookan linguistic stock.

Location. As reported by Lewis and Clark, the Chilluckittequaw lay along the north side of Columbia River, in the present Klickitat and Skamania Counties, from about 10 miles below the Dalles to the neighborhood of the Cascades. Spier (1936) thinks they may have been identical with the White Salmon or Hood River group of Indians and perhaps both. In the latter case we must suppose that they extended to the south side of the Columbia.

Columbia River Indian Traditional Foods

SOURCE: Columbia River Inter-Tribal Fish Commission, https://www.critfc.org/for-kids-home/for-kids/indians-and-indian-tribes/

Columbia River Indians

Indians have lived along the Columbia River for thousands of years. There are hundreds of different groups, now known as "tribes." Each one is unique in some way: clothing, language, houses, or government. There are many tribes in the Pacific Northwest. Four of these tribes are the Yakama, Umatilla, Warm Springs, and Nez Perce. These tribes are known as "Plateau tribes" because their home is called the Columbia Plateau. The Plateau Indians are still here today. Many live in special areas called reservations that were set aside for them in the 1800s.

Foods

The Plateau tribes were semi-nomadic. They moved from place to place throughout the year to gather edible vegetables and fruits. The gathering of these plants is still a traditional way of life among many of the people of these tribes today. Fishing was very important to these tribes. Salmon made up a major part of their food supply. They caught salmon with nets and spears. Salmon are still an important part of their cultures. Plateau Indians today eat up to 10 times the amount of salmon that an average American eats. Some fishers prefer to catch salmon with traditional nets and spears on platforms. Many fishers also use fishing boats and nets or fishing poles now.

The Plateau tribes hunted many types of animals. They used these animals for food, clothing and other items. They hunted using a bow and arrow or traps. Today, hunting is still an important activity for Indians and many depend on the meat they get to feed their families. Most Indians today hunt with rifles, but there are some hunters who still use a bow and arrow or traps.

Why Salmon are Important to the Tribes

As a main dish at almost every meal, salmon is at the center of the cultures of the Plateau tribes. Feasts were held to celebrate their return each year! The salmon's return was a promise of plenty of food to help the people grow healthy and strong.
Salmon are also a part of the Pacific Northwest tribes' religions. One creation legend teaches how important salmon was:

> When the Creator was preparing to bring humans onto the earth, He called a grand council of all the animal people, plant people, and everything else. In those days, the animals and plants were more like people because they could talk. He asked each one to give a gift to the humans—a gift to help them survive, since they were pitiful and would die without all their help. The first to come forward was Salmon. He gave the humans his body for food. The second give a gift was Water. She promised to be the home to the salmon. After that, everyone else gave the humans a gift, but it was special that the first to give their gifts were Salmon and Water. When the humans finally arrived, the Creator took away the animals' power of speech and gave it to the humans.

SOURCE: Columbia River Inter-Tribal Fish Commission, https://www.critfc.org/for-kids-home/for-kids/indians-and-indian-tribes/

He then told the humans that since the animals could no longer speak for themselves, it was their responsibility to speak for them.

Salmon and Water are always served first at tribal feasts to this day to remember the story and honor the first foods. Modern Indians don't eat as much salmon as their ancestors, but they still eat more than other people. Salmon still help feed the tribes and many Indians still practice their culture by fishing for salmon. The tribes still value the ancient promise that was made to honor the gifts of the animal and plant people and to speak for them. If we don't honor that promise, these foods will go away.

Seasonal Gathering Rounds Sustained Columbia River Peoples

Source: The Confluence Project, http://www.confluenceproject.org/blog/seasonal-gathering-rounds-sustained-columbia-river-peoples/
By Mary Rose

Through the centuries, Native American women of the Pacific Northwest have been known as the "gatherers" of their tribes, picking berries, digging roots, and cutting grasses, plants and bark for medicinal remedies. They have collected wapato and aquatic plants from their canoes and prepared their harvests for winter storage. They have woven beautiful baskets, beaded buckskin and created moccasins for utility and for trade. Later, with men, they harvested domestic fruits and hops for field wages. Most important were the seasonal gathering rounds or journeys. It was a time of sharing travel and trade expeditions among families, often traversing the land for several hundred miles in a few weeks. The women prepared the hides during great hunts and cleaned the fish along Pacific Northwest rivers. Using handmade scrapers and ancient methods, they prepared the skins for use or trade. They sun-dried the fish and eel or berries, placing them into sealed hand woven baskets for secure winter storage.

A lesser known fact true to many of the Columbia River people was that women conducted most of the barter and trade. Through trade, they often acquired beads and shells for the elegant work that decorated their family's clothing. They created moccasins, shirts, dresses, harnesses and teepees and huts made of animal skins and woven tullies. Collection and trade was central to the seasonal lives of Columbia River peoples and women were often the key figures who bore the knowledge, talent and traditions through many generations.

Seasonal gatherings were a marvelous adventure for young people and adults but also a great deal of work. There was the ever-present risk of the unsuccessful hunt or the shortfall in abundance of wild berries that would carry families and villages through the winter. Leah Conner, an elder with the Confederated Tribes of the Umatilla Indian Reservation, recalled one such adventure many years ago when her mother was a young woman in the early 1920's:

"All summer long they would take off with their uncle and father and his sister and Elsie and Vera and a couple of dogs and a cat. Cats rode on my mother's saddle… And dogs [they] made boxes [moccasins?] for the dogs, so they could travel and not get sore feet. And then they got to Heppner and started digging roots. [And they went] on to the mountains and they'd stop at Sumpter and traded for coffee and sugar. And they traded what they had made on the way — a dried deer tan hide and made moccasins and gloves and things they could sell or trade for….It was their life on the seasonal rounds. They collected all their food in the summer time and by the time they got to Vale on the Snake River they'd dry all the fish and they'd come home with dried fish, dried deer meat, and dried all kinds of roots and berries. And they would have all this food and even though they had all this food, small portions, packs of this food, they would still take in people, relatives, who didn't have a home. And they lived this way all their lives. And it was beautiful how they took care of each other — the dogs survived and the cat survived, all the way from Heppner to Vale and back." [1]

By today's calculations on roads that cross desert lands and pass through the Umatilla National Forest this was a journey of nearly 500 miles.[2] Their timing was impeccable — based on traditions, experience and stories often repeated in the winter time as families gathered close to

Source: The Confluence Project, http://www.confluenceproject.org/blog/seasonal-gathering-rounds-sustained-columbia-river-peoples/

share the preserved harvest. A few photos follow to help illustrate the remarkable stories of seasonal gathering and women's implicit role in the Native Americans' cycle of life.

At the Sandy River Delta in July 2016, cultural keeper Greg Archuleta of the Grand Ronde tribe in Oregon recounted the story of collecting another staple food – wapato.

"Wapato, or Indian Potato, or Arrowleaf, is a bulb that grows along the banks of the river. Women would walk along the bank, feeling the bottom with their toes and finding/digging out the wapato bulbs. The diking and damning that happened all along the river destroyed the ecosystem that supports the wapato. It was a very important trade resource as well."

Foods gathered and preserved through seasonal rounds not only provided families with sustenance through the winter but they also became one of the mainstays of intertribal trade. When white explorers came to the region, closely followed by fur traders and trappers, the preserved foods were an important part of survival for the newcomers and trade for the Native Americans. Following tradition, women conducted most of the trade between villages and other native peoples, but men usually made trade arrangements with the foreigners whether they traveled overland or came by ships on the coastal route. This gave rise to exquisite bead work and embroidery among women in the tribes as colorful glass beads, usually produced in Europe, became important trade items. Dentalium shells were traded between native people who lived near sea coasts with those of inland tribes. The farther eastward and inland the shells were traded, the greater the value of Dentalium shells.

Basket making was also a highly developed art as well as a utilitarian talent among many Native American women in the Northwest. Often woven from grasses, bark, cattails, stinging nettles, roots or tullies, Columbia River baskets served as gathering and storage vessels, but they were also the artistic hallmark of the maker.

These photos help illustrate the remarkable heritage of the indigenous women of the Northwest. Enjoy!

Seasonal Gathering Rounds Sustained Columbia River Peoples

Source: The Confluence Project, http://www.confluenceproject.org/blog/seasonal-gathering-rounds-sustained-columbia-river-peoples/

Drying eels at the camp of Billy Barnhart, a Umatilla Indian, on the bluffs overlooking the Umatilla River, on the Umatilla Reservation. Two women stand beside a rack on which the lamprey eels are hung. 1903, Photo by Lee Moorhouse (1850–1926), UO 5508

Seasonal Gathering Rounds Sustained Columbia River Peoples

Source: The Confluence Project, http://www.confluenceproject.org/blog/seasonal-gathering-rounds-sustained-columbia-river-peoples/

CS00378-02. Cooking fish at the Feast of the First Salmon, Celilo Indian village, April 24, 1955

9305-B7046. Nancy Jim (left) and Hannah Sohappy Yallup are cleaning the first salmon caught for the traditional Feast of the First Salmon at Celilo village, April 7, 1940.

THE PLATEAU SEASONAL ROUND

Excerpts from the White Salmon Subbasin Plan (2004), pg. xxv-xxvi
Entire document: https://www.nwcouncil.org/media/116771/EntirePlan_screen.pdf

3.2.4 Anthropogenic Disturbances

Anthropologists date human occupation of the area surrounding the White Salmon river basin in south central Washington around 9,000 years ago (Haring 2003). Archaeological evidence indicates that at least 12 Klickitat villages occupied the valley at that time. They included summer gathering sites on the flanks of Mt. Adams, and permanent settlements adjacent to fishing sites at the Columbia confluence, Husum Falls, and falls at BZ Corner and Trout Lake (Lane and Lane 1981).

The earliest recorded inhabitants of the White Salmon region were those encountered by the Lewis and Clark expedition in 1805. The explorers named these people, who generally inhabited the north bank of the Columbia from the Dalles downstream to the White Salmon mouth, the Chilluckittequaw and estimated the tribe's population at 1,400. Lewis and Clark encountered a second group of people, the Klickitats, who also inhabited the White Salmon region during this time. Fishing was the primary economic pursuit of all aboriginal tribes within the Columbia Gorge region. Fishermen generally speared or netted fish in rapids or falls. Native women collected and stored various plant foods from the uplands. Men also hunted various mammals, including deer and elk in the uplands as well (Haring 2003).

After Lewis and Clark passed by the mouth of the White Salmon in 1805, no subsequent exploration of the area by non-Indian people occurred until 1853, when the McClellan expedition passed through the Trout Lake valley during a railroad survey (USFS 1991).

Early European settlers named the White Salmon after the pale bodies of spawning fish which at times nearly choked the mouth of the stream (GORP 2004). The Trout Lake valley was first settled in 1880; raising livestock was the principal economic activity. Irrigated farming was introduced to the Trout Lake valley in 1887. Timber harvest became a significant economic pursuit in the White Salmon once the first access roads were built in 1882. Near the turn of the century, splash dams became a common means of transporting logs downs the White Salmon River. Since 1882, it is estimated that at least 90% of the forest within the White Salmon basin has been harvested at least once. As land clearing progressed after the turn of the century, a shift in land-use from pasture/hay to orchards took place. Between 1890 and 1900, many small open tracts were planted to cherries, pears, and apples (BOR 1974). Commercial orchard production started in about 1902. Today, a relatively narrow range of human economic activities is being practiced within the White Salmon watershed. Forestland management is overwhelmingly the predominant land use. Secondary land uses include agriculture, recreation, and residential and commercial development (Haring 2003).

Historical information indicates that, until extensive logging opened up the White Salmon watershed, there were few if any deer. Seeing a deer historically was comparable to now seeing a cougar, a novel sight. Also, there were few elk present in the White Salmon River watershed

until the last 25 years or so. Historically, most wildlife seen consisted of brown and black bear. Hunter Hill, a successful hunting lodge between Husum and BZ Corners started in the late 1800s, focused only on bear since the animals were abundant (Haring 2003).
Until recent years, timber harvest typically extended to the edge of the stream/river. Extensive grazing has occurred since the late 1800s in the Rattlesnake Creek watershed and in the Trout Lake Valley. Large historical marsh areas in the upper Rattlesnake Creek watershed were actively drained in the early 1900s to improve grazing conditions. The watershed is recovering from some past land use actions; many other impacts of past land use actions remain in the watershed (Haring 2003).

Condit dam was constructed in 1913, precluding all upstream anadromous access. Irrigation diversions date back to the late 1800s, and most diversions/withdrawals have been in place since the early 1900s. There are anecdotal reports of significant LWD accumulations in the vicinity of the dam prior to its construction. There are historical recollections from the period 1907-1910 of a logjam in the river, probably 500 feet upstream of the location of Condit Dam and extending for 0.5 mile, with an estimated 20 million board feet in the jam (Quaempts 1973, as cited in Lane and Lane 1981).

Hennelly et al. (1994) identified numerous private garbage dump locations down the banks of the lower White Salmon River. These dumps have been cleaned up through several volunteer garbage rodeo cleanup efforts. Illegal dumps are no longer considered to be a problem in the lower White Salmon River (Haring 2003).

In order to increase the priority of habitat protection, the USFS implemented the President Forest Plan and the State of Washington has increased habitat protection through the Timber, Fish, and Wildlife process beginning 1989 (Rawding 2000).

Basic Condit Dam History: *Information from Condit Hydroelectric Project Interpretive Plan & PacifiCorp Final Slides.*

Condit Dam was built in 1913 by the Northwestern Electric Company. The dam was built in order to generate hydroelectric power for the Crown Columbia Paper Mill, located in Camas, Washington. The 125- foot dam and powerhouse took about a year to construct. Due to the construction of the dam, a lake was formed behind the dam known as Northwestern Lake which was about 2 miles long. 900 people worked on the dam everyday. In order to build the dam, the workers had to divert the water around the dam site so they could build the dam up from bedrock. The finished dam created 12 MW (megawatts) of electricity, about enough to power 9,000 modern homes. Bonneville Dam, on the other hand, produces 526 MW, enough to power close to 400,000 homes. Condit represents about 2% of power generating capacity as compared to Bonneville.

However, along with the construction of the dam came impacts to the salmon runs in the area, salmon which were protected by treaty. In 1855, heads of many of the tribes in the area signed a treaty with the U.S. government and were united as one nation under the name "Yakama." The treaty set aside exclusive reservation land for Yakama Nation and acknowledged the right for Yakama Nation to take fish in all of the streams bordering the reservation, the ceded area (larger area used by the tribes prior to the treaty), and in all their usual and accustomed places. With continued development in the area by White homesteaders, ranches, orchards, and cities overtook wild places, wildlife, and foraging areas used by the Nation.

Even though the original dam did feature a fish ladder. It was destroyed in 1914 by a flood. The ladder was rebuilt the same year, but also washed out by a flood in 1918. According to the Condit Hydroelectric Project Interpretative Plan, "from 1918 to 2011 the natural migration of fish past the dam both upstream and downstream all but ceased. Instead, in 1919, a fish hatchery was constructed on the lower Columbia River, funded in part by Northwestern Electric Company as mitigation for the loss of the fish ladder." The White Salmon River before the dam was constructed had a tremendous Tule Chinook Salmon run every fall.

In the 1970s several federal court decisions (*U.S. v Oregon and U.S. v Washington*) established Yakama Nation as a sovereign co-manager of fishery resources, and there became more recognition of the need to stand by original treaties especially in regards to protecting usual and accustomed places to fish. In addition, many species of salmon were listed as endangered species under the Endangered Species Act, requiring legal protection. With these legal victories, federal hydropower relicensing requirements for safe fish passage increased.

In 1996 the Federal Energy Regulatory Commission (FERC) issued an Environmental Impact Statement (EIS) that required PacifiCorp to install $30 million worth of fish ladders and screens for fish passage. With these additional costs, PacifiCorp understood it would be too expensive to keep operating the dam. Removal of the dam was believed to be the most cost-effective way to allow adult salmon to migrate upstream and juveniles to migrate downstream and would return the river to more natural conditions. In 2011, Condit Dam was dynamited and removed.

In this case, the decision-makers were PacifiCorp and FERC. However, there were many stakeholders who may have helped to move the decommissioning process along such as tribes and environmental groups and those who may have contributed to additional time and expense of the project such as local landowners. The Yakama people currently participate in the co-management of shared resources, such as salmon and lamprey management, along the White Salmon River.

Lamprey found above Condit Dam site on White Salmon River

By Tammy Ayer; tayer@yakimaherald.com**;** Mar 12, 2016

SOURCE: Yakima Herald -- http://www.yakimaherald.com/news/local/lamprey-found-above-condit-dam-site-on-white-salmon-river/article_7869617a-e8ea-11e5-a5d2-ef3fc0cee45c.html?utm_medium=social&utm_source=email&utm_campaign=user-share

Pacific lamprey, an ancient native fish with notable cultural and ecological significance, have returned to the White Salmon River above the former site of Condit Dam. The fact that the lamprey have been found above the former dam location signals an important step forward in habitat restoration, lamprey conservation and partnership in the Columbia River Basin, officials with the Yakama Nation and the U.S. Fish & Wildlife Service said in a news release Friday.

“This is a good day,” Patrick Luke, Yakama Nation tribal councilman, said in the release. “We are recognizing asum (lamprey) making their mighty return to Mitula Wana (White Salmon).” Sometimes referred to as the forgotten fish, Pacific lamprey are a traditional food source for the Yakama people, as well as a wide variety of wildlife species. They spend their early years nestled in creek beds before transforming into parasitic adults that migrate to the ocean to feed for years before returning to spawn.

While not endangered, populations of lamprey are dropping dramatically across the Columbia Basin, in part because adult lamprey struggle to use the fish ladders designed for salmon at hydropower dams.

Staff from the Yakama Nation and the Fish & Wildlife Service began monitoring lamprey distribution in the basin in 2007. Prior to the 2011 removal of Condit Dam — which blocked passage of upstream migrating fish for more than 100 years — surveys found no Pacific lamprey above the dam, only below.

Last summer, as part of the post dam removal monitoring, the wildlife service surveyed for lamprey in several watersheds as well as the mainstem of the White Salmon River above and below the former dam site. Pacific lamprey were found at three locations upstream of the former dam site, in areas previously inundated by Northwestern Reservoir.

The larvae, which are the size and shape of a small earthworm, are likely offspring of adults spawning in previously inaccessible habitat. This is one of the few documentations of Pacific lamprey natural recolonization after the removal of a dam.

Their parasitic nature gave the fish a bad reputation with many fishermen. But some scientists say that larger lamprey populations would benefit salmon because the high-fat fish provides a preferred alternative snack for predators like gulls and sea lions.

Further monitoring is planned to document if the Pacific lamprey continue to use new areas over time, officials said.

“All lamprey need is a chance to recolonize on their own,” Luke said.

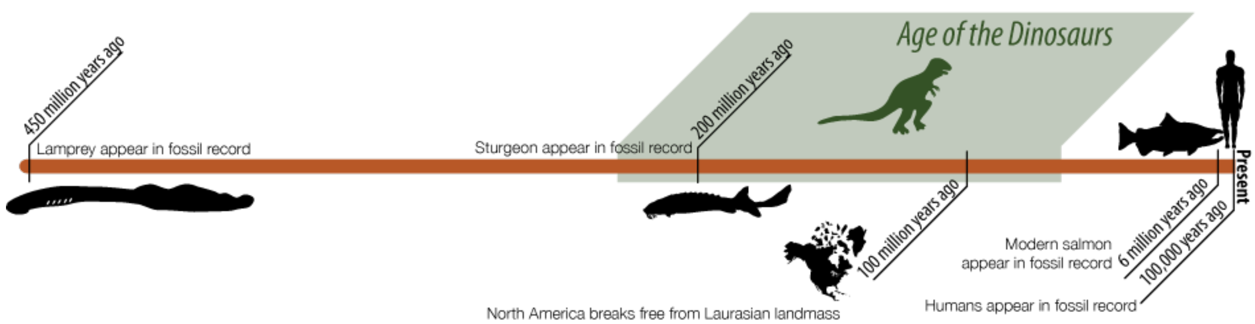
Pacific Lamprey -- A Cultural Resource

SOURCE: Columbia River Inter-tribal Fish Commission http://www.critfc.org/fish-and-watersheds/columbia-river-fish-species/the-pacific-lamprey/

A Cultural Resource

The Pacific lamprey provided an important source of food for the tribes of the Columbia River Basin, who prized them for their rich, fatty meat. They were served alongside salmon at tribal feasts and celebrations. While generally considered a trash fish by the non-tribal population, the tribes have attempted to maintain their connection to the lamprey. As the numbers of returning lamprey declined throughout the Columbia River Basin, the few places that lamprey remained abundant became even more precious—most notably at Willamette Falls at Oregon City, Oregon.

Pacific Lamprey Evolution and Biology



Entosphenus tridentatus

The Pacific lamprey is distributed throughout the Pacific Rim from Japan to Mexico. Lampreys belong to a primitive group of fishes that are eel-like in form but lack the jaws and paired fins of true fishes. It is from this resemblance that they are sometimes called eels. (Click here to learn the differences between lamprey and eels.) Lamprey have a round sucker-like mouth, no scales, and breathing holes instead of gills. The Pacific lamprey is an ancient fish that has survived ice ages, mass extinctions, and shifting continental plates for hundreds of millions of years. Now, in less than a century, they have declined to the point where their very existence is in peril. The tribes of the Columbia Basin, honor-bound to protect them, are working to restore this important part of the ecosystem and tribal culture.

Lamprey Life-cycle

After hatching from eggs, lamprey young, called ammocoetes, burrow in the mud and sand of freshwater streams. They are toothless and have only rudimentary eyes. The ammocoetes filter feed on microorganisms from five to seven years, after which they undergo a radical metamorphosis into adult lamprey. This metamorphosis includes rearranging the internal organs and the development of eyes and their characteristic toothed sucking disc. The adult lamprey

SOURCE: Columbia River Inter-tribal Fish Commission http://www.critfc.org/fish-and-watersheds/columbia-river-fish-species/the-pacific-lamprey/

then migrate to the ocean where they spend one to two years feeding before returning to fresh water to spawn. As adults in the marine environment, Pacific lamprey are parasitic and feed on a variety of prey. After spending one to three years in the marine environment, they cease feeding and migrate to freshwater in the spring. They are thought to overwinter and remain in freshwater habitat for at least a year before spawning the following summer. There is much that science does not know about these ancient creatures. Often treated as a "trash fish," they have never been a priority for research. This has been changing, particularly due to the efforts of tribal scientists who are focusing their efforts and research on them in an effort to increase our understanding of the Pacific lamprey and give us as much information about them as possible in order to create appropriate and effective restoration plans to rescue this threatened species.

Lamprey are an Important Part of the Ecosystem

Due to their unique life history, the Pacific lamprey is an important component to the ecosystem both as a predator and prey. As a predator, Pacific lamprey has co-evolved with native fish assemblages in the Pacific Ocean and freshwater ecosystems. As prey, lamprey is important to many species of fish, birds, and mammals, including humans. Like other anadromous fish species, they transport nutrients from the ocean to the freshwater environment.
Juvenile lamprey ammocoetes spend up to seven years filter feeding in the silt and gravel of stream beds. This behavior makes them particularly susceptible to pollutants and contaminants that settle out of the water.

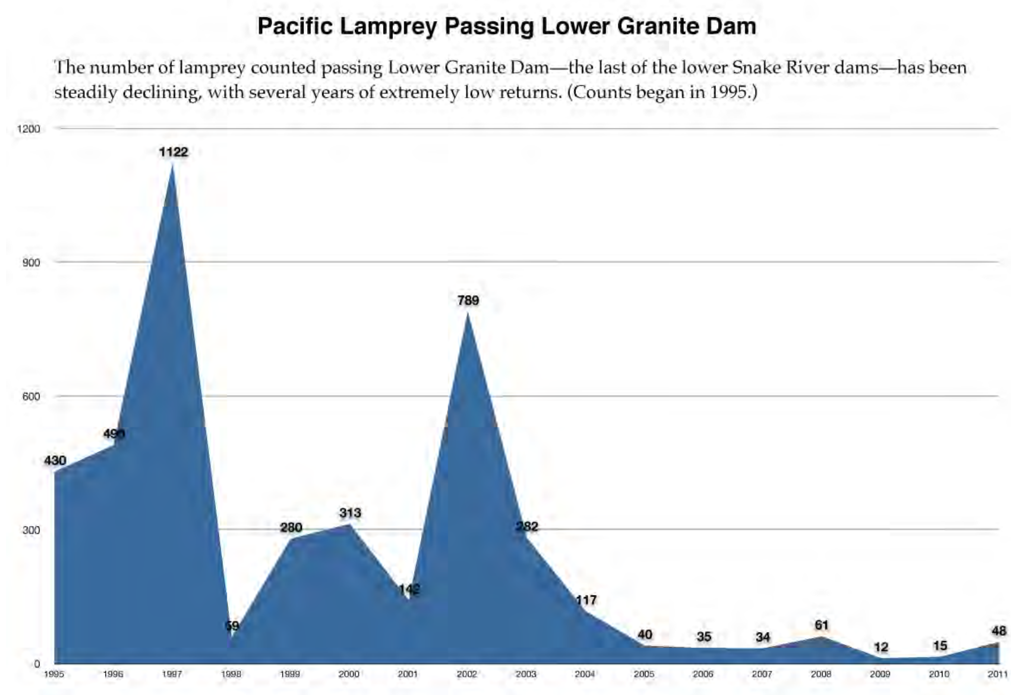
The Threat of Extinction and Work to Restore Lamprey

Similar to salmon, the lamprey life-cycle requires relatively pristine freshwater rivers and streams for spawning and rearing, mainstem river conditions conducive to migration to the ocean and back, and favorable ocean conditions. All three of these requirements have been degraded or impacted by human activity in the past 80 years, threatening the existence of this ancient creature. Counts of 400,000 adults were recorded at Bonneville Dam 60 years ago. Current counts are less than 20,000. The lamprey returning to Idaho face an ever more dire situation. In the past eight years, the number of lamprey passing Lower Granite Dam—the last mainstem dam before reaching Idaho—has been in the double digits. With this trend, the tribes are concerned that the lamprey in Idaho could soon go extinct unless something is done to reverse it.

The number of lamprey counted passing Lower Granite Dam—the last of the lower Snake River dams—has been steadily declining, with several years of extremely low returns. (Counts began in 1995.)

Pacific Lamprey -- A Cultural Resource

SOURCE: Columbia River Inter-tribal Fish Commission http://www.critfc.org/fish-and-watersheds/columbia-river-fish-species/the-pacific-lamprey/



In the past few years, the tribes have been the species' primary advocates, calling for the protection and restoration of the Pacific lamprey. To address the lamprey's decline, the Columbia River treaty tribes created the Tribal Pacific Lamprey Restoration Plan, the most comprehensive restoration plan for Pacific lamprey that the Columbia Basin has seen. Lamprey research, restoration projects, hydropower facility modifications, and policy creation are being performed by the Yakama, Umatilla, Warm Springs, and Nez Perce tribes and their collective body the Columbia River Inter-Tribal Fish Commission.

Three lamprey summits have already been held, bringing together tribal, state, and federal agencies to address lamprey decline and ways to reverse the trend. The Tribal Pacific Lamprey Restoration Plan emerged from the efforts of the second lamprey summit, and marks the formal beginning of a coordinated, concerted effort by the region's governments and agencies to protect and restore these fish whose ancestors swam the earth well before the lands that comprise the Columbia River Basin had even emerged from the primordial ocean.

Basket-makers of the White Salmon Tribe, Blythe.
Source: Jeanette Burkhardt, Yakama Nation Fisheries

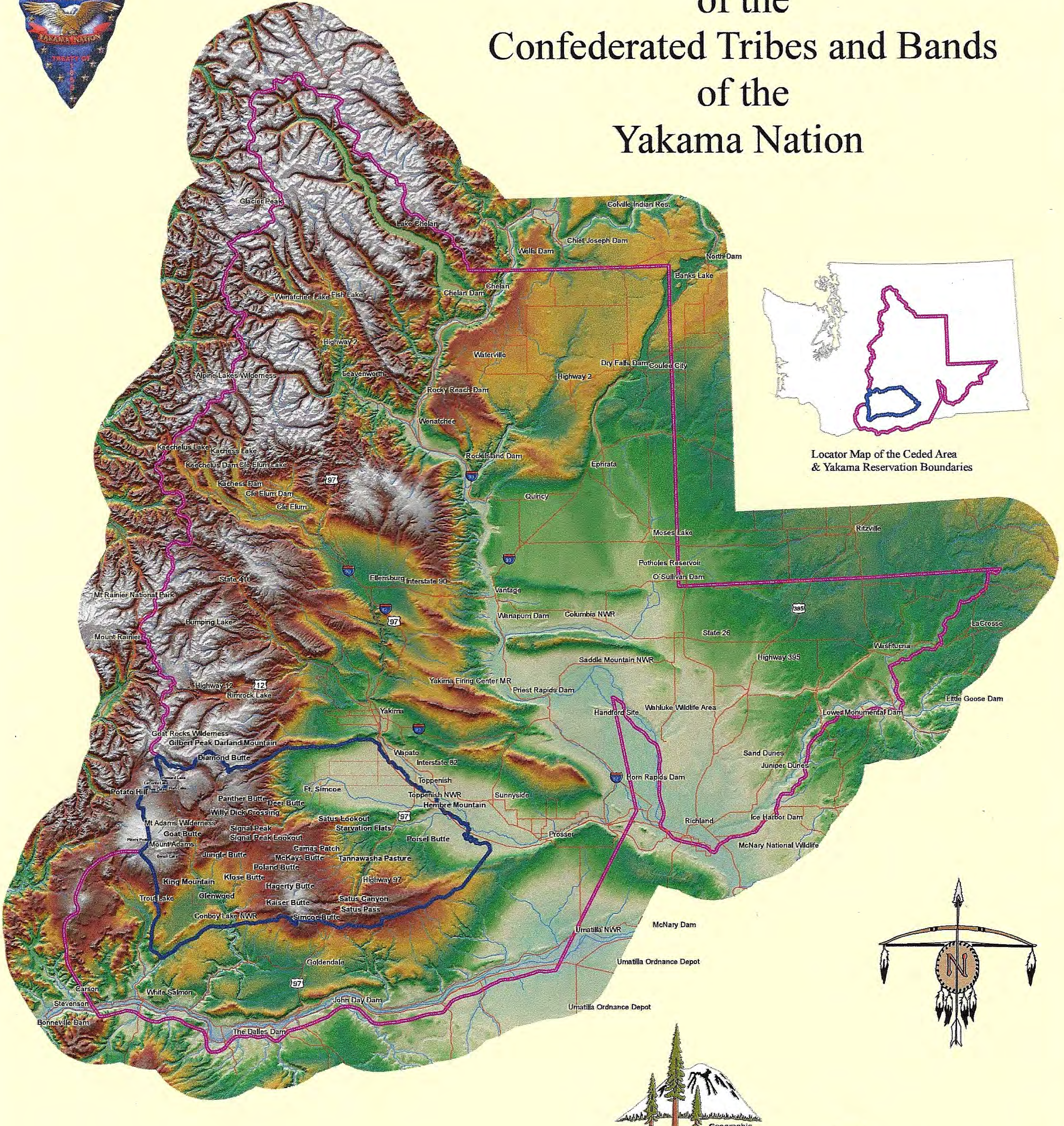
Drying Salmon at the mouth of the White Salmon River.
Source: Jeanette Burkhardt, Yakama Nation Fisheries

Historic Underwood fishing

village, 1936.
Source: Jeanette Burkhardt, Yakama Nation Fisheries

Jacob Hunt Jr. and Jacob Hunt Sr.
Source: Jeanette Burkhardt, Yakama Nation Fisheries

Ceded Area and Reservation Boundary of the Confederated Tribes and Bands of the Yakama Nation



This Map was produced by GIS staff from the BIA Branch of Forestry, DNR Water Resources and DNR Wildlife programs. The data for the map was derived from a 1:250,000 Digital Elevation Model. The forest vegetation was digitized from 7.5 minute USGS Quad sheets. A compiled list of Tribal names for various features was supplied by the Cultural Resources program. This list was derived from many sources, including Tribal elders and other participants.

Miles

40 20 0 40

Scale 1:700,000 in or 1:11mi

Legend

Yakama Nation Ceded & Reservation Boundaries

- Yakama Nation Ceded Area
- Yakama Nation Reservation
- Lakes & Reservoirs
- Rivers & Streams
- Major Roads

State of Washington

Yakama Indian Nation, Economic Development Program, GIS Office, Wapato, WA, June 1995

Resources For Condit Dam Lesson Plans

- Condit Dam History Jigsaw Grades 6-8 & 9-12
    - Hydroelectric Perspective & Building of the Dam
        - Condit Dam Background document
        - History of Condit document
        - Basic Condit Dam History document
        - PacifiCorp Condit Info document
        - Condit Dam History and Decommissioning document
        - Condit FAQ document
        - Impacts on Habitats in White Salmon Subbasin document
        - White Salmon Restored: A Timelapse Project document
        - Condit Dam Powerpoint Presentation
        - Maps (2) including PacifiCorp Condit Dam map and PNW dams & salmon spawning map
        - Photos of Condit Dam 3-D Model

Condit Dam Background Information

The project was located approximately 3.3 miles upstream from the confluence of the White Salmon and Columbia rivers. The dam was a 125-foot high, 471-foot long concrete gravity diversion dam, with an intake structure that directed water into a 13.5-foot diameter by 5,100-foot long wood stave flow line. Approximately 30,000 cubic yards of material were removed in the decommissioning work.

SOURCE: PacifiCorp website,
http://www.pacificorp.com/about/newsroom/2012nrl/artwsrapsscdr.html

Condit Dam background and settlement agreement The Condit Dam and other components of the Condit Hydroelectric Project were built during 1912-1913 on the White Salmon River in south central Washington State, spanning Skamania and Klickitat counties. The project was designed to produce hydroelectricity to supply the Crown Willamette Paper Co. in Camas, Wash. and the growing municipal market from Washougal, Wash. to Portland, Ore. After nearly a century of serving customers of the former Northwestern Electric Company, Pacific Power & Light and now PacifiCorp, physical removal of the Condit Dam began in late August 2011, fulfilling a multi-party settlement agreement signed in 1999.

SOURCE: PacifiCorp website,
http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Hydro/Condit_Overview.pdf

Timeline of Events: Condit Dam (Excerpt from Laura Wallace Thesis):

In 2010, Washington waterways contained 763 dams, over 60 of which measured more than 100 feet (30.5 m) in height. Before being dismantled, the Condit Dam was one of these, measuring 125 feet (38.1 m) high and 471 feet (143.6 m) long (FERC 1996, 2-4; Becker 2006, 3; Army Corps of Engineers 2010). Condit Dam was built on the White Salmon River, a tributary of the Columbia River, in southern Washington in 1913 by the Northwestern Power Company (Figure 3.14, Figure 3.15, and Figure 3.16). It provided power to a local paper mill—Crown Columbia Paper Mill in Camas, Washington—and was "to anticipate the energy needs of a growing regional population," selling any surplus energy to other users in the Northwest (Becker 2006, 3; see also Bonham 1999). Originally, fish ladders were installed, but they were washed out by floods in 1914 and 1918. After the second failure, the Northwest Electric Company (the dam owner which later became PacifiCorp Electric) was obliged by the Washington State Fisheries Department to help construct a fish hatchery in order to mitigate the loss of fish passage. Efforts to provide fish passage around the dam were eventually abandoned after experiments with a fish elevator failed to be effective (Haring 2003; PacifiCorp 2011).

Nearly fifty years later, in 1963, then-owner of Condit Dam, Pacific Power and Light Company (now PacifiCorp) applied to the Federal Power Commission (now FERC) for a license of operation for the 14.7-megawatt (MW) Condit Dam, pursuant to section 15 of the Federal Power Act (FPA). On December 31, 1968, the Pacific Power and Light Company (PPL) was granted their license, effective retroactively on May 1, 1965, and set to expire nearly 30 years later on December 31, 1993.

In 1980, PPL was ordered by FERC, in accordance with their 1968 license, to conduct a study investigating various options for installing some form of fish passage at the dam. After doing so, the company chose the trap-and-haul method as their preferred fish passage alternative, at the same time calling into question the cost effectiveness of restoration and the quality and quantity of the upstream habitat. PPL expressed concern about how returning salmon to this part of the river would affect the resident trout population (a factor in the "scenic" designation of the reach upstream of Northwestern Lake to Gilmer Creek under Section 10 of the Wild and Scenic River Act) (FERC 1996; Bonham 1999). Desiring more to be done on behalf of the salmon, in their Columbia River Basin Fish and Wildlife Plan of 1982, the Northwest Power Planning Council called for FERC to require PPL to construct fish passage facilities by November 15, 1985. The Plan's instructions to install fish passage were never acted upon (Becker 2006).

In December 1991 PacifiCorp applied to FERC to renew the Condit Dam license without including the installation of fish passage among the list of proposed improvements to the hydroelectric project, though increased capacity and generation were requested (FERC 1996; Bonham 1999; Becker 2006). Around this time, seeing an opportunity to restore connectivity to the White Salmon River and encourage the growth of native salmon fisheries, the group of organizations supporting dam removal—known in legal documents as the Intervenors—petitioned FERC to require fish passage structures to be installed or for the Condit Dam to be removed entirely (Settlement Agreement 1999).

In both the DEIS and FEIS (1995 and 1996, respectively), FERC echoed this, stating and restating that, while PacifiCorp did not have to decommission and remove the dam, fish passage facilities were a requirement (FERC 1996; PacifiCorp

The Northwest Power Planning Council was formed in 1981 by the Pacific Northwest Power Planning and Conservation Act of 1980 to act as "an interstate policy-making and planning body for electrical power development and fish and wildlife resource protection in the Columbia Basin" (Bonham 1999, 6).

1999; Bonham 1999; Wellner 2007; FERC 2010; PacifiCorp 2011). PacifiCorp protested that FERC's preferred alternative, at an estimated $33 million in deconstruction costs, was "uneconomic" (Settlement Agreement 1999, 2). Certainly, project retirement with dam removal appeared even less appealing at an estimated cost of nearly $60 million (1996 dollars). The table below lists the estimated construction/demolition costs of each fish passage alternative according to FERC's 1996 analysis, including PacifiCorp's original proposal of continuing operations without fish passage (Table 3.2; FERC 1996).

Alternative & Construction/Demolition Cost (1996 $)
PacifiCorp's proposal (no fish passage) $9.391M
PacifiCorp's proposal with modifications $33.409M
Project retirement with dam removal $58.796M
Partial dam removal with upstream diversion $67.066M
No-action alternative $0M

Table 3.2. Estimated capital costs of relicensing alternatives (FERC 1996, p. 2-24)

Seeking a more affordable option, PacifiCorp eventually agreed to begin negotiations to discuss the feasibility of dam removal as a solution. The process lasted from 1997 to 1999. In January 1997, PacifiCorp filed a request for the temporary suspension of relicensing proceedings with FERC in order to take the time to review dam removal alternatives with Intervenors. By March of the same year, PacifiCorp joined with the Yakama Nation and the Columbia River Intertribal Fisheries Commission (CRITFC) in hiring an independent engineering firm as a consultant to perform a separate cost estimate and to explore what it would take to engineer such a project. Two years, an additional engineering report (prepared by R.W. Beck with assistance from a firm hired by American Rivers), and two remove Condit Dam entitled “Condit Hydroelectric Project Settlement Agreement” (1999 Settlement Agreement).

FERC issued a declaratory order in December 2001 and a clarification order in 2002 which stated that FERC considered the 1999 Settlement Agreement to be an application to surrender PacifiCorp’s Condit Dam license with “a future effectiveness date” (FERC 2010, 1; see also Becker 2006; Wellner 2007).

Also in 2002, PacifiCorp asked FERC to keep the relicense application in reserve in case the company couldn’t meet the legal and administrative requirements of dam removal (e.g., permitting and construction contracts) or if a court or administrative order were to prevent PacifiCorp from implementing the requirements of the settlement, removal plan, or surrender order by December 31, 2005. FERC denied this request, saying that even in the event that costs were unexpectedly high, they would not replace their license surrender proposal with their relicense application (FERC 2010). As it turned out, PacifiCorp was able to continue dam operations until October 1, 2011, through annual licenses which, FERC reasoned, gave “PacifiCorp considerable time to fund removal costs...and otherwise resolve many of the permitting and cost contingencies on which the surrender proposal might depend” (FERC 2010, 15, 67).

The 1999 Settlement Agreement originally listed October 2006 as the official date of deconstruction, but this would be delayed annually until 2010, when FERC accepted their Agreement (FERC 2010). The permitting process, particularly requirements under Section 401(a)(1) of the Clean Water Act for obtaining state water quality certification for the project, is what caused the long delay. PacifiCorp initially applied for water quality certification on June 15, 2001, and simultaneously withdrew and resubmitted their application each year when Ecology rejected their application as insufficient. Their application for Section 401 water quality certification was finally accepted on October 12, 2010 (Susewind 2010, 1; FERC 2010, 14). In the interim, FERC published its Final Supplemental Final Environmental Impact Statement (FSFEIS) in June of 2002. The Washington State Department of Ecology also published its Final State Environmental Protection Act (SEPA) Supplemental Environmental Impact Statement (FSEIS) in 2007 addressing a few additional considerations required by the SEPA (e.g., sedimentation and turbidity in the White Salmon and Columbia Rivers, impacts on fish, and impacts on surrounding land use) (Wellner 2007). FERC accepted PacifiCorp’s application to surrender its operating license in 2010, and demolition on Condit Dam began in October 2011. Deconstruction was completed one year later on September 15, 2012 (Florip 2012) (Figure 3.17. Northwestern Lake draining following Condit Dam removal, October 30, 2011 (photo courtesy of Wayne Lease).).

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PacifiCorp

A MIDAMERICAN ENERGY HOLDINGS COMPANY

NEWS RELEASE

Contact: Tom Gauntt
PacifiCorp, 503-813-7291

June 14, 2011
FOR IMMEDIATE RELEASE

PacifiCorp to remove Condit Dam

With regulatory approvals received after 12 years of effort, decommissioning now working toward October 2011 event

PORTLAND, Ore. – After nearly a century of serving PacifiCorp customers, Condit Dam on the White Salmon River in south central Washington will start to be removed this fall, fulfilling a multi-party settlement agreement signed in 1999.

Decommissioning the hydroelectric project is now moving forward after receipt of an essential sediment management permit from the U.S. Army Corps of Engineers, the final major regulatory step. On Dec. 16, 2010, PacifiCorp received a Surrender Order from the Federal Energy Regulatory Commission providing for dam decommissioning. The commission modified the Surrender Order on April 21, which, with the Corps permit, provides the regulatory certainty PacifiCorp needed to proceed to remove the 125-foot high dam. On June 8, 2011, the commission completed review and approval of requisite project removal design and resource management plans.

"We have notified our contractors to move forward," said Todd Olson, program manager for PacifiCorp. "The project has been in the planning stages for more than a decade. These recent regulatory approvals enable us to now move forward with the commitment we made to the settlement parties to remove the dam as soon as feasible."

Dam removal was determined to be less costly to PacifiCorp customers than the fish passage that would be required for operation as part of the federal dam relicensing process. The cost of decommissioning Condit is currently estimated at about $32 million, including funds already spent during the planning process.

"While we move forward on this complex task with determination, it will be sad to see Condit go," Olson said. "It has been supplying low-cost, renewable and emission-free power for our customers since 1913, long before those phrases were even in use."

"The decommissioning of Condit Dam represents a momentous and long-awaited day," said Virgil Lewis, of the Yakama Nation Tribal Council, one of the parties to the 1999 settlement. "This is an essential step in restoring the ecosystem's resources and rebuilding the natural balance that supported the Yakama people and a significant tribal fishery for millennia. We are excited to welcome home the salmon, steelhead and lamprey that have been absent from the White Salmon River over the last century."

American Rivers, a leading national conservation organization advocating for clean water and healthy rivers, pointed to the cooperation behind the decommissioning.

"After years of hard work, we will soon celebrate one of the nation's biggest and most exciting river restoration projects," said Brett Swift, Northwest regional director of American Rivers. "Condit Dam served a useful purpose, but now the time has come to remove it and restore a healthy, free-flowing White Salmon River. We applaud PacifiCorp for its leadership. It isn't every day that we get to witness a river coming back to life."

Plans call for a summer full of meticulous preparation before a carefully planned breach in October releases Northwestern Lake through a 13-foot hole blasted out near the base of the dam. Steps to be completed before the breach include the initial excavation of the 90-foot long drain tunnel, dredging the upstream side of the dam at the drain tunnel, work to strengthen a bridge that crosses Northwestern Lake, and also relocating a water pipeline that crosses the reservoir.

"Safety for everyone involved is a key priority," said Tom Hickey, PacifiCorp's project manager. "People working on the project will be taking special care, and PacifiCorp will also implement a public safety plan. It will be important for people in the area to abide by closure signs and stay out of the project area."

After the initial breach and draining of the reservoir in October, demolition of the remaining portion of the dam is scheduled to begin in spring 2012 and be completed by August 31, 2012. Restoration work throughout the former reservoir area is planned to be completed by the end of 2012.

Throughout this time, PacifiCorp will continue to work with county officials and local residents on access restrictions and other safety measures as the project progresses. Timely public notices will be posted concerning any closures.

For general information on the Condit project, visit: http://www.pacificorp.com/es/hydro/hl/condit.html

The construction contractor for the decommissioning project is JR Merit Industrial Contractors, Inc. of Vancouver, Wash. with engineering and construction monitoring services being provided by Kleinfelder, an international engineering consulting firm based in San Diego, Calif. with a local office in Portland, Oregon.

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About PacifiCorp

PacifiCorp is one of the lowest-cost electricity producers in the United States, serving more than 1.7 million customers in the West. PacifiCorp operates as Pacific Power in Oregon, Washington and California, and as Rocky Mountain Power in Utah, Wyoming and Idaho. With a generating capability of more than 10,620 megawatts from coal, hydro, gas-fired combustion turbines and renewable wind and geothermal power, the company works to meet growing energy demand while protecting and enhancing the environment.

Facts about Condit

- The project is located approximately 3.3 miles upstream from the confluence of the White Salmon and Columbia Rivers. Project facilities consist of a **125-foot high, 471-**

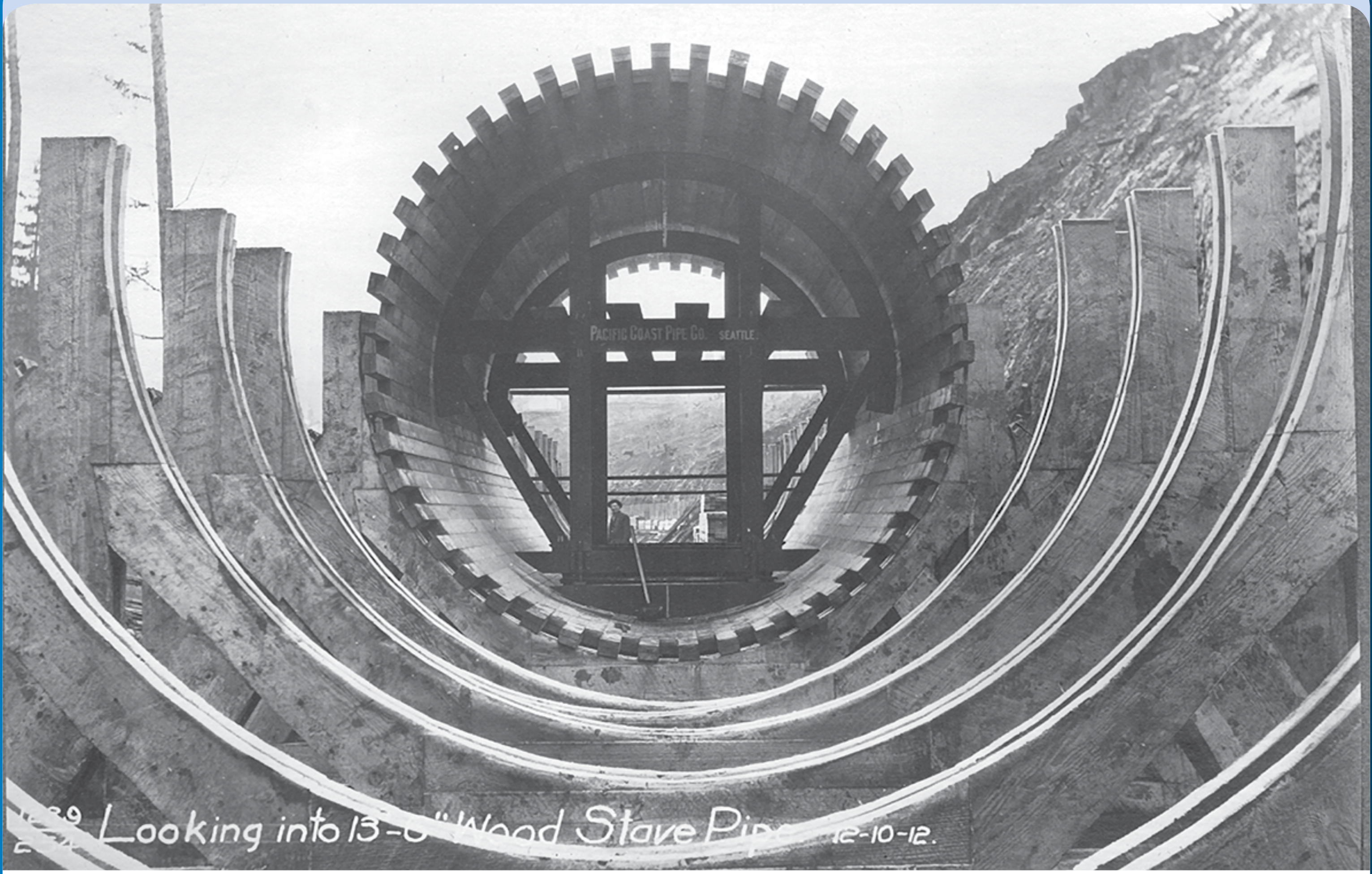
foot long concrete gravity diversion dam, and an intake structure that directs water into a 13.5-foot diameter by 5,100-foot long wood stave flow line.

- The powerhouse contains two double horizontal Francis turbines with an installed capacity of **14.7 megawatts** (enough to power about **7,000 average homes** for a year). The project creates a reservoir, Northwestern Lake, which extends 1.8 miles upstream of the dam and covers approximately 92 acres.
- In 1999, the Condit Settlement Agreement was signed by PacifiCorp and project stakeholders. The settlement agreement was amended in 2005 to extend the dates for project removal.
- Settlement parties include: American Rivers, American Whitewater Association, Columbia Gorge Audubon Society, Columbia Gorge Coalition, Columbia River United, Federation of Fly Fishers, Friends of the Columbia Gorge, Friends of the Earth, Friends of the White Salmon, The Mountaineers, Rivers Council of Washington, The Sierra Club, Trout Unlimited, Washington Trout, Washington Wilderness Coalition, the Columbia River Inter-Tribal Fish Commission , the Yakama Nation, the U.S. Forest Service, the U.S. Department of the Interior, the National Marine Fisheries Service, the Washington Department of Ecology, the Washington Department of Fish and Wildlife and PacifiCorp.

Maps and photos available upon request.

Condit Dam Decommissioning
History and Key Dates

PacifiCorp Energy
Pacific Power
Rocky Mountain Power



Condit's unique history

The Condit Dam dates to the earliest years of Northwestern Electric Company, a firm that merged into Pacific Power & Light in 1947, and is known today as PacifiCorp. PacifiCorp operates in six western states and serves approximately 1.7 million customers. The dam is an important part of PacifiCorp's history and its electricity production has powered thousands of homes for several generations. The Condit Dam was supplying renewable, emission-free and cost-effective power before any of these phrases became popular. It was originally built to support the Crown Willamette Paper Co. in Camas, Wash. and the growing municipal market from Washougal, Wash. to Portland, Ore.

The dam came on line at a time when Woodrow Wilson was president, Washington's population had just crested one million and a ballpark called Fenway became the newest jewel in professional baseball. The dam was relatively large for its time and in terms of generating capacity, the project was ranked 12th in the West. If anything distinguished Condit from its predecessors, it was the massive water pipeline, or flowline, that delivered water to the turbines. A 1913 publication of Engineering News called the flowline at Condit Dam "probably the largest wood-stave pipe in the world."

The transmission line from the Condit powerhouse to Camas, Wash. was the first to be built through the Columbia River Gorge and represented an early use of aluminum line reinforced with steel. Its construction was complicated by the fact that there was no road along the north bank of the river. Materials and supplies were transported by steamer to various landings where they were hauled to work sites by horses or, in particularly rugged places, carried by hand.

Multiple attempts at fish passage unsuccessful at Condit

Fish passage played an important role in the history of the dam as evidenced by the multiple attempts to assist fish in navigating the structure. Fish ladders were part of Condit's original design,

continued

but these facilities twice washed out due to floods during the early life of the dam. After the second washout, the Washington State Fisheries Department required Northwestern Electric to contribute to construction of a state fish hatchery rather than rebuild the fish ladders. A final attempt was made in 1925, when experiments were done on a newly designed fish elevator, without success. Just as in the 1920s, PacifiCorp understands the importance of appropriate fish passage, but the cost to customers must also be considered. In the case of Condit, removing the dam instead of installing expensive fish passage over or around the project is the best alternative for customers.

Condit Powerhouse during the early years of operation

Key Dates – Condit's Present

KEY DECOMMISSIONING ACTIVITIES	DATE
All regulatory and removal designs approved by FERC	June 2011
Work initiated to reinforce Northwestern Lake Bridge and reroute City of White Salmon's water supply line	June 2011
Floating barriers placed in White Salmon River to notify boaters of decommissioning activity	July 2011
Docks removed/secured from Northwestern Lake	August 2011
Northwestern Lake drawdown begins – Lake drawn down 10 feet	August 2011
Powerhouse Road and boat ramp near Condit Dam closed	August 2011
Northwestern Lake closed to all boating, swimming and wading	August 2011
Tunneling project begins at Condit Dam	Late August 2011
BREACH DAM AND DRAIN NORTHWESTERN LAKE	LATE OCTOBER 2011
Project area (Northwestern Lake shoreline down to water's edge and White Salmon River shoreline downstream to powerhouse) closed; upstream river area to Northwestern Lake park boater take-out remains open.	Late October 2011
PacifiCorp initiates sediment management actions in former Northwestern Lake	November 2011
Condit Dam demolition and concrete disposal along flowline begins	May 2012
Condit Dam and other facilities removed from White Salmon River	August 2012
Boat launch modifications completed at Northwestern Lake park	August 2012
White Salmon River within former project area opened to boaters	September 2012
Project completion	October 2012

Key Dates – Condit's Past

HISTORY OF THE CONDIT DAM	DATE
Ben C. Condit Dam and power generation facilities completed	1913
Customers in Camas, Wash. and Portland, Ore. receive power from the Condit Dam via a new transmission line through the Columbia River Gorge	1913
Original wooden fish ladder washed out during flood (Ladder rebuilt)	1914
Second fish ladder washed out by flood (Ladder not rebuilt)	1918
Fish hatchery built to mitigate for loss of fish ladder	1919
Experimental fish elevator attempted and failed	1925
Condit project issued its first operating license following enactment of the Federal Power Act; license effective May 1, 1965	1968
Condit Dam upgraded with various structural reinforcements	1972
PacifiCorp's first federal operating license expires	1993
The Federal Energy Regulatory Commission (FERC) issues Environmental Impact Statement requiring PacifiCorp to install fish ladders and screens for fish passage	1996
PacifiCorp requests that FERC halt the relicensing proceedings in order to reach a settlement agreement to decommission the Condit Dam	1997
PacifiCorp agrees to Settlement Agreement to decommission the Condit Dam	1999

Scan code here with your smart phone to link to PacifiCorp's Condit Dam page or go to pacificorp.com/condit

Condit Dam Decommissioning

Frequently Asked Questions

PacifiCorp Energy
Pacific Power
Rocky Mountain Power

What is happening at the Condit Dam and where is it located?

The Condit Dam is located on the White Salmon River in south central Washington State, in Skamania and Klickitat Counties. The dam is approximately 3.3 miles upstream from the confluence of the White Salmon and Columbia rivers, in the Columbia Gorge. The dam is scheduled for removal beginning in late August 2011.

What is the history of the Condit Dam?

The Condit Dam is an important part of PacifiCorp's history and its electricity production has powered thousands of homes for many generations. Condit was supplying renewable, emission-free and cost-effective power before any of these phrases became popular. The Condit Dam was originally constructed in 1912 – 1913 to support the Crown Willamette Paper Co. in Camas, Wash. and the growing municipal market from Washougal, Wash. to Portland, Ore.

What facilities make up the Condit Dam project and what will be removed?

The Condit Dam facilities consist of the 125-foot high, 471-foot long concrete gravity diversion dam, an intake structure that directs the water into a 13.5 foot diameter by 5,100-foot long wood-stave flowline (wooden barrel-like pipeline), and through a 40-foot diameter concrete surge tank. The flowline splits into two 9-foot diameter penstocks inside the surge tank that directs water to the turbines in the powerhouse. The dam creates the reservoir, Northwestern Lake, which extends 1.8-miles upstream of the dam and covers approximately 92 acres. All facilities, with the exception of the powerhouse, will be removed.

Why is PacifiCorp removing the Condit Dam now?

In November 1996, the Federal Energy Regulatory Commission issued a final Environmental Impact Statement that required PacifiCorp to install fish ladders and screens for a state-of-the-art fish passage system. FERC, the regulating agency charged with licensing hydroelectric dams, also required higher in-stream flows that would have reduced Condit's overall energy production. Combined, the new requirements would have rendered the longstanding project uneconomical for PacifiCorp's customers.

What is the Settlement Agreement?

PacifiCorp joined with 22 other parties to determine the future of the dam as part of a 1999 settlement negotiation regarding the federal relicensing of the project. After two years of negotiation, the participants reached an agreement to shut down power generation at a future date and remove the dam. In reaching this agreement, settlement parties balanced the short-term impacts of dam removal with the long-term gains provided by restoration of a natural river environment and a cost-effective plan for PacifiCorp's customers.

Who are the parties to the Settlement Agreement?

Settlement parties include: American Rivers, American Whitewater Association, Columbia Gorge Audubon Society, Columbia Gorge Coalition, Columbia River United, Federation of Fly Fishers, Friends of the Columbia River Gorge, Friends of the Earth, Friends of the White Salmon, The Mountaineers, Rivers Council of Washington, The Sierra Club, Trout Unlimited, Washington Trout, Washington Wilderness Coalition, the Columbia River Inter-Tribal Fish Commission, the Yakama Nation, the U.S. Forest Service, the U.S. Department of the Interior, the National Marine Fisheries Service, the Washington Department of Ecology, the Washington Department of Fish and Wildlife and PacifiCorp.

What regulatory approvals were needed to decommission the dam?

PacifiCorp has regulatory approvals to remove the project in accordance with the amended Condit Dam Settlement Agreement and the Project Removal Design Report. Regulatory approvals include Clean Water Act permits issued under Section 401 by the Washington Department of Ecology, and issued under Section 404 by the U.S. Army Corps of Engineers; Biological Opinions from the U.S. Fish and Wildlife Service and National Marine Fisheries Service, and a Surrender Order from FERC.

How much power is generated at the Condit Dam and how will PacifiCorp replace this power?

The powerhouse contains two turbines with an installed capacity of 13.7 megawatts – enough to power approximately 7,000 average homes for a year. PacifiCorp is looking into options regarding how to replace this relatively small amount of power, consistent with its long-term resource planning. Potential options include upgrades at existing projects and new energy resources.

What work was done this summer near the Condit Dam?

Earlier this summer, PacifiCorp initiated efforts to stabilize the Northwestern Lake Bridge and began the funding of the relocation of the City of White Salmon's water supply line, which previously was located under Northwestern Lake.

The work at the Northwestern Lake Bridge consists of drilling new piers into the river bottom to further stabilize the bridge. Additional trusses are being added to the bridge in order to provide support for the river crossing of the City of White Salmon's water supply line.

In late August 2011, contractors began pre-demolition work and tunnel boring for the actual breach to take place in late October.

Is the White Salmon River currently closed to boaters?

Parts of the river are closed, but boaters will continue to have access to the river upstream of the reservoir during decommissioning activities. To protect the public, the White Salmon River was closed beginning in July 2011, from the Northwestern Lake Bridge downstream to the White Salmon Ponds fish facility. PacifiCorp communicated these closures with local commercial recreation companies and the public through direct notification and through navigation signs, buoys and signage at access points and on the river. The river closure will continue until the completion of the dam removal process and channel restoration work in August 2012.

Is Northwestern Lake currently closed?

Yes. In early August 2011, Northwestern Lake and its associated boat ramps were posted and closed to all on-water activities as work at the dam site intensified in preparation for the October breaching.

What benefits to the environment will be seen when the Condit Dam is removed?

The dam is the only man-made impoundment between Mt. Adams and the Columbia River and its removal will open approximately 33 miles of new spawning and rearing grounds for steelhead and 15 miles of new habitat for salmon in the White Salmon River basin. Since as much as 2.4 million cubic yards of reservoir sediment is estimated to rest behind the dam, removal will occur during periods when fisheries are expected to be minimally affected.

Do Northwest tribes approve of the dam's removal?

The cultural benefits associated with the restoration of the White Salmon River fish runs and traditional fishery are important to Northwest tribes. The Yakama Nation was a party to the settlement agreement and in statements released in June 2011 said that restoration of the river habitat is an essential step in welcoming home the salmon, steelhead and lamprey that have been absent from the White Salmon River over the last century.

What will happen on the day the dam is breached?

Initial action to remove the dam began in late August 2011. Blasting work is creating a 13-foot high by 18-foot wide drain tunnel near the base of the dam. When the final section of the dam is removed by blasting in the fall, the drain tunnel will discharge water at a rate of approximately 10,000 cubic feet-per-second. For perspective, the flow rate will be approximately one-quarter of the estimated peak discharge during the February 1996 flood event on the White Salmon River. It is anticipated that Northwestern Lake will drain in approximately six hours.

What river closures will be in effect on the day the dam is breached?

Additional river closures will be in effect during the actual breaching event in late October 2011, to protect the public. These closures will be communicated to local communities, the public and the media. Updates on closures can be found online at **pacificorp.com/condit**.

What happens after the dam is breached in late October?

Once Northwestern Lake is drained, activity will focus on addressing accumulated sediment and slope stability within the area of the former lake. In spring 2012, the dam will be removed along with the wood-stave flowline, surge tank and penstocks. Concrete from the dam will be broken into rubble and buried onsite; other materials will be salvaged or transported to the Klickitat County waste facility. The powerhouse will be left intact.

How long will it take to complete the dam removal process and reclamation of the area?

PacifiCorp expects the dam removal process to take approximately one year. Additionally, in fall 2012, work will begin on re-vegetation of the former lake bottom with native trees and grasses and restoration of the wetlands. Long-term monitoring and work to control invasive plants is also planned to ensure a successful reclamation of the riverside areas. The temporary upstream dam (cofferdam) that was used during the initial construction of the dam will be removed from the White Salmon River as soon as practicable after the breaching.

How long after completion of the removal project do you anticipate the sediment concentrations to drop and the White Salmon River to form a stable river channel?

Sediment concentrations in the river will be high at the time of breaching in late October 2011. Erosion will continue thereafter as the river forms a channel in the area where Northwestern Lake was previously, but sediment from deposits will gradually decline and cease after a stable river channel forms. Surface runoff from rain and melting snow is expected to erode upland sediment intermittently for three to five years until vegetation is re-established. After this period, the only sediment contributions to the river are expected to be from higher and rarer floods that erode embankments and surfaces not reached by previous floods.

What will the White Salmon River offer in terms of recreation in the years to come?

The 92-acre Northwestern Lake will be lost as a recreation area as the lake drains after the dam is breached in late October. In time, however, new recreation opportunities will present themselves. New stretches of white water rapids are expected on the river and could become a playground for kayakers and rafters. The former reservoir area, once it is deemed safe for access, will be available for angling as determined by the state of Washington.

What will PacifiCorp do with the land and the powerhouse after decommissioning?

After the removal is complete, ownership of the land along the river and the powerhouse structure will be retained by PacifiCorp. The company has no firm plans at this time concerning the future of the lands and powerhouse; however PacifiCorp will continue to honor the many land leases for cabins in the area.

Did PacifiCorp hire a local contractor to perform the construction work?

Yes. PacifiCorp hired JR Merit Industrial Contractors, a local contractor from Vancouver, Wash.

How will PacifiCorp protect the public during the decommissioning process?

Protecting the public from hazards is vital to a successful decommissioning of the dam facilities. Access restrictions have been communicated to the local community and will be in place throughout the dam decommissioning project. Fencing, construction signs, barricades and no trespassing signs have been placed to notify and protect the public. PacifiCorp asks for the public's patience and appreciates the cooperation of all parties during this process.

How will PacifiCorp communicate with the local community and the public during the decommissioning process?

Local residents, communities and other interested parties will receive regular updates about the decommissioning process via direct mailings, a project newsletter and website postings. As the process progresses, we encourage you to bring questions or issues to PacifiCorp's attention as quickly as possible so they can be resolved.

Where can I find updates or contact PacifiCorp staff about this project?

You can email the project team at **Condit.Decommissioning@PacifiCorp.com** or call us at **1-503-331-4361**. Updates will also be available on the Condit page of PacifiCorp's website at **pacificorp.com/condit**.

Scan code here with your smart phone to link to PacifiCorp's Condit Dam page or go to pacificorp.com/condit

Impacts on Habitat in White Salmon Subbasin

Excerpts from White Salmon Subbasin Plan, pages xxvii-xxx

Source: Northwest Power &Conservation Council, https://www.nwcouncil.org/media/116771/EntirePlan_screen.pdf

Impoundments and Diversions

Anadromous salmonid distribution in the White Salmon River watershed has been limited to downstream of Condit Dam (RM 3.3) since 1913. Condit Dam is currently undergoing relicensing through the Federal Energy Regulatory Commission (FERC). A certain outcome of the relisencing process is than anadromous fish will have access to habitat above the dam for the first time since 1913, and most likely this will be achieved by removal of the dam.

No information available on Goose Springs Dam.

There are numerous irrigation surface water diversions and pump intakes in the watershed. Few of the surface water diversions are screened to prevent entrainment of juvenile salmonids into the irrigation network. Although several of the culverts in the watershed have been qualitatively evaluated for fish passage status, there has been no comprehensive assessment of culverts and associated fish passage status in the watershed (Haring 2003).

The majority of irrigation in the watershed is flood irrigation (Stampfli 1994), one of few areas in the state that has not converted to more efficient and less environmentally impacting irrigation practices (Haring 2003).

3.2.6 Terrestrial/Wildlife Resources

Riparian Habitat
The majority of terrestrial vertebrate species use riparian habitat for essential life activities and the density of wildlife in riparian areas is comparatively high. Forested riparian habitat has an abundance of snags and downed logs that are critical to many cavity birds, mammals, reptiles, and amphibians. This habitat is often characterized relatively dense understory and overstory vegetation. Cottonwood, alder, and willow are commonly dominant tree species in riparian areas. While riparian habitats are often forested, they may contain important subcomponents such as marshes and ponds that provide critical habitat for a number of species including Virginia rails, sora rails, and marsh wren. Riparian habitats also function as travel corridors between and connectivity to essential habitats for breeding, feeding, and seasonal ranges (see Wildlife Assessment).

Inundation of the lower reaches of the assessment unit by the Bonneville Dam pool has resulted in the loss of riparian habitat and connectivity between the White Salmon River to the Columbia River (Rawding 2000). For most wildlife species, there is a lack of essential historical data to adequately evaluate the impacts of Bonneville pool inundation.

3.2.7 Aquatic/Fish

Impacts on Habitat in White Salmon Subbasin

Excerpts from White Salmon Subbasin Plan, pages xxvii-xxx

Source: Northwest Power &Conservation Council, https://www.nwcouncil.org/media/116771/EntirePlan_screen.pdf

Habitat conditions of the rivers and creeks in the assessment unit range from pristine to heavily impacted. The range of conditions reflects the variety of land use including wilderness, hydropower development, commercial forestry, agriculture, commercial and residential development, and urbanization. Principal impacts have been caused by Condit Dam at RM 3.3, riparian forest removal, splash damming and removal of LWD from the mainstem and tributaries, draining and channelization of tributaries and adjacent floodplain, fish passage barriers, and lack of screening to prevent entrainment of juvenile salmonids into surface water diversions and pumps (Haring 2003).

3.2.8 Fish Resources

Fish assemblages in the White Salmon River are divided into the area above and below the Condit Dam. Species found downstream from the dam include spring and fall chinook, coho salmon, winter and summer steelhead, large-scale and bridgelip suckers, pacific and brook lamprey, threespine stickleback, sculpins, white sturgeon, redside shiners, peamouth, and northern pikeminnow rainbow trout, and bull trout. Historically, sea-run cutthroat trout, pink salmon, and chum salmon likely used this area, but are believed to be extirpated. Species found upstream of the dam include cutthroat trout, rainbow trout, sculpin, and brook trout (nonendemic) (Rawding 2000).

Category Archives: *History*

Condit Dam History – Part 8

04 Sunday Mar 2012

Posted by Steve Stampfli in History

≈ 5 Comments

About 15 years ago, the pioneering White Salmon River whitewater outfitter Phil Zoller hypothesized that the White Salmon may have once harbored a population of what he called "June hogs". June hog was the term used by early European inhabitants of the Columbia basin for an almost mythological run of summer or spring Chinook salmon that once migrated far up the Columbia past Kettle Falls and on to British Columbia. These fish grew to almost 100 pounds and over 4 feet in length. Phil based his belief on the large river cobbles that characterize the White Salmon's bed, and reasoned that only a large 50+ pound fish would be capable of churning the heavy rock into a spawning bed. *The 85 pound "June hog" pictured above was caught at Astoria in 1925 (photo courtesy NWCouncil.org). Compare this to fish possibly caught in White Salmon River below.*

Fifteen years ago was also the time that tribal, state and federal fish managers began discussing what fish might be suitable for recolonizing the White Salmon after dam removal. Although I was only peripherally involved these discussions through our local White Salmon River technical committee, we all continued to share Phil's wonder as what fish may have been in the river before the dam, and whether June hogs may have been part of the mix.

Somewhat unexpectedly, in 2004 a gentleman in The Dalles, Oregon named Bill Kreps shared a collection of his family photographs showing construction of the dam. It turned out that one of Bill's relatives was actually the original superintendent at the dam, and had photographed aspects of his job, and also his fishing expeditions. After scanning Bill's collection, I examined them with fish biologists who were working on the issue, including Larry Marchant (manager of the USFWS Spring Creek Hatchery) and Brian Bair (fish biologist with USFS). *A few images from the Krep's collection are included below. The first shows a huge "June hog" next to a young boy, probably near the superintendent's house. The second shows men who were likely connected to Condit, shown with steelhead males.*

Today, White Salmon fish managers are pretty certain that the river above Condit Dam once held populations of steelhead, fall Chinook, spring Chinook, coho and Pacific lamprey. Although the Kreps photos show tantalizing evidence of what fish may have found a home in the White Salmon, we can't be 100% certain that the fish pictured were actually caught in the river. Perhaps the answer will never be known, but if anyone reading this article has any additional information (identity of the people pictured, scenes, other photos related to fishing on the river, etc.), posting that information to this site would be appreciated (or email me at stampfli@gorge.net).

Condit Dam History – Part 7

28 *Tuesday* *Feb 2012*

Posted by Steve Stampfli in Dam Removal Updates!, History, Timelapse, Video

≈ **1 Comment**

My interest in photographically documenting the removal of Condit Dam began about 8 years ago, during a year-long project sponsored by US Fish & Wildlife Service and PacifiCorp. The goal for the year was simply the expansion of public knowledge surrounding the decommissioning. During that time, Gail Miller and Arianne Poindexter of PacifiCorp provided me with an amazing collection of photos from the company's archives, which documented most phases of the original construction. Here were images of the Greek immigrants who built the dam, their housing in great tent camps, the original equipment, and many other aspects of construction. The photos were likely a tool used by Northwestern Electric Company to monitor implementation of the project by their contractor Stone & Webster of Boston, Massachusetts. It's also likely that they were photographing the work for posterity sake, knowing that their work was shaping the future of the Northwest.

In my work, it soon became obvious that the builders were documenting dam construction using an early "time-lapse" photo technique. For all its modern complexities, time-lapse is simply the process of taking a sequence of pictures over time from the same vantage point.

Using topographic maps, I was able to roughly determine where their main photo point must have been. It seemed that their main station had been on the very steep basalt slope above and west of the dam. Armed with the original photos, I set-off hiking one morning, starting at the original rock quarry and rock crusher site, and proceeded down the route of the old rock chute to the dam. After scrambling down and across 100%+ gradient slopes, I found a bare, east facing rock knob, that seemed to provide the original vantage used by Northwestern Electric almost a century before.

The work being done today by Andy and me is centered on documenting the removal of Condit Dam, charting the rapid changes in the reservoir sediments, and capturing a record of vegetation recovery in the recently uncovered "Condit Canyon". This is largely being accomplished via photography from the historic west dam photo point (current “Station 1”).

The video below represents a first attempt at compiling a time-lapse sequence of pictures taken at Station 1 over the past 99 years. The first historical image gives a good overview of the canyon’s appearance in August 1912, and even a glimpse of the exact location of the upstream coffer dam. The series continues through the date the reservoir filled and water first spilled over the top on March 21, 1913. It concludes with recent images taken in late October 2011, when the dam was breached.

Removal of Condit Dam is scheduled for completion in fall 2012… some 100 years plus a few months after the very first work began…

Condit Dam Removal Update #4

13 *Sunday* *Nov 2011*

Posted by Steve Stampfli in Dam Removal Updates!, History

≈ **5 Comments**

There’s been reference to “coffer dams” (or cofferdams) on this site, but what does the term mean? A coffer dam is defined as a watertight enclosure from which water is pumped to expose the bottom

November 2011 View of #2 (upstream) coffer dam.

of a body of water to permit construction of piers, dams, etc.

One of the many fascinations of the Condit Dam breaching was re-emergence of the original coffer dam used to re-route the river during construction 99 years ago (see Condit Dam History Part 5). All of the wood submerged by the reservoir seems to have been well preserved, including tree stumps, coffer dams, flumes and crib walls.

This outcome has some real significance in terms of river restoration. On the negative side, Coffer Dam #2 is now preventing the exit of some sediment from the upstream river canyon. If left in place, the dam would also limit upstream passage of fish. To alleviate the blockage, the coffer dam, and adjacent crib wall that originally directed water into the bell mouth of Tunnel #1, will be removed this winter. The structures will soon transition into history.

On the positive side, however, the preservation of tree stumps below the reservoir shores has provided the river restorationist with an accurate record of the species, density and size of the trees that grew along the canyon 99 years ago. They also define the pre-project ground topography, which will be important in devising regrading plans. This data has special importance, since there is very little photographic, map or written description of the canyon before 1912.

The photo below provides a glimpse of the untouched canyon above the dam. As expected, the steep, dry, shallow-soil hillsides immediately above the river supported species such as Oregon white oak, dry adapted shrubs like mockorange and hazel, and scattered conifers. Where hill slopes were less steep and supported deeper soils, the primary trees were probably a mixture of ponderosa pine and Douglas fir.

(click on image(s) for larger view)

Condit Dam History – Part 6

26 *Monday*
SEP 2011

August 1912 View of #2 (upstream) coffer dam.

POSTED BY STEVE STAMPFLI IN HISTORY

≈ 1 COMMENT

The total workforce employed by Stone and Webster of Boston Massachusetts (Northwestern Electric Company's contractor) averaged 900 men during the 11 months required to build the Condit dam and powerhouse. Most of the men were recent Greek immigrants, having been contracted through an employment firm in Portland, OR.

After diverting the river's flow, the next major step in dam construction involved preparing the river channel for pouring of the dam foundation. This highly illustrative photo shows important components of this work, including survey of river channel, using high pressure water jets to wash sediment from the bedrock channel, and hoisting of resulting debris from the canyon for disposal. Meticulous cleaning of the dam's foundation was absolutely critical to preventing water leakage below and through the dam, which could cause subsequent erosion and dam failure.

Up to 12 feet of alluvium (i.e., river rock) had to be removed from the original river bed before reaching stable bedrock. By all accounts, an excellent job was accomplished by Stone and Webster. The integrity of the dam's concrete and foundation are still excellent today

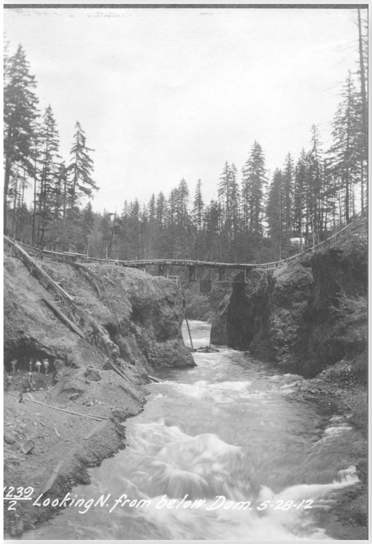
Above is a downstream view of the dam site. The photo below shows an upstream view… both taken 99 years ago. Remember that you can click on any of the images in this blog for a larger view.

Condit Dam History – Part 5

08 *Thursday* *SEP 2011*

POSTED BY STEVE STAMPFLI IN HISTORY

≈ 1 COMMENT



This May 28, 1912 scene shows the White Salmon River banks shortly before being merged by Condit Dam, and first phase of dam building at the Cameron Bridge site. If the current dam was transposed onto this photo, the reservoir drain tunnel would be in the center of this image, and its course would follow upstream along the bottom of the river channel. And too, the canyon that re-emerges from the concrete next summer will look similar to what is shown.

On the left, workers are in the process of boring one of three tunnel segments needed to divert the river's flow around the dam site during construction. This tunnel opening is still visible today. Without diversion and the utilization of mining technology to construct the tunnels, building Condit would have been impossible. In many respects, this work phase (constructing a diversion tunnel to provide a dry environment for building the dam), is analogous in reverse to happenings today (boring a tunnel to drain the reservoir and allowing deconstruction in a dry environment). Almost 100 years later, construction has intersected deconstruction (see the last post).

Two months later (August 3, 1912), this photo shows the Cameron Bridge dam site from upstream, and the canyon topography we expect to see after the dam is breached in late October 2011. Illustrated here is construction of the rock-filled crib dam used to divert the river into the three diversion tunnels and connecting wood flumes, which are visible on the west bank. Once diversion was completed and the river re-routed, actual dam construction began.

(Note that time-lapse Station 2, being monitored and reported on during this project, is located just upstream of this view, along what's currently the west shoreline of the reservoir at Cypher's cabin. This crib dam should be visible after the October flush, along with the Jaws river canyon).

Condit Dam History – Part 4

28 *Sunday* *Aug 2011*

Posted by Steve Stampfli in History

≈ Leave a Comment

As mentioned in the last post, Northwestern Electric Company's preferred location for a dam on the White Salmon was at The Narrows. Foundation (geotechnical) surveys under the direction of the company's chief engineer Frank Walsh began in September 1911, to determine whether solid bedrock existed for the dam's foundation.

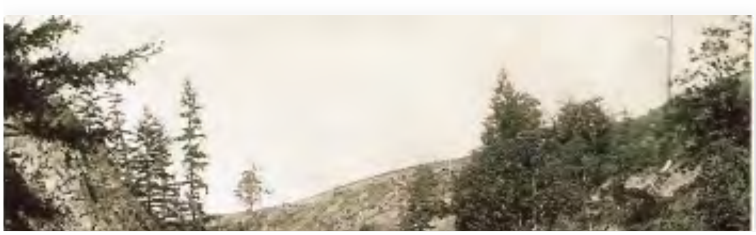
This photo shows the considerable "test hole" dug into the east bank, on property once owned by Charles Frick. Early excavation was done via "hydraulic sluicing", or the use of high pressure water jets to erode away the soil mantle. Later, the company switched to tunneling. The steam donkey pictured (essentially a large steam powered winch) was used to muck rock from the tunnel. Suitable bedrock was never intercepted, and by early April 1912 the company's evaluations shifted upstream to The Jaws and eventually Cameron Bridge.

Condit Dam History – Part 3

24 *Wednesday* *Aug 2011*

Posted by Steve Stampfli in History

≈ 2 Comments



The Northwestern Electric Company initiated work on what was to become Condit Dam in 1910. The first step was the hiring of B.C. Condit as project supervisor, and the dam design and construction firm Stone and

Webster of Boston. After detailed hydrologic investigations by Condit, Northwestern Electric's chief engineer Frank Walsh selected three dam site alternatives. The Narrows (pictured left, and located just upstream of the current surge tank) was the best site for building a tall dam with maximum hydraulic head. It remains today one of the most scenic reaches of the White Salmon. Alternate sites were "Cameron Bridge", where the dam was eventually located, and "Jaws", a deep canyon just upstream of the current dam near the confluence of Little Buck Creek. To gain rights to the Narrows, Northwestern Electric acquired 5 acres owned by German homesteader Charles Frick, who then returned to his homeland.

It will be fascinating to see the re-emergence of the Jaws canyon from Northwestern Lake in late October of this year. The name itself captures your attention, and also the fact that one of the only two traumatic fatalities during construction happened here. As reported in The Enterprise in spring 1912, a Greek laborer named Peter Drusete fell from a small bridge atop Jaws, smashed his head on the rocks below, and fell unconscious into the White Salmon. His body floated downstream, never to be recovered.

Condit Dam History – Part 2

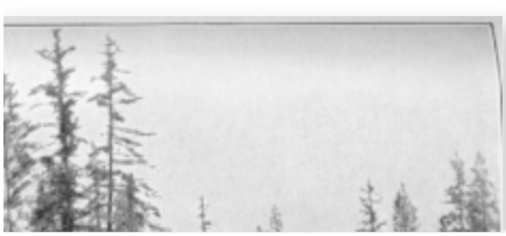
18 *Thursday* *Aug 2011*

Posted by Steve Stampfli in History

≈ Leave a Comment

Tags

Andy Maser, Condit Dam, dam removal, Husum, Klickitat, PacifiCorp, Steve Stampfli, Washington



Before hydropower, irrigation diversions and commercial rafting, the main commercial use of the White Salmon (and surrounding rivers of the Columbia River Gorge) was for transporting logs harvested along the river corridor. Several "splash dams" were constructed, as far north as the Trout Lake

B. LOG DRIVING ON WHITE SALMON RIVER NEAR HUSUM GAGING STATION.

valley. When collapsed, these dams would create surges of water large enough to carry logs downriver to mill off-load sites. Logging and farming were mainstays of the pioneer White Salmon valley economy, as they are to a large degree today.

The scene shifted in 1910 with publication of a US Geological Survey professional paper, which reported on the department's field assessment of the hydroelectric generating potential of the White Salmon, Little White Salmon, Klickitat and Lewis river basins. That study by John C. Stevens (Water Supply Paper 253) concluded that the basins with the highest production potentials were the Klickitat, followed by the White Salmon and Lewis. Concurrently, Herbert and Mortimer Fleishhacker of San Francisco were seeking ways to power their Crown Willamette Paper Mill in Camas, WA. Harnessing the White Salmon via another of their financial interests, the Northwestern Electric Company, became a possible mode.

Condit Dam History – Part 1

18 *Thursday* *Aug 2011*

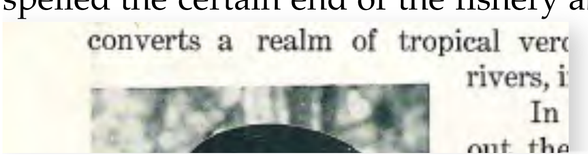
Posted by Steve Stampfli in History

≈ 4 Comments

Tags

1855, Andy Maser, Condit Dam, dam removal, Husum, jacob hunt, Klickitat, Nakipanic, PacifiCorp, Steve Stampfli, Washington, yakama treaty

When looking back over the human history that surrounds the White Salmon River and Condit Dam, it is easy to forget that the lower river had been used for thousands of years by Klickitat people (and their predecessors) for harvesting salmon, steelhead and perhaps Pacific lamprey. Some historians have estimated the native American population at Nakipanic (the village site at Husum Falls, now Husum) was several hundred. Given that, there were more people living in the Husum town center before 1855 (date of the Yakima Treaty) than there are today. This concentration of people lends strong support to the presence of a large and vibrant community before homesteading… perhaps more vibrant than today's. While construction of Condit Dam in 1913 spelled the certain end of the fishery above river mile 3.2 (i.e., Condit Dam), it's likely that the 1855


converts a realm of tropical verc
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treaty that resulted in translocation of people north to the Yakama reservation, spelled the real end of the fishery and an early way of life on the White Salmon. The photo

An original American — "Jake" Hunt, former Klickitat chief, 112 years old. He is said to be the oldest Indian on the Columbia.

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at left (taken from Williams "Guardians of the Columbia", 1912), shows Jacob Hunt, who was born and lived his life in Nakipanic.

Condit Dam History and 2011-12 Decommissioning

Presented by Steve Stampfli

Trout Lake, WA 8Oct11

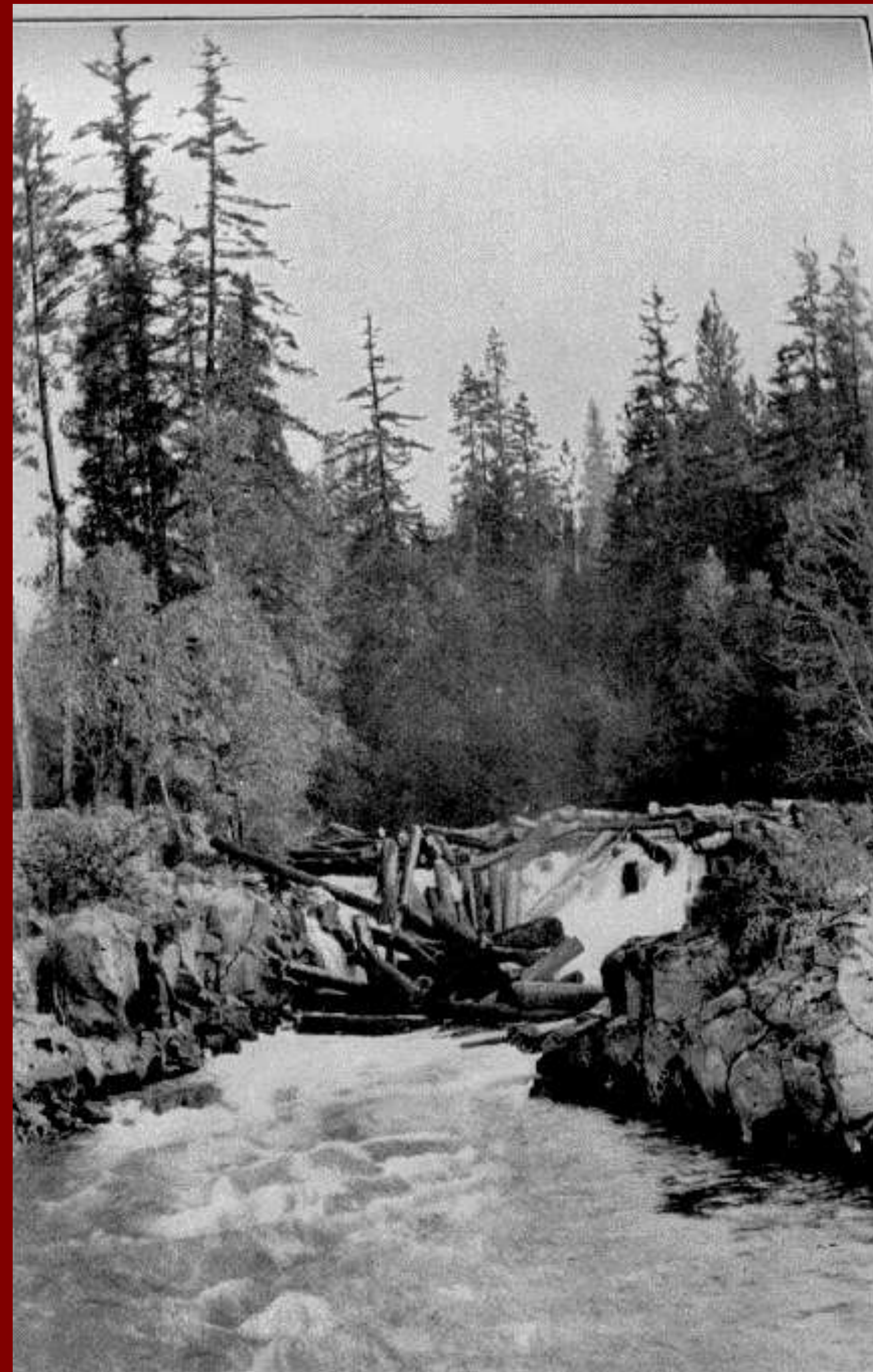
1909 USGS Stevens Survey

First scientific evaluation of hydro potential in southern Cascades

Surveyed Klickitat, White Salmon, Little White Salmon and Lewis river basins

Report (USGS Water Supply Paper 253) published in 1910

Concluded highest potential on Klickitat, followed by WS and Lewis rivers

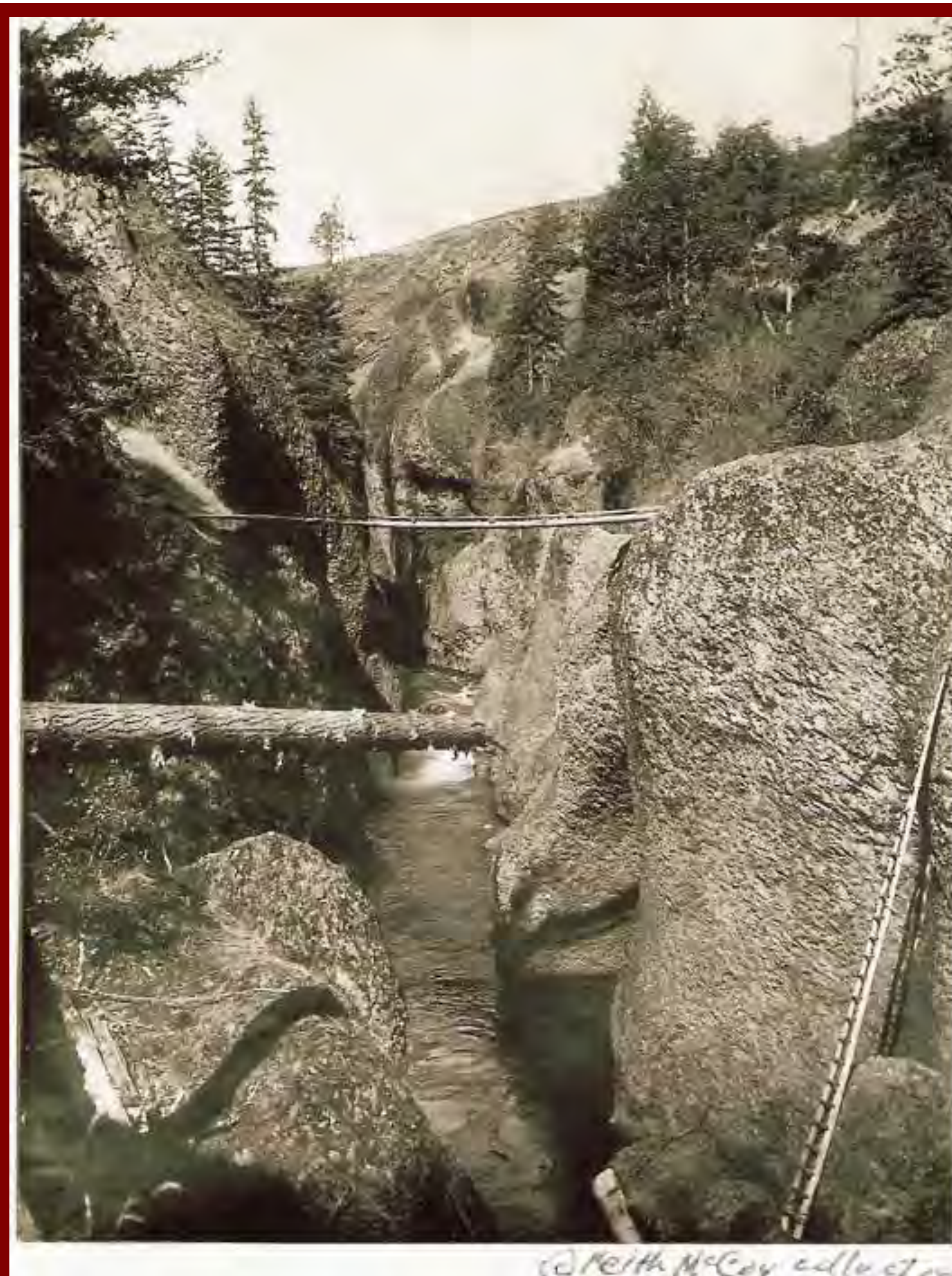


B. LOG DRIVING ON WHITE SALMON RIVER NEAR HUSUM GAGING STATION.

The Narrows

One of three sites examined in 1910 by Northwestern Electric Company (B.C. Condit, Engineer)

Best site in terms of hydraulic head



Exploring Dam Foundation Conditions at Narrows

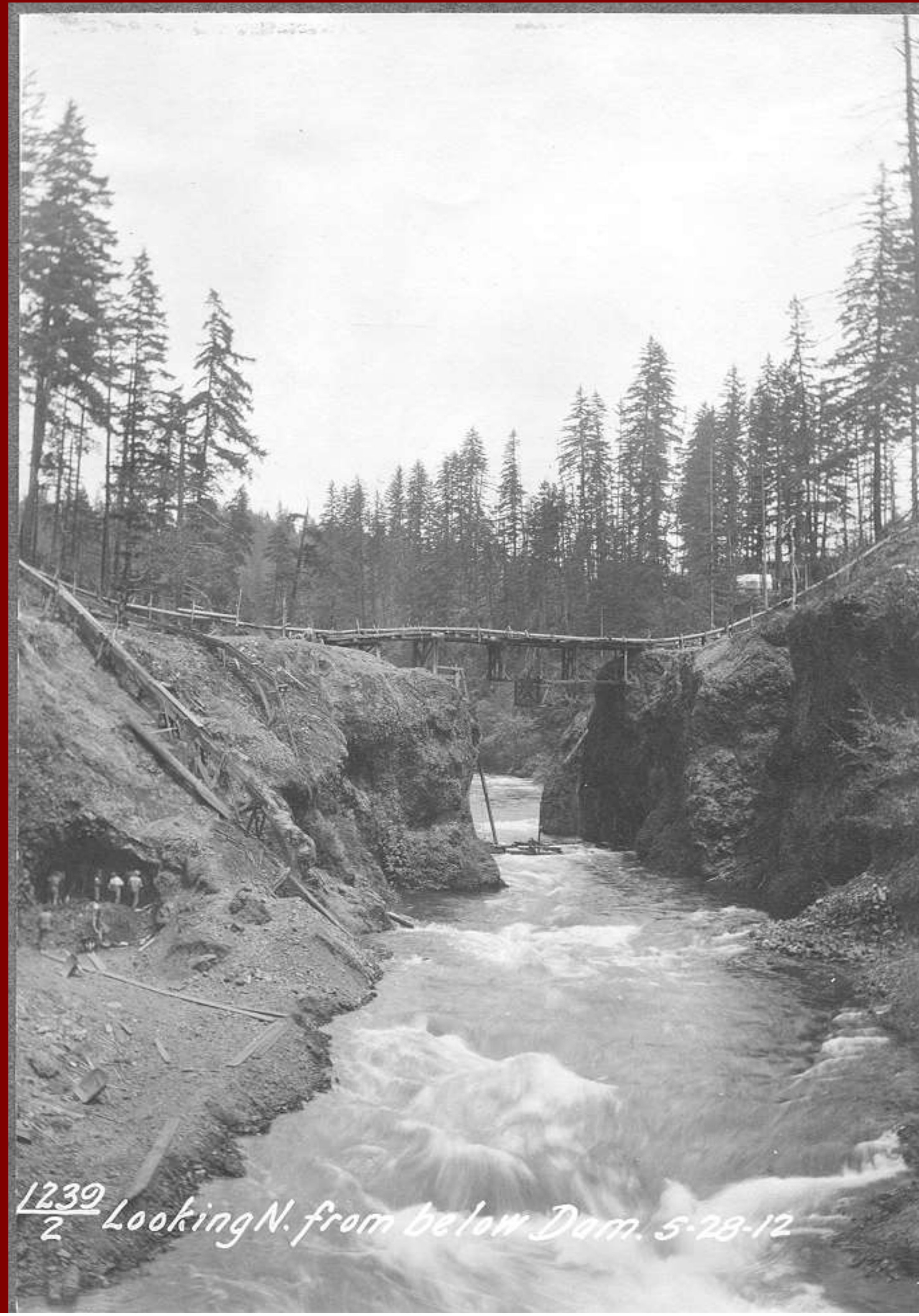
Cameron Bridge Site

Selected site

View is looking upstream toward narrow gap that is center of current dam

Located at RM 3.25

Date: May 1912



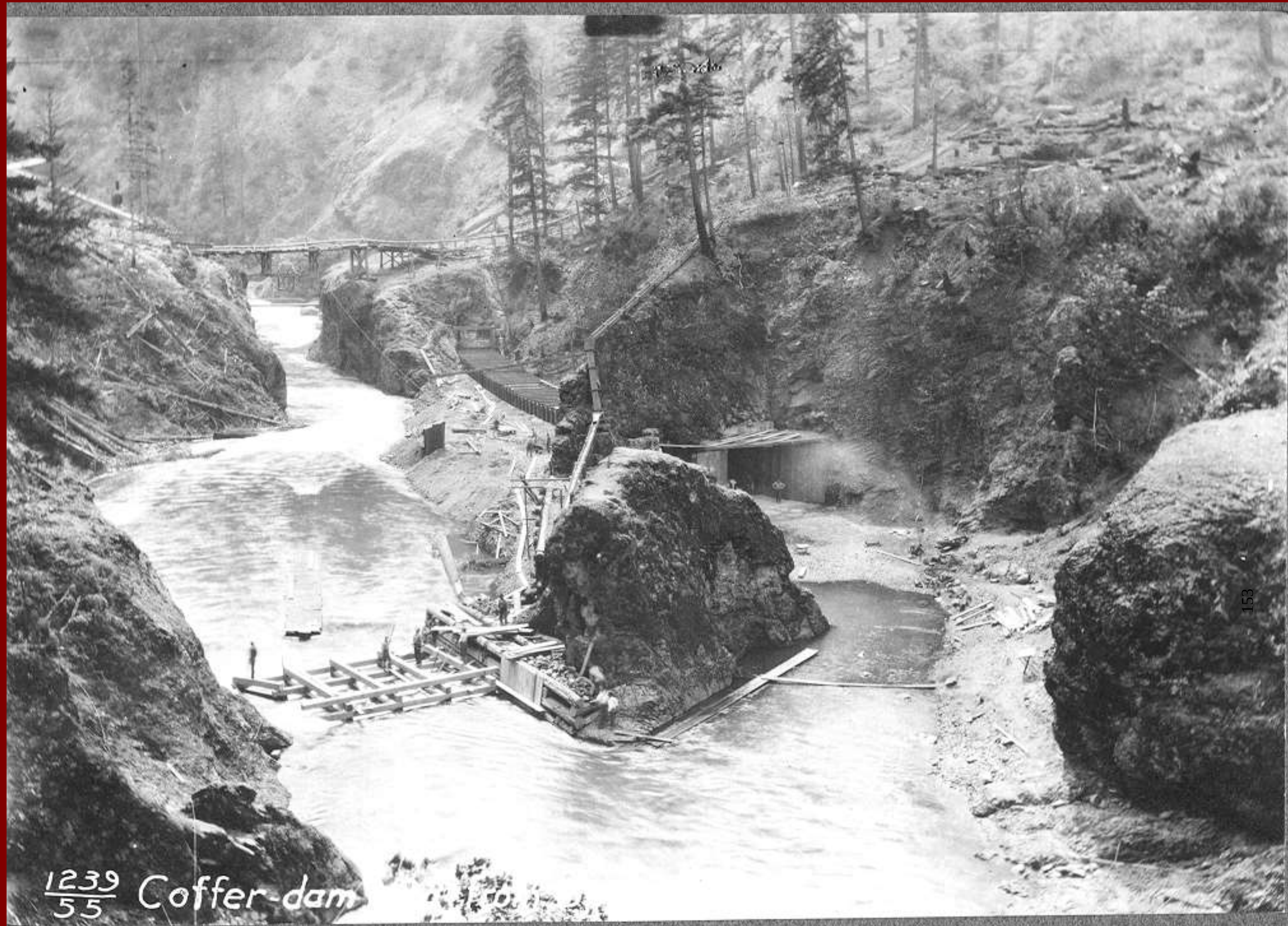
Completed Water Diversion Works

Crib and rock-filled coffer dams

Tunnels 1,2 &3

Flumes

Gate at Tunnel 2



Preparing River Channel for the Dam‘s Foundation

Hydraulic washing

Shoveling

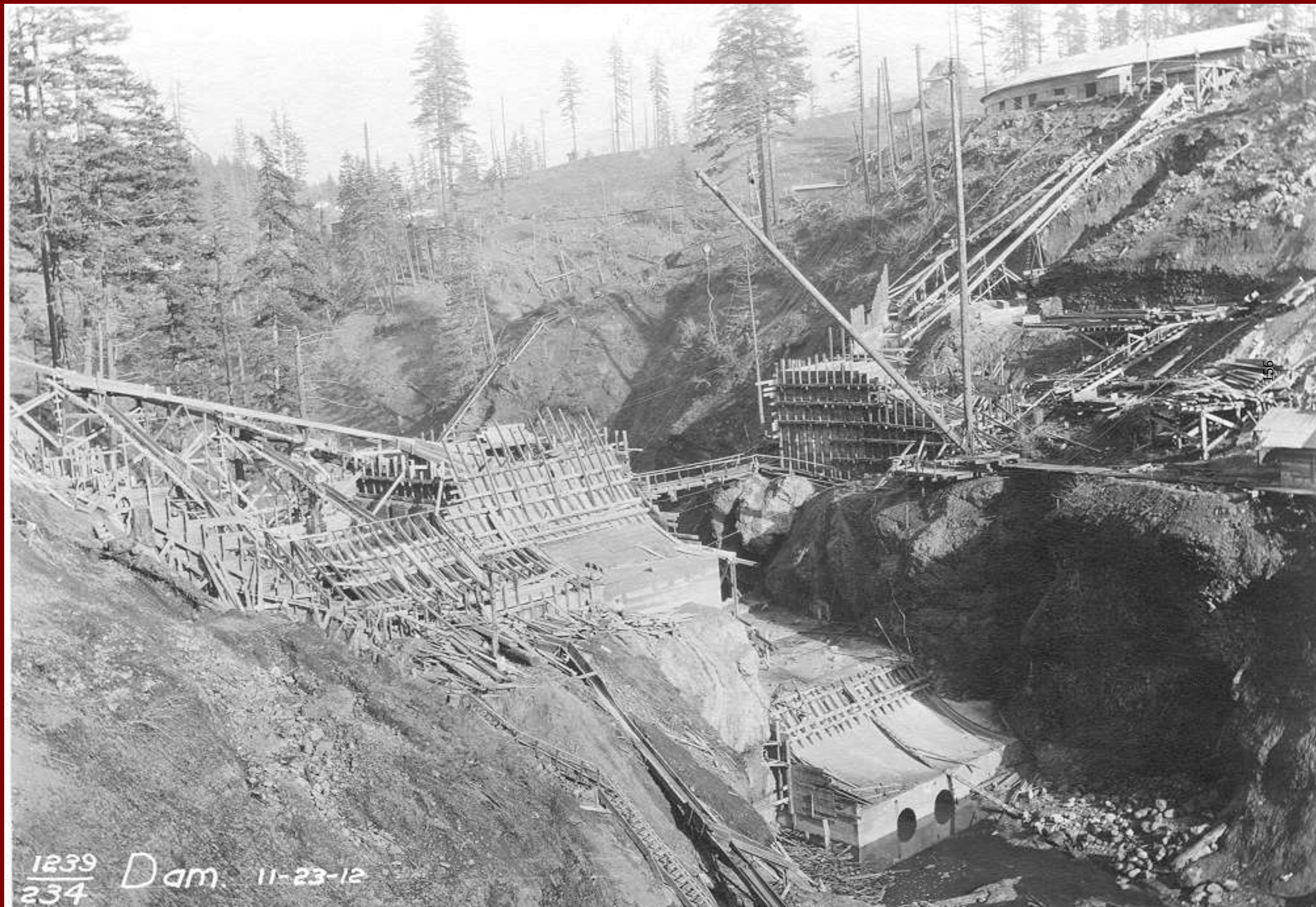
Hoisting

Pumping

Up to 12 feet of alluvium removed

Dam Construction Photo 1 October 31, 1912 (Month 6)

Dam Construction Photo 2 November 23, 1912 (Month 7)



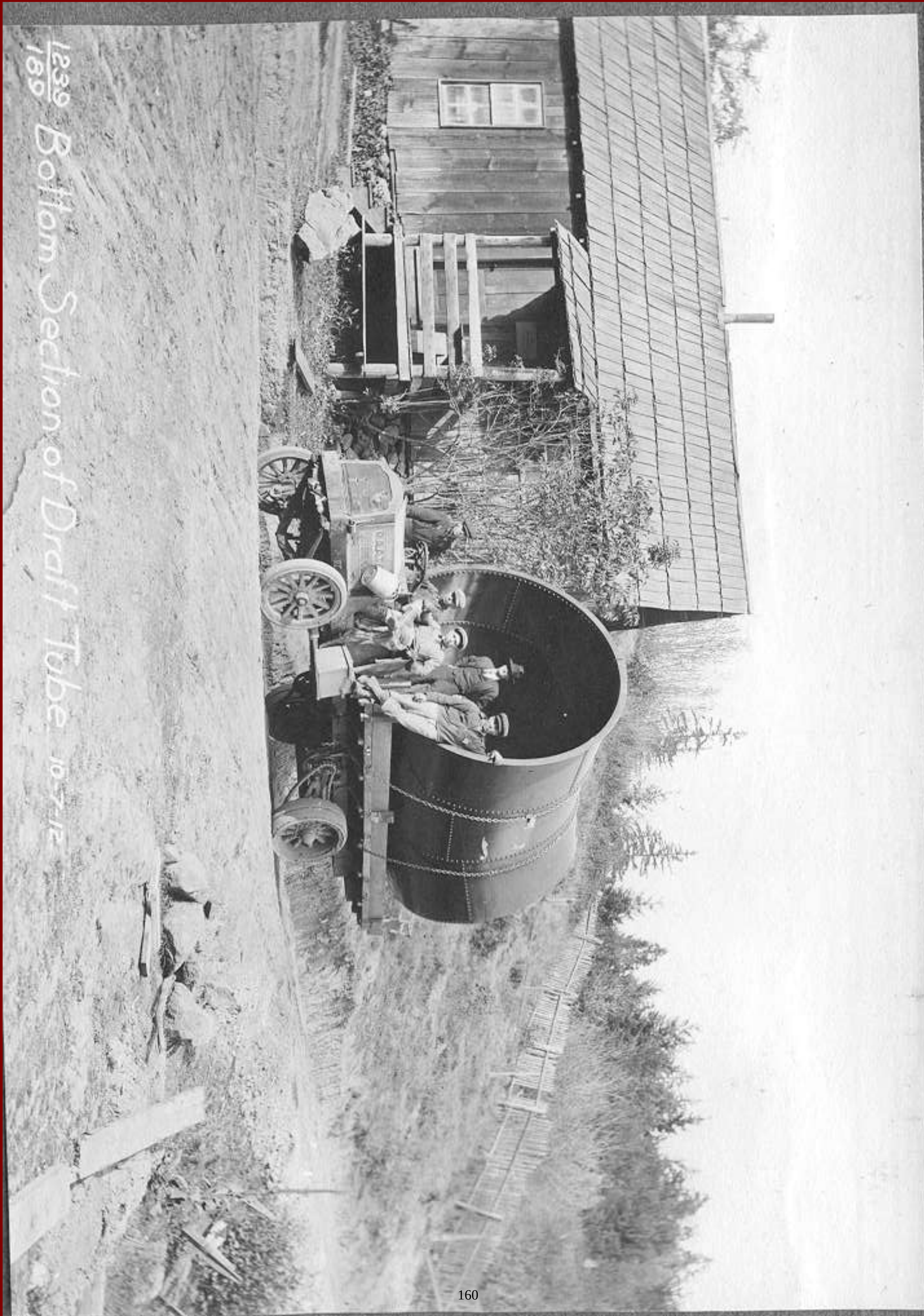
Dam Construction Photo 3 January 4, 1913 (Month 9)

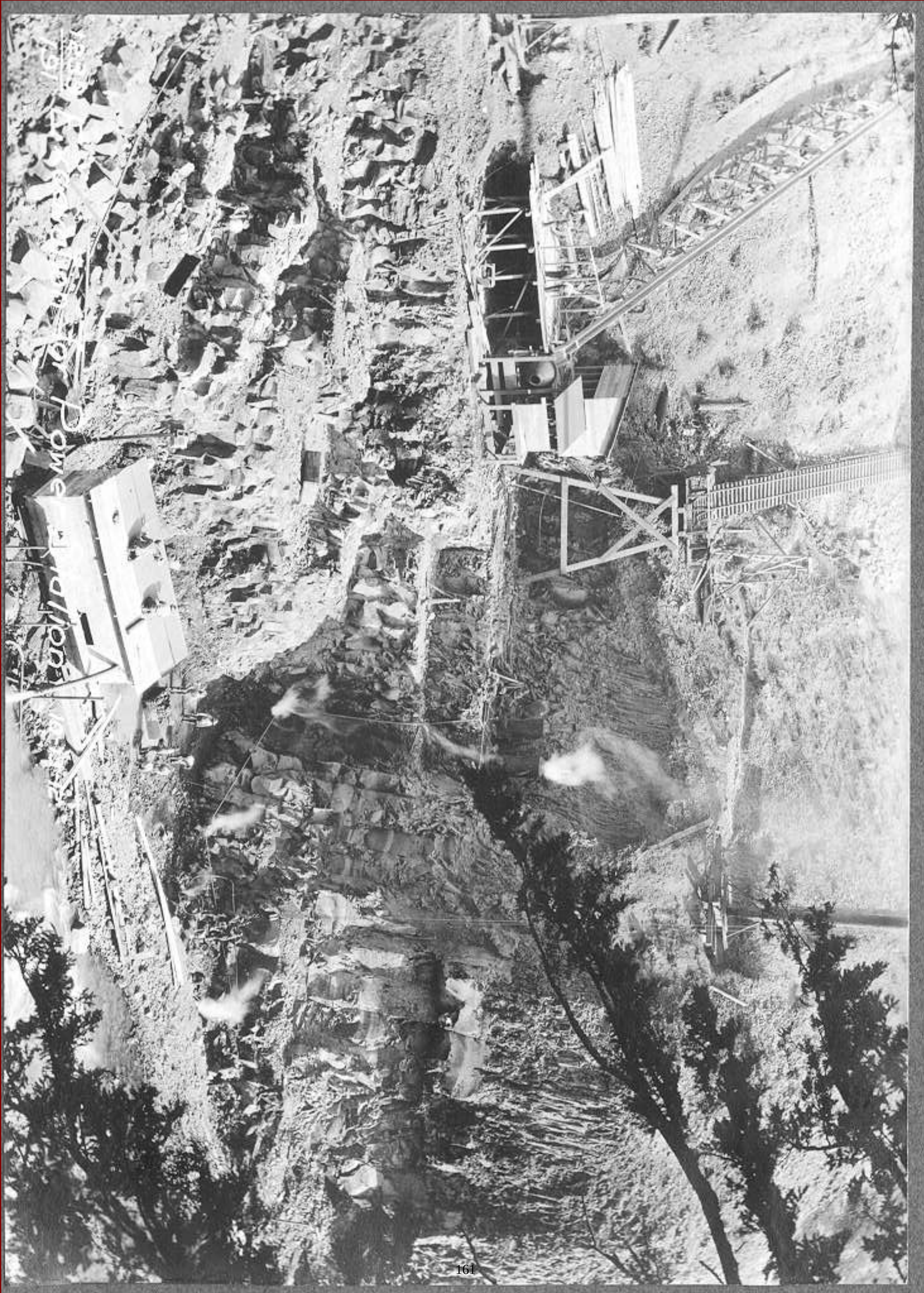
Dam Construction Photo 4 March 21, 1913 (Month 11)

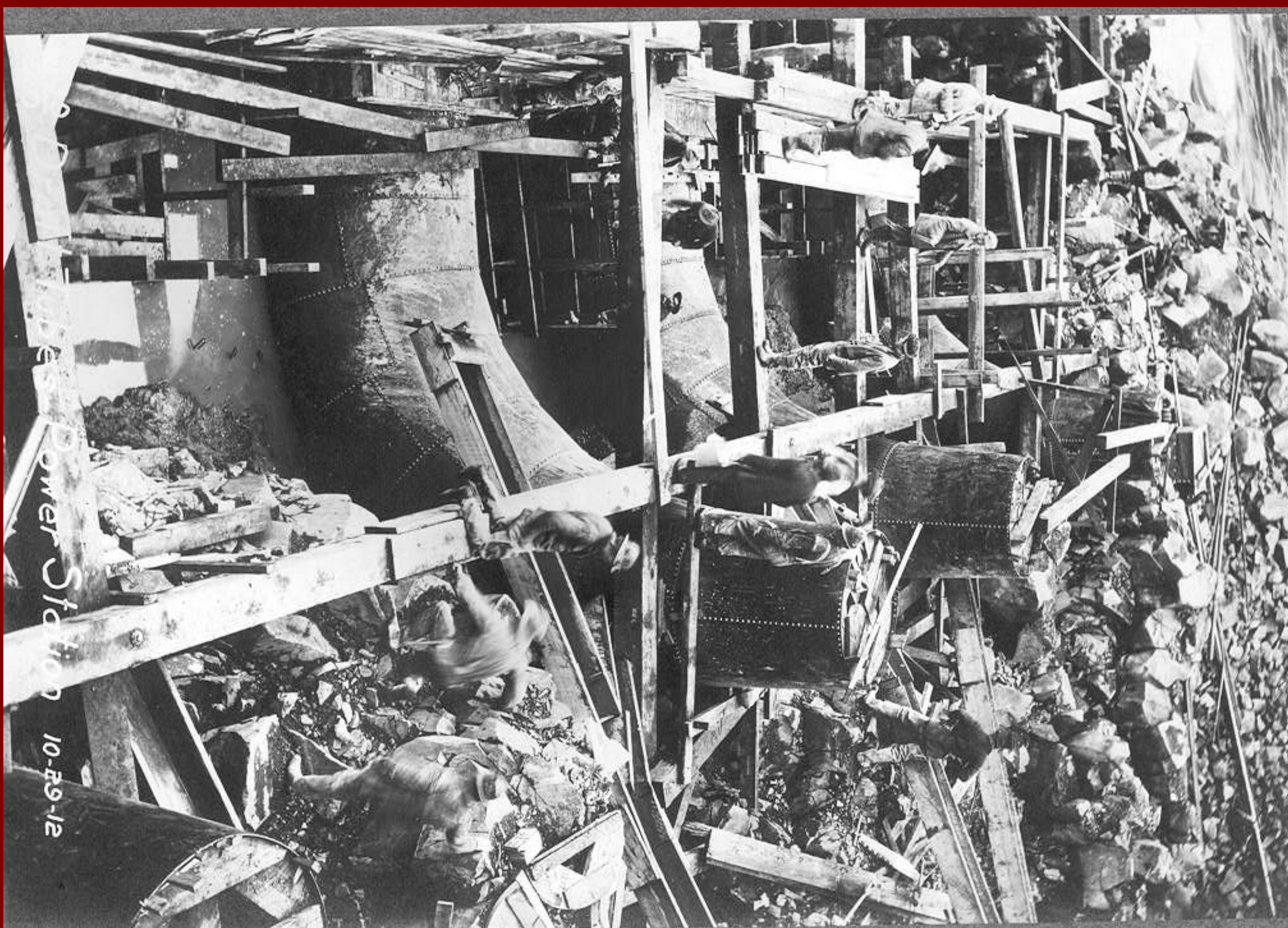
Powerhouse Construction

Located at RM 2.3 (one mile below dam)

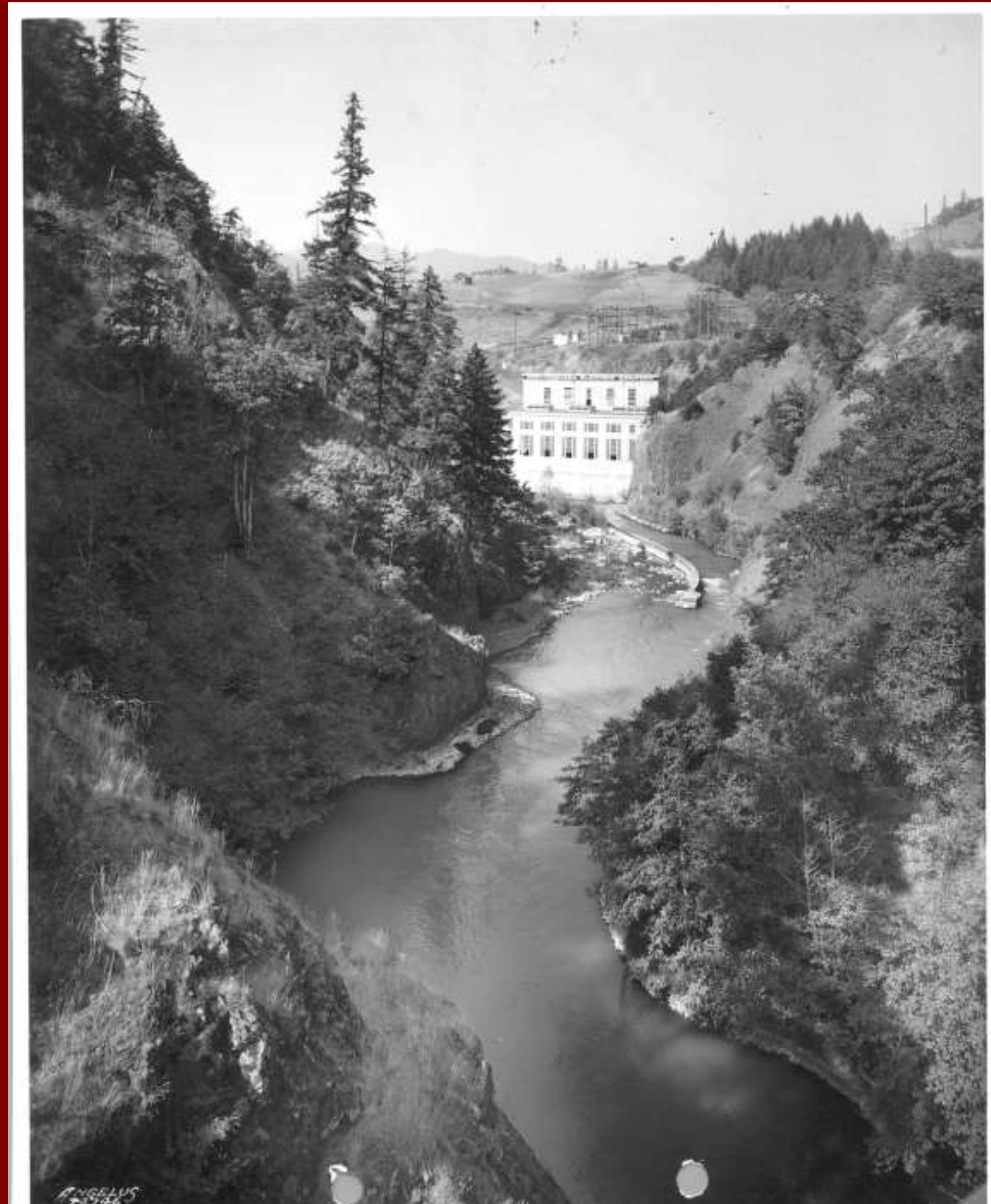
Construction began in spring 1912 (simultaneous to dam)


1239
189
Bottom Section of Draft Tube 10-7-12




Power Station 10-29-12

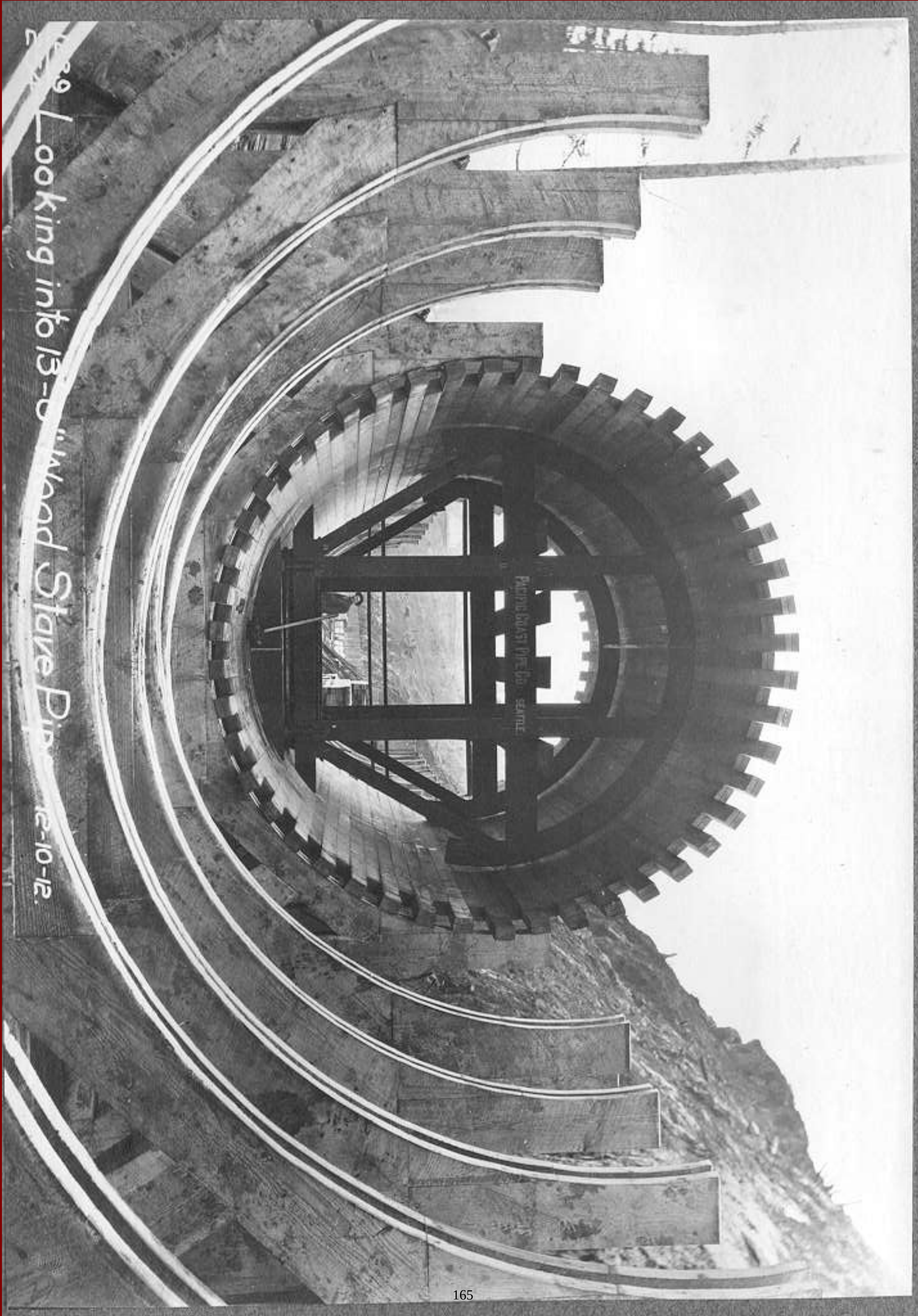
Completed Powerhouse



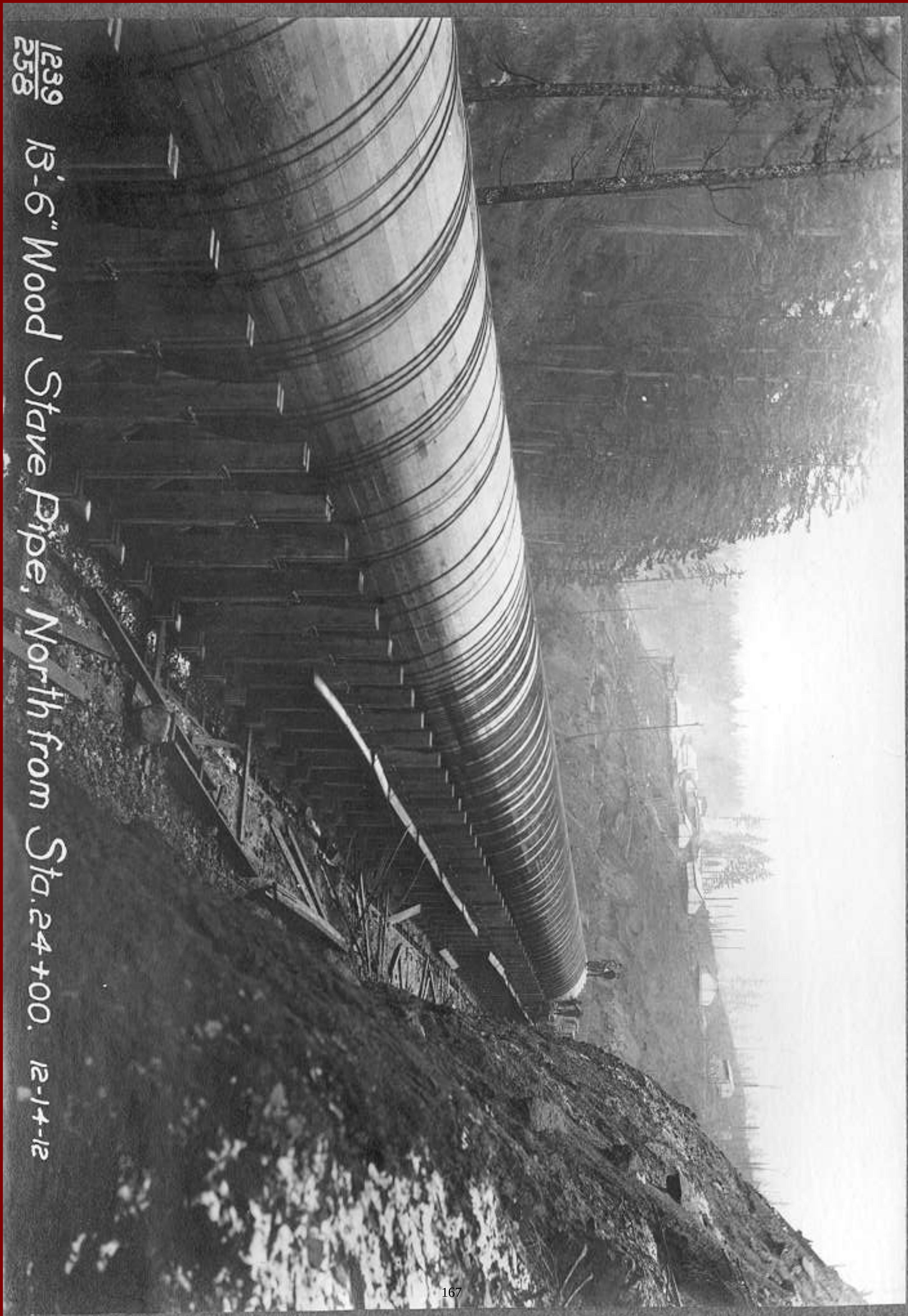
Pipeline Between Dam Headworks and Powerhouse

One mile long

12.5 foot diameter


Looking into 13-0" Wood Stave Pip
12-10-12.
PACIFIC COAST PIPE CO. SEATTLE


1239
304
Inside 13'-6" Wood


1239
258
13'-6" Wood Stave Pipe, North from Sta.24+00. 12-14-12

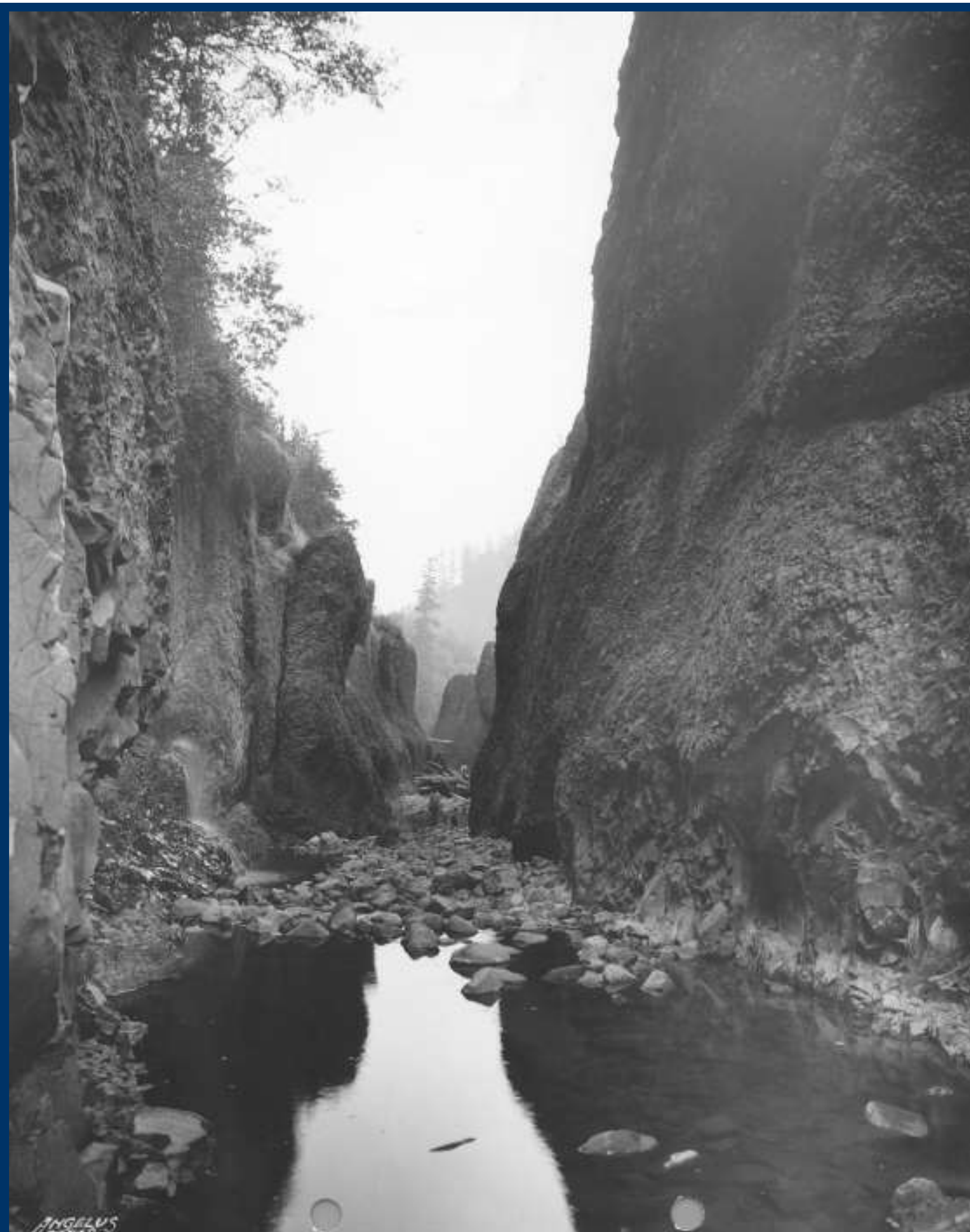
Camp Life

Dewatered Bypass Channel

Perspective on why the project is being retired in 2011-12

Need to amend minimum flows in by-pass reach for fish decreases revenue potential

However, lack of fish passage at dam constitutes the prime restriction to continued operation…



Original Fish Ladder

Perspective on why the project is being retired in 2011-12

Two ladder attempts prior to 1919

Both failed due to washout or collapse from ice

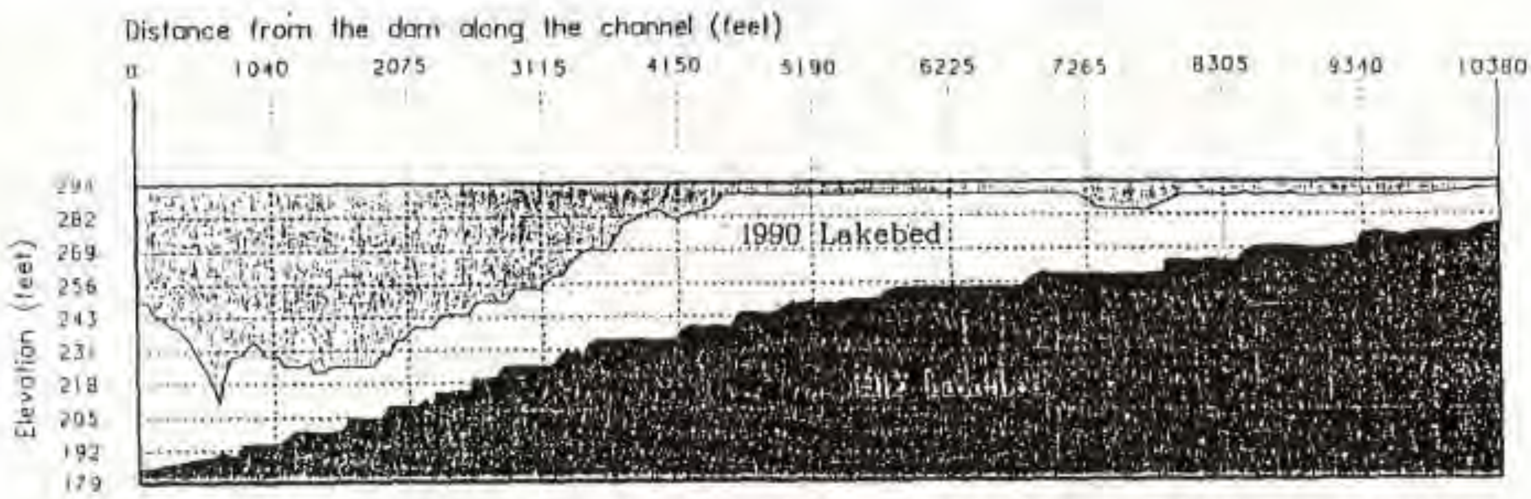
Settlement signed with State of WA in 1919 forgiving future passage mandate

Accumulation of Sediment

Perspective on why the project is being retired in 2011-12

2.4 million cubic yards of sediment has eliminated 60% of the reservoir's capacity

Loss of capacity translates into loss of ramping ability… consequently decreased power revenues



Approximate channel profiles for Northwestern Lake in 1912 and 1990

Table 2. Size Distribution of Reservoir Material

Volume of Reservoir Material - by Fractions[2]

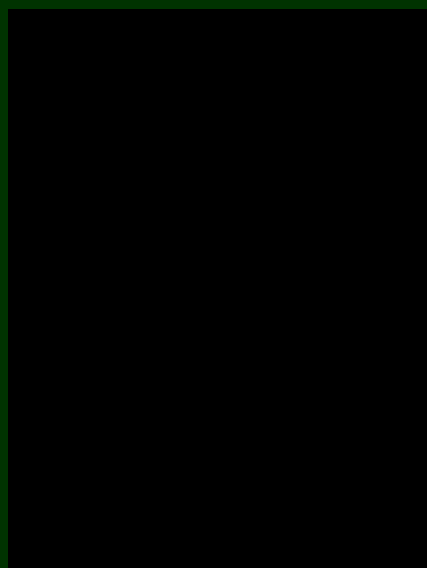
Material Description	Min size mm	Max. Size mm	Percentage of Material	Cubic Yards
Clay		.004	7.4 %	178,257
Silt	0.004	.0625	28.8 %	697,783
Very Fine Sand	0.0625	0.125	23.6%	571,936
Fine Sand	0.125	0.250	16.2%	392,217
Medium Sand	0.250	0.500	10.8%	260,805
Coarse Sand	0.500	1.000	7.6%	183,103
Very Coarse Sand	1.000	2.000	2.3 %	56,695
Very Fine Gravel	2.000	4.000	1.1 %	25,938
Gravel and Larger	4.000		2.3 %	54,805

Drainage Tunnel Method of Dam Removal

First time this method has been used to remove a dam…

Step 1: Excavate tunnel along base of dam

Step 2: Drain water and reservoir sediments at rate of 10,000 cfs… at around noon on 26Oct11

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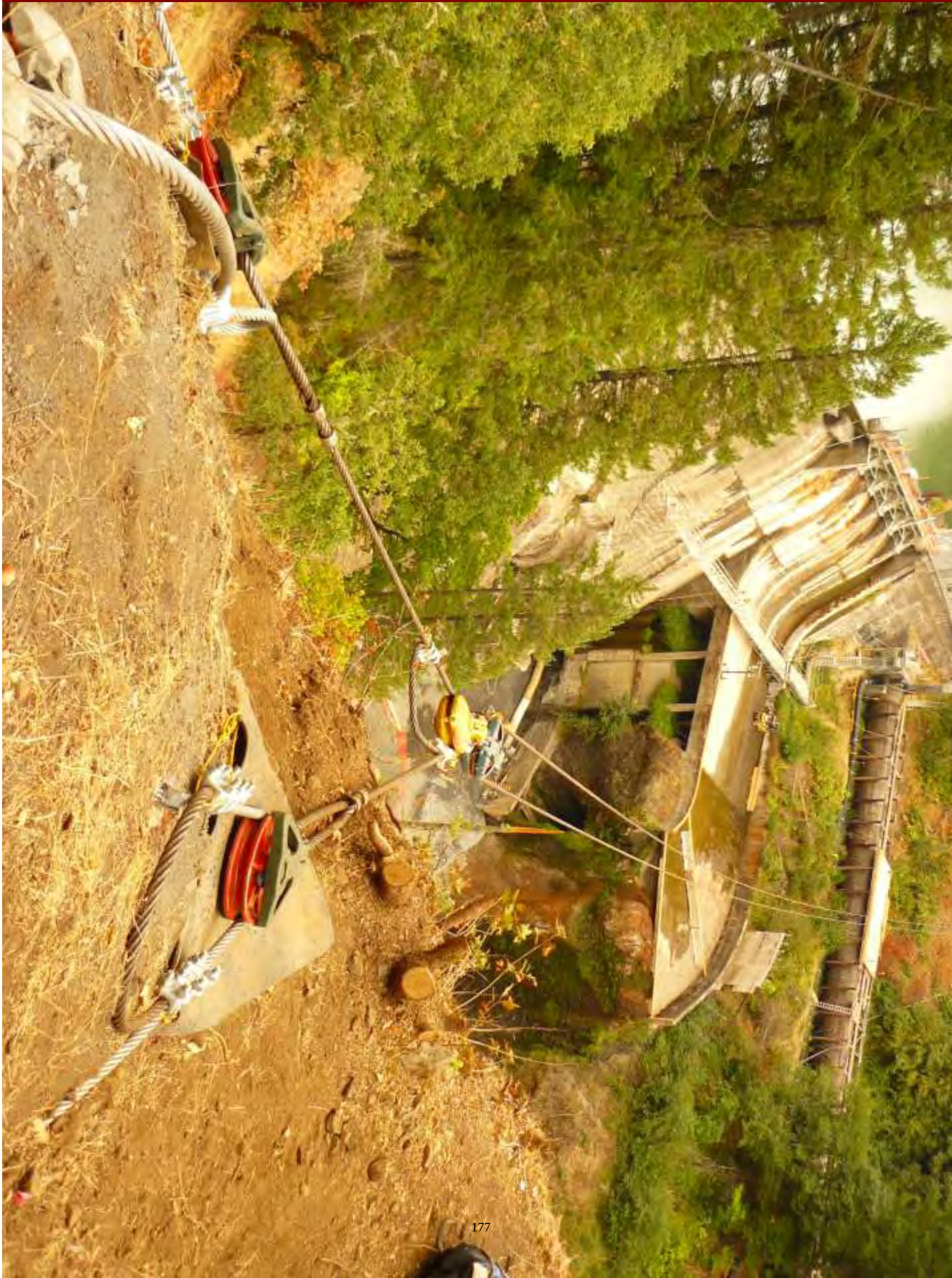
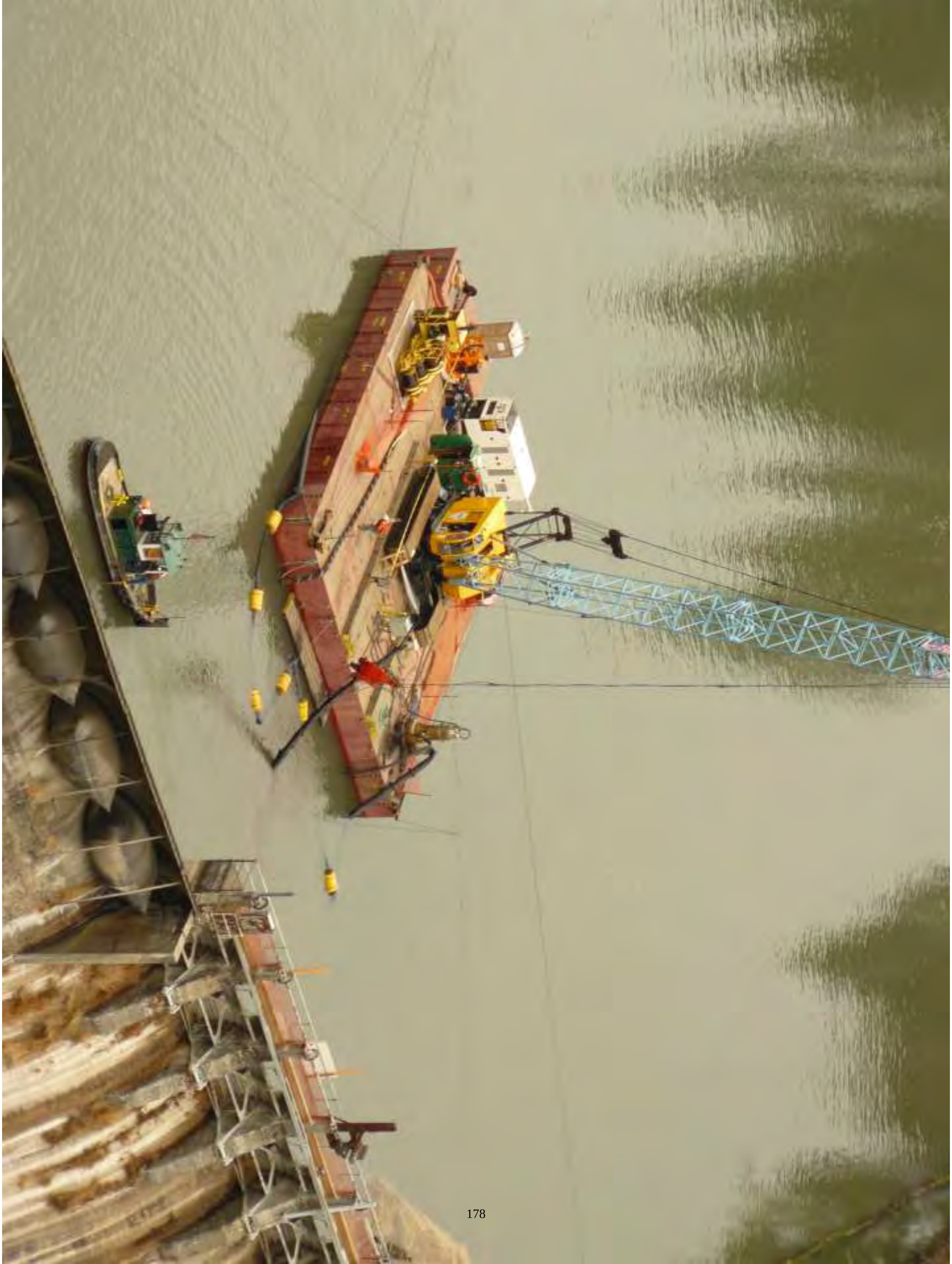
© 2011 Andy Maser & Steve Stampfli



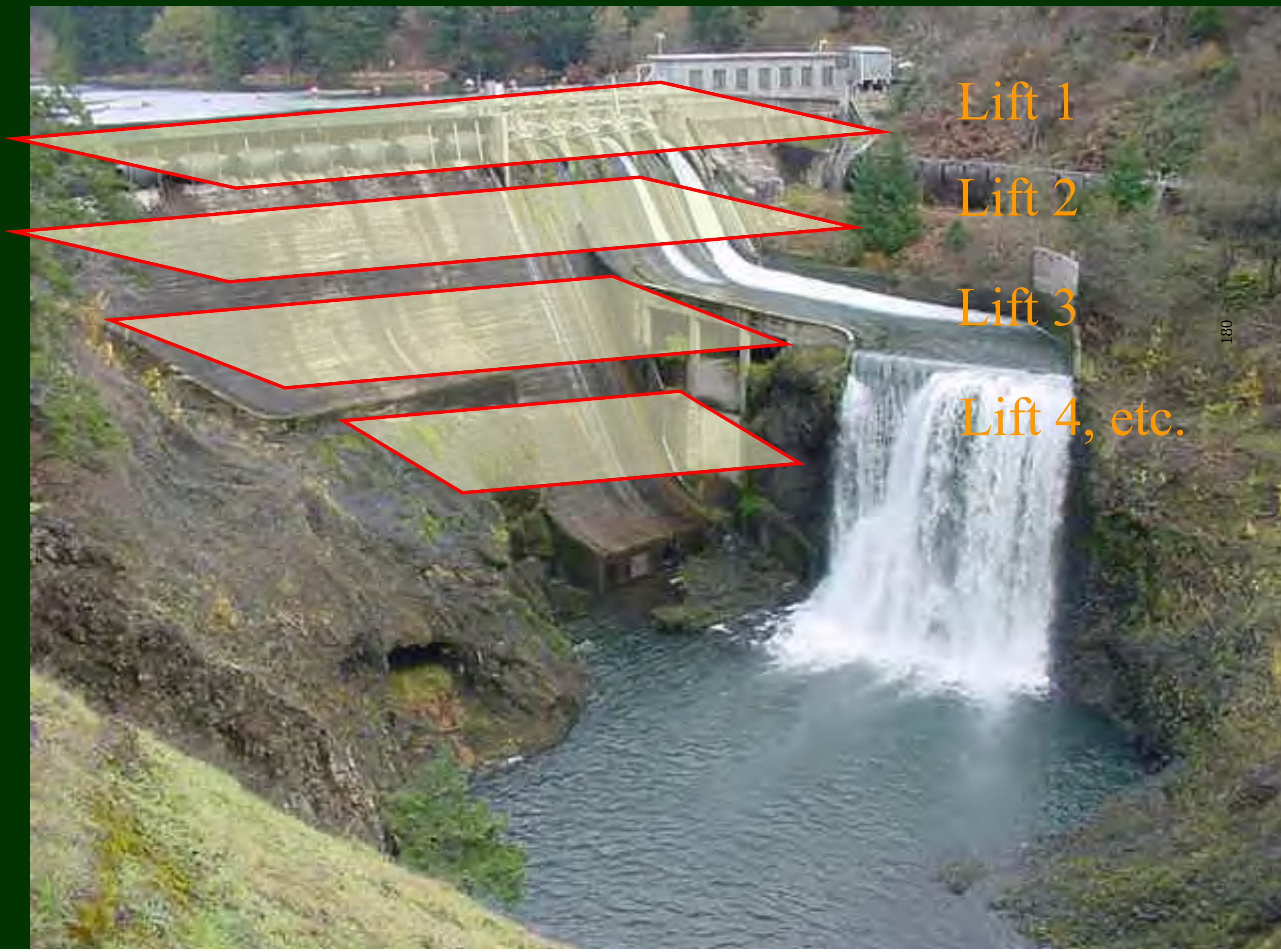


Quarried Removal of Dam

Step 3: Remove dam structure by quarrying in lifts

Special blasting and removal methods to prevent concrete from entering river

Demolition material either recycled or disposed



Remove Allied Structures

Headworks

Gates

Coffer Dams

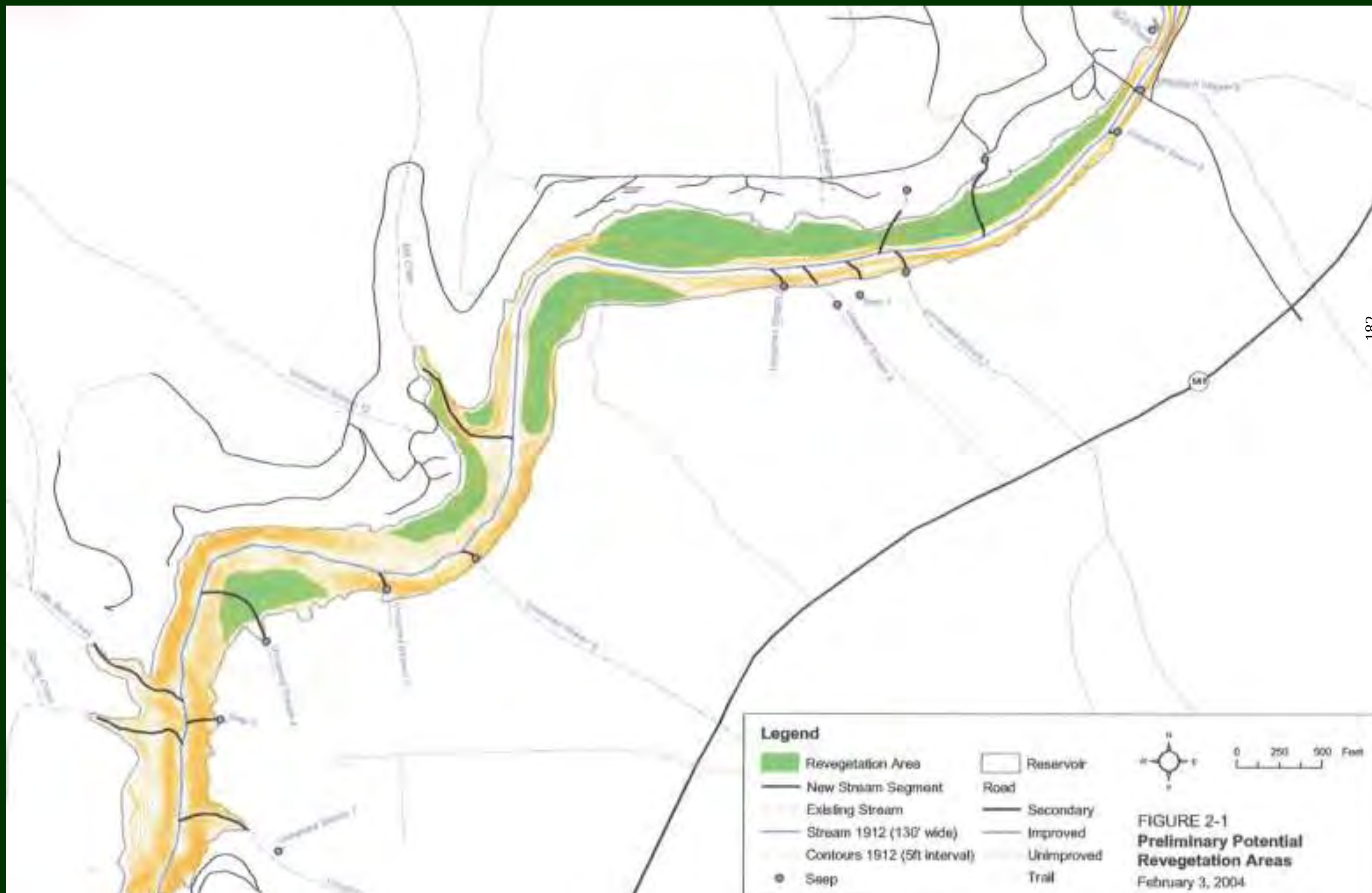
Pipeline

Penstock

Surge Tank

Fill-in and contour tailrace

Revegetation of Newly Emerged River Banks



Protection or Relocation of Public Infrastructure

- City water pipeline
- Orchard water out-take
- Northwestern Lake Bridge

Project Retirement Schedule

1.3 SCHEDULE

Time Period	Action
August 2006	Mobilization
August – October 2006	Site layout – setup and clearing staging areas, set up barge in reservoir
August – September 2006	Construction of access roads including road to spillway slab below dam
September 2006	Construct drain tunnel
September – October 2006	Remove Obermeyer gates, Tainter gate and radial gates
September - October 2006	Install temp water line
September – October 2006	Mt. Adams Orchard water supply relocation
September – October 2006	Northwestern Lake Bridge modification
October 2006	Remove debris from drain tunnel location
October 2006	Blast tunnel plug and drain reservoir
November 2006	Demolish headworks
November 2006 – July 2007	Demolish dam
March – May 2007	Remove wood stave pipeline and wood and steel penstocks. Surge tank removal
October 2006 – April 2007	Cofferdam removal
March 2007 – March 2008	Remove transmission line and substation
February – April 2007	Fill in tail race
August 2007	Demobilization for dam removal activities

Long-Term Monitoring

Suspended sediment in downstream waters of the White Salmon and Columbia

Revegetation success

Condit Time-lapse Project Plan

Project Partners: Steve Stampfli and Andy Maser

Purpose: a) public education, b) tracking of revegetation success, and c) helping to track sediment behavior

Two stations: (one above and one below dam)

Duration: 2-3 years (during 3 seasons)

Photo Frequencies:

- prior to day of blast:	1 photo / hour
- during day of blast:	1 photo / 2 sec
- dam removal:	3 photos / day
- post dam removal	2 photos / month

End

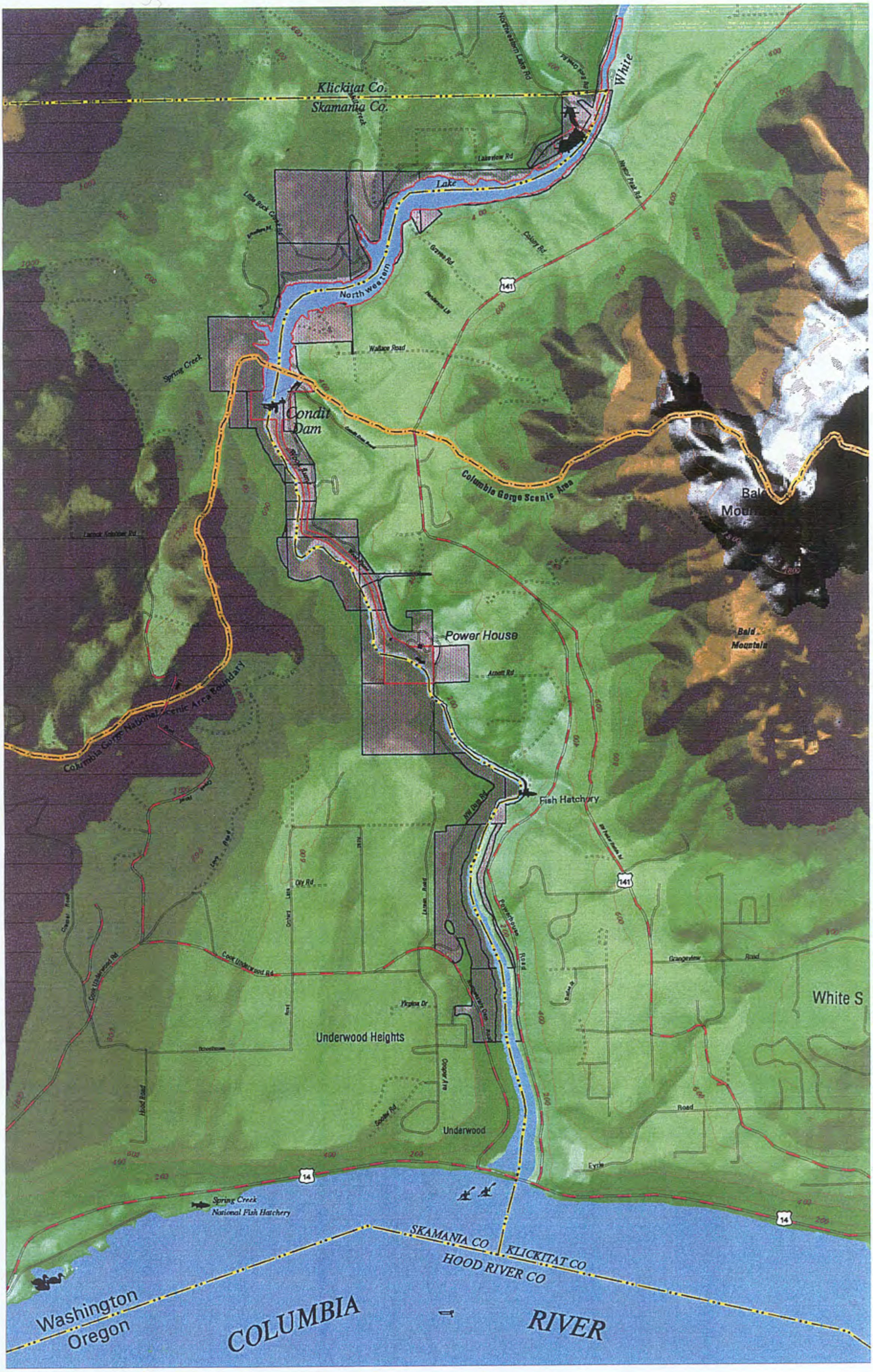
and Thank You!

More information at:

https://whitesalmontimelapse.wordpress.com

http://www.pacificorp.com/es/hydro/hl/condit.html

(and please do your best to discourage people from accessing any part of project during the blast day. Helicopters will be patrolling, and the location of anyone within a 1,500’ radius of the dam will delay the project and threaten public safety)



Condit Hydro Project
Northwestern Lake
Washington

GIS PACIFICORP
Property Mgt. Geographic Information System

Scale 1:20000

0 100 200 300 400 500 600 700 800 900 1000
Meters

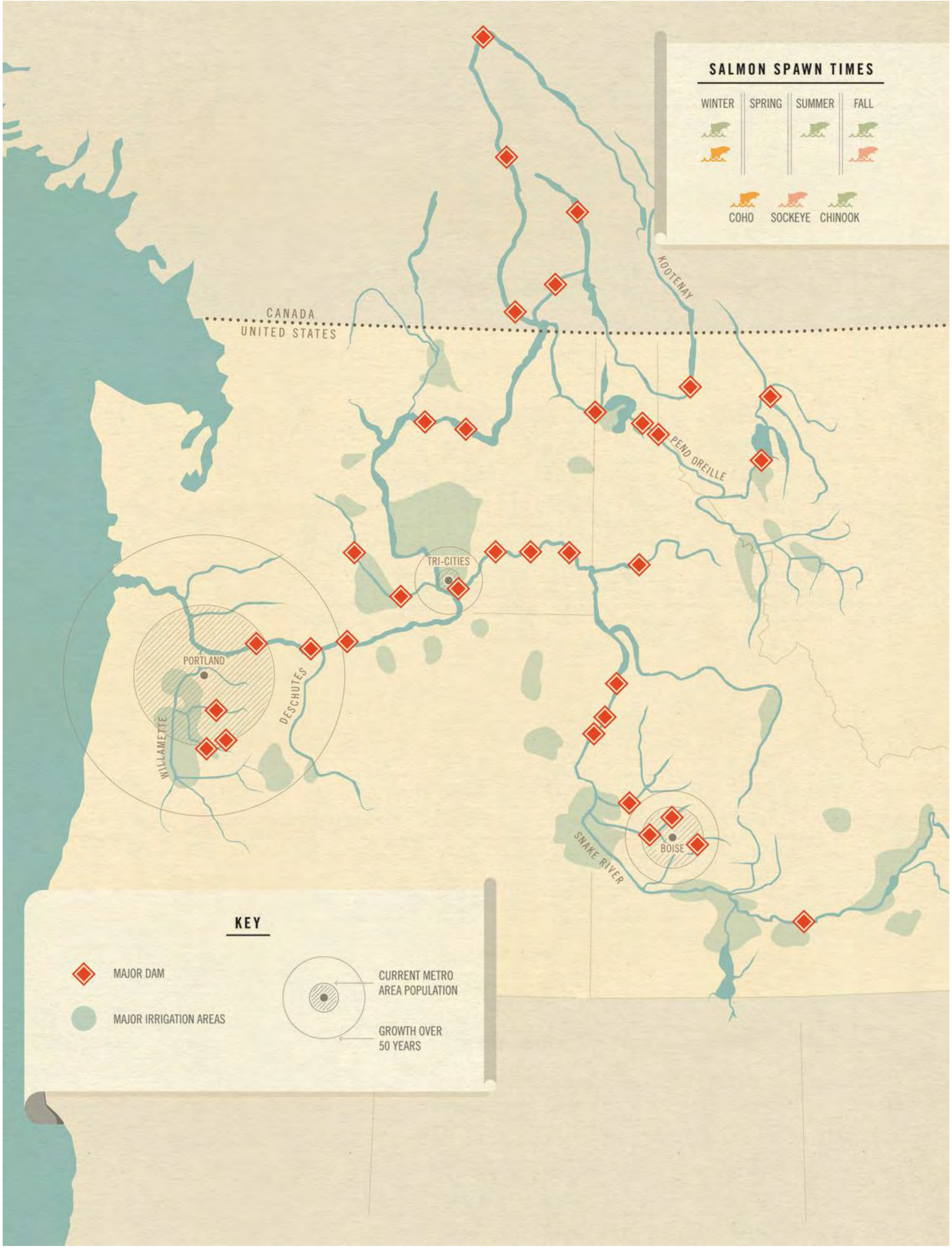
0 1000 2000 3000 4000 5000
Feet

PacifiCorp Property
Primary Roads
Secondary Roads
Improved Roads
Unimproved
Interstate Route
State Route
Columbia Gorge SAB
County
FERC bnd

January 25, 2000

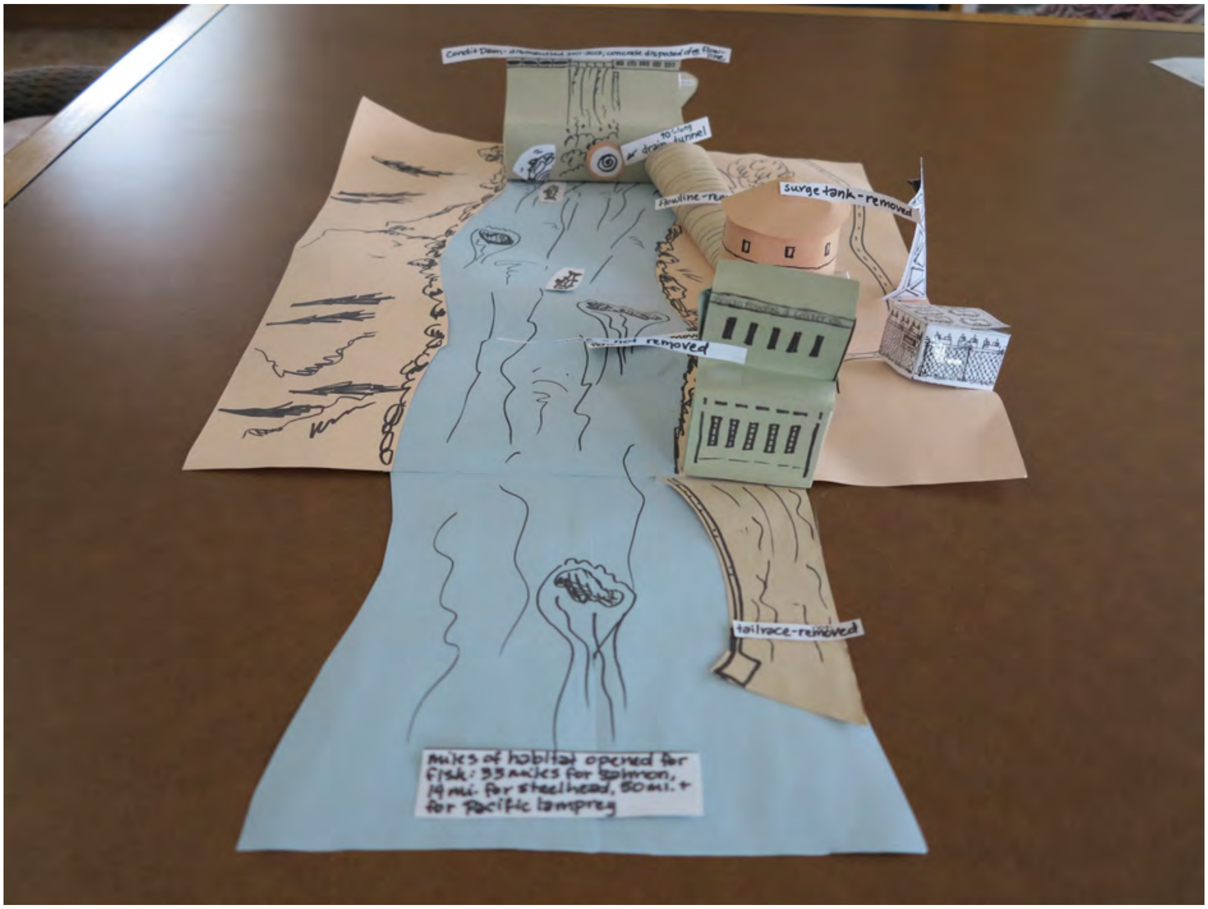
Pacific Northwest Dams & Salmon Spawning Map

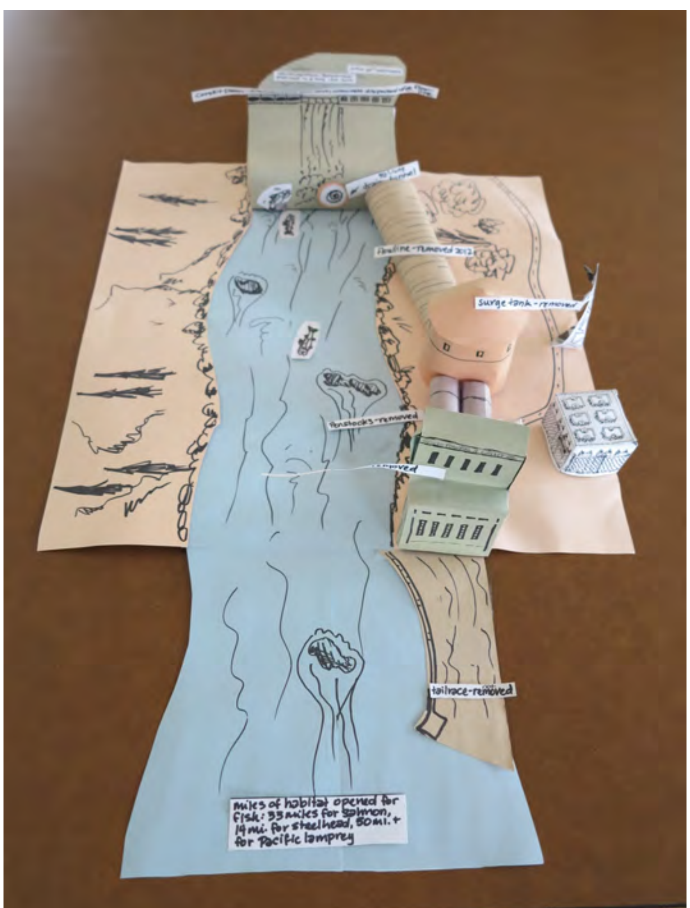
Source: http://oregonstate.edu/terra/2010/10/countdown-on-the-columbia/



Photos of Condit Dam 3-D Model

Created by Jeanette Burkhardt, Yakama Nation Fisheries





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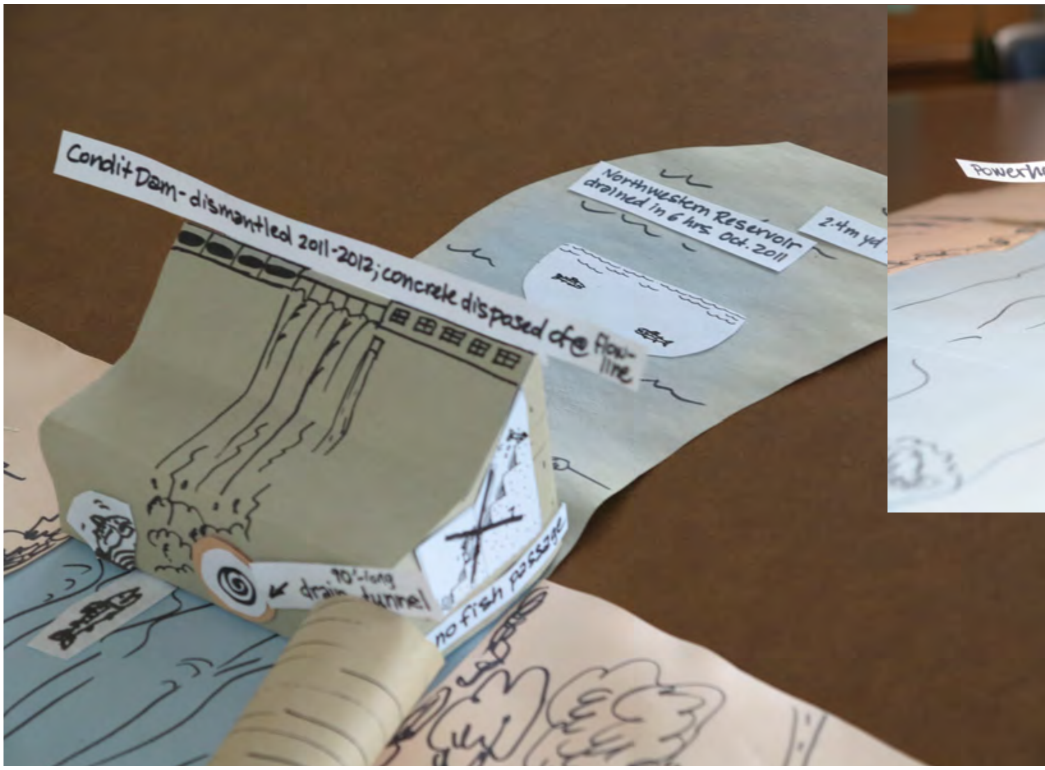

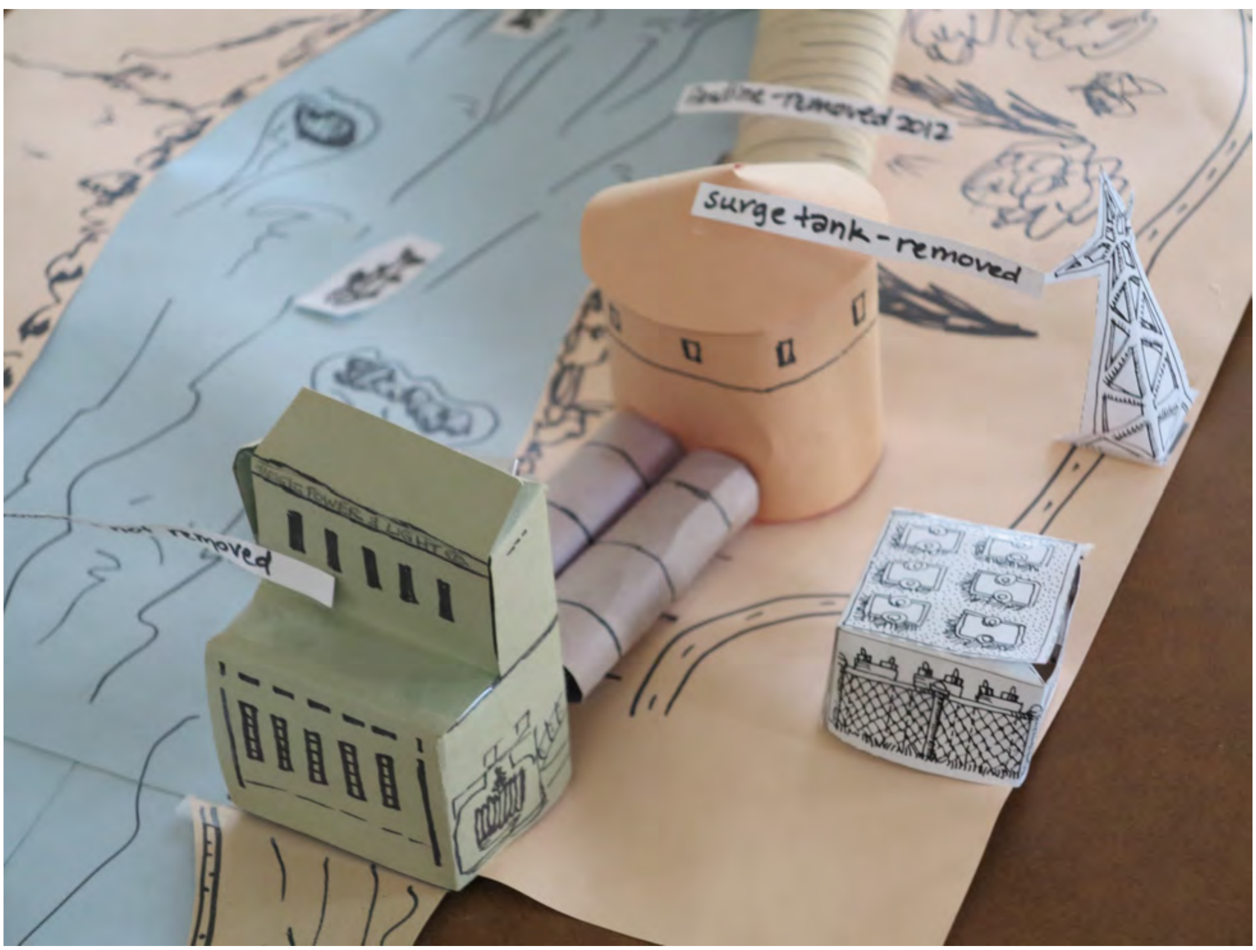

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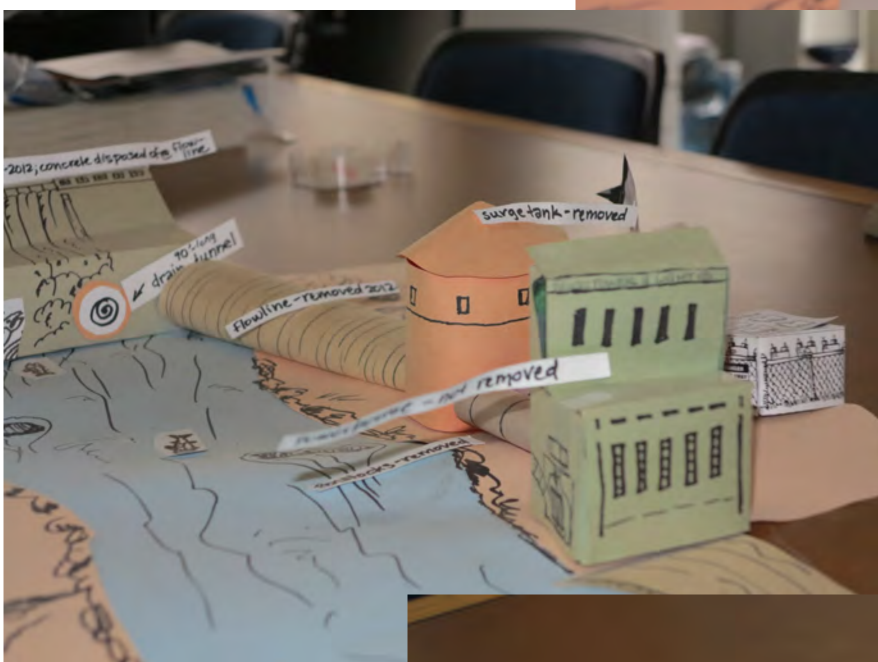

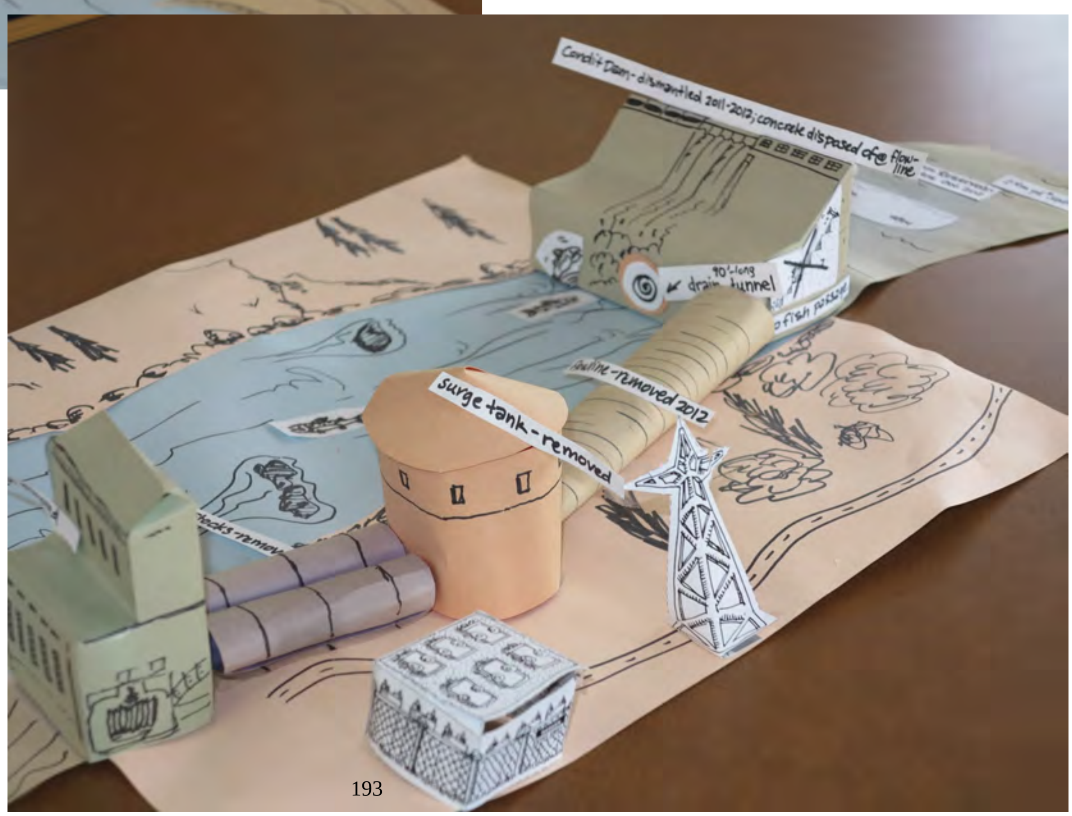

Resources For Condit Dam Lesson Plans

- ❑ Condit Dam History Jigsaw Grades 6-8 & 9-12
    - ❑ Ecological Impacts of the Dam
        - ❑ Ecological Impacts of Condit Dam document
        - ❑ Ecological Impacts of Dams document
        - ❑ Beneficial & Adverse Effects of Dam Removal document
        - ❑ American Dipper Study article
        - ❑ Lamprey found on White Salmon River Yakima Herald article
        - ❑ Terrestrial and Aquatic Resources of the White Salmon document
        - ❑ Tule Salmon Capture & Transfer document
        - ❑ PacifiCorp Newsletter Condit Summer 2012
        - ❑ How Dams Harm Rivers document
        - ❑ American Rivers Dam Removal article
        - ❑ Why Trees Need Salmon article
        - ❑ Salmon Keystone Species diagram
        - ❑ Maps (2) including White Salmon River Salmon Habitat map & White Salmon Fish Recolonization map

Ecological Impacts of Condit Dam

Written by Jeanette Burkhardt, Yakama Nation Fisheries

Most of the “press” around reasons for removing Condit Dam was about the lack of fish passage for ESA-listed salmonids, but that’s only part of the issue. Part of what would have made passage expensive was needing to provide not just upstream passage for adult salmon & steelhead (like a fish ladder), but also a safe, healthy downstream migration route for juvenile fish heading out to the ocean. These juvenile passage devices can often be quite complicated and costly. Without a downstream passage structure of some sort, juveniles had the option of either dropping 120’+ over the spillway or going a mile down the pipeline and through the turbines (which I liken to a blender).

One of the less-publicized factors leading to dam removal was the poor water quality in the by-pass reach—the 1.1 miles between where the water was diverted at the dam and sent down the flowline to where it re-entered the river at the tailrace of the powerhouse. That 1.1-mile stretch had unnaturally low flows and subsequent water quality issues (high temps) that threatened aquatic life. PacifiCorp would have been required to not just provide passage, but also leave more water in the river during lower flow times of the year to provide benefits to that reach, meaning they would have had to reduce the amount of water with which they were generating power (and therefore money).

Other ecological impacts of dams and Condit Dam:

- Dams block sediment transport (like bedload movement including boulders and gravel), which is needed for channel formation and other critical instream habitat. The White Salmon River has tight, steep high energy activity so does not have a lot of the lower meandering zone. This means sediment comes through quickly.
- Dams block the delivery and distribution of those critical marine- derived nutrients that salmon bodies bring into the watershed, which are key to 132 other species and the food web.
- Dams impede transport of biotic and abiotic materials entering the stream through erosive processes/large events (which contribute to water quality).
- Dams block large woody debris transport, which also provides important hydraulic and ecological function to streams & their inhabitants
- Dams block high flows from seasonal floods and freshets that can scour pools and sort gravels (when there is Large Woody Debris (LWD) and other instream structure to sort the gravels), transport LWD, bedload, etc.—i.e. they alter the natural hydrologic regime (and as we are seeing in the Columbia River, slowing flows also heats the water in the reservoirs)
- Studies starting to show that dams can be a source of greenhouse gas emissions (poses questions: are hydroelectric dams truly “green”?) and they emit more methane.

SOURCE: PacifiCorp Website,
http://www.pacificorp.com/about/newsroom/2012nrl/artwsrapsscdr.html
Removal opened approximately 33 miles of new spawning and rearing grounds for steelhead and 14 miles for salmon in the White Salmon River basin. In the summer of 2011, fish biologists moved more than 500 salmon upstream of the dam, which spawned in their new habitat that fall and then descended the White Salmon River unimpeded by the dam.

SOURCE: Friends of the White Salmon River Website,
http://friendsofthewhitesalmon.org/issues-2/habitat/
According to the Washington Department of Fish & Wildlife (WDFW), and US Geological Survey in their (April 2016 report in Fisheries) both salmon and steelhead species seem to be taking advantage of new spawning and rearing habitat options made available via the removal of Condit Dam. The former dam restricted anadromous fish to less suitable spawning and rearing habitat downstream of the dam and blocked up to 50 km of potential habitat for steelhead, 7 km of habitat for fall Chinook Salmon, 15 km of habitat for spring Chinook Salmon, and 27 km of habitat for Coho Salmon.

WDFW reports that spring Chinook are utilizing the area above Condit Dam's former location with most of the spawning occurring below Husum" Falls. The falls, ranging from 10-12 feet in height, are about 4.5 miles from BZ Falls, which would stop all but the most athletic fish.
The spawning in long-vacant areas upstream of the former dam and its reservoir, Northwestern Lake, indicates the first success of the salmon restoration for the White Salmon basin, the natural re-colonization of species that flourished in the river prior to dam construction.

SOURCE: US Fish & Wildlife Service, http://www.fws.gov/pacific/fisheri es/sp_habcon/lamprey/index.html

Threats on Pacific Lamprey
THREATS:
Pacific lampreys face a variety of threats to its various life history stages. Taking into account the potential for lamprey utilization of an area is essential to their conservation. This is especially critical for lamprey ammocoetes because they are unable to move from areas of disturbance and a single dewatering event, physical disturbance, or contamination may have a significant effect on a local lamprey population.

Passage (dams, culverts, water diversions, tide gates, other barriers) both upstream & downstream. Artificial barriers can impede upstream migrations by adult lampreys and downstream movement of ammocoetes and macropthalmia. During downstream migrations juvenile lampreys may be entrained in water diversions or turbine intakes. In many cases, water diversions and hydroelectric projects have been screened to bypass juvenile salmonids. However, due to their size and weak swimming ability, juvenile lampreys are frequently impinged on the screens resulting in injury or death. There is evidence that many dams with fish ladders designed to pass salmonids do not effectively pass lampreys. The excessive use of swimming energy required by adult Pacific lampreys to negotiate fish ladders or culverts combined with sharp angles and high water velocities, effectively block or restrict passage. A hanging culvert, even a couple of inches, is a barrier to lampreys.

Lampreys travel deeper in the water column (no air bladder) compared to salmonids, therefore, traditional spill gates may block passage. Pacific lampreys persist for only a few years above impassable barriers before dying out.

Beneficial & Adverse Effects of Dam Removal

Excerpts from Condit Dam Environmental Impact Statement, pages 1-8 to 1-11
Source: WA State Dept of Ecology, http://ykfp.org/klickitat/Library/ECY_damremEIS.pdf

1.6 IMPACTS AND MITIGATION MEASURES

1.6.1 Beneficial Effects of Dam Removal

Since a major impetus for removing the Condit Dam is to provide benefits to fish, it is appropriate to summarize the beneficial effects that are expected. This will allow a direct comparison of the adverse effects in order to understand the tradeoffs of the proposed action.

The most notable beneficial effects would accrue to the fish and aquatic organisms that would use the free-flowing stream. Potentially, 32 miles of new steelhead habitat and 15 miles of new salmon habitat may be accessed by anadromous salmonids after dam removal, increasing the run size of anadromous salmonids in the White Salmon River and increasing the availability of salmon and steelhead angling opportunities in the White Salmon river basin. New thermal refuge habitat for migrating Columbia River anadromous salmonids from other sub-basins also will be accessible after the removal of Condit Dam. Additional stream habitat for resident fish will be created in the lakebed of the former reservoir. Additionally, the small increase in water temperature below Condit Dam from the discharge of warmed reservoir surface water will be eliminated, improving the quality of thermal refuge, and the recruitment of gravel and large woody debris from sources above the dam site will be reestablished. Foraging, wintering, and refuge habitat, and possibly spawning habitat, will be created for Columbia River bull trout. Juvenile anadromous salmonids will provide forage for bull trout, and salmon carcasses in the watershed above the site of Condit Dam will provide an additional source of marine-derived nutrients to the watershed. There will be more suitable substrate for stream-dwelling aquatic macroinvertebrates after the stream substrate has stabilized.

In addition to benefits to aquatic organisms, there will be other changes that will benefit some users and adversely affect others. For example, while there would no longer be reservoir-based recreation opportunities, there would be river-based recreation opportunities, such as kayaking and stream fishing.

1.6.2 Direct Impacts and Mitigation Measures

The impacts and mitigation measures for the proposed action alternative (dam removal) are summarized by element of the environment in Table 1-1 at the end of this chapter.

1.6.3 Significant Unavoidable Adverse Impacts

Geology, Soils and Sediments

Downstream from the dam, movement of sediment through the channel and floodplain redevelopment and formation are unavoidable adverse impacts. Therefore, much more sediment will be deposited in the Bonneville pool of the Columbia River than with the Condit Dam in

Beneficial & Adverse Effects of Dam Removal

Excerpts from Condit Dam Environmental Impact Statement, pages 1-8 to 1-11
Source: WA State Dept of Ecology, http://ykfp.org/klickitat/Library/ECY_damremEIS.pdf
place, especially at and near the in-lieu site at the mouth of the White Salmon River. The natural sediment flux in the lower White Salmon River will then deposit into the Bonneville pool rather than a free-flowing Columbia River. The sediment deposition will be a result of the Bonneville dam.

Water Resources

Significant unavoidable adverse impacts identified with respect to surface water include massive turbidity and sediment transport as part of the dam breaching and removal. Total suspended solids (TSS) within the six hours after the dam breach could range from 100,000 to 250,000 Parts per million (ppm) and turbidity values could range from 50,000 to 127,000 nephelometric turbidity units (NTUs). Elevated TSS and NTU are expected through the first year following the dam breach as bank and river channel stabilization occurs. These turbidity spikes are predicted to near background levels within 3 to 5 years. Elevated turbidity levels are expected in the Bonneville pool, where the waters of the Columbia River and the White Salmon River mix. Clay particles will likely remain suspended in the Columbia River, thus temporarily increasing turbidity, all the way to the mouth of the Columbia River.

Aquatic Resources

All fish and aquatic macroinvertebrates within the White Salmon River channel downstream of the dam will likely be killed or displaced by the load of suspended solids that will occur during dam breaching. While the actions having the effects will be short-term in duration and will diminish as the level of suspended sediments is reduced over time, the effect on populations of macroinvertebrates will likely take several years to fully reestablish.

One potential year-class of the few naturally spawned chum salmon imprinted to return to the White Salmon River is expected to be lost due to the high concentrations of suspended and deposited sediment and their inability to access stream habitat above the dam or cofferdam. Chum salmon spawners that pass Bonneville Dam will not enter the White Salmon River during the fall and winter months following dam removal and will spawn in other Columbia River tributary or mainstem habitat. Run size during the years the lost year-class would be expected to return as mature spawners will be reduced and composed entirely of spawners from other year classes. This impact will be long-term (potentially several generation cycles for chum salmon). In addition, it is likely that the spawning substrate necessary for their reproduction will be impaired by fine sediment during the second year (and not fully recovered for 1 to 3 years after that). New gravel recruited from upstream may not reach the lower 2.6 miles during that time. The result will be essentially a loss of several year-classes of chum salmon. The small number of chum salmon spawners currently documented to occur in the White Salmon are likely strays from a population below Bonneville Dam and do not represent a viable population. The NMFS Biological Opinion (NMFS 2006) provides for the incidental take. The long-term increase in

Beneficial & Adverse Effects of Dam Removal

Excerpts from Condit Dam Environmental Impact Statement, pages 1-8 to 1-11
Source: WA State Dept of Ecology, http://ykfp.org/klickitat/Library/ECY_damremEIS.pdf
available chum salmon spawning habitat is expected to increase chances of successful recolonization of the White Salmon River basin by chum salmon.

During the period immediately following the breaching of the dam, suspended sediment concentrations entering the Bonneville Pool will be relatively high and the discharge of the White Salmon River will make up approximately seven percent of the Columbia River flow. Columbia River fish may be displaced from the most sediment-laden portions of the plume until it has completely mixed with the Columbia River, approximately three miles downstream from the mouth of the White Salmon River (PacifiCorp 2005). Beyond this point, the plume may briefly interfere with foraging behavior and predator-prey relationships through the Bonneville Pool and downstream of Bonneville Dam (PacifiCorp 2005, Korstrom and Birtwell 2006).

Because listed fish would be in the Bonneville Pool at that time, they could be displaced by the heavy sediment plume, which has been considered a "take" under the Endangered Species Act (NMFS 2006).

There would be an unavoidable short-term impact to available thermal refuge in the White Salmon River until sediment deposited in: (1) pools between river mile (RM) 0.5 and RM 3.3; and (2) the lake bed between RM 3.3 and RM 5.0 is transported to below RM 0.5 and a channel forms below RM 0.5. However, new thermal refuge habitat will be available above RM 5.0 as soon as passage is possible past the dam and cofferdam sites.

Blasting during the removal of Condit Dam, the cofferdam, sediment slopes, or woody debris jams would create hydrostatic shock waves that cause direct mortalities to any fish in the vicinity of a blast. A short-term unavoidable adverse impact to local fish populations would occur due to the mortality of fish in the proximity of in-water blasting activities (if blasting activities occur when fish are present).

Sediments flushed out of the reservoir would bury and kill any adult California floater mussels, if they are present in the river below RM 3.3. If any adult California floaters are present in Northwestern Lake, they could be flushed downstream and deposited in pools. California floaters that are deposited near the surface of the substrate in appropriate habitat may survive, while those that are buried or deposited in fast riffles and runs are unlikely to survive. Depending on the presence of adult California floaters upstream of the reservoir or the reestablishment of a population from the migration of host fish into the river reach below RM 5.0, a short- or long-term unavoidable adverse impact may occur if California floaters are present in the White Salmon River below RM 5.0.

Beneficial & Adverse Effects of Dam Removal

Excerpts from Condit Dam Environmental Impact Statement, pages 1-8 to 1-11
Source: WA State Dept of Ecology, http://ykfp.org/klickitat/Library/ECY_damremEIS.pdf
After dam breaching, sediment accumulations with an average depth of approximately 5 feet will occur in the Columbia River downstream from the mouth of the White Salmon River. This area will extend into the Columbia River channel about 1,500 feet and downstream for about 1 mile, and cover about 100 acres (PacifiCorp 2005). The Bonneville pool is about 4,000 feet wide at this location and sediment depth is expected to be zero in the navigation channel. Benthic macroinvertebrates, such as crustaceans, aquatic insects, and freshwater mussels will be physically buried (PacifiCorp 2005). With the exception of mussels, recolonization should occur within 6 months to a year. Mussels have longer life-spans and are relatively slow growing and will take more time to recolonize new substrates.

Wetland Resources
Unavoidable adverse wetland impacts include the loss of approximately 2.8 acres of lake fringe wetlands. These impacts are expected to be mitigated by the establishment of riverine and slope wetlands within 1 to 5 years of dam removal.

Terrestrial Resources
There will be no significant unavoidable adverse impacts.

Transportation
With the implementation of the identified mitigation measures, no significant unavoidable adverse impacts are expected to occur to transportation or traffic.

Air Quality
There are unlikely to be any significant unavoidable adverse impacts from demolition of the Condit Dam if the mitigation measures are implemented fully and in a timely fashion.

Noise
Several residences (i.e., sensitive noise receptors) are located adjacent to the dam, the concrete disposal site, and the roads along which trucks and construction equipment would travel during the proposed action. Intermittently, construction noise levels at these residences would significantly exceed the modeled noise levels. The noise levels at these sensitive receptors due to construction activities do not exceed state or local noise standards due to exemptions for construction in the Klickitat County, Skamania County, and State of Washington noise regulations. However, construction noise impacts to adjacent residential properties would be significant due to the duration and intensity of noise that would be received. Therefore, construction noise impacts to adjacent residential properties are considered a short-term significant unavoidable adverse impact for the proposed action.

Land Use/Critical Areas

Beneficial & Adverse Effects of Dam Removal

Excerpts from Condit Dam Environmental Impact Statement, pages 1-8 to 1-11
Source: WA State Dept of Ecology, http://ykfp.org/klickitat/Library/ECY_damremEIS.pdf
If the PacifiCorp Sediment Assessment and Management, Bank Stabilization, and Canyon and Woody Debris Management Plans (PacifiCorp 2004) are implemented, no long-term unavoidable significant adverse impacts to land use/critical areas are anticipated. There would be short-term unavoidable impacts to sites along or near the reservoir that would be used for work areas, construction staging or for disposal, and from the access roads that would be built in several locations.

Aesthetics and Scenic Resources
Short-term significant unavoidable adverse impacts to views along the reservoir would occur until revegetation occurs and the free flowing river is reestablished. One overall significant long-term change to aesthetics and scenic resources would remain and would be unavoidable. That would be the change from a lake view to a view of a stream corridor. However, depending on one's perception, this may or may not be a significant impact.

Public Safety
If the proposed mitigation measures for public safety are implemented, no significant unavoidable impacts are expected.

Public Services
If the Public Safety and Traffic Control Management Plans prepared by PacifiCorp (2004) are implemented, no significant unavoidable adverse impacts are expected.

Songbird Study Shows River Ecosystem Recovery After Dam Removal, Return Of Salmon Nutrients

SOURCE: The Columbia Basin Bulletin, http://www.cbbulletin.com/435773.aspx

A songbird species that flourishes on the salmon-rich side of dams in the western United States struggles when it tries to nest on the side closed off from the fish and the nutrients they leave behind.

But the songbird and the rest of the divided ecosystem rebounds, faster than some experts expected, when dams come down and rivers are allowed to resume their natural flow.

Two new studies led by Christopher Tonra, assistant professor of avian wildlife ecology at The Ohio State University, illustrate the stress dams impose on species that rely on salmon and the impact of dam removal on the well-being of that wildlife.

The areas previously depleted of salmon are on a fast track to recovery in a shorter time than he ever expected after the dam removal, Tonra said.

"It's exciting to be able to show a real positive outcome in conservation. We don't always get that," he said. "That these rivers can come back within our own generation is a really exciting thing."

During his time conducting the studies in Washington, Tonra watched reservoir beds that looked like moonscapes return to vibrant, rich habitat and cascades emerge where none had been, at least for the last century.

"Watching that happen was just incredible," he said.

Tonra and his colleagues studied the American dipper, a bird set apart by its unusual feeding style. Dippers, which are equipped with a transparent second eyelid (think water goggles for birds), dive below the river's surface and walk the riverbed scouring the rocky floor for meals, mostly aquatic insects in their larval stage. They also eat some small fish, including juvenile salmon when they're available.

The studies are the first to examine the effects of dams, and dam removal, on the dipper, considered an indicator species and the only bird of its type found in North America. Dippers that are faring well point to a strong ecosystem in and around the river.

"These birds are right where aquatic and terrestrial ecosystems meet," Tonra said.

Tonra and his colleagues spent four years in Washington's Olympic National Park and surrounding tribal, federal and private lands. The Elwha River winds through the park and is the site of the largest dam removal in history. Crews started tearing down the Elwha and Glines

Canyon dams in 2011 and concluded in 2014, freeing the path for migratory fish for the first time in a century.

Salmon, which do most of their growing in the ocean, carry marine-derived nitrogen and carbon back into freshwater systems when they return to spawn and die. They benefit animals and plants, whether through direct consumption or because nutrients find their way into plants and other food, including larval mayflies and other insects for which the dipper dives.

"They're truly fertilizing the river and so that makes its way all the way up through the food chain," Tonra said.

In one study, the researchers documented that American dippers with access to salmon were in better physical condition and more likely to attempt multiple broods of offspring in a season. They also produced larger female offspring and were more likely to stay in breeding territories year-round. The research, published early online, will appear in an upcoming issue of the journal Ecography http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1600-0587

Tonra and his colleagues worked along four streams, three of which were blocked to salmon either by waterfalls or dams. They banded the birds, weighed them and collected blood samples. They looked at carbon and nitrogen in the birds' blood to determine their level of marine-derived nutrient intake.

The research team watched for multiple attempts to breed and an inclination to stay in the nesting area year-round, and tracked what type of food was delivered to nestlings.

The birds with salmon access had more marine-derived nutrients and were 20 times more likely to attempt multiple broods. They were 13 times more likely to stay year-round and had an annual adult survival rate that was 11 percent higher than their salmon-deprived peers.

The female birds with access to salmon had larger body mass, suggesting they were healthier. Fledgling females raised in areas with salmon also were larger.

The birds without access to salmon and food enriched by their presence "weren't in very good condition and it looked like they weren't attempting to breed as much," Tonra said.

And they took off after they fledged a single brood, presumably for salmon-rich waters.

"Within the same river you basically have two different populations," Tonra said.

Songbird Study Shows River Ecosystem Recovery After Dam Removal, Return Of Salmon Nutrients

SOURCE: The Columbia Basin Bulletin, http://www.cbbulletin.com/435773.aspx

There's good news in the team's second dipper study, published in the December 2015 issue of the journal Biological Conservation: Within a year of the Elwha Dam removal, Tonra and his colleagues were able to document an increase in salmon-derived nutrients in American dippers.

Tonra was surprised, and delighted, by how quickly the salmon returned.

"It was pretty much as soon as the first dam came out and fish were beating up against the second, wanting to go." Tonra, previously with the Smithsonian Migratory Bird Center, worked with Kimberly Sager-Fradkin of the Lower Elwha Klallam Tribe and Peter Marra of the Smithsonian on both studies. Sara Morley of the Northwest Fisheries Science Center and Jeffrey Duda of the Western Fisheries Research Center contributed to the study published in Biological Conservation.

Tonra said he'd like to return to the Pacific Northwest soon to measure changes in the birds' patterns and health since the dam removal. He's hopeful that other birds and bats that feast on insects in the air and on the trees near the river will become stronger as well.

The research was supported by the U.S. Fish and Wildlife Service, the Lower Elwha Klallam Tribe, the National Oceanic and Atmospheric Administration, the U.S. Geological Survey, the Smithsonian Institution and the National Zoo.

Lamprey found above Condit Dam site on White Salmon River

By Tammy Ayer; tayer@yakimaherald.com**;** Mar 12, 2016

SOURCE: Yakima Herald -- http://www.yakimaherald.com/news/local/lamprey-found-above-condit-dam-site-on-white-salmon-river/article_7869617a-e8ea-11e5-a5d2-ef3fc0cee45c.html?utm_medium=social&utm_source=email&utm_campaign=user-share

Pacific lamprey, an ancient native fish with notable cultural and ecological significance, have returned to the White Salmon River above the former site of Condit Dam. The fact that the lamprey have been found above the former dam location signals an important step forward in habitat restoration, lamprey conservation and partnership in the Columbia River Basin, officials with the Yakama Nation and the U.S. Fish & Wildlife Service said in a news release Friday.

“This is a good day,” Patrick Luke, Yakama Nation tribal councilman, said in the release. “We are recognizing asum (lamprey) making their mighty return to Mitula Wana (White Salmon).” Sometimes referred to as the forgotten fish, Pacific lamprey are a traditional food source for the Yakama people, as well as a wide variety of wildlife species. They spend their early years nestled in creek beds before transforming into parasitic adults that migrate to the ocean to feed for years before returning to spawn.

While not endangered, populations of lamprey are dropping dramatically across the Columbia Basin, in part because adult lamprey struggle to use the fish ladders designed for salmon at hydropower dams.

Staff from the Yakama Nation and the Fish & Wildlife Service began monitoring lamprey distribution in the basin in 2007. Prior to the 2011 removal of Condit Dam — which blocked passage of upstream migrating fish for more than 100 years — surveys found no Pacific lamprey above the dam, only below.

Last summer, as part of the post dam removal monitoring, the wildlife service surveyed for lamprey in several watersheds as well as the mainstem of the White Salmon River above and below the former dam site. Pacific lamprey were found at three locations upstream of the former dam site, in areas previously inundated by Northwestern Reservoir.

The larvae, which are the size and shape of a small earthworm, are likely offspring of adults spawning in previously inaccessible habitat. This is one of the few documentations of Pacific lamprey natural recolonization after the removal of a dam.

Their parasitic nature gave the fish a bad reputation with many fishermen. But some scientists say that larger lamprey populations would benefit salmon because the high-fat fish provides a preferred alternative snack for predators like gulls and sea lions.

Further monitoring is planned to document if the Pacific lamprey continue to use new areas over time, officials said.

“All lamprey need is a chance to recolonize on their own,” Luke said.

Terrestrial and Aquatic Resources (From Laura Wallace's Thesis, 2009, "Condit Dam Removal: a decision-making comparison with removal of Elwha River Dams", pages 38-39)

The White Salmon River watershed supports a wide variety of terrestrial wildlife species native to the area. Mammals found in the area include black-tailed deer (Odocoileus hemionus), beaver (Castor canadensis), mink (Mustela vison), river otter (L. canadensis), and the western grey squirrel (Sciurus griscus) which is listed as "threatened" under the Washington State Endangered Species Act (FERC 1996, 3-39 – 3-40). Several bird species found in the Project area include the bald eagle (H. leucocephalus), pileated woodpecker (Dryocopus pileatus), Vaux's swift (Chaetura vauxi), tern species (Podicipedidae spp.), great blue heron (Ardea herodias), and osprey (Pandion haliaetus) (FERC 1996, F- 3; PacifiCorp 2009, 23-25).

While the dam was still in place, fish species diversity was decidedly greater in the river below the dam than it was in Northwestern Lake and further upstream. A total of 16 species have been found downstream of the dam, including spring and fall Chinook (king) salmon (Oncorhynchus tshawytsch), Coho (silver) salmon (O. kisutch), winter and summer steelhead (O. mykiss), and bull trout (Salvelinus confluentus). Upstream of the dam were significantly fewer species. These included cutthroat trout (O. clarkii), rainbow trout (O. mykiss), non-native brook trout (S. fontinalis), and sculpin (Cottus bairdii) (Rawding 2000, 5). Endangered species include several subspecies of lower Columbia River Chinook salmon (O. tshawytscha), middle Columbia steelhead (O. mykiss), lower Columbia coho salmon (O. keta), Columbia bull trout (S. confluentus), and others (Wellner 2007; Silver, Hudson, and Whitesel 2011). A list of salmon and steelhead species of concern may be found summarized in the table below (Table 3.1).

Salmon and Condit Dam

Before the dam's placement, the White Salmon River supported large populations of wild fish. This natural resource was so abundant that the river was able to support two native fishing villages (Becker 2006). Due to the absence of any kind of fish passage at the dam, however, one hundred years later most of the river's wild salmon runs are endangered, and its spring Chinook salmon population is already extinct, "due in large part to Condit Dam" (Bonham 1999, 2). In an attempt to mitigate the impact of the dam on the White Salmon River's native fish stocks, the U.S. Fish and Wildlife Service installed a fish hatchery for spring Chinook salmon nearby. While it operated with some success, it has not resulted in self-sustaining populations, at least when the dam was still in place (Haring 2003). Now that the dam has been removed, this is expected to change. Salmon now have 14 miles of river habitat restored to them, and steelhead are reconnected to 33 miles of their original habitat. The hope is that this will result in the restoration of pre-dam abundance and diversity (Wellner 2007; Susewind 2010).

White Salmon Technical Working Group

Adult Tule Fall Chinook Capture & Transport above Condit Dam, Fall 2011

ESA-listed ("Threatened") tule fall Chinook salmon return to the White Salmon River in September and October and spawn naturally in the lower river downstream of Condit Dam.

A large sediment event will occur during the breach of Condit and draining of Northwestern Reservoir in late October 2011, immediately after tule fall Chinook spawning, and other elevated sediment delivery is possible periodically throughout the winter during weather events. These events could scour out or bury Chinook salmon eggs deposited in the lower White Salmon River.

To prevent loss of these salmon offspring, adult tule salmon were captured in two ways:

1) by seining (corralling with a long net) just downstream of the first spawning area and
2) by blocking their upstream passage with a channel-spanning weir across the river, and detouring them into a set of raceways belonging to the USFWS at approx. river mile 1 in the lower river.

Fish were then transported by a special water tanker truck above Condit Dam and released at 3 locations between Husum and Northwestern Reservoir. "Seeding" the river upstream of the dam with spawning fish will ensure that tule fall Chinook salmon will avoid sediment impacts from dam removal, allowing them to rear naturally and outmigrate to the ocean in late spring 2012.

Approximately 675 tule fall Chinook have already been relocated from downstream of the dam to the available habitat upstream of the dam. Large numbers of redds (nests of salmon eggs) have already been documented.

Condit Dam Decommissioning

Newsletter | Spring/Summer 2012

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A Busy Winter at Condit Dam Site

The winter of 2012 was a busy one at the Condit Dam site. A century after the initial construction began on the dam, its removal has begun in earnest. Winter and spring rains moved sediment downstream toward the Columbia River and slope stabilization work began to reshape the banks of the White Salmon River where Northwestern Lake once resided. For safety, signs are posted along unstable banks and near construction sites to warn the public to steer clear of these areas.

Decommissioning work continued throughout the winter at Condit Dam.

Structural Removal of the Dam and Facilities Moves Forward

Removal of the dam structure and associated facilities began in January. The wooden flow line was dismantled and crews operating heavy machinery, such as hydraulic hammers, began breaking up the face of the concrete dam. The treated-wood remains of the flow line are being transported to the Klickitat County waste facility and concrete rubble from the dam, estimated at 34,000 cubic yards, will be spread onto the area where the flow line once was. Eventually, the area will be capped with 18 inches of soil cover and planted with native vegetation. The project is on track to have the dam completely removed by the end of August 2012.

Demolition of the dam and facilities will continue through the summer months.

What others are saying

"Right about now, juvenile fall Chinook salmon are likely outmigrating from the White Salmon River. These juveniles are the progeny of the adults we transported upstream of the dam and were not impacted by the sediment released by the dam deconstruction. I think 2012 has a lot of promise for the river continuing to re-shape, restore and re-design itself. For this summer, I plan on getting a good look at the White Salmon River from the mouth up through what was Northwestern Reservoir to see what the returning fall Chinook salmon adults might do when they arrive in September. We are busily working with partners and co-managers on the data that they'd like to collect on salmon spawning this first year post-Condit Dam deconstruction as well as developing some longer-term plans. In general, I'm just excited about what the river is going to look like... I want to go through my memories of locations in the lower river from years past and see what they look like now."

Rod Engle
Hatchery Assessment Team, U.S. Fish and Wildlife Service,
Columbia River Fisheries Program Office, Vancouver, Wash.

"We are pleased to see Condit Dam removal on track and thrilled to have access to Northwestern Park restored. It has been exciting to watch the river reclaim its former channel and we wait in anxious anticipation for the opportunity to see the rest of the river later this year."

Thomas O'Keefe
Pacific NW Stewardship Director
American Whitewater

Public safety is PacifiCorp's top priority and we ask the public to obey all signs in the construction areas.

Public Safety a Top Priority

The White Salmon River banks continue to be an evolving landscape both upstream and downstream of the dam. PacifiCorp, local law enforcement and river experts are reminding the public to obey posted signs in the area. As deconstruction work continues through the spring and summer, PacifiCorp will maintain public access closures for the dam site, the reservoir area and the canyon reach downstream of the dam during the spring and summer months of 2012. As the spring and early summer rains and snowmelt further sculpt the riverbed and river banks, PacifiCorp and state and federal authorities will regularly monitor the river as it continues its transformation to its natural state. The area from the Northwestern Lake Bridge downstream to the powerhouse remains an active construction site and an unsafe area for the public. The river downstream of the powerhouse has been reopened for fishing and is accessible except via routes posted as private property.

Repair Work at Northwestern Lake Bridge and Bank Stabilization Work Continues

Public safety also will be a high priority in the vicinity of Northwestern Lake Bridge, where additional bridge stabilization work is expected to continue through the summer. Following approval from the U.S. Army Corps of Engineers, PacifiCorp placed riprap in late December 2011 to stem the erosion of the river banks under the bridge and additional riprap was placed in late March 2012. The next phase of this work is to construct a soil nail wall at the west abutment of the Northwestern Lake Bridge to ensure its long-term stability. Soil nailing stabilizes and reinforces existing soil by grouting threaded steel bars into slopes or cuts as wall construction proceeds from the top down. The total treatment length will be approximately 220 feet centered on the bridge. The result will be a wall with a height of 37 feet at its center. Temporary access and work areas will be constructed and protected from the river by riprap. Upon completion of the soil nail wall, the riprap will be reconfigured to provide additional protection against scour at the base of the wall. PacifiCorp continues to evaluate whether additional stabilization measures are necessary for the east side of the Northwestern Lake Bridge.

Grading operations are also underway in several locations along the former reservoir to address slope stability for public safety, to prevent future erosion and prepare for hydro seeding and mulching this fall.

The grading of the riverbanks was done in the spring in preparation for fall hydro seeding.

Access to Northwestern Park

Northwestern Park remains open, but barricade fencing and signs are posted to warn the public to stay out of the former reservoir area. There also are signs posted at various points around the White Salmon River to warn boaters to take out at Northwestern Park; boater safety warning posters are located at the common boat launch locations upstream. As restoration work continues and the final riverbank contours are formed, a new whitewater boat take-out and other improvements will be completed. The access road used for construction at the Northwestern Lake Bridge also will be adapted to provide a boat take-out. During the construction work at the bridge, boaters will continue to use a boat access ramp recently established approximately 300 feet downstream of the bridge. Once the construction work is completed, the permanent boat take-out location will be available just downstream of the bridge.

Boater safety is a top priority for PacifiCorp. Please obey all signs in the river and along the banks.

Demolition of the Original Cofferdam

The decommissioning plans included demolition of the original cofferdam and diversion structures that were built just upstream of the dam during the initial construction. The cofferdam was left in place when the reservoir was filled in 1913 and remained well preserved underwater. To complete the demolition, an access road was built from the location of the former boat ramp on the east bank near the dam.

The cofferdam was tied to a rock outcrop and about 250 cubic yards of rock were removed from the top to provide a work platform for the demolition. The river level in the area upstream of the cofferdam dropped approximately 10 feet upon its removal in late April.

The old cofferdam was removed ahead of schedule on April 24, 2012 and the White Salmon River is flowing unobstructed for the first time in 100 years.

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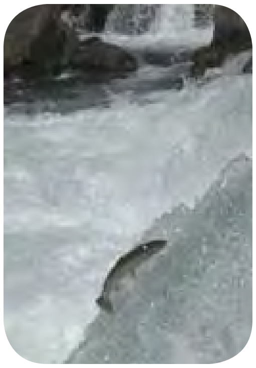
Pacific Power
Rocky Mountain Power



New spawning and rearing grounds are now open for steelhead and salmon in the White Salmon basin.

An Active Watercourse

The White Salmon River, corralled by the Condit Dam for 100 years, is returning to its natural course after the breaching event last October and is clearly responding by re-establishing its form and function within the formally submerged canyon. One of the major questions surrounding the decommissioning of the Condit Dam was the uncertainty of how the surrounding land and banks of the former reservoir would reshape themselves once the sediment moved downstream. Erosion and slope instability are causing PacifiCorp to work closely with a few cabin owners on safety matters. PacifiCorp also has been working with cabin and well owners in the area regarding well issues that have surfaced since the reservoir draining. The sediment that has moved downriver to the confluence of the Columbia River to date constitutes about two-thirds of what had built up in the reservoir during Condit Dam's lifetime. A significant amount of sediment remains at the boat ramp located at the Underwood In-Lieu site, owned by the Bureau of Indian Affairs, near the confluence of the river. This sediment has made the former boat ramp unusable; restoration of the site is under development.

PacifiCorp continues to work with the U.S. Coast Guard to regularly monitor activity at the mouth of the river.

PacifiCorp is also maintaining a buoy to warn boaters of the delta at the mouth of the White Salmon River and communicating with the U.S.Coast Guard and the Army Corps of Engineers regarding the conditions at the delta. As the spring and early summer runoff flows begin on the Columbia River, the delta has started to erode.

About PacifiCorp

PacifiCorp is one of the lowest-cost electricity producers in the United States, providing approximately 1.7 million customers in the West with reliable, efficient energy. PacifiCorp operates as Pacific Power in Oregon, Washington and California, and as Rocky Mountain Power in Utah, Wyoming and Idaho. PacifiCorp's electric generation, commercial and energy trading, and mining functions are operated as PacifiCorp Energy.

If you have comments or questions please call 1-503-331-4361, email us at condit.decommissioning@pacificorp.com or visit our website at pacificorp.com/condit

Date	Key Decommissioning Activities
January 2012 – Present	Demolition of Condit Dam and facilities continues
April 24, 2012	Cofferdam removed from White Salmon River
Spring/Summer 2012	Regrading of river banks
August 2012	Repairs at Northwestern Lake Bridge completed
August 2012	Boat launch modifications completed at Northwestern Park
End of August 2012	Condit Dam completely removed from White Salmon River
September 2012	White Salmon River within former project area open to boaters
September 2012	Hydro seeding of river banks
October 2012	Project completion

How Dams Harm Rivers (from AmericanRivers.Org)

Over the past 100 years, the United States led the world in dam building. We blocked and harnessed rivers for a variety of purposes. Those purposes include hydropower, irrigation, flood control and water storage.

The U.S. Army Corps of Engineers has catalogued at least 90,000 dams greater than six-feet tall that are blocking our rivers and streams. There are tens of thousands of additional small dams that fall through the cracks of our national inventory.

While dams can benefit society, they also cause considerable harm to rivers. Dams have depleted fisheries, degraded river ecosystems, and altered recreational opportunities on nearly all of our nation's rivers.

Today, many dams that were once at the epicenter of a community's livelihood are now old, unsafe or no longer serving their intended purposes. Although not all dams damage rivers in exactly the same way, here are some of the most common ways they inflict harm.

FOUR WAYS DAMS DAMAGE RIVERS

1. DAMS BLOCK RIVERS

Dams prevent fish migration. This limits their ability to access spawning habitat, seek out food resources, and escape predation. Fish passage structures can enable a percentage of fish to pass around a dam, but their effectiveness decreases depending on the species of fish and the number of dams fish have to traverse.

2. DAMS SLOW RIVERS

Aquatic organisms, including fish such as salmon and river herring, depend on steady flows to guide them.

Stagnant reservoir pools disorient migrating fish and can significantly increase the duration of their migration.

Dams can also alter the timing of flows. Some hydropower dams, for example, withhold and then release water to generate power for peak demand periods.

These irregular releases destroy natural seasonal flow variations that trigger natural growth and reproduction cycles in many species.

3. DAMS ALTER HABITAT

Dams change the way rivers function. They can trap sediment, burying rock riverbeds where fish spawn.

Gravel, logs, and other important food and habitat features can also become trapped behind dams. This negatively affects the creation and maintenance of more complex habitat (e.g., riffles, pools) downstream.

Dams that divert water for power and other uses also remove water needed for healthy in-stream ecosystems. Peaking power operations can cause dramatic changes in reservoir water levels. This can leave stretches below dams completely de-watered.

4. DAMS IMPACT WATER QUALITY

Slow-moving or still reservoirs can heat up, resulting in abnormal temperature fluctuations which can affect sensitive species. This can lead to algal blooms and decreased oxygen levels.

Other dams decrease temperatures by releasing cooled, oxygen-deprived water from the reservoir bottom

Dam Removal

Few things have such a fundamental impact on a river as a dam or culvert. River restoration brings rivers back to life by removing dams, replacing culverts, and restoring floodplains. We manage projects, train others, and work on state/federal policies to improve the practice of river restoration.

DID YOU KNOW

90,000

Estimated number of dams in the U.S.

72

Dams removed in 2016

REMOVING DAMS

210 feet tall

Largest dam removed

1,384

Dams removed since 1912

Few things have such a fundamental impact on a river as a dam. Dams block the movement of fish and other aquatic species, inundate river habitat, impair water quality, and alter the flow regime necessary to sustain river life. As dams age and decay, they can also become public safety hazards, presenting a failure risk and a dangerous nuisance.

Many, perhaps most, of the more than 90,000 dams in the country are no longer serving the purpose that they were built to provide decades or centuries ago.

There is no faster or effective way to bring a river back to life than removing a dam. American Rivers leads the nation in restoring rivers through dam removal.

American Rivers has directly worked on more than 200 dam removals and helped many other projects by assisting government agencies and nonprofits to expand their capacity to restore rivers through trainings and focused program assistance.

REPLACING CULVERTS

Stream crossings, where roads and railroads cross rivers and streams, are frequently unseen barriers to the movement of fish and other species. The most common culprits are culverts, pipes that serve as conduits for rivers under roads and railroads.

Culverts often become barriers because they are perched above the riverbed, or they have flow that is too shallow or too swift for fish movement. American Rivers focuses on policy efforts to improve culvert installation and replacement across the country.

RESTORING FLOODPLAINS AND MEADOWS

Floodplains are the lands adjacent to a river that become regularly flooded during high river flows. As a result of this periodic flooding, floodplains are among the most biodiverse and productive lands on the planet. Floodplains also reduce downstream flooding, filter excessive nutrients, and replenish groundwater. Healthy mountain meadows function similarly, reducing peak floods, storing water, and improving water quality and groundwater recharge.

Unfortunately, connected floodplains and healthy meadows are scarce throughout the country, and the benefits they could provide are rarely provided. American Rivers is leading a national effort to reconnect rivers to their floodplains and restore healthy meadows through our advocacy, partnership-building, and project management.

Environmental Case Study

Why Trees Need Salmon

Ecologists have long known that salmon need clean, fast-moving streams to breed, and that clear streams need healthy forests. Surprising new evidence now indicates that some forests themselves need salmon to remain healthy, and that bears play an important intermediary role in this dynamic relationship.

The yearly return of salmon from the open Pacific Ocean to coastal waters of western North America is one of nature's grand displays. Salmon (*Onchorhyncus* sp.) are anadromous: They hatch in freshwater lakes and streams, spend most of their lives at sea, then return to the stream where they were born, to breed and die. To reproduce successfully, these fish require clear, cold, shaded streams and clean gravel riverbeds. If forests are stripped from riverbanks and surrounding hillsides, sediment washes down into streams, clogging gravel beds and suffocating eggs. Open to the sunlight, the water warms, lowering its oxygen levels, and reducing survival rates of eggs and young fish.

Every year, as millions of fish return to spawn and die in rivers of the Pacific Northwest, they provide a bonanza for bears, eagles, and other species. Ecologist Tom Reimchen estimates that each bear fishing in British Columbia's rivers catches about 700 fish during the 45-day spawn, and that 70 percent of the bear's annual protein comes from salmon. After a quick bite on the head to kill the fish, the bears drag their prey back into the forest, where they can feed undisturbed. Some bears have been observed carrying fish as much as 800 m (0.5 mi) from the river before feeding on them.

Bears don't eat everything they catch. They leave about half of each carcass to be scavenged by eagles, martens, crows, ravens and gulls. A diversity of insects, including flies and beetles, also feed on the leftovers. Within a week, all the soft tissue is consumed, leaving only a bony skeleton. Reimchen calculates that between the nutrients leeching directly from decomposing carcasses and the excreta from bears and other scavengers, the fish provide about 120 kg of nitrogen per hectare of forest along salmon-spawning rivers. This is comparable to the rate of fertilizer applied by industry to commercial forest plantations. Altogether, British Columbia's 80,000 to 120,000 brown and black bears could be transferring 60 million kg of salmon tissue into the rainforest every year.

How do ecologists know that trees absorb nitrogen from salmon? Analyzing different kinds of nitrogen atoms, researchers can distinguish between marine-derived nitrogen (MDN) and that from terrestrial sources. Marine phytoplankton (tiny floating plant cells) have more of a rare, heavy form of nitrogen called 15N compared to most terrestrial vegetation, in which 14N, the more common, lighter form, predominates. Using a machine called a mass spectrometer, researchers can separate and measure the kinds and amounts of nitrogen in different tissues. We'll discuss different forms of atoms (called isotopes) later in this chapter. Because salmon spend most of their lives feeding on dense clouds of plankton far out to sea, they have higher ratio of 15N/14N in their bodies than do most freshwater or terrestrial organisms. When the fish die and decompose, they contribute their nitrogen to the ecosystem. Bears and other scavengers distribute this nitrogen throughout the forest where they drop fish carcasses or defecate in the woods.

Robert Naiman and James Helfield from the University of Washington found that foliage of spruce trees growing in bear-impacted areas is significantly enriched with MDN relative to similar trees growing at comparable distances from streams with and without spawning salmon. These results suggest that in feeding on salmon, bears play an important role in transferring MDN from the stream to the riparian (streamside) forest. Nitrogen is often a limiting nutrient for rainforest vegetation. Tree ring studies show that when salmon are abundant, trees grow up to three times as fast as when salmon are scarce. For some streamside trees, researchers estimate that between one-quarter to one-half of all their nitrogen is derived from salmon. Not only do salmon replenish the forest, but they also vitalize the streams and lakes

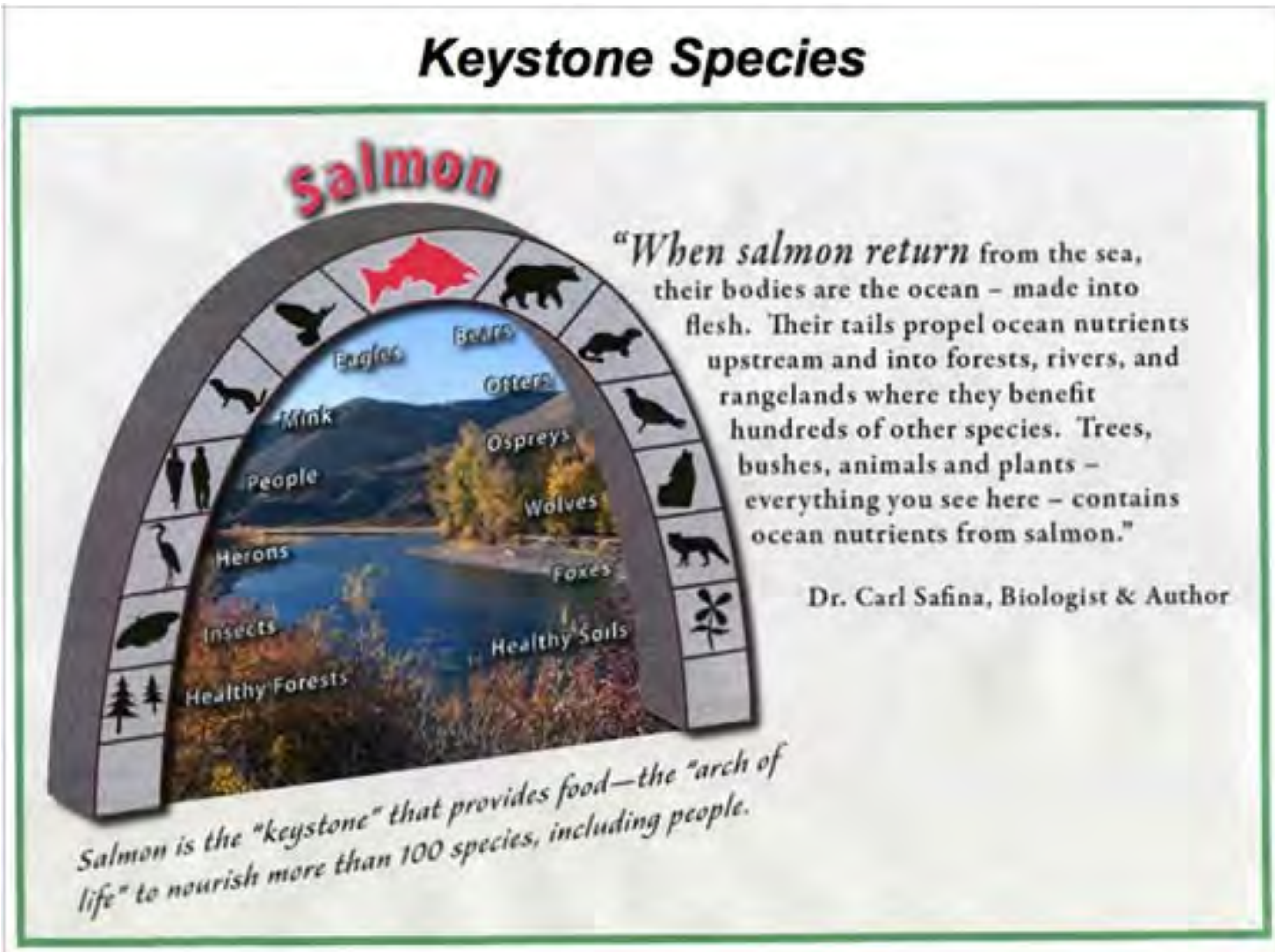
Environmental Case Study
Why Trees Need Salmon

with carbon, nitrogen, phosphorous, and micronutrients. Nearly 50 percent of the nutrients that juvenile salmon consume comes from dead parents.

This research is important because salmon stocks are dwindling throughout the Pacific Northwest. In Washington, Oregon, and California, most salmon populations have fallen by 90 percent from their historic numbers, and some stocks are now extinct. Because of the close relationship of salmon and the trees, biologists argue, forest, wildlife, and fish management need to be integrated. Each population—rainforest trees, bears, hatchlings, and ocean-going fish—affects the stability of the others. Salmon need healthy forests and streams to reproduce successfully, and forests and bears need abundant salmon. Stream ecosystems need standing trees to retain soil and provide shade. So healthy streams depend on fish, just as the fish depend on the streams. As this case shows, the flow of nutrients and energy between organisms can be intricate and complex. Relationships between apparently separate environments, such as rivers and forests, can be equally complex and important.

For more information, see

Helfield, J. M., and R. J. Naiman. 2001. Effects of salmon-derived nitrogen on riparian forest growth and implications for stream productivity. *Ecology* 82(9):2403–9.
Reimchen, T., et al. 2003. Isotopic evidence for enrichment of salmon-derived nutrients in vegetation, soil and insects in riparian zones in coastal British Columbia. *American Fisheries Society Symposium* 34:59–69.


Keystone Species
Salmon
Eagles
Bears
Otters
Mink
Ospreys
People
Wolves
Herons
Foxes
Insects
Healthy Soils
Healthy Forests
"When salmon return from the sea, their bodies are the ocean – made into flesh. Their tails propel ocean nutrients upstream and into forests, rivers, and rangelands where they benefit hundreds of other species. Trees, bushes, animals and plants – everything you see here – contains ocean nutrients from salmon."
Dr. Carl Safina, Biologist & Author
Salmon is the "keystone" that provides food—the "arch of life" to nourish more than 100 species, including people.

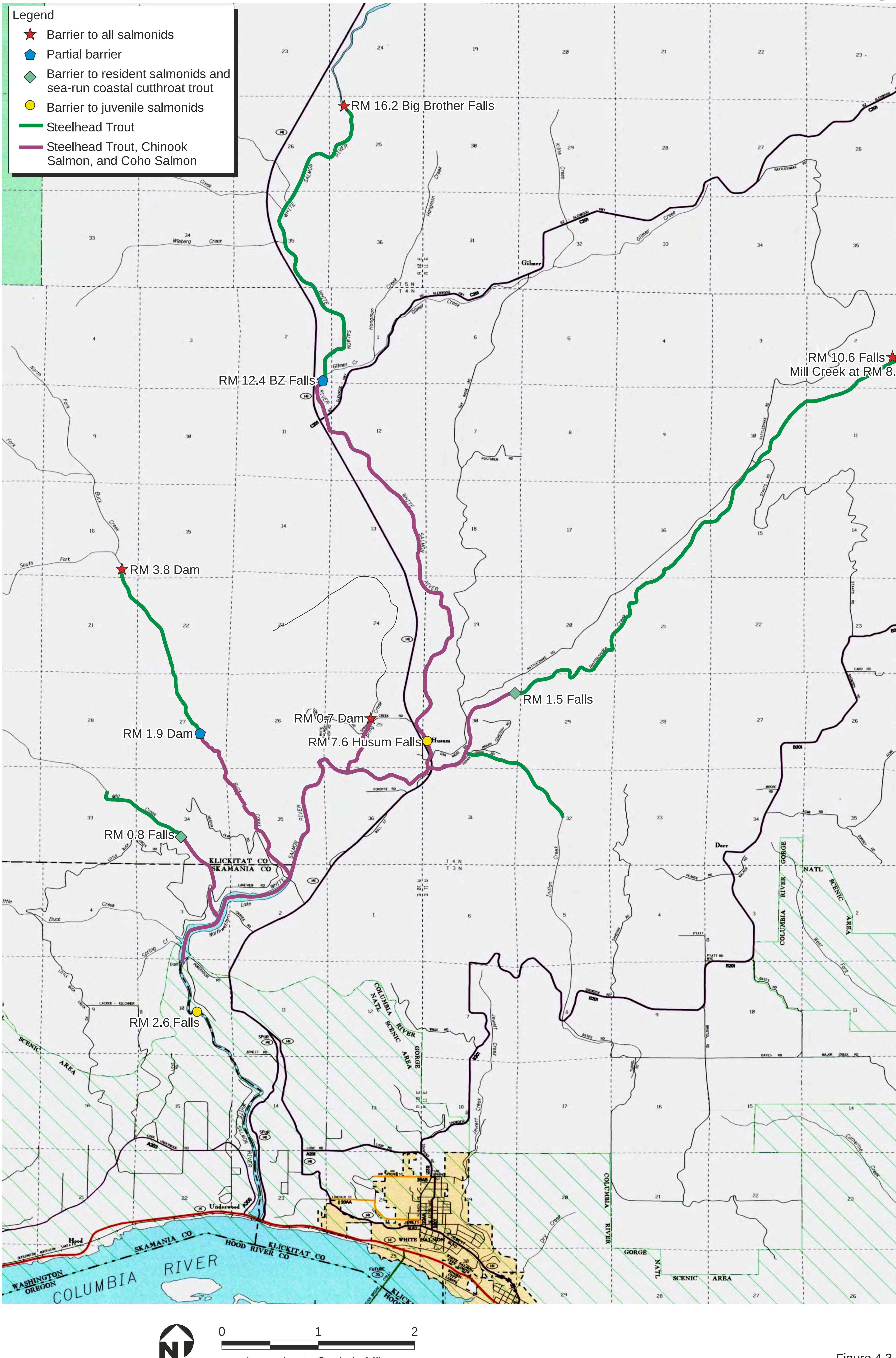
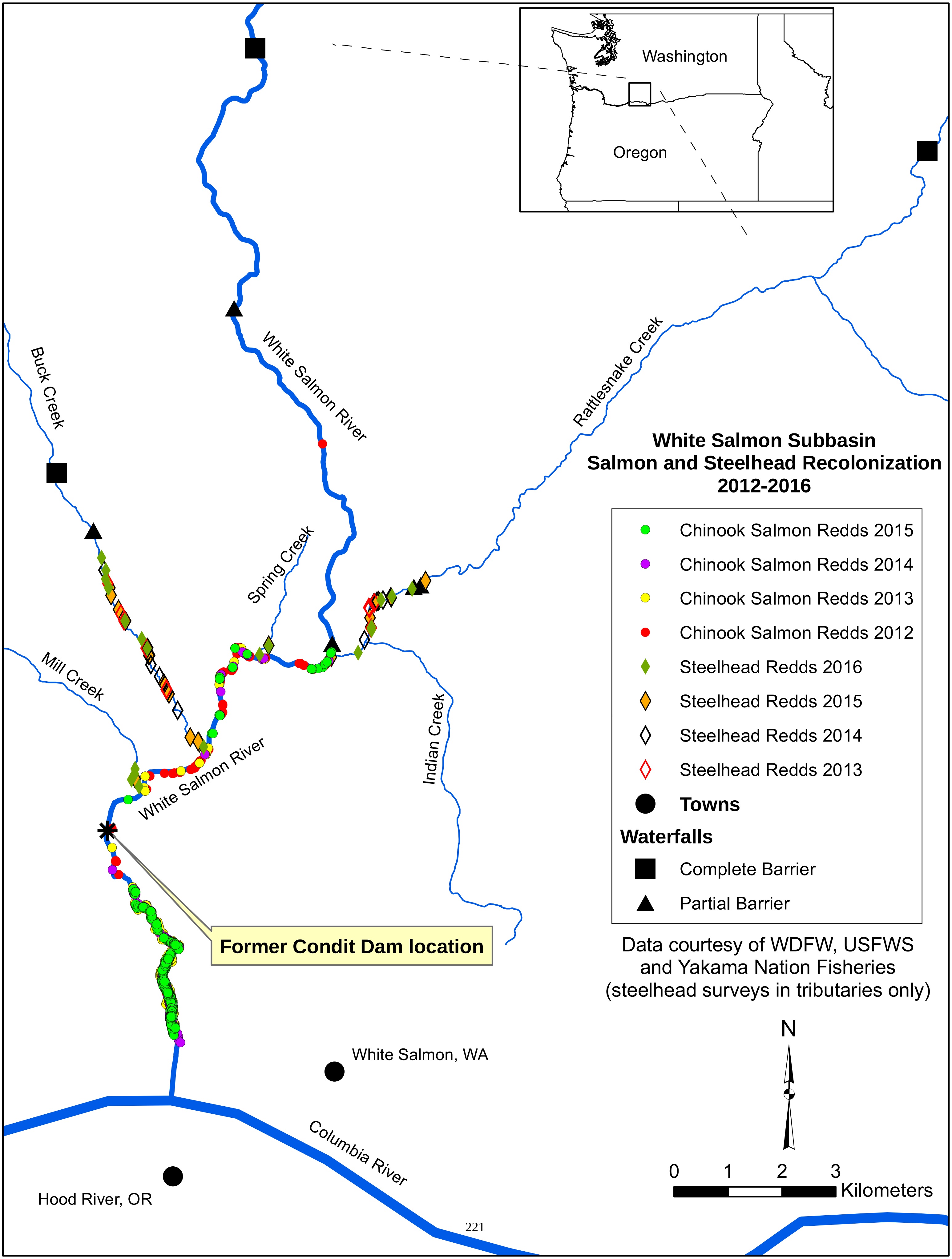


Figure 4.3-3
Potentially Accessible Anadromous Salmonid Habitat Above Condit Dam

Job No. 33757695

URS

Condit Dam Removal Project
White Salmon, Washington


White Salmon Subbasin
Salmon and Steelhead Recolonization
2012-2016
Chinook Salmon Redds 2015
Chinook Salmon Redds 2014
Chinook Salmon Redds 2013
Chinook Salmon Redds 2012
Steelhead Redds 2016
Steelhead Redds 2015
Steelhead Redds 2014
Steelhead Redds 2013
Towns
Waterfalls
Complete Barrier
Partial Barrier
Data courtesy of WDFW, USFWS
and Yakama Nation Fisheries
(steelhead surveys in tributaries only)
Washington
Oregon
Buck Creek
White Salmon River
Rattlesnake Creek
Spring Creek
Mill Creek
Indian Creek
Former Condit Dam location
White Salmon, WA
Hood River, OR
Columbia River
N
0
1
2
3
Kilometers

Resources For Condit Dam Lesson Plans

- ❑ Condit Dam History Jigsaw Grades 6-8 & 9-12
  - ❑ Decommissioning Process
    - ❑ History of Condit document
    - ❑ Access Restored to White Salmon River PacifiCorp article
    - ❑ Condit Dam Breach PacifiCorp article
    - ❑ Condit FAQ document
    - ❑ PacifiCorp Condit Info document
    - ❑ PacifiCorp newsletter Condit Summer 2012
    - ❑ Condit Settlement & Decommissioning Overview document
    - ❑ Condit Dam History and Decommissioning document
    - ❑ Condit Decommissioning Overview document

Timeline of Events: Condit Dam (Excerpt from Laura Wallace Thesis):

In 2010, Washington waterways contained 763 dams, over 60 of which measured more than 100 feet (30.5 m) in height. Before being dismantled, the Condit Dam was one of these, measuring 125 feet (38.1 m) high and 471 feet (143.6 m) long (FERC 1996, 2-4; Becker 2006, 3; Army Corps of Engineers 2010). Condit Dam was built on the White Salmon River, a tributary of the Columbia River, in southern Washington in 1913 by the Northwestern Power Company (Figure 3.14, Figure 3.15, and Figure 3.16). It provided power to a local paper mill—Crown Columbia Paper Mill in Camas, Washington—and was "to anticipate the energy needs of a growing regional population," selling any surplus energy to other users in the Northwest (Becker 2006, 3; see also Bonham 1999). Originally, fish ladders were installed, but they were washed out by floods in 1914 and 1918. After the second failure, the Northwest Electric Company (the dam owner which later became PacifiCorp Electric) was obliged by the Washington State Fisheries Department to help construct a fish hatchery in order to mitigate the loss of fish passage. Efforts to provide fish passage around the dam were eventually abandoned after experiments with a fish elevator failed to be effective (Haring 2003; PacifiCorp 2011).

Nearly fifty years later, in 1963, then-owner of Condit Dam, Pacific Power and Light Company (now PacifiCorp) applied to the Federal Power Commission (now FERC) for a license of operation for the 14.7-megawatt (MW) Condit Dam, pursuant to section 15 of the Federal Power Act (FPA). On December 31, 1968, the Pacific Power and Light Company (PPL) was granted their license, effective retroactively on May 1, 1965, and set to expire nearly 30 years later on December 31, 1993.

In 1980, PPL was ordered by FERC, in accordance with their 1968 license, to conduct a study investigating various options for installing some form of fish passage at the dam. After doing so, the company chose the trap-and-haul method as their preferred fish passage alternative, at the same time calling into question the cost effectiveness of restoration and the quality and quantity of the upstream habitat. PPL expressed concern about how returning salmon to this part of the river would affect the resident trout population (a factor in the "scenic" designation of the reach upstream of Northwestern Lake to Gilmer Creek under Section 10 of the Wild and Scenic River Act) (FERC 1996; Bonham 1999). Desiring more to be done on behalf of the salmon, in their Columbia River Basin Fish and Wildlife Plan of 1982, the Northwest Power Planning Council called for FERC to require PPL to construct fish passage facilities by November 15, 1985. The Plan's instructions to install fish passage were never acted upon (Becker 2006).

In December 1991 PacifiCorp applied to FERC to renew the Condit Dam license without including the installation of fish passage among the list of proposed improvements to the hydroelectric project, though increased capacity and generation were requested (FERC 1996; Bonham 1999; Becker 2006). Around this time, seeing an opportunity to restore connectivity to the White Salmon River and encourage the growth of native salmon fisheries, the group of organizations supporting dam removal—known in legal documents as the Intervenors—petitioned FERC to require fish passage structures to be installed or for the Condit Dam to be removed entirely (Settlement Agreement 1999).

In both the DEIS and FEIS (1995 and 1996, respectively), FERC echoed this, stating and restating that, while PacifiCorp did not have to decommission and remove the dam, fish passage facilities were a requirement (FERC 1996; PacifiCorp

The Northwest Power Planning Council was formed in 1981 by the Pacific Northwest Power Planning and Conservation Act of 1980 to act as "an interstate policy-making and planning body for electrical power development and fish and wildlife resource protection in the Columbia Basin" (Bonham 1999, 6).

1999; Bonham 1999; Wellner 2007; FERC 2010; PacifiCorp 2011). PacifiCorp protested that FERC's preferred alternative, at an estimated $33 million in deconstruction costs, was "uneconomic" (Settlement Agreement 1999, 2). Certainly, project retirement with dam removal appeared even less appealing at an estimated cost of nearly $60 million (1996 dollars). The table below lists the estimated construction/demolition costs of each fish passage alternative according to FERC's 1996 analysis, including PacifiCorp's original proposal of continuing operations without fish passage (Table 3.2; FERC 1996).

Alternative & Construction/Demolition Cost (1996 $)
PacifiCorp's proposal (no fish passage) $9.391M
PacifiCorp's proposal with modifications $33.409M
Project retirement with dam removal $58.796M
Partial dam removal with upstream diversion $67.066M
No-action alternative $0M

Table 3.2. Estimated capital costs of relicensing alternatives (FERC 1996, p. 2-24)

Seeking a more affordable option, PacifiCorp eventually agreed to begin negotiations to discuss the feasibility of dam removal as a solution. The process lasted from 1997 to 1999. In January 1997, PacifiCorp filed a request for the temporary suspension of relicensing proceedings with FERC in order to take the time to review dam removal alternatives with Intervenors. By March of the same year, PacifiCorp joined with the Yakama Nation and the Columbia River Intertribal Fisheries Commission (CRITFC) in hiring an independent engineering firm as a consultant to perform a separate cost estimate and to explore what it would take to engineer such a project. Two years, an additional engineering report (prepared by R.W. Beck with assistance from a firm hired by American Rivers), and two requests for the postponement of relicensing proceedings later, PacifiCorp and the Intervenors (together, “the Parties” to the legal agreement) had put together a comprehensive plan to retire and remove Condit Dam entitled “Condit Hydroelectric Project Settlement Agreement” (1999 Settlement Agreement).

FERC issued a declaratory order in December 2001 and a clarification order in 2002 which stated that FERC considered the 1999 Settlement Agreement to be an application to surrender PacifiCorp’s Condit Dam license with “a future effectiveness date” (FERC 2010, 1; see also Becker 2006; Wellner 2007).

Also in 2002, PacifiCorp asked FERC to keep the relicense application in reserve in case the company couldn’t meet the legal and administrative requirements of dam removal (e.g., permitting and construction contracts) or if a court or administrative order were to prevent PacifiCorp from implementing the requirements of the settlement, removal plan, or surrender order by December 31, 2005. FERC denied this request, saying that even in the event that costs were unexpectedly high, they would not replace their license surrender proposal with their relicense application (FERC 2010). As it turned out, PacifiCorp was able to continue dam operations until October 1, 2011, through annual licenses which, FERC reasoned, gave “PacifiCorp considerable time to fund removal costs...and otherwise resolve many of the permitting and cost contingencies on which the surrender proposal might depend” (FERC 2010, 15, 67).

The 1999 Settlement Agreement originally listed October 2006 as the official date of deconstruction, but this would be delayed annually until 2010, when FERC accepted their Agreement (FERC 2010). The permitting process, particularly requirements under Section 401(a)(1) of the Clean Water Act for obtaining state water quality certification for the project, is what caused the long delay. PacifiCorp initially applied for water quality certification on June 15, 2001, and simultaneously withdrew and re-submitted their application each year when Ecology rejected their application as insufficient. Their application for Section 401 water quality certification was finally accepted on October 12, 2010 (Susewind 2010, 1; FERC 2010, 14). In the interim, FERC published its Final Supplemental Final Environmental Impact Statement (FS FEIS) in June of 2002. The Washington State Department of Ecology also published its Final State Environmental Protection Act (SEPA) Supplemental Environmental Impact Statement (FSEIS) in 2007 addressing a few additional considerations required by the SEPA (e.g., sedimentation and turbidity in the White Salmon and Columbia Rivers, impacts on fish, and impacts on surrounding land use) (Wellner 2007). FERC accepted PacifiCorp’s application to surrender its operating license in 2010, and demolition on Condit Dam began in October 2011. Deconstruction was completed one year later on September 15, 2012 (Florip 2012) (Figure 3.17. Northwestern Lake draining following Condit Dam removal, October 30, 2011 (photo courtesy of Wayne Lease).).

Access Restored to White Salmon River After PacifiCorp's Safe, Successful Condit Dam Removal

SOURCE: PacifiCorp Website, http://www.pacificorp.com/about/newsroom/2012nrl/artwsrapsscdr.html

November 05, 2012

WHITE SALMON, Wash. – A year after a dynamite blast punched a hole in the Condit Dam, the last remnants of the structure are gone and access restrictions on the White Salmon River are now lifted downstream of Northwestern Park. Caution is still advised as the rapids on the lower river are significant.

"This has been a long journey for PacifiCorp and the partners in the settlement agreement that led to the Condit Dam removal," said Todd Olson, program manager for PacifiCorp. "Work still remains in restoring area vegetation and demobilizing equipment from the work area, but this has been a very successful project. No one from the public has been hurt, and there have been no lost-time injuries among our contractors during more than 64,000 hours worked on the project. We want to especially thank the local community for understanding that access restrictions have been necessary to assure safety, and for abiding by them."

The last pieces of the dam came out in September. Just last week, PacifiCorp's Vancouver, Wash.-based contractor, J.R. Merit, completed removal of a large logjam that would have significantly blocked boats drifting the river. Experienced guides from the local rafting community have inspected the river from the Northwestern Lake Road Bridge to the White Salmon's confluence with the Columbia River and confirmed that major obstacles are gone, though some rapids in the area are for experts only.

"The restoration of a free-flowing river is an exciting event for the whitewater boating community," said Thomas O'Keefe, Pacific Northwest stewardship director for American Whitewater. "Paddling the restored reach will be a treasured, yet challenging, experience for many. Downstream from the stretch of river near Northwestern Park, the river enters the White Salmon Narrows, a dramatic canyon guarded by a rapid with powerful hydraulics that only expert paddlers should attempt to navigate."

Some access restrictions will remain along the river banks, where signs will identify areas recently planted with native vegetation. Also, O'Keefe reminded water enthusiasts to respect the privacy and property of cabin owners in the area. Do not park on cabin access roads or traverse through cabin areas. River access should be only at the public access point at Northwestern Park.

Settlement parties to the Condit Dam removal agreement originally signed in 1999 include: American Rivers, American Whitewater, Columbia Gorge Audubon Society, Columbia Gorge Coalition, Columbia River United, Federation of Fly Fishers, Friends of the Columbia Gorge,

Access Restored to White Salmon River After PacifiCorp's Safe, Successful Condit Dam Removal

SOURCE: PacifiCorp Website, http://www.pacificorp.com/about/newsroom/2012nrl/artwsrapsscdr.html

Friends of the Earth, Friends of the White Salmon, The Mountaineers, Rivers Council of Washington, The Sierra Club, Trout Unlimited, Washington Trout, Washington Wilderness Coalition, the Columbia River Inter-Tribal Fish Commission, the Yakama Nation, the U.S. Forest Service, the U.S. Department of the Interior, the National Marine Fisheries Service, the Washington Department of Ecology, the Washington Department of Fish and Wildlife and PacifiCorp.

Facts about the Condit Dam removal

- The project was located approximately 3.3 miles upstream from the confluence of the White Salmon and Columbia rivers. The dam was a **125-foot high, 471-foot long** concrete gravity diversion dam, with an intake structure that directed water into a 13.5-foot diameter by 5,100-foot long wood stave flow line. Approximately 30,000 cubic yards of material were removed in the decommissioning work.
- Removal opened approximately 3**3 miles of new spawning and rearing grounds for steelhead and 14 miles for salmon** in the White Salmon River basin. In the summer of 2011, fish biologists moved more than 500 salmon upstream of the dam, which spawned in their new habitat that fall and then descended the White Salmon River unimpeded by the dam.

Condit Dam Breach Marks New Turn in River's Future

Source: PacifiCorp Website - http://www.pacificorp.com/about/newsroom/2011nrl/cdbmntirf.html

October 26, 2011; WHITE SALMON, Wash. – After nearly a century of producing electricity for PacifiCorp customers, the White Salmon River in south central Washington is again running unimpeded to the Columbia River.

A muffled roar and a puff of pulverized concrete preceded a rush of water today at the dam, about three miles upstream from the White Salmon's confluence with the Columbia River. Immediately after today's 12:11 p.m. detonation, the waters of Northwestern Lake immediately began pouring through a tunnel created in the dam's 90-foot wide base during August and September. PacifiCorp and prime contractor JR Merit of Vancouver, Wash., along with the detonation crew from Kiewit Infrastructure West, also of Vancouver, surveyed the blast zone, took readings from sensing devices on the dam and flew over the area in a helicopter before declaring the breach event a success and the remaining structure safe.

"Condit has served our customers very well for nearly a century," said Micheal Dunn, president and chief executive officer of PacifiCorp Energy, which operates 46 hydroelectric facilities in the West. "We are sad to lose this emission-free source of power. But we made a decision to work with our settlement partners to come to the most reasonable solution for everyone involved, especially the cost to our customers. For the next 11 months, we will proceed with the safe dismantling of the dam structure and work toward restoring the natural streambed of the area."

Dam removal was determined to be less costly to PacifiCorp customers than the fish passage that would be required for dam operation to be granted under a new federal hydroelectric power license. The cost of decommissioning and removing Condit is currently estimated at about $33 million, including funds already spent during the planning process over the 12 years since the settlement was originally announced.

About 150 representatives of the settlement parties, contractors and local leaders gathered a safe distance away from the dam to watch a live webcast of the final blast. The gathering also was used to acknowledge the efforts of all parties to the decommissioning settlement agreement. "Getting to this point took a long time and a focused work effort," said Todd Olson, program manager for PacifiCorp Energy. "Many people have worked to get the project to this point and PacifiCorp recognizes their contribution."

Demolition of the remaining portion of the dam is scheduled to begin in spring 2012 and be completed by Aug. 31, 2012. Restoration work throughout the former reservoir area is planned to be completed by the end of 2012.
Throughout this restoration, the former reservoir area and project area will remain closed to the public. PacifiCorp will continue to work closely with county officials and local residents on access restrictions and other safety measures as the project progresses.

Condit Dam Breach Marks New Turn in River's Future

Source: PacifiCorp Website - http://www.pacificorp.com/about/newsroom/2011nrl/cdbmntirf.html

"Our focus at all times is on safety," said Dale Kuykendall, project manager, JR Merit. "The public needs to understand that the former reservoir and the mile-long stretch of river below the dam is an active work zone and they should refrain from trying to access the area."

About PacifiCorp

PacifiCorp is one of the lowest-cost electricity producers in the United States, serving more than 1.7 million customers in the West. PacifiCorp operates as Pacific Power in Oregon, Washington and California, and as Rocky Mountain Power in Utah, Wyoming and Idaho. With a generating capability of more than 10,620 megawatts from coal, hydro, gas-fired combustion turbines and renewable wind and geothermal power, the company works to meet growing energy demand while protecting and enhancing the environment.

Facts about Condit breach

- The project is located approximately 3.3 miles upstream from the confluence of the White Salmon and Columbia Rivers. Project facilities consist of a 125-foot high, 471-foot long concrete gravity diversion dam, and an intake structure that directs water into a 13.5-foot diameter by 5,100-foot long wood stave flow line.
- Removal will open approximately 33 miles of new spawning and rearing grounds for steelhead and 15 miles for salmon in the White Salmon River basin. Before the breach, fish biologists moved more than 500 salmon above the dam, which are already spawning in new habitat. The juveniles from these eggs will descend the White Salmon unimpeded by the dam.
- The powerhouse, which was permanently turned off just before the blast, contains two double horizontal Francis turbines with an installed capacity of 13.7 megawatts (enough to power about 7,000 average homes for a year). There are no plans to dismantle the powerhouse.
- The project created a reservoir, Northwestern Lake, which extended 1.8 miles upstream of the dam and covered approximately 92 acres. It is expected to drain in roughly six hours.
- In 1999, the Condit Settlement Agreement was signed by PacifiCorp and project stakeholders. The settlement agreement was amended in 2005 to extend the dates for project removal.
- Settlement parties include: American Rivers, American Whitewater, Columbia Gorge Audubon Society, Columbia Gorge Coalition, Columbia River United, Federation of Fly Fishers, Friends of the Columbia Gorge, Friends of the Earth, Friends of the White Salmon, The Mountaineers, Rivers Council of Washington, The Sierra Club, Trout Unlimited, Washington Trout, Washington Wilderness Coalition, the Columbia River Inter-Tribal Fish Commission , the Yakama Nation, the U.S. Forest Service, the U.S. Department of the Interior, the National Marine Fisheries Service, the Washington Department of Ecology, the Washington Department of Fish and Wildlife and PacifiCorp.

Condit Dam Decommissioning
Frequently Asked Questions

PacifiCorp Energy
Pacific Power
Rocky Mountain Power

What is happening at the Condit Dam and where is it located?

The Condit Dam is located on the White Salmon River in south central Washington State, in Skamania and Klickitat Counties. The dam is approximately 3.3 miles upstream from the confluence of the White Salmon and Columbia rivers, in the Columbia Gorge. The dam is scheduled for removal beginning in late August 2011.

What is the history of the Condit Dam?

The Condit Dam is an important part of PacifiCorp's history and its electricity production has powered thousands of homes for many generations. Condit was supplying renewable, emission-free and cost-effective power before any of these phrases became popular. The Condit Dam was originally constructed in 1912 – 1913 to support the Crown Willamette Paper Co. in Camas, Wash. and the growing municipal market from Washougal, Wash. to Portland, Ore.

What facilities make up the Condit Dam project and what will be removed?

The Condit Dam facilities consist of the 125-foot high, 471-foot long concrete gravity diversion dam, an intake structure that directs the water into a 13.5 foot diameter by 5,100-foot long wood-stave flowline (wooden barrel-like pipeline), and through a 40-foot diameter concrete surge tank. The flowline splits into two 9-foot diameter penstocks inside the surge tank that directs water to the turbines in the powerhouse. The dam creates the reservoir, Northwestern Lake, which extends 1.8-miles upstream of the dam and covers approximately 92 acres. All facilities, with the exception of the powerhouse, will be removed.

Why is PacifiCorp removing the Condit Dam now?

In November 1996, the Federal Energy Regulatory Commission issued a final Environmental Impact Statement that required PacifiCorp to install fish ladders and screens for a state-of-the-art fish passage system. FERC, the regulating agency charged with licensing hydroelectric dams, also required higher in-stream flows that would have reduced Condit's overall energy production. Combined, the new requirements would have rendered the longstanding project uneconomical for PacifiCorp's customers.

What is the Settlement Agreement?

PacifiCorp joined with 22 other parties to determine the future of the dam as part of a 1999 settlement negotiation regarding the federal relicensing of the project. After two years of negotiation, the participants reached an agreement to shut down power generation at a future date and remove the dam. In reaching this agreement, settlement parties balanced the short-term impacts of dam removal with the long-term gains provided by restoration of a natural river environment and a cost-effective plan for PacifiCorp's customers.

Who are the parties to the Settlement Agreement?

Settlement parties include: American Rivers, American Whitewater Association, Columbia Gorge Audubon Society, Columbia Gorge Coalition, Columbia River United, Federation of Fly Fishers, Friends of the Columbia River Gorge, Friends of the Earth, Friends of the White Salmon, The Mountaineers, Rivers Council of Washington, The Sierra Club, Trout Unlimited, Washington Trout, Washington Wilderness Coalition, the Columbia River Inter-Tribal Fish Commission, the Yakama Nation, the U.S. Forest Service, the U.S. Department of the Interior, the National Marine Fisheries Service, the Washington Department of Ecology, the Washington Department of Fish and Wildlife and PacifiCorp.

What regulatory approvals were needed to decommission the dam?

PacifiCorp has regulatory approvals to remove the project in accordance with the amended Condit Dam Settlement Agreement and the Project Removal Design Report. Regulatory approvals include Clean Water Act permits issued under Section 401 by the Washington Department of Ecology, and issued under Section 404 by the U.S. Army Corps of Engineers; Biological Opinions from the U.S. Fish and Wildlife Service and National Marine Fisheries Service, and a Surrender Order from FERC.

How much power is generated at the Condit Dam and how will PacifiCorp replace this power?

The powerhouse contains two turbines with an installed capacity of 13.7 megawatts – enough to power approximately 7,000 average homes for a year. PacifiCorp is looking into options regarding how to replace this relatively small amount of power, consistent with its long-term resource planning. Potential options include upgrades at existing projects and new energy resources.

What work was done this summer near the Condit Dam?

Earlier this summer, PacifiCorp initiated efforts to stabilize the Northwestern Lake Bridge and began the funding of the relocation of the City of White Salmon's water supply line, which previously was located under Northwestern Lake.

The work at the Northwestern Lake Bridge consists of drilling new piers into the river bottom to further stabilize the bridge. Additional trusses are being added to the bridge in order to provide support for the river crossing of the City of White Salmon's water supply line.

In late August 2011, contractors began pre-demolition work and tunnel boring for the actual breach to take place in late October.

Is the White Salmon River currently closed to boaters?

Parts of the river are closed, but boaters will continue to have access to the river upstream of the reservoir during decommissioning activities. To protect the public, the White Salmon River was closed beginning in July 2011, from the Northwestern Lake Bridge downstream to the White Salmon Ponds fish facility. PacifiCorp communicated these closures with local commercial recreation companies and the public through direct notification and through navigation signs, buoys and signage at access points and on the river. The river closure will continue until the completion of the dam removal process and channel restoration work in August 2012.

Is Northwestern Lake currently closed?

Yes. In early August 2011, Northwestern Lake and its associated boat ramps were posted and closed to all on-water activities as work at the dam site intensified in preparation for the October breaching.

What benefits to the environment will be seen when the Condit Dam is removed?

The dam is the only man-made impoundment between Mt. Adams and the Columbia River and its removal will open approximately 33 miles of new spawning and rearing grounds for steelhead and 15 miles of new habitat for salmon in the White Salmon River basin. Since as much as 2.4 million cubic yards of reservoir sediment is estimated to rest behind the dam, removal will occur during periods when fisheries are expected to be minimally affected.

Do Northwest tribes approve of the dam's removal?

The cultural benefits associated with the restoration of the White Salmon River fish runs and traditional fishery are important to Northwest tribes. The Yakama Nation was a party to the settlement agreement and in statements released in June 2011 said that restoration of the river habitat is an essential step in welcoming home the salmon, steelhead and lamprey that have been absent from the White Salmon River over the last century.

What will happen on the day the dam is breached?

Initial action to remove the dam began in late August 2011. Blasting work is creating a 13-foot high by 18-foot wide drain tunnel near the base of the dam. When the final section of the dam is removed by blasting in the fall, the drain tunnel will discharge water at a rate of approximately 10,000 cubic feet-per-second. For perspective, the flow rate will be approximately one-quarter of the estimated peak discharge during the February 1996 flood event on the White Salmon River. It is anticipated that Northwestern Lake will drain in approximately six hours.

What river closures will be in effect on the day the dam is breached?

Additional river closures will be in effect during the actual breaching event in late October 2011, to protect the public. These closures will be communicated to local communities, the public and the media. Updates on closures can be found online at **pacificorp.com/condit**.

What happens after the dam is breached in late October?

Once Northwestern Lake is drained, activity will focus on addressing accumulated sediment and slope stability within the area of the former lake. In spring 2012, the dam will be removed along with the wood-stave flowline, surge tank and penstocks. Concrete from the dam will be broken into rubble and buried onsite; other materials will be salvaged or transported to the Klickitat County waste facility. The powerhouse will be left intact.

How long will it take to complete the dam removal process and reclamation of the area?

PacifiCorp expects the dam removal process to take approximately one year. Additionally, in fall 2012, work will begin on re-vegetation of the former lake bottom with native trees and grasses and restoration of the wetlands. Long-term monitoring and work to control invasive plants is also planned to ensure a successful reclamation of the riverside areas. The temporary upstream dam (cofferdam) that was used during the initial construction of the dam will be removed from the White Salmon River as soon as practicable after the breaching.

How long after completion of the removal project do you anticipate the sediment concentrations to drop and the White Salmon River to form a stable river channel?

Sediment concentrations in the river will be high at the time of breaching in late October 2011. Erosion will continue thereafter as the river forms a channel in the area where Northwestern Lake was previously, but sediment from deposits will gradually decline and cease after a stable river channel forms. Surface runoff from rain and melting snow is expected to erode upland sediment intermittently for three to five years until vegetation is re-established. After this period, the only sediment contributions to the river are expected to be from higher and rarer floods that erode embankments and surfaces not reached by previous floods.

What will the White Salmon River offer in terms of recreation in the years to come?

The 92-acre Northwestern Lake will be lost as a recreation area as the lake drains after the dam is breached in late October. In time, however, new recreation opportunities will present themselves. New stretches of white water rapids are expected on the river and could become a playground for kayakers and rafters. The former reservoir area, once it is deemed safe for access, will be available for angling as determined by the state of Washington.

What will PacifiCorp do with the land and the powerhouse after decommissioning?

After the removal is complete, ownership of the land along the river and the powerhouse structure will be retained by PacifiCorp. The company has no firm plans at this time concerning the future of the lands and powerhouse; however PacifiCorp will continue to honor the many land leases for cabins in the area.

Did PacifiCorp hire a local contractor to perform the construction work?

Yes. PacifiCorp hired JR Merit Industrial Contractors, a local contractor from Vancouver, Wash.

How will PacifiCorp protect the public during the decommissioning process?

Protecting the public from hazards is vital to a successful decommissioning of the dam facilities. Access restrictions have been communicated to the local community and will be in place throughout the dam decommissioning project. Fencing, construction signs, barricades and no trespassing signs have been placed to notify and protect the public. PacifiCorp asks for the public's patience and appreciates the cooperation of all parties during this process.

How will PacifiCorp communicate with the local community and the public during the decommissioning process?

Local residents, communities and other interested parties will receive regular updates about the decommissioning process via direct mailings, a project newsletter and website postings. As the process progresses, we encourage you to bring questions or issues to PacifiCorp's attention as quickly as possible so they can be resolved.

Where can I find updates or contact PacifiCorp staff about this project?

You can email the project team at **Condit.Decommissioning@PacifiCorp.com** or call us at **1-503-331-4361**. Updates will also be available on the Condit page of PacifiCorp's website at **pacificorp.com/condit**.

Scan code here with your smart phone to link to PacifiCorp's Condit Dam page or go to pacificorp.com/condit

PACIFICORP
A MIDAMERICAN ENERGY HOLDINGS COMPANY

NEWS RELEASE

Contact: Tom Gauntt
PacifiCorp, 503-813-7291

June 14, 2011
FOR IMMEDIATE RELEASE

PacifiCorp to remove Condit Dam

With regulatory approvals received after 12 years of effort, decommissioning now working toward October 2011 event

PORTLAND, Ore. – After nearly a century of serving PacifiCorp customers, Condit Dam on the White Salmon River in south central Washington will start to be removed this fall, fulfilling a multi-party settlement agreement signed in 1999.

Decommissioning the hydroelectric project is now moving forward after receipt of an essential sediment management permit from the U.S. Army Corps of Engineers, the final major regulatory step. On Dec. 16, 2010, PacifiCorp received a Surrender Order from the Federal Energy Regulatory Commission providing for dam decommissioning. The commission modified the Surrender Order on April 21, which, with the Corps permit, provides the regulatory certainty PacifiCorp needed to proceed to remove the 125-foot high dam. On June 8, 2011, the commission completed review and approval of requisite project removal design and resource management plans.

"We have notified our contractors to move forward," said Todd Olson, program manager for PacifiCorp. "The project has been in the planning stages for more than a decade. These recent regulatory approvals enable us to now move forward with the commitment we made to the settlement parties to remove the dam as soon as feasible."

Dam removal was determined to be less costly to PacifiCorp customers than the fish passage that would be required for operation as part of the federal dam relicensing process. The cost of decommissioning Condit is currently estimated at about $32 million, including funds already spent during the planning process.

"While we move forward on this complex task with determination, it will be sad to see Condit go," Olson said. "It has been supplying low-cost, renewable and emission-free power for our customers since 1913, long before those phrases were even in use."

"The decommissioning of Condit Dam represents a momentous and long-awaited day," said Virgil Lewis, of the Yakama Nation Tribal Council, one of the parties to the 1999 settlement. "This is an essential step in restoring the ecosystem's resources and rebuilding the natural balance that supported the Yakama people and a significant tribal fishery for millennia. We are excited to welcome home the salmon, steelhead and lamprey that have been absent from the White Salmon River over the last century."

American Rivers, a leading national conservation organization advocating for clean water and healthy rivers, pointed to the cooperation behind the decommissioning.

"After years of hard work, we will soon celebrate one of the nation's biggest and most exciting river restoration projects," said Brett Swift, Northwest regional director of American Rivers. "Condit Dam served a useful purpose, but now the time has come to remove it and restore a healthy, free-flowing White Salmon River. We applaud PacifiCorp for its leadership. It isn't every day that we get to witness a river coming back to life."

Plans call for a summer full of meticulous preparation before a carefully planned breach in October releases Northwestern Lake through a 13-foot hole blasted out near the base of the dam. Steps to be completed before the breach include the initial excavation of the 90-foot long drain tunnel, dredging the upstream side of the dam at the drain tunnel, work to strengthen a bridge that crosses Northwestern Lake, and also relocating a water pipeline that crosses the reservoir.

"Safety for everyone involved is a key priority," said Tom Hickey, PacifiCorp's project manager. "People working on the project will be taking special care, and PacifiCorp will also implement a public safety plan. It will be important for people in the area to abide by closure signs and stay out of the project area."

After the initial breach and draining of the reservoir in October, demolition of the remaining portion of the dam is scheduled to begin in spring 2012 and be completed by August 31, 2012. Restoration work throughout the former reservoir area is planned to be completed by the end of 2012.

Throughout this time, PacifiCorp will continue to work with county officials and local residents on access restrictions and other safety measures as the project progresses. Timely public notices will be posted concerning any closures.

For general information on the Condit project, visit: http://www.pacificorp.com/es/hydro/hl/condit.html

The construction contractor for the decommissioning project is JR Merit Industrial Contractors, Inc. of Vancouver, Wash. with engineering and construction monitoring services being provided by Kleinfelder, an international engineering consulting firm based in San Diego, Calif. with a local office in Portland, Oregon.

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About PacifiCorp

PacifiCorp is one of the lowest-cost electricity producers in the United States, serving more than 1.7 million customers in the West. PacifiCorp operates as Pacific Power in Oregon, Washington and California, and as Rocky Mountain Power in Utah, Wyoming and Idaho. With a generating capability of more than 10,620 megawatts from coal, hydro, gas-fired combustion turbines and renewable wind and geothermal power, the company works to meet growing energy demand while protecting and enhancing the environment.

Facts about Condit

- The project is located approximately 3.3 miles upstream from the confluence of the White Salmon and Columbia Rivers. Project facilities consist of a **125-foot high, 471-**

foot long concrete gravity diversion dam, and an intake structure that directs water into a 13.5-foot diameter by 5,100-foot long wood stave flow line.

- The powerhouse contains two double horizontal Francis turbines with an installed capacity of **14.7 megawatts** (enough to power about **7,000 average homes** for a year). The project creates a reservoir, Northwestern Lake, which extends 1.8 miles upstream of the dam and covers approximately 92 acres.
- In 1999, the Condit Settlement Agreement was signed by PacifiCorp and project stakeholders. The settlement agreement was amended in 2005 to extend the dates for project removal.
- Settlement parties include: American Rivers, American Whitewater Association, Columbia Gorge Audubon Society, Columbia Gorge Coalition, Columbia River United, Federation of Fly Fishers, Friends of the Columbia Gorge, Friends of the Earth, Friends of the White Salmon, The Mountaineers, Rivers Council of Washington, The Sierra Club, Trout Unlimited, Washington Trout, Washington Wilderness Coalition, the Columbia River Inter-Tribal Fish Commission , the Yakama Nation, the U.S. Forest Service, the U.S. Department of the Interior, the National Marine Fisheries Service, the Washington Department of Ecology, the Washington Department of Fish and Wildlife and PacifiCorp.

Maps and photos available upon request.

A Busy Winter at Condit Dam Site

The winter of 2012 was a busy one at the Condit Dam site. A century after the initial construction began on the dam, its removal has begun in earnest. Winter and spring rains moved sediment downstream toward the Columbia River and slope stabilization work began to reshape the banks of the White Salmon River where Northwestern Lake once resided. For safety, signs are posted along unstable banks and near construction sites to warn the public to steer clear of these areas.

Decommissioning work continued throughout the winter at Condit Dam.

Structural Removal of the Dam and Facilities Moves Forward

Removal of the dam structure and associated facilities began in January. The wooden flow line was dismantled and crews operating heavy machinery, such as hydraulic hammers, began breaking up the face of the concrete dam. The treated-wood remains of the flow line are being transported to the Klickitat County waste facility and concrete rubble from the dam, estimated at 34,000 cubic yards, will be spread onto the area where the flow line once was. Eventually, the area will be capped with 18 inches of soil cover and planted with native vegetation. The project is on track to have the dam completely removed by the end of August 2012.

Demolition of the dam and facilities will continue through the summer months.

What others are saying

"Right about now, juvenile fall Chinook salmon are likely outmigrating from the White Salmon River. These juveniles are the progeny of the adults we transported upstream of the dam and were not impacted by the sediment released by the dam deconstruction. I think 2012 has a lot of promise for the river continuing to re-shape, restore and re-design itself. For this summer, I plan on getting a good look at the White Salmon River from the mouth up through what was Northwestern Reservoir to see what the returning fall Chinook salmon adults might do when they arrive in September. We are busily working with partners and co-managers on the data that they'd like to collect on salmon spawning this first year post-Condit Dam deconstruction as well as developing some longer-term plans. In general, I'm just excited about what the river is going to look like... I want to go through my memories of locations in the lower river from years past and see what they look like now."

Rod Engle
Hatchery Assessment Team, U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, Wash.

"We are pleased to see Condit Dam removal on track and thrilled to have access to Northwestern Park restored. It has been exciting to watch the river reclaim its former channel and we wait in anxious anticipation for the opportunity to see the rest of the river later this year."

Thomas O'Keefe
Pacific NW Stewardship Director
American Whitewater

Public safety is PacifiCorp's top priority and we ask the public to obey all signs in the construction areas.

Public Safety a Top Priority

The White Salmon River banks continue to be an evolving landscape both upstream and downstream of the dam. PacifiCorp, local law enforcement and river experts are reminding the public to obey posted signs in the area. As deconstruction work continues through the spring and summer, PacifiCorp will maintain public access closures for the dam site, the reservoir area and the canyon reach downstream of the dam during the spring and summer months of 2012. As the spring and early summer rains and snowmelt further sculpt the riverbed and river banks, PacifiCorp and state and federal authorities will regularly monitor the river as it continues its transformation to its natural state. The area from the Northwestern Lake Bridge downstream to the powerhouse remains an active construction site and an unsafe area for the public. The river downstream of the powerhouse has been reopened for fishing and is accessible except via routes posted as private property.

Repair Work at Northwestern Lake Bridge and Bank Stabilization Work Continues

Public safety also will be a high priority in the vicinity of Northwestern Lake Bridge, where additional bridge stabilization work is expected to continue through the summer. Following approval from the U.S. Army Corps of Engineers, PacifiCorp placed riprap in late December 2011 to stem the erosion of the river banks under the bridge and additional riprap was placed in late March 2012. The next phase of this work is to construct a soil nail wall at the west abutment of the Northwestern Lake Bridge to ensure its long-term stability. Soil nailing stabilizes and reinforces existing soil by grouting threaded steel bars into slopes or cuts as wall construction proceeds from the top down. The total treatment length will be approximately 220 feet centered on the bridge. The result will be a wall with a height of 37 feet at its center. Temporary access and work areas will be constructed and protected from the river by riprap. Upon completion of the soil nail wall, the riprap will be reconfigured to provide additional protection against scour at the base of the wall. PacifiCorp continues to evaluate whether additional stabilization measures are necessary for the east side of the Northwestern Lake Bridge.

Grading operations are also underway in several locations along the former reservoir to address slope stability for public safety, to prevent future erosion and prepare for hydro seeding and mulching this fall.

The grading of the riverbanks was done in the spring in preparation for fall hydro seeding.

Access to Northwestern Park

Northwestern Park remains open, but barricade fencing and signs are posted to warn the public to stay out of the former reservoir area. There also are signs posted at various points around the White Salmon River to warn boaters to take out at Northwestern Park; boater safety warning posters are located at the common boat launch locations upstream. As restoration work continues and the final riverbank contours are formed, a new whitewater boat take-out and other improvements will be completed. The access road used for construction at the Northwestern Lake Bridge also will be adapted to provide a boat take-out. During the construction work at the bridge, boaters will continue to use a boat access ramp recently established approximately 300 feet downstream of the bridge. Once the construction work is completed, the permanent boat take-out location will be available just downstream of the bridge.

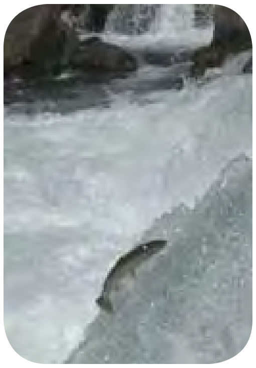
Boater safety is a top priority for PacifiCorp. Please obey all signs in the river and along the banks.

Demolition of the Original Cofferdam

The decommissioning plans included demolition of the original cofferdam and diversion structures that were built just upstream of the dam during the initial construction. The cofferdam was left in place when the reservoir was filled in 1913 and remained well preserved underwater. To complete the demolition, an access road was built from the location of the former boat ramp on the east bank near the dam.

The cofferdam was tied to a rock outcrop and about 250 cubic yards of rock were removed from the top to provide a work platform for the demolition. The river level in the area upstream of the cofferdam dropped approximately 10 feet upon its removal in late April.

The old cofferdam was removed ahead of schedule on April 24, 2012 and the White Salmon River is flowing unobstructed for the first time in 100 years.



New spawning and rearing grounds are now open for steelhead and salmon in the White Salmon basin.

An Active Watercourse

The White Salmon River, corralled by the Condit Dam for 100 years, is returning to its natural course after the breaching event last October and is clearly responding by re-establishing its form and function within the formally submerged canyon. One of the major questions surrounding the decommissioning of the Condit Dam was the uncertainty of how the surrounding land and banks of the former reservoir would reshape themselves once the sediment moved downstream. Erosion and slope instability are causing PacifiCorp to work closely with a few cabin owners on safety matters. PacifiCorp also has been working with cabin and well owners in the area regarding well issues that have surfaced since the reservoir draining. The sediment that has moved downriver to the confluence of the Columbia River to date constitutes about two-thirds of what had built up in the reservoir during Condit Dam's lifetime. A significant amount of sediment remains at the boat ramp located at the Underwood In-Lieu site, owned by the Bureau of Indian Affairs, near the confluence of the river. This sediment has made the former boat ramp unusable; restoration of the site is under development.

PacifiCorp continues to work with the U.S. Coast Guard to regularly monitor activity at the mouth of the river.

PacifiCorp is also maintaining a buoy to warn boaters of the delta at the mouth of the White Salmon River and communicating with the U.S.Coast Guard and the Army Corps of Engineers regarding the conditions at the delta. As the spring and early summer runoff flows begin on the Columbia River, the delta has started to erode.

About PacifiCorp

PacifiCorp is one of the lowest-cost electricity producers in the United States, providing approximately 1.7 million customers in the West with reliable, efficient energy. PacifiCorp operates as Pacific Power in Oregon, Washington and California, and as Rocky Mountain Power in Utah, Wyoming and Idaho. PacifiCorp's electric generation, commercial and energy trading, and mining functions are operated as PacifiCorp Energy.

If you have comments or questions please call 1-503-331-4361, email us at condit.decommissioning@pacificorp.com or visit our website at pacificorp.com/condit

Date	Key Decommissioning Activities
January 2012 – Present	Demolition of Condit Dam and facilities continues
April 24, 2012	Cofferdam removed from White Salmon River
Spring/Summer 2012	Regrading of river banks
August 2012	Repairs at Northwestern Lake Bridge completed
August 2012	Boat launch modifications completed at Northwestern Park
End of August 2012	Condit Dam completely removed from White Salmon River
September 2012	White Salmon River within former project area open to boaters
September 2012	Hydro seeding of river banks
October 2012	Project completion

Condit Dam Decommissioning
Project Overview

PACIFICORP
PacifiCorp Energy
Pacific Power
Rocky Mountain Power

Condit Dam background and settlement agreement

The Condit Dam and other components of the Condit Hydroelectric Project were built during 1912-1913 on the White Salmon River in south central Washington State, spanning Skamania and Klickitat counties. The project was designed to produce hydroelectricity to supply the Crown Willamette Paper Co. in Camas, Wash. and the growing municipal market from Washougal, Wash. to Portland, Ore. After nearly a century of serving customers of the former Northwestern Electric Company, Pacific Power & Light and now PacifiCorp, physical removal of the Condit Dam began in late August 2011, fulfilling a multi-party settlement agreement signed in 1999.

PacifiCorp joined with 22 other parties to determine the future of the dam as part of a 1999 settlement negotiation regarding federal relicensing of the project. The parties included the Yakama Indian Nation, National Marine Fisheries Service, U.S. Fish and Wildlife Service, U.S. Forest Service, Washington Department of Ecology, Washington Department of Fish and Wildlife, numerous environmental groups and PacifiCorp. After two years of negotiations, the participants reached an agreement to shut down power generation at a future date and remove the dam. In reaching this agreement, settlement parties balanced the short-term impacts of dam removal with the long-term gains provided by restoration of a natural river environment and a cost-effective plan for PacifiCorp's customers.

Federal requirements led to local agreement

Hydroelectric dams across the United States are licensed by the Federal Energy Regulatory Commission. The Condit Dam was originally licensed in 1968 with an effective date of May 1, 1965 after enactment of the Federal Power Act. In November 1996, FERC issued a final Environmental Impact Statement that required

PacifiCorp to install fish ladders and screens for a state-of-the-art fish passage system. While fish ladders were part of Condit's original design, these facilities twice washed out due to floods during the dam's early years. FERC also required higher in-stream flows, which would reduce Condit's overall energy production from the current 14 megawatt average. Combined, the new requirements would have rendered the nearly 100 year-old dam uneconomical for PacifiCorp's customers.

Decommissioning moves forward

On December 16, 2010, following 12 years of studies, permit filings and stakeholder negotiations, PacifiCorp received a Surrender Order from FERC, providing for dam decommissioning. Subsequently, the U.S. Army Corps of Engineers issued an essential sediment management permit, the final major regulatory step in actual physical decommissioning and removal. FERC further modified the Surrender Order on April 21, 2011. These actions provided the regulatory certainty PacifiCorp needed to proceed in removing the 125-foot high dam. On June 8, 2011, FERC completed its review and approval of the requisite project removal design.

Benefits to the environment and the community

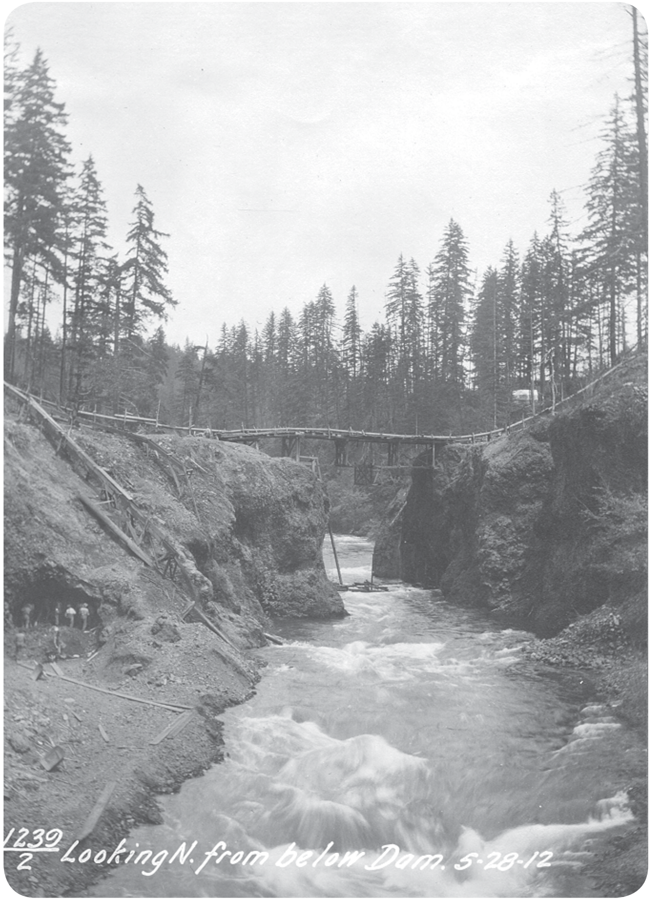
Removal of the Condit Dam will result in both environmental and cultural benefits for the local community. The dam is the only man-made impoundment between Mt. Adams and the Columbia River and its removal will open approximately 33 miles of new spawning and rearing grounds for steelhead and 15 miles of new habitat for salmon in the White Salmon River basin. Since as much as 2.4 million cubic yards of reservoir sediment is estimated to rest behind the dam, removal will occur during periods when fisheries are expected to be minimally affected.

The cultural benefits associated with the restoration of the White Salmon River fish runs and the traditional fishery is important to Northwest tribes. The Yakama Nation was a party to the settlement agreement and in statements released in June 2011 that said that restoration of the river habitat is an essential step in welcoming home the salmon, steelhead and lamprey that have been absent from the White Salmon River over the last century.

The White Salmon, Wash. community will also benefit from construction-related activities and expenditures that will be ongoing in the coming years as the dam is removed and the site is restored.

PacifiCorp customers will benefit from the company focusing on low net-cost electricity generation resources to meet their energy needs.

The multi-stage dam removal process and restoration is scheduled to be completed by the fall of 2012. PacifiCorp has hired a local Vancouver, Wash. construction contractor, JR Merit Industrial Contractors, to perform the work.



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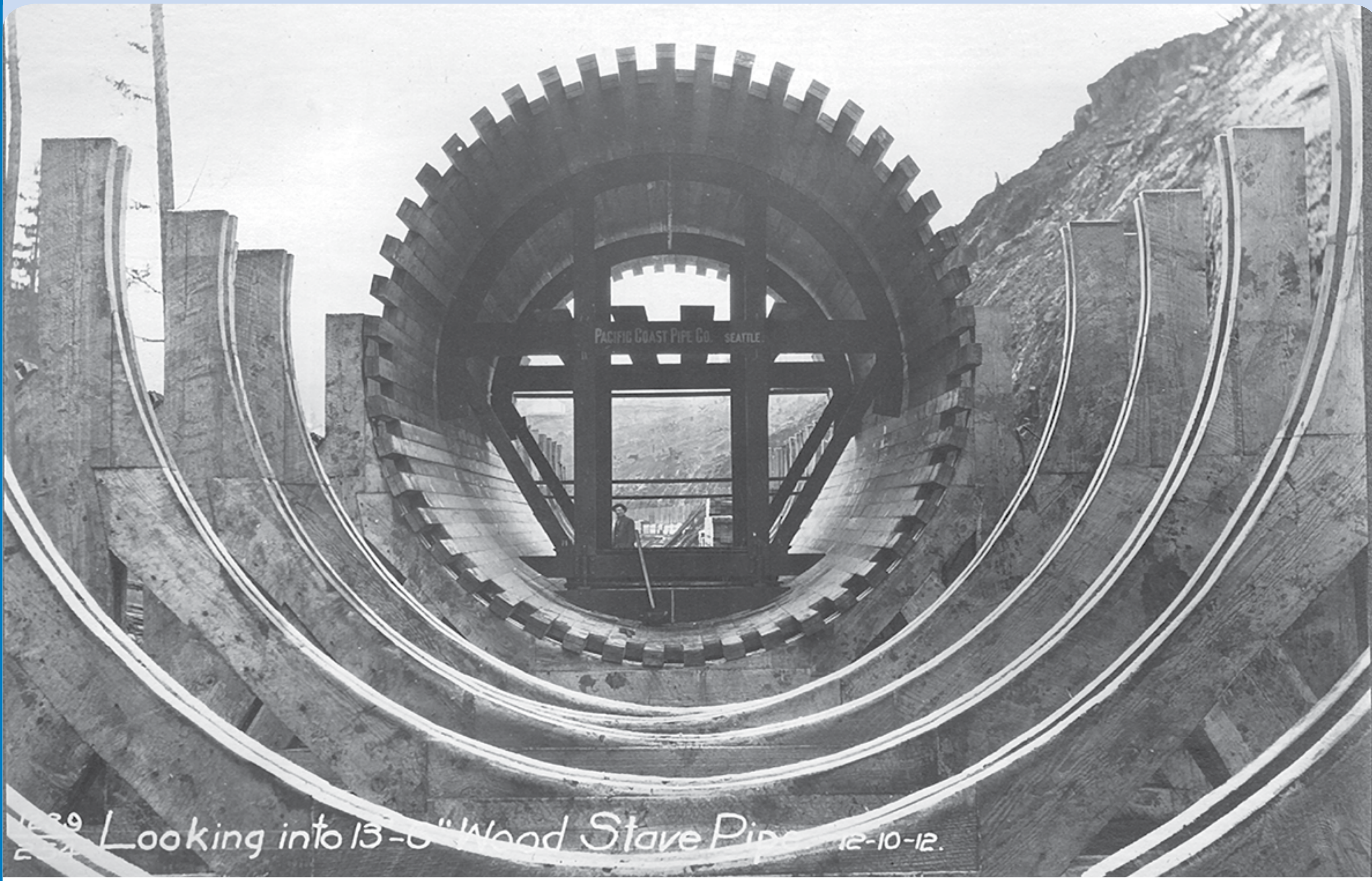
Condit Dam Decommissioning
History and Key Dates



Condit's unique history

The Condit Dam dates to the earliest years of Northwestern Electric Company, a firm that merged into Pacific Power & Light in 1947, and is known today as PacifiCorp. PacifiCorp operates in six western states and serves approximately 1.7 million customers. The dam is an important part of PacifiCorp's history and its electricity production has powered thousands of homes for several generations. The Condit Dam was supplying renewable, emission-free and cost-effective power before any of these phrases became popular. It was originally built to support the Crown Willamette Paper Co. in Camas, Wash. and the growing municipal market from Washougal, Wash. to Portland, Ore.

The dam came on line at a time when Woodrow Wilson was president, Washington's population had just crested one million and a ballpark called Fenway became the newest jewel in professional baseball. The dam was relatively large for its time and in terms of generating capacity, the project was ranked 12th in the West. If anything distinguished Condit from its predecessors, it was the massive water pipeline, or flowline, that delivered water to the turbines. A 1913 publication of Engineering News called the flowline at Condit Dam "probably the largest wood-stave pipe in the world."

The transmission line from the Condit powerhouse to Camas, Wash. was the first to be built through the Columbia River Gorge and represented an early use of aluminum line reinforced with steel. Its construction was complicated by the fact that there was no road along the north bank of the river. Materials and supplies were transported by steamer to various landings where they were hauled to work sites by horses or, in particularly rugged places, carried by hand.

Multiple attempts at fish passage unsuccessful at Condit

Fish passage played an important role in the history of the dam as evidenced by the multiple attempts to assist fish in navigating the structure. Fish ladders were part of Condit's original design,

continued

but these facilities twice washed out due to floods during the early life of the dam. After the second washout, the Washington State Fisheries Department required Northwestern Electric to contribute to construction of a state fish hatchery rather than rebuild the fish ladders. A final attempt was made in 1925, when experiments were done on a newly designed fish elevator, without success. Just as in the 1920s, PacifiCorp understands the importance of appropriate fish passage, but the cost to customers must also be considered. In the case of Condit, removing the dam instead of installing expensive fish passage over or around the project is the best alternative for customers.

Condit Powerhouse during the early years of operation

Key Dates – Condit's Present

KEY DECOMMISSIONING ACTIVITIES	DATE
All regulatory and removal designs approved by FERC	June 2011
Work initiated to reinforce Northwestern Lake Bridge and reroute City of White Salmon's water supply line	June 2011
Floating barriers placed in White Salmon River to notify boaters of decommissioning activity	July 2011
Docks removed/secured from Northwestern Lake	August 2011
Northwestern Lake drawdown begins – Lake drawn down 10 feet	August 2011
Powerhouse Road and boat ramp near Condit Dam closed	August 2011
Northwestern Lake closed to all boating, swimming and wading	August 2011
Tunneling project begins at Condit Dam	Late August 2011
BREACH DAM AND DRAIN NORTHWESTERN LAKE	LATE OCTOBER 2011
Project area (Northwestern Lake shoreline down to water's edge and White Salmon River shoreline downstream to powerhouse) closed; upstream river area to Northwestern Lake park boater take-out remains open.	Late October 2011
PacifiCorp initiates sediment management actions in former Northwestern Lake	November 2011
Condit Dam demolition and concrete disposal along flowline begins	May 2012
Condit Dam and other facilities removed from White Salmon River	August 2012
Boat launch modifications completed at Northwestern Lake park	August 2012
White Salmon River within former project area opened to boaters	September 2012
Project completion	October 2012

Key Dates – Condit's Past

HISTORY OF THE CONDIT DAM	DATE
Ben C. Condit Dam and power generation facilities completed	1913
Customers in Camas, Wash. and Portland, Ore. receive power from the Condit Dam via a new transmission line through the Columbia River Gorge	1913
Original wooden fish ladder washed out during flood (Ladder rebuilt)	1914
Second fish ladder washed out by flood (Ladder not rebuilt)	1918
Fish hatchery built to mitigate for loss of fish ladder	1919
Experimental fish elevator attempted and failed	1925
Condit project issued its first operating license following enactment of the Federal Power Act; license effective May 1, 1965	1968
Condit Dam upgraded with various structural reinforcements	1972
PacifiCorp's first federal operating license expires	1993
The Federal Energy Regulatory Commission (FERC) issues Environmental Impact Statement requiring PacifiCorp to install fish ladders and screens for fish passage	1996
PacifiCorp requests that FERC halt the relicensing proceedings in order to reach a settlement agreement to decommission the Condit Dam	1997
PacifiCorp agrees to Settlement Agreement to decommission the Condit Dam	1999

Scan code here with your smart phone to link to PacifiCorp's Condit Dam page or go to pacificorp.com/condit

Condit Dam Decommissioning

Decommissioning Overview

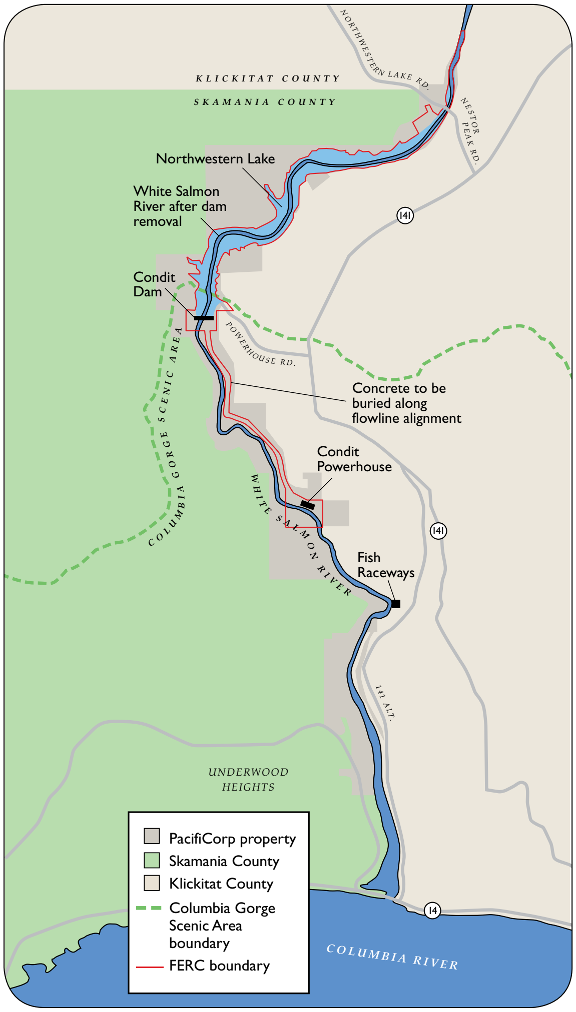
PACIFICORP
PacifiCorp Energy
Pacific Power
Rocky Mountain Power

Condit Dam decommissioning work ongoing

Preparations and planning to decommission the Condit Dam have been underway for many years as necessary studies and management and design plans have been presented to local, state and federal agencies for approval. With all necessary permits and regulatory approvals in hand, the physical work to remove the Condit Dam began in the summer of 2011. Earlier this summer, PacifiCorp initiated efforts to stabilize the Northwestern Lake Bridge and began funding the relocation of the City of White Salmon's water supply line, which previously was located underneath Northwestern Lake.

The work at the Northwestern Lake Bridge consists of drilling new piers into the river bottom to further stabilize the bridge. Additional trusses are being added to the bridge in order to provide support for the river crossing of the City of White Salmon's water supply line.

In early August 2011, Northwestern Lake and its associated boat ramps were closed to all activities, in order to ensure public safety. The water level was also drawn down 10 feet in order to allow the drain tunnel at the base of the dam to be constructed prior to the breaching of the dam in late October.



Multiple project facilities and materials to be removed

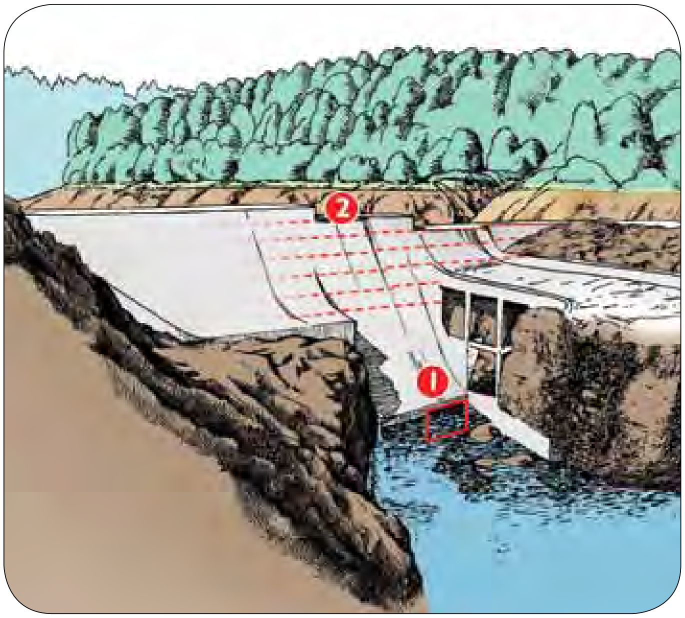
The Condit Dam facilities consist of the 125-foot high, 471-foot long concrete gravity diversion dam, an intake structure that directs the water into a 13.5 foot diameter by 5,100-foot long wood-stave flowline (wooden barrel-like pipeline), and through a 40-foot diameter concrete surge tank. The flowline splits into two 9-foot diameter penstocks inside the surge tank, which directs water into the turbines in the powerhouse. The powerhouse contains two double horizontal turbines with an installed capacity of 13.7 megawatts – enough to power approximately 7,000 average homes for a year. The dam creates the reservoir, Northwestern Lake, which extends 1.8 miles upstream of the dam and covers approximately 92 acres. All facilities, with the exception of the powerhouse, will be removed.

continued

Final regulatory approvals that were required to remove the dam include Clean Water Act permits issued under Section 401 by the Washington Department of Ecology, and issued under Section 404 by the U.S. Army Corps of Engineers; Biological Opinions from the U.S. Fish and Wildlife Service and National Marine Fisheries Service, and a Surrender Order from the Federal Energy Regulatory Commission. PacifiCorp has received these documented regulatory approvals and is moving forward with decommissioning.

Plan of action for Condit Dam removal

Significant actions to remove the dam began in late August 2011. Blasting and boring work will create a 13-foot high by 18-foot wide drain tunnel on the downstream side, near the base of the dam. When the final section of the tunnel is removed by blasting in the fall, the drain tunnel will discharge water at a rate of approximately 10,000 cubic feet per second. For perspective, the flow rate will be approximately one-quarter of the estimated peak discharge during the February 1996 flood event on the White Salmon River. It is anticipated that Northwestern Lake will drain in approximately six hours. Rapid draining of the lake is expected to mobilize much of the 2.4 million cubic yards of sediment that is estimated to have accumulated behind the dam since 1913. This work is specifically planned for late October, when fisheries are expected to be minimally affected.



1 The water will be drained through a 13-foot high by 18-foot wide drain tunnel drilled in the base of the dam.

2 The dam will be broken into rubble.

Work continues into 2012

Once Northwestern Lake is drained, activities will focus on addressing the sediment and slope stability within the area of the former lake. Starting in the spring of 2012, the dam structure will be removed along with the wood-stave flowline, surge tank and penstocks. Concrete from the dam will be broken into rubble and buried onsite; other materials will be salvaged or transported to the Klickitat County waste facility. The powerhouse will be left intact. The temporary upstream dam (cofferdam) that was used during the initial construction of the dam will be removed from the White Salmon River as soon as practicable, after the breaching.

PacifiCorp expects the full dam removal process to take approximately one year. Meanwhile, in the fall of 2012, work will begin on re-vegetation of the former lake bottom with native trees and grasses, along with restoration of the wetlands. Long-term monitoring and work to control invasive plants is also planned to ensure a successful restoration on the riverbanks and reclamation of Northwestern Lake.

Scan code here with your smart phone to link to PacifiCorp's Condit Dam page or go to pacificorp.com/condit

- ❑ Take a Stand Grades 4-5, 6-8, & 9-12
    - ❑ SHARE Educational Handout
    - ❑ Wood in the River
    - ❑ Leave No Trace Principles
    - ❑ Aquatic Invasive Species

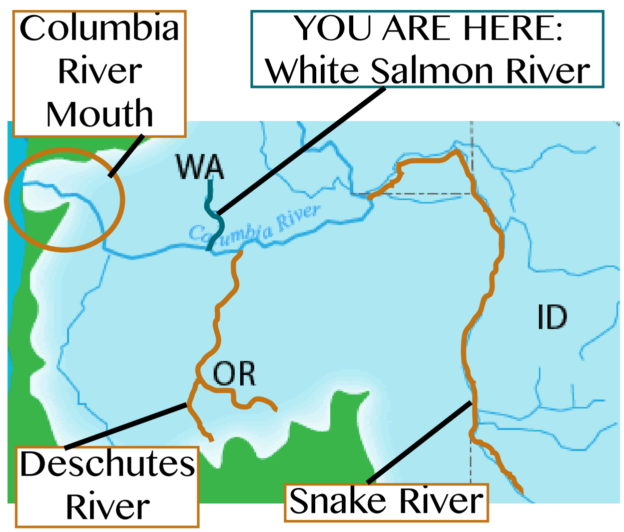
Preventing Aquatic Invasives

Why Care About Invasive Species?

- They REDUCE biodiversity
- They cause ECONOMIC Stress
- They threaten HUMAN HEALTH

Where are Aquatic Invasive Species?

New Zealand Mud Snails, one species threatening the White Salmon River's exceptional ecosystem, can be found in the Columbia River Mouth, Deschutes and Snake Rivers.



Map: WA Dept of Ecology

Large Wood as Salmon Habitat

Wood is Essential for Healthy Fish Habitat

Fallen trees, rootwads, and branches along the edges and channel of streams and rivers provide vital habitat for salmon and other creatures. On the White Salmon River, large wood creates pool habitat and places for fish to rest, hide, and find food.

Wood provides:

- Hiding spots for juveniles
- Bank stabilization
- Food for aquatic insects
- Pools for young fish
- A diverse ecosystem

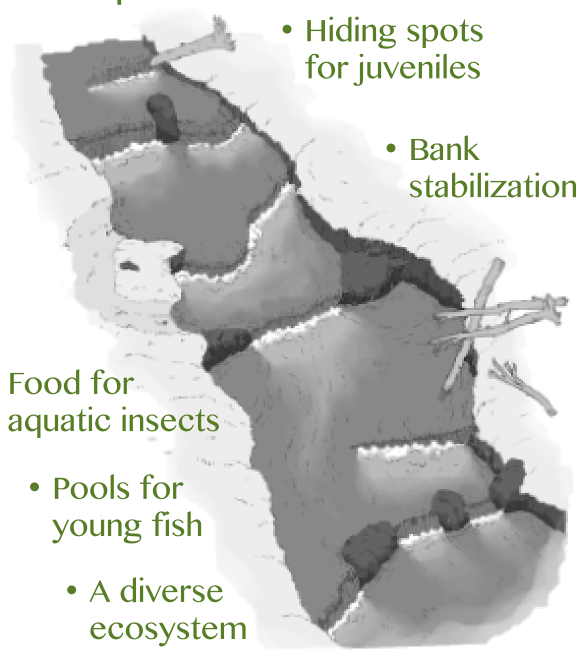


Figure: American Whitewater

Salmon in the River

What is a REDD?

Redd: A nest that salmon or steelhead dig in the gravel river bottom to lay their eggs.

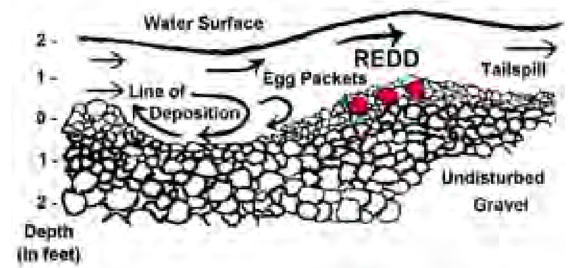


Image: WA Department of Fish and Wildlife

Where are the Redds on the White Salmon?

Redds can be located at any cobble bar on the river. Avoid disturbing these areas where the fish may spawn. Redds can be present at anytime throughout the year.

Brought to you by:

SHARE the White Salmon

SHARE is a multi-stakeholder group working to educate river users about ways to protect and respect river resources for the shared benefit of all.

http://midcolumbiarfeg.com/

Salmon in the River

They are HOME!

Salmon are a **keystone species** for the White Salmon River ecosystem. After Condit Dam's breach and removal, they are moving into new spawning and rearing habitat.

The river is home to 5 species of salmon and steelhead:

- Spring Chinook
- Fall Chinook
- Coho
- Chum
- Steelhead

All 5 species plus Bull Trout are listed as **Threatened** under the Endangered Species Act.

The White Salmon River is also home to Pacific Lamprey, a "species of concern".

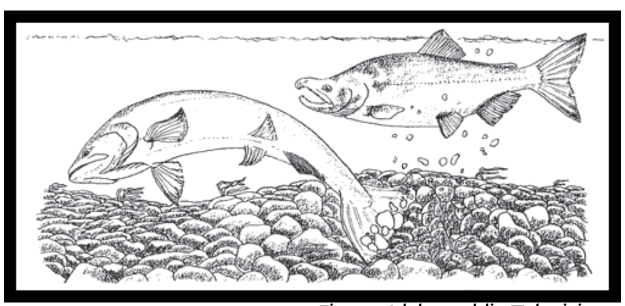


Figure: Idaho Public Television

Large Wood as Salmon Habitat

Boaters - Stay Alert!

Wood hazards including channel-spanning logs are a known hazard on the White Salmon River. It is important that paddlers avoid wood and understand that floating into and becoming entrapped in a piece of wood can be fatal. Stay alert and be sure to scout.

Scout and portage when necessary!

Figure: American Whitewater

Dangerous Wood? Move it with a Permit.

Permits are required to re-position, cut, or remove logs and down wood from rivers in Washington. Contact the WA Department of Fish and Wildlife (360-902-2537) if you are concerned about a wood hazard.

Preventing Aquatic Invasives

What Can YOU Do?

CLEAN

- Remove mud, plants, critters from boat/gear BEFORE you leave a river.
- Extra credit: Wash with a hose!

DRAIN

- Dump water out of boats while still at the river

DRY

- All your gear
- Moisture = Survival
- Try rotating between 2 pairs of shoes

Images: North Forest Canoe Trail

Highlights

Trees Slow River for Fish to Grow

If healthy forests provide us with much more than clean air to breathe, you might wonder—why are we helping to cut down trees in California? And what do trees have to do with fish habitat? The answer: for fish to grow big and strong.

Pacific salmon and trout in northern California have declined rapidly since the mid-1900s. Part of the decline was due to historic logging industry practices. Logging companies harvested streamside trees and left wood clogging creeks. This debris mingled with fallen trees in the creeks, creating fish migration barriers and causing flooding. So many local agencies removed all the wood—seems like the obvious solution, right?

But this solution produced another problem. Fish like endangered coho salmon need streams and rivers to have both slow and fast currents—they rest and grow in the slow currents, and breed in the faster water. Logs and other natural woody debris help slow the flow of water in parts of creeks and rivers, providing habitat for the fish. With all the wood removed, little impeded the water; it sluiced through creeks and rivers, and the fish had much less of the habitat they needed to survive. As a result of this and other factors, salmon populations declined rapidly.

With funding from the NOAA Restoration Center, The Nature Conservancy and the Conservation Fund are taking a unique approach for environmental groups: they are cutting down trees and strategically placing them in tributaries of the Garcia River in Mendocino County.

Traditional, salmon habitat restoration projects using wood were engineered and anchored in place, but that method can be expensive and time intensive. Our partners collaborated with the NOAA Restoration Center and others to test an innovative approach. We let stream flow move and place the wood, forming natural log jams that slow the water—creating critical habitat that fish need to survive.

These projects cost one-third or less than traditional methods, and allow restoration over much larger areas than before.

http://www.habitat.noaa.gov/highlights/casalmonrestoration.html

The Leave No Trace Seven Principles (https://lnt.org/learn/7-principles)

The Leave No Trace Seven Principles are the bedrock of the Leave No Trace program. They provide guidance to enjoy our natural world in a sustainable way that avoids human-created impacts. The principles have been adapted to they can be applied in your backyard or your backcountry.

Plan Ahead and Prepare

- Know the regulations and special concerns for the area you'll visit.
- Prepare for extreme weather, hazards, and emergencies.
- Schedule your trip to avoid times of high use.
- Visit in small groups when possible. Consider splitting larger groups into smaller groups.
- Repackage food to minimize waste.
- Use a map and compass to eliminate the use of marking paint, rock cairns or flagging.

Travel and Camp on Durable Surfaces

- Durable surfaces include established trails and campsites, rock, gravel, dry grasses or snow.
- Protect riparian areas by camping at least 200 feet from lakes and streams.
- Good campsites are found, not made. Altering a site is not necessary.
    - In popular areas:
        - Concentrate use on existing trails and campsites.
        - Walk single file in the middle of the trail, even when wet or muddy.
        - Keep campsites small. Focus activity in areas where vegetation is absent.
        - In pristine areas:
        - Disperse use to prevent the creation of campsites and trails.
        - Avoid places where impacts are just beginning.

Dispose of Waste Properly

- Pack it in, pack it out. Inspect your campsite and rest areas for trash or spilled foods. Pack out all trash, leftover food and litter.
- Deposit solid human waste in catholes dug 6 to 8 inches deep, at least 200 feet from water, camp and trails. Cover and disguise the cathole when finished.
- Pack out toilet paper and hygiene products.

• To wash yourself or your dishes, carry water 200 feet away from streams or lakes and use small amounts of biodegradable soap. Scatter strained dishwater.

Leave What You Find

• Preserve the past: examine, but do not touch cultural or historic structures and artifacts.
• Leave rocks, plants and other natural objects as you find them.
• Avoid introducing or transporting non-native species.
• Do not build structures, furniture, or dig trenches.

Minimize Campfire Impacts

• Campfires can cause lasting impacts to the backcountry. Use a lightweight stove for cooking and enjoy a candle lantern for light.
• Where fires are permitted, use established fire rings, fire pans, or mound fires.
• Keep fires small. Only use sticks from the ground that can be broken by hand.
• Burn all wood and coals to ash, put out campfires completely, then scatter cool ashes.

Respect Wildlife

• Observe wildlife from a distance. Do not follow or approach them.
• Never feed animals. Feeding wildlife damages their health, alters natural behaviors, and exposes them to predators and other dangers.
• Protect wildlife and your food by storing rations and trash securely.
• Control pets at all times, or leave them at home.
• Avoid wildlife during sensitive times: mating, nesting, raising young, or winter.

Be Considerate of Other Visitors

• Respect other visitors and protect the quality of their experience.
• Be courteous. Yield to other users on the trail.
• Step to the downhill side of the trail when encountering pack stock.
• Take breaks and camp away from trails and other visitors.
• Let nature's sounds prevail. Avoid loud voices and noises.

Washington Department of Fish and Wildlife (http://wdfw.wa.gov/ais/)

Aquatic Invasive Species

Aquatic invasive species pose an ongoing threat to Washington's environment and economy. Anyone who uses Washington's waters – for work or play – can help stop the spread of these non-native species.

Invasive species, such as zebra and quagga mussels, European green crab and New Zealand mudsnails, are often spread by boats, trailers and other means of transportation. Once non-native species become established in a new environment, where their natural enemies are missing, these invaders can spread rapidly.

Invasive species can damage irrigation and water systems, clog hydroelectric dam intakes, disrupt efforts to recover endangered salmon stocks, and out-compete native and commercially grown species. Non-native species also affect recreation, potentially reducing fish populations for anglers and forcing the closure of waterbodies for boaters and others who enjoy Washington's waters.

Both marine and freshwater can harbor invasive species. One of the most well-known invasive species are zebra and quagga mussels. Zebra and quagga mussels have caused billions of dollars in economic and ecological damage to the Great Lakes, and have spread throughout North America. Quagga mussels are present in Lake Mead (Nev. and Ariz.) and Lake Havasu, Calif., which greatly increases the risk of introduction into Washington state.

Readily observed examples of aquatic invasive species in the inland marine waters of Puget Sound include tunicates, oyster drills, varnish or dark mahogany clams, and cordgrasses. Freshwater invasive species in Washington include New Zealand mudsnails, Asian clams, Red Swamp crayfish, and Eurasian water milfoil.

Preventing the introduction and spread of aquatic invasive species in Washington is challenging and unpredictable. Discovery and continued findings of potentially invasive species on Japanese tsunami marine debris is a good example of a new threat to the state's coastal waters. The Washington Department of Fish and Wildlife (WDFW) asks anyone who visits state waters to take **simple steps** to prevent the spread of aquatic invasive species. Penalties for transporting aquatic invasive species in Washington include up to one year in jail and a maximum fine of $5,000.

Before Leaving & Before Launching...
Inspect Everything!
Dock Lines
Storage Compartments
Anchor
Live Wells
Bilge
Prop
Zebra Zapper
Through-Hull Fittings
Trailer
Hull
Axle
Rollers/Bunks
Gimble Area
Motor Intakes

Salmon and Watershed Lesson Plans:

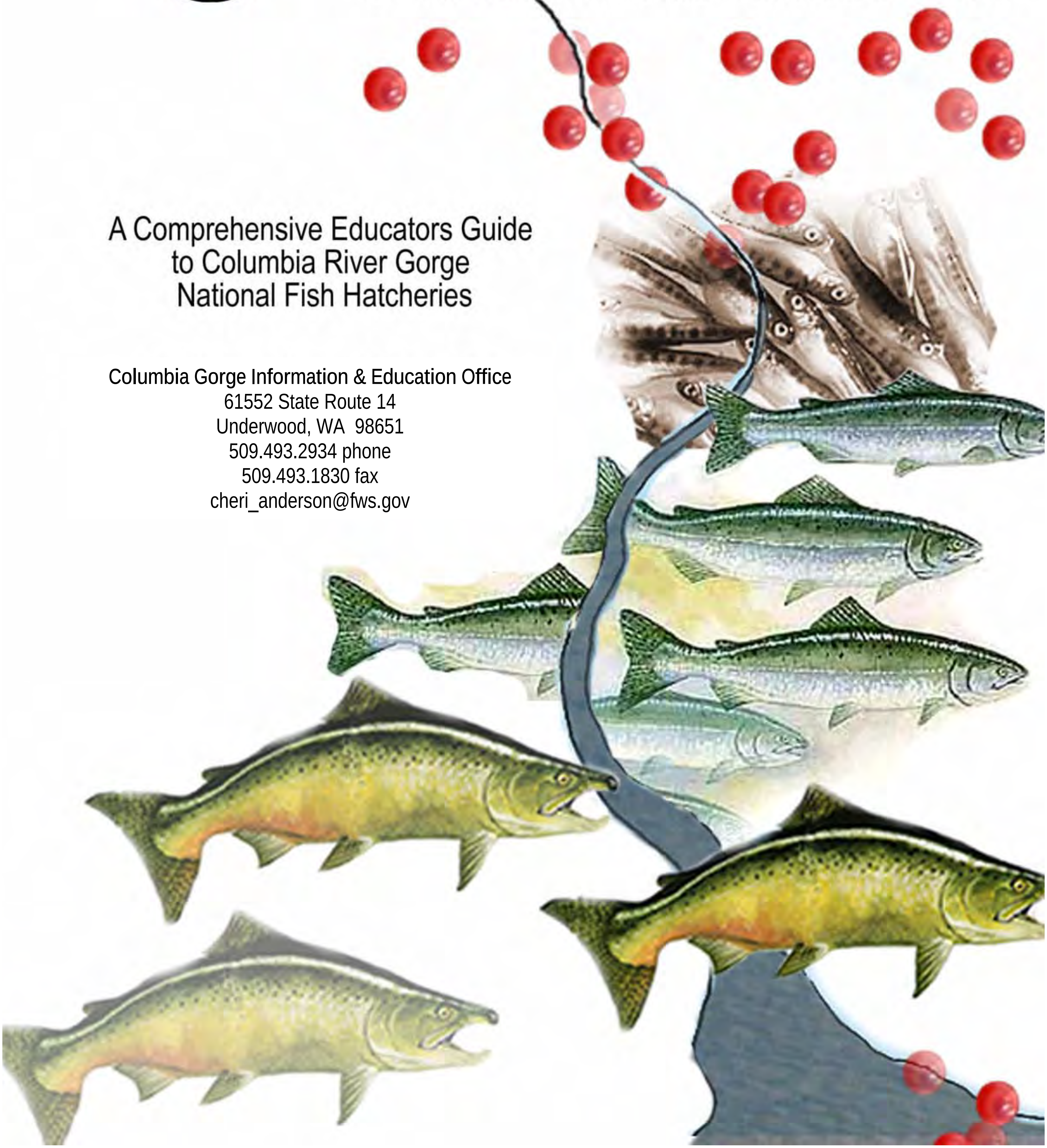
- ❑ Salmon in the Classroom Curriculum

U.S. Fish & Wildlife Service

Salmon in the Classroom

A Comprehensive Educators Guide to Columbia River Gorge National Fish Hatcheries

Columbia Gorge Information & Education Office
61552 State Route 14
Underwood, WA 98651
509.493.2934 phone
509.493.1830 fax
cheri_anderson@fws.gov



U.S. Fish & Wildlife Service

Dear Educator:

Congratulations! You are reading the guide to Columbia Gorge National Fish Hatcheries and Salmon, its development is based on the same framework of goals that distinguish the Columbia Gorge National Fish Hatchery Information and Education Office programs. Its content goes directly to the challenge of meeting the new standards of education of our schools and ties environmental education objectives to the Grade Level Expectations in all subject areas.

Research has now demonstrated learning in all basic subject areas is increased when the students can explore and apply skills in a real world context. With that in mind, the natural and human-made community around the hatchery can be a laboratory for learning and the abundance of excellent environmental education curricula can bring excitement and positive results from the process.

At no time in history has an understanding and maintenance of the environment been of such importance in the lives of everyone. As our region grows and changes, environmental challenges will continue to confront us. As educators, we are playing a critical role in preparing each generation to deal with these challenges thoughtfully and constructively.

We would love for you to call upon the Columbia Gorge Information and Education Office for assistance and information as you plan your instructional programs. We think this educational guide will assist this process and I welcome any thoughts you may have on how we can improve its content.

Sincerely,

Cheri A. Anderson

Cheri A. Anderson
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Helping Salmon through Education and Stewardship

In addition to improving, identifying and carrying out habitat enhancement projects, the U.S. Fish and Wildlife Service (FWS) is committed to communicating with partners and the public to promote involvement and influence attitudes and actions with the goal of improving stewardship of our natural resources.

The Service encourages teachers in the Columbia River Basin to bring their students on tours of hatchery facilities. During these tours, FWS representatives from the Columbia Gorge Information and Education Office (I & E) explain how hatcheries operate and how they fit in the role of salmon enhancement. As a stand-alone piece or as a supplement, the hatchery will provide a 12 minute DVD, which addresses hatchery practices and environmental impacts.

Finally, FWS supports the efforts of other organizations that try to teach people, particularly young people, about how they can help salmon. The FWS provides financial contributions as well as volunteer support.

The I & E Office provides support to local schools by providing teachers with this course of instruction called *Salmon in the Classroom*. This educational curriculum for Columbia Gorge schools encompasses cross-curriculum programming for classrooms, field studies and work experience for all students. The education program gives students a first-hand experience of the natural world particularly the natural world of salmon. Classrooms can participate in a Watershed Assessment which can feature a monthly nature walk, observation of stream conditions, journaling and storytelling. The students can also participate in water quality monitoring, stream surveys and stream mapping. It is a way for students to learn a little bit more about the relationship between humans' activities and their effect on salmon and good stewardship.

Many other resources and teaching aids are also available from the I & E Office. They house an assortment of other curricula, Aquatic Education Bins (fin bins) and a wide array of videos. I & E staff are also available to assist in the classroom in a variety of exercises varying from assisting with a lesson to leading a salmon dissection. If you are interested in us assisting in your classroom, please give us a call at 509-493-2934.

Preparing for a Hatchery Visit

Activities:

- History of the Columbia River Hatcheries
- Columbia River Timeline
- Hatchery Operations

History of Columbia River Hatcheries

To understand the history of Chinook salmon hatcheries in the Columbia River Basin, we need to summarize the history of the rise and fall of Columbia River Basin Chinook salmon fishery. From the first known commercial venture in 1823 to about 1883, the salmon fishery was reaping the benefits of harvesting the lightly exploited populations of Chinook salmon.

In 1877, in response to a perceived decline of the salmon runs, and to avoid proposed restrictions in the fishery, Livingston Stone, a biologist from the U.S. Bureau of Fisheries, was sent to the Columbia River to help the Oregon and Washington Fish Propagating Company (OWFPC) build and operate a hatchery. A site on the Clackamas River was selected and hatchery buildings and racks across the river were constructed. OWFPC leased it to the State of Oregon five years later in 1882. In 1888, it was transferred to the United States Fish Commission. After 1888, there would never be another year in which the reproduction of salmon in the Columbia Basin was entirely natural. By 1928, fifteen hatcheries were operating in the basin and a total of 2 billion artificially propagated fry and fingerlings had been released into the river.

It is important to note that these early hatcheries were not built to save a species, but an industry. People and governments during this time were not focused on the cause of subsequent salmon declines or seeking to correct them, but rather would adopt what seemed a logical and relatively painless solution. If enough fish were not produced naturally, then they would fill the void themselves. Their goal - produce more fish for the commercial harvest. The far reaching impact of this “More is Better” approach to maintaining salmon numbers was not considered, or understood as an issue at the time.

The 1930's witnessed the beginning development of large hydroelectric dams on the main-stem of the Columbia River. The first surge of big river dam building on the Columbia during this period began with operations at the Rock Island Dam in 1933, Bonneville in 1938, and Grand Coulee in 1941. Over fishing was a primary factor in the decline of salmon runs. Additionally, the combination of big river hydroelectric development, timber harvest practices, increased agriculture and cintinued fishing pressure led to the collapse of the fishing industry on the Columbia River.

Artificial propagation has been an important tool used by salmon managers in the Columbia River Basin for the past 120 years. It was the first management activity undertaken in the basin. In the early years of its development, artificial propagation of salmon was carried out at a small scale in low cost facilities and required little effort. However as early as 1898, 26 million salmon fry were being released from hatcheries into the Columbia Basin each year. These early attempts at large scale propagation were largely ineffective, thus early hatcheries may not have had a significant effect on the number of adult salmon returning to the river. Nevertheless, the program did have a lasting and major influence on fisheries management, philosophy and approach.

Hatcheries are still a major part of the restoration program and make a significant contribution to the remnant runs of salmon into the river. Today, about 80 percent of the adult salmon and steelhead entering the Columbia River were hatched and reared in a hatchery. The National Fish Hatcheries have a unique responsibility in helping to recover species listed under the Endangered Species Act, restoring native aquatic populations, mitigating for fisheries lost as a result of federal water projects, and providing fish to benefit Tribes and national wildlife refuges.

Columbia River Basin Timeline

1792 - Capt. Robert Gray discovers the Columbia River
1800 - Smallpox epidemic decimates Indian populations in the Columbia Basin
1805 - Lewis and Clark explore the Columbia River Basin
1825 - Fort Vancouver established
1827 - First sawmill constructed at Vancouver, Washington
1830 to 35 - Pestilence kills more than half the 80,000 Indians living in the Columbia River Basin
1848 - Oregon Territory established and gold discovered in California
1853 - Washington Territory established
1866 - First salmon cannery built on the Columbia River
1871 - Congress creates the United States Fish Commission (former U.S. Fish and Wildlife Service)

- Pre-1877 - before Europeans arrived in the basin, Native American tribes used salmon primarily for subsistence and trading. Defacto fishery management occurred through tribal cultural practices and harvest techniques.

1877 - The OR and WA Fish Propagating Company constructs the first salmon hatchery on the Clackamas River.
1878 - First fishwheel erected at the Cascades (present day Cascades Locks)
1880 - Splash dams introduced to timber harvest techniques
1883 - 55 canneries operating on or near the Columbia River
1884 - Columbia River canneries pack 629,400 cases of salmon annually
1885 - Columbia River canneries pack 553,800 salmon cases annually
1887 - Columbia River canneries pack 356,000 salmon cases annually
1889 - Washington obtains statehood
1896 - Little White Salmon Hatchery built
1899 - 76 fishwheels operating on the Columbia River
1900 - Large scale logging begins in the Columbia Basin
1901 - Big White Sub-station in operation. (Spring Creek National Fish Hatchery)

- 1877 - 1910 *Hatchery Program Goal:* To supply the fishing industry. *Program Development:* In 1866 the first cannery opened on the Columbia River, Washington canneries packed about 4,000 cases of canned fish. The canning industry rapidly reaches a high of 629,000 cases in 1883 and declining to 321,000 cases by 1889.

1910 - Only 10 canneries remain in operation
1912 - Trolling for salmon begins off the mouth of the Columbia River
1920 - Population soars to 2.5 million in the Pacific Northwest
1920's - Annual salmon harvest is approximately 34 million pounds
1926/27 - Oregon state outlaw's fishwheels on the Columbia River

- 1910 - 1930 *Hatchery Program Goal:* To supply the fishing Industry. *Program Development:* During the early 1900s over harvest of natural runs in the basin continued. Habitat destruction also continued as the building of small dams, logging, irrigation diversions, mining and other activities became more widespread and severe. As a result catches continued to decline despite increased artificial propagation. If an effort to improve adult returns hatchery managers began examining their hatchery rearing practices. To increase the commercial catch managers commonly transferred stocks among hatcheries and around the basin as needed to meet hatchery production objectives. There was not a clear understanding of the donor stock suitability and little if any consideration was given to where they were transferred from. They also planted hatchery fish throughout the basin without regard for potential impact on native fish since there was little concern about the interaction

- between hatchery stocks and natural or wild stocks at the time. Fishing laws during this period were few and not well enforced.

1930's - Annual harvest decline to 24 million pounds
1933 - Rock Island Dam completed
1933 - Bonneville Dam project begins
1934 - Washington state outlaw's fishwheels on the Columbia River
1938 - Bonneville Dam completed
1940's - Annual harvest declines to 20 million pounds
1941 - Grand Coulee Dam is completed
1950's - Annual harvest drops to 9 million pounds

- 1930 - 1960 *Hatchery Program Goals:* To supply fish for sport and commercial fishing and mitigate for lost habitat. *Program Development: S*everal critical changes in the Columbia River watershed during this period dramatically transformed the ecosystem and its ability to support meaningful natural anadromous fish production. These changes resulted in the decline and even extinction of many important salmon runs. Beginning in the 1930s, a series of large, multipurpose dams were constructed on the main-stem Columbia and Snake Rivers. Losses in fish production and habitat during this time were compounded by continued logging, fishing, agricultural, mining and other land-use activities. Following dam development on the Columbia and Snake River, a large number of hatcheries were upgraded or built to mitigate or compensate for habitat losses. Funding for these upgrades or new hatcheries was provided under the Mitchell Act, passed by Congress in 1938.

1960 - 1970 - Fourteen high dams completed on the Columbia River
1970 - 1980 - Commercial catch declines from 12 million pounds to 1.2 million pounds per year

- 1960 - 1980 *Hatchery Program Goals:* To supply fish for sport and commercial fishing and mitigate for lost habitat. *Program Development:* Several major shifts in outlook occurred during this period. The conservation of fishery resources emerged as a necessary public value rather than an amenity, reflecting a growing awareness of ecological values. Also during this period, beginning in 1977, the basin began experiencing what was to become a major drought cycle.

1980 - Northwest Power Act signals a new era to preserve and restore the region's anadromous runs
1985 - U.S. Canada Pacific Salmon Treaty

- 1980 - Present *Hatchery Program Goals:* To mitigate for lost fish resulting from habitat destruction and to conserve genetic resources. *Program Development:* Today, the Columbia River Basin contains over 90 artificial production facilities. Roughly three-quarters of the basin's adult salmon come from these hatcheries (ODFW and WDFW 1995). These facilities are operated by several different entities with separate mitigation obligations.

Carson National Fish Hatchery

The Carson National Fish Hatchery, built by the Civilian Conservation Corps, began rearing salmon and trout in 1937. During the 1950's the hatchery began rearing spring Chinook salmon exclusively. Because of the loss and degradation of spawning habitat and the impact of dams on migration, the spring Chinook was in rapid decline. Today the Carson hatchery releases more than 1.17 million smolts (young salmon) annually.

Location: The hatchery is at the confluence of Tyee Creek and Wind River 14 miles north of the Columbia River, about 60 miles east of Vancouver, Washington. To visit the hatchery, turn north off State Highway 14 at the Wind River Highway (about 3 miles east of Stevenson) and go 14 miles to the hatchery. Visitors are welcome daily except holidays and some weekends.. Call in advance for information on group tours, lectures on fish culture and dates of hatchery activities. (509) 427-5905

Best Time to Visit:

- May through August to view adult salmon
- May to see fry being marked before release
- August to view spawning
- Hatchery tours are given year round, however, many groups prefer to visit during the spring when the adult fish are returning. There are fish in some stage of development at the hatchery throughout the year.

Spring Creek National Fish Hatchery

The Spring Creek National Fish Hatchery was established in 1901 to raise Tule Fall Chinook salmon. In 1972, the U.S. Army Corps of Engineers reconstructed the hatchery and increased its capacity to raise 15 million fish to partially mitigate lost fall Chinook salmon spawning grounds destroyed by the construction of the John Day Lock and Dam. The hatchery uses spring water recycled through a biological filtration bed.

Location: Spring Creek Hatchery is located 2 miles west of the Hood River/White Salmon bridge on State Highway 14. Visitors are welcome at the hatchery from 7:30 a.m. to 4:00 p.m. daily, September through May, and weekday’s mid-May through August. Call ahead to arrange for a group or guided tour.
(509) 493-1730

Best Time to Visit: September to view adult Tule Fall Chinook and spawning. Hatchery tours are given anytime during the year; however, September field trips are generally more eventful. At this time, spawning is taking place and adults are coming up the fish ladder and in the holding ponds. Tours during mid-October through December feature eggs and small fry in indoor incubation trays. In January the fry are put out in the raceways and the ponds are full. Marking trailers are at Spring Creek late-January to early April. Release of smolts happen in two release dates during April and May.

U.S. Fish & Wildlife Service

Little White Salmon/Willard National Fish Hatchery Complex

The Little White Salmon/Willard National Fish Hatchery Complex, the oldest of the three federal hatcheries in the Columbia Gorge, was established in 1896 at the mouth of the Little White Salmon River. The hatchery raises spring and Upriver Bright fall Chinook salmon. Fish are released into the Little White Salmon River and in tributaries of the upper Columbia River to assist with endangered species recovery efforts. Adult salmon return to the Little White Salmon Hatchery for spawning and can be viewed through holding pond underwater viewing windows. An observation deck overlooking the Little White Salmon River provides views of salmon spawning in natural habitat.

The Willard Hatchery produces salmon to support reintroduction efforts in the mid and upper-Columbia River area. Eggs are collected from adult salmon returning to the Little White Salmon Hatchery or other watersheds and transferred to Willard for incubation, rearing and transfer back to the watershed of origin for release.

Location: The Little White Salmon Hatchery is located 12.5 miles east of Stevenson, WA along State Route 14. The hatchery entrance road is located at the west end of the Little White Salmon River Bridge at Milepost 57. Turn north at the west end of Drano Lake and go about one mile to the hatchery.

The Willard Hatchery is located approximately 5 miles up the west end of the Cook-Underwood Road on the Little White Salmon River. Visitors are welcome at both hatcheries from 7:30 a.m. to 4:00 p.m. daily. Call the Administrative Offices in advance to arrange for group tours at both hatcheries. 509-538-2755

Best Time to Visit:

- May through July to see adult spring Chinook salmon returning to the hatchery
- September through October to see fall Chinook salmon returning up the fish ladders
- August to view spring Chinook salmon spawning
- October through mid-November to view fall Chinook salmon spawning

General Hatchery Operations – the hatchery life cycle

Fish hatcheries are somewhat similar to agriculture in that they acquire their “seed” (eggs) from a chosen source, cultivate their seed and then release the product. There are differing operations depending upon water supplies, species produced, and number of physical, behavioral and physiological objectives.

Most hatcheries in the basin have enclosed areas that provide for inside incubation of eggs and sometimes the rearing of small fish called “fry.” Outside facilities generally consist of ponds and/or cement holding areas for rearing fish to the larger size of smolt.

The preferred water supply for a fish hatchery is a large spring. Because spring-fed water supplies are scarce, most Columbia River hatcheries use tributary water. Water temperatures are critical to the success of a hatchery, as salmon rear best at temperatures in the mid-50°F. Both Spring Creek and Carson National Fish Hatcheries are spring fed.

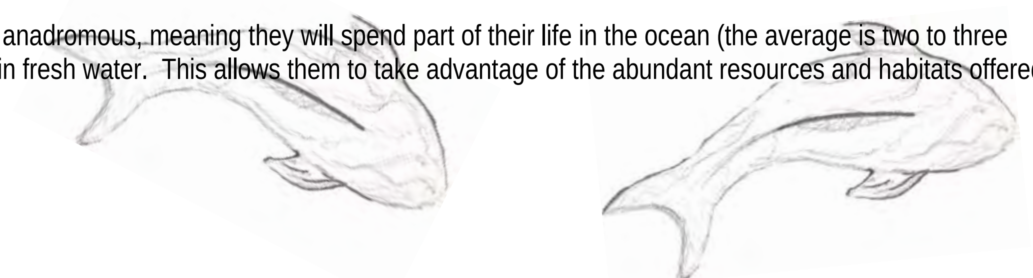
Traditionally, hatcheries in the Columbia Basin acquire fish eggs directly from adult salmon that come back to the hatchery. To facilitate this return of adults, the hatcheries release their smolts at or near the hatchery. When they return as adults they will be held for a short period and checked periodically to determine if the males and females are mature. When the eggs and milt flow freely, hatchery operators remove or “strip” the eggs from the female and fertilize the eggs with sperm or “milt” from the male.

The eggs are then moved to the incubation building and placed in incubator trays where they are held until they “eye up,” a developmental stage where an eye is clearly visible in the translucent egg. At this time the eggs develop some resistance to shock and can be moved if required or stay until they hatch. Because salmon are cold-blooded, hatching time is directly dependent upon water temperature. For instance, eggs that are placed in the incubation tray with water about 50°F would hatch in about 50 days. The warmer the water the faster the eggs will hatch.

During incubation water flow (to deliver oxygen and carry away waste products) and temperature (40° to 65°F) must be suitable. Salmon are cold water fish and do not tolerate temperatures above 68° F.
Newly hatched fish are called “sac fry” and have their own food supply in the form of an attached protein sac. Once the young have exhausted this self-contained food source, they have become fry and will be moved to outside raceways. One important part of the rearing program is feeding the fish. The fish food is a carefully manufactured diet developed by biologists to ensure maximum growth.

Fish are reared at the hatchery between 90 days and 16 months, depending on the species. Releases are carefully planned to reduce interaction and competition with wild species. Once grown to a decided size or correct physiological stage, they are released directly from the hatchery into the watershed.

The salmon are anadromous, meaning they will spend part of their life in the ocean (the average is two to three years) and part in fresh water. This allows them to take advantage of the abundant resources and habitats offered by both.



Hatchery Fish: The Arguments For and Against

- We have a moral obligation to do something about the fish populations that are dying.
- Hatchery fish compensate for declines in native fish populations.
- Hatcheries help support the economy of the region by supplying fish.
- Hatchery fish help support the angling industry.
- 80% of the salmon caught by the commercial fishing industry are hatchery fish.
- The salmon are of great traditional importance to Native Americans.
- Hatchery fish could be used to supplement natural stocks.
- We have a moral obligation to do something to repair the habitat that we have destroyed.
- Hatcheries create a false sense of abundance, making people less concerned about conserving the habitat that remains.
- Native fish waste precious energy competing against hatchery fish for limited resources.
- Hatchery fish are more prone to disease than native fish.
- When native fish die, their carcasses provide nutrients to the rivers and streams where they spawn.
- Native fish learn to avoid predators, and find food on their own.
- Hatchery fish are hand fed by humans.
- Through a process called natural selection, the native fish that are best suited to their environments are the fish that survive to spawn.
- Genes carry pieces of information that allow fish to inherit traits from their parents. In a population of natural fish with al lot of genetic diversity, there is a greater chance that at least some fish will have the traits necessary to survive if there is a sudden change in environmental conditions.
- Populations of hatchery fish have less genetic diversity than populations of native fish because hatchery fish have had fewer ancestors than wild fish.
- Raising hatchery fish is very expensive.

Meet the Fish

U.S. Fish & Wildlife Service Take Home Messages

"Salmon issues are extremely complex and include species other than salmon"

The issues involve watershed health, other species and broad scale efforts to increase survival at all stages of the salmon life cycle.

- Twenty -three (23) Pacific salmon and steelhead populations are presently listed under the Endangered Species Act on the west coast. Many more are at significant risk of further decline and require changes in management of Hydro facilities (dams), Habitat protection, Harvest (fishing), and Hatchery operation to recover/restore.
- The salmon issue is more than salmon; it is a watershed health issue that effects many other species, e.g. bull trout, cutthroat trout, snails, sturgeon.
- Salmon issues are international in scope and complexity with significant implications to federal responsibilities to treaties with Native American Tribes and Canada.
- The problems are large, complex and cut across agency and governmental boundaries, therefore no single agency is in charge or can restore salmon on their own. It will require a coordinated state, tribal, and federal effort.

"The Fish and Wildlife Service is a key action agency for salmon recovery"

- The Service has been active in salmon restoration since the first Commissioner of Fisheries sent an expedition to explore the reasons for decline of Columbia River salmon in the 1880's.
- The Service began the first Federal salmon restoration effort with construction of Federal hatcheries in California and the Columbia River in the 1880's - 1890's.
- From the early efforts in the late 1800's, the Service evolved beyond fish culture into over 40 offices and field stations strategically positioned on major aquatic systems of the west from San Francisco Bay to Puget Sound, to the Columbia River, to Alaska and is actively engaged in all Hydro, Habitat, Harvest and Hatchery (these are referred to as the four H's of Mangement) salmon issues dealing with habitat restoration, harvest management, hydro operations, hatchery management, Endangered Species Act recovery, and more.

Pacific Salmon

There are five species of Pacific salmon: Chinook (king), Chum (dog), Coho (silver), Pink (humpy), and Sockeye (red). All pacific salmon are anadromous, meaning they spend part of their life in the ocean and part in fresh water. That allows them to take advantage of the abundant resources of the ocean and the protection fresh water habitats offer for spawning. In the rich ocean environment salmon can grow rapidly, gaining over a pound a month. These salmon mature and return to freshwater within 2 - 8 years.

As salmon grow in the ocean environment, they are essentially accumulating marine nutrients and storing them in their bodies. Pacific salmon spawn only once in their life cycle and during this event they transport those nutrients back to their stream of origin when they die and decay. Salmon release their eggs and milt back into the freshwater to re-seed the cycle. Eggs that don't get buried in the gravel become immediately available as food for other fish, birds and insects. After spawning the salmon die, and as they decay valuable nutrients are released. These nutrients fertilize the water that feeds the developing salmon, filter feeding insects, and aquatic and terrestrial plant life. This process of salmon accumulating marine nutrients and returning them to freshwater streams has been referred to as "the great nutrient cycle."

One of the most amazing facts about Pacific salmon is their ability to return to their "natal" or home stream or lake. Salmon are thought to use several navigation aids to find their way back to where they were hatched. Scientists believe salmon use a combination of a magnetic orientation, celestial orientation, the memory of their home stream's unique smell, and a circadian calendar to return to their natal stream to spawn. The memory and smell centers' in a salmon's brain grow rapidly just before it leaves its home stream for the sea. A salmon can detect one drop of water from its home stream mixed up in 250 gallons of sea water. Salmon will follow this faint scent trail, with the aid of the other methods mentioned above, back to their home stream to spawn.

Although a single female salmon can lay 1,000 to 7,000 eggs, very few of those eggs actually survive from fertilization to maturity. An average of 3 fish returning from every parent fish that spawns would be considered good production. Many natural and human-related factors cause this high mortality. During spawning, eggs may not be fertilized, or may not get buried in the gravel before they are either eaten by predators (birds and fish) or become damaged as they bounce along the river bottom. Some eggs may not mature and hatch due to freezing, drying out if the water level drops too low, being trapped in the gravel, or silt smothering the eggs.

Those eggs that successfully hatch to the "alevin" stage continue to grow, and then emerge from the gravel as "fry." Fry become subjected to a whole new batch of obstacles (dams, irrigation systems, development, etc.) and predators, since salmon at this stage are near the bottom of the food chain. Pink and chum salmon juveniles head out to sea immediately. The other species may spend as many as two years in freshwater before their seaward journey. During times of these seaward migrations you can find corresponding concentrations of predators, such as arctic terns, gulls and other fish species.

Columbia River Salmon Species (courtesy of the Northwest Power Planning Council)

Along the rim of the Pacific Ocean from Asia to North America, live five species of salmon and steelhead (an ocean-migrating trout) belonging to the genus *Oncorhynchus* (meaning hooked snout). The six described on these pages Sockeye, Coho, Chinook, Chum, Pink and Steelhead–are native to the Columbia River Basin. A seventh species, the cherry salmon (*Oncorhynchus masu*), is found only in Japan, Korea and the Soviet Union.

The Columbia River system produces more steelhead than any other river system in the world. Steelhead were once considered a form of trout, more closely related to Atlantic salmon than Pacific and Asian salmon. In 1988, however, after years of debate and study, Pacific steelhead were reclassified as members of the genus *Onchorynchus*.

Sockeye Salmon (*Oncorhynchus nerka*)

(Known as red in Alaska or blueback in the Columbia Basin)

Sockeye, the most common salmon in the Pacific, spawn in streams that have lakes in their watershed. Historically there were eight lake systems in the Columbia River Basin inhabited by sockeye. Today only Lake Wenatchee in Washington and Osoyoos Lake in British Columbia produce any significant numbers, although a remnant run is still produced in Idaho's Redfish Lake. Landlocked forms of sockeye salmon, called kokanee, or little redfish are found in some lakes and many reservoirs in the Columbia Basin.

After hatching, the young Sockeye spend from one to three years in the lake before migrating to the ocean. Then, between their first and fourth year at sea, the adults weighing an average of 3 to 5 pounds, return to the Northwest streams from July through October to spawn and produce their next generation.

Coho Salmon (*Oncorhynchus kisutch*)

Coho were originally found in many North American streams from the Bering Strait to the Sacramento River. They rarely travel far inland, preferring, in the Columbia system, to spawn in the lower river tributaries below Bonneville Dam. However, in the past, some have migrated as far as the Spokane River. The young fish spend one year in the natal stream, then typically two years in the ocean before returning from early October through late December to the natal stream. Coho at maturity weigh about 7 to 9 lbs.

Chinook Salmon (*Oncorhynchus tschawytscha*)

Chinook are the most important salmon species for West Coast sport and commercial fisheries and are found from the Bering Sea to Monterey Bay. They also have been successfully introduced in the Great Lakes and in New Zealand. Chinook reach maturity when they are between 3 and 7 years old–living the longest of the Pacific salmon. They are also the largest of the salmon, with recorded weights over 100 lbs.

In the Columbia River system, most Chinook return to spawn in the spring or fall, but some can be found in the river almost any months of the year. Before dams blocked off the upper Columbia, Chinook spawning grounds extended from the lower tributaries to the top of the basin in Canada.

The three major divisions in the Chinook species are based on the season of their adult migration to the spawning streams; spring, summer and fall. Each division has two segments based on where they spawn.

The fish of the lower river spring run migrate upriver from January to May, with the peak in late March or early April, and head for the river's tributaries below Bonneville Dam. The upper river spring Chinook run journeys to the Snake and upper Columbia tributaries in late March through May, peaking in late April or early May.

Summer Chinook return to the river system in June through August. One segment heads for the Salmon River drainage in Idaho and the other for tributaries of the Columbia above the confluence with the Snake River. These fish probably were the bulk of the lower river commercial catch in the late 1800s.

From August through December, one segment of the fall Chinook run, called tules, goes to the lower river in early August through December and the other, the upriver brights, continues on to the mid-river tributaries between Bonneville and McNary dams.

Chum Salmon (*Onchorynchus keta*)

Chum are the second most abundant species along the whole Pacific Rim, although relatively few are found in the Columbia River Basin. Those few enter the Columbia River in mid-October and November heading for the lower tributaries primarily in Washington. Young Chum start for the sea almost as soon as they hatch. Formerly quite abundant in the Columbia Basin, they have declined drastically in numbers this century because of habitat degradation. This degradation primarily is the result of logging activities near spawning streams.

Steelhead Salmon (*Oncorhynchus mykiss*)

Steelhead long were considered ocean-migrating tout and close relatives of Atlantic salmon. In 1988, after years of scientific debate and study, steelhead were reclassified by the Names of Fishes Committee of the American Fisheries Society as members of the family of Pacific salmon.

Like the Atlantic salmon, they do not always die immediately after spawning–some have been known to spawn three times. (In contrast, other Pacific salmon spawn only once before dying.) After hatching, juvenile Steelhead stay in the stream for one to two years. The adults will return to that stream to spawn in their third, fourth or fifth year. At maturity they can weigh up to 40 pounds.

Winter Steelhead migrate in November though June heading to the lower Columbia tributaries to spawn. Summer steelhead migrate from June to October. This migration is divided into two segments: group A–smaller fish returning to the mid- and upper Columbia and Snake River tributaries and group B–larger, later fish that spawn primarily in the Clearwater River drainage in Idaho. Steelhead are rarely caught in the ocean, but are an important sport fish in Idaho, Oregon and Washington.

Pink Salmon (*Oncorhynchus gorbuscha*)

Only a few pink salmon are found in the Columbia River– the southernmost extent of their range. Most are native to Alaska, British Columbia and Puget Sound. Pinks are the smallest of the Pacific salmon, weighing only about 4½ pounds.

Up Close and Personal (with a hatchery fish at Spring Creek NFH)

Who gets the salmon?
More profoundly than any other species in the Pacific Northwest, salmon are part of our identity. To tribes, salmon are spiritual, cultural and physical nourishment. To sport fishers, they are recreation, time outdoors, and the heart and soul of a fishing trip; to commercial fishers, a livelihood; to the Pacific Northwest, an icon of our environment.

How different are they?
Hatchery fish do differ from wild fish in their early life stages. Hatcheries provide protection from adverse environmental conditions that salmon might experience in the wild. However, streams are more dynamic and prepare young fish for the rigors of surviving in a wild environment. But as adults, both hatchery and wild salmon face the same trials in their journeys to and from their ocean habitat.

Where do hatchery fish come from?
Historically, all salmon reared in hatcheries were derived from wild fish produced in the natural stream environment. As compensation for the losses of wild salmon production, artificial propagation facilities (i.e. Hatcheries) were built throughout the Columbia Basin.

What kind of fish is raised at Spring Creek National Fish Hatchery (NFH)?
Tule Fall Chinook salmon are raised at this hatchery. They are indigenous to the White Salmon River. That means they lived in this part of the Columbia River even before we began raising them and releasing them back into the river. The Spring Creek NFH has been here since 1901, and has reared tules for over 100 years.

How old are the adults when they return?
Most of the adult fish returning to the Spring Creek NFH are 3 to 4 years old.

How big are the fish when they return?
The average weight of the fish when they enter the Spring Creek hatchery is about 23 pounds. The biggest recorded fish that returned to the hatchery was 63 pounds. When Tule Fall Chinook enter fresh water they stop eating and use stored energy to return to their spawning area. By the time they enter the hatchery, they have lost 25% to 30% of their ocean body weight.

How many fish does the hatchery need to get enough eggs?
The Hatchery needs about 10,000 returning adults in order to take the 20 million eggs needed for full production. Each female has an average of 5,000 eggs. The hatchery releases 15.1 million smolts annually.

Did you Know??

- The oldest verified fossil for a freshwater version of the salmon is 50 million years old. Five to six million years ago salmon had fangs, weighed 500 pounds, and were ten feet long. The modern anadromous Pacific salmon emerged about two million years ago in the cold mountain streams of the Pacific Northwest.

- Salmon species have adapted to use virtually every part of every stream here in the northwest. Big rivers are used by pink salmon in the lower reaches, Chinook in the mainstream and larger tributaries, Coho in small tributaries.

- Small streams are used by chum in the lower reaches, and Coho next.

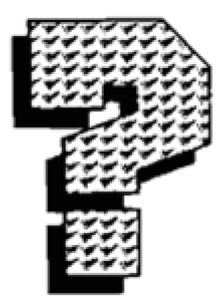
- Humans have given many nicknames to salmon. Chum are often called "dogs" because of large canine teeth they develop during spawning. They are also called "calicos" because of their bright spawning colors. Spawning pink males develop a large humped back and are called "humpies."

- Salmon do not have ears. Instead they hear low frequency sound waves which vibrate through water to a row of sensory pores, called lateral lines, on the sides of the salmon. Scientists believe lateral lines also may help salmon navigate in the ocean.

- A moving fry is much easier to see than a motionless one. This is why salmon tend to spawn in parts of the stream that their offspring use for rearing; the emerging fry do not have to travel far to find rearing areas.

- The size of a salmon is usually related to its age. Pink salmon are the smallest fall-spawning salmon and are also the youngest, at two years. Chinook can live up to nine years, the longest, which is why some Chinook can grow to over 100 pounds.

- There is a sixth fall-spawning salmon, the masu, or cherry salmon, which is found only in Asia. This fish occupies the same niche that the sea-run cutthroat trout (or steelhead) occupies here in North America.



- Salmon in their saltwater phase travel around 18 miles a day, but are capable of maintaining an average of 34 miles per day over long distances. Salmon often travel much more slowly to feed.

- Coho and sockeye are found in freshwater year round; Coho in small costal streams and sockeye in lakes. They are very susceptible to poor water quality, such as high temperatures and pollution.

- Young salmon moving to sea travel at night to avoid predators. They also drift backwards facing upstream which may allow them to continue feeding and also may provide better control in the downstream current.

- Salmon need cold, clean, well oxygenated water. Even salmon raised in hatcheries spend some portion of their lives in a river or stream. Without healthy watersheds, salmon cannot survive.

- The Chinook salmon is also known as the “King” or “Tyee” (meaning chief) salmon. It is the largest of the salmon species, weighing in at records of 125 pounds.

- Scientists call Pacific salmon *Oncorhynchus*, the Latin word for “hooked snout” because of the curved jaws which develop during sexual maturation.

- Salmon from many rivers swim together in the same areas through much of their ocean going life.

- Salmon in one run may have different weights and sizes; a three year old may weigh 4 pounds, while a seven year old might weigh 50 pounds.

- “Jacks” are small salmon, usually males, which mature after spending only one winter in the ocean before returning.

Lesson 1 – Habitat, Ecosystems and Salmon

Purpose: This lesson is designed to explore the concepts of habitat, ecosystem and the food chain/web and how these concepts relate to Pacific Salmon. It will also illustrate the effects of removing any one part from an ecosystem to gain an understanding of just how closely related all components of the system are.

Activities:

Habitat – background information

All species of animals and plants need a proper combination of food, water, cover, and space in order to live and reproduce. Together, these elements make up their "habitat," an area meeting these needs. Habitat is the key to the survival of any species.

Why Habitat Needs Vary

The specific habitat requirements of many animals and plants differ, although a variety of species may live in the same area. White-tail deer, ruffed grouse, and tree squirrels, for example, prefer woodland, while cotton-tail rabbits and song sparrow favor fields. Waterfowl, fishes, mussels, and pitcher plants are at home in wetlands or rivers, while other species, such as the desert tortoise and most cacti, depend on dry habitat. The common pigeon, starlings, and roof rats can easily adapt to the urban habitats of large cities, towns, and suburbs.

Some animals may require different habitats at various stages of their lives. For example, salmon need clean, cold water in which to live and reproduce. They begin their lives as fertilized eggs in fresh water. Adult salmon lay and fertilize their eggs in clean gravel nests known as a redd. Depending on the species, some salmon may stay in streams or lakes for months or even years after hatching. Others go directly to the ocean to feed and grow in the estuaries or bays. Eventually they all make it to the ocean were they will live from one to eight years depending on the species, with the average being three years.

Habitat and Endangered Species

Conserving habitat is especially critical for the continued survival of endangered plants and animals. Habitat loss or degradation is often the key factor which has led to a species becoming endangered.

Another factor contributing to the imperiled status of many endangered species is a lack of adaptability to different environmental conditions, such as habitat. If a species can only live in a certain type of habitat, such as grassland, and much of that habitat is destroyed, the species may become endangered. The salmon - a fish on the verge of extinction - has declined, in part because of the loss of its habitat. Salmon need large expanses of clean, cold fresh water to reproduce. When salmon lay their eggs, they find gravel bars in the streambed where the eggs can settle, hidden from predators such as crayfish. After the young salmon hatch, they must have aquatic plants, quiet pools, and bottom rubble to provide cover to escape great blue herons, mink, and other predators.

Protecting habitat helps people too

Wildlife and plants, especially those species which are endangered, are often viewed as the "canary in the coal mine," serving as a warning signal that the environment is about to become unhealthy for people, too. For example, many mussel species are endangered because of pollutants in the water supply - the same water supply people often depend on for their drinking water.

Creating, restoring, enhancing, and protecting areas of habitat can prevent the loss of wildlife. Conserving remaining areas of wildlife habitat is a large but very important task. Every concerned citizen can become involved. To learn more about wildlife and its habitat in your area, contact the state or local natural agency, local chapters of conservation organizations, or the U.S. Fish and Wildlife Service.

Ecosystems and Salmon

Ecosystems Depend of Salmon

More than 137 species of fish and wildlife - from Killer Whales to caddis flies - depend on the Northwest Pacific salmon for their survival, and that should make salmon recovery efforts of far greater importance than just producing them artificially. It is well documented that salmon have always played a vital role in a watershed as a food staple for humans, but little has been documented on the role they play on the health of a watershed.

When Pacific salmon return from the ocean, they bring back vital nutrients to their watersheds. The carcasses and eggs contributed by the spawning fish are eaten directly by juvenile salmon, other fish, insects and wildlife. Salmon are not only feeding their own young, they are feeding the whole neighborhood. Many species depend on salmon both directly and indirectly - feeding on salmon as well as preying on species that eat salmon. The insects feed on the carcasses, and then become food for adult and juvenile mammals, birds, and fish.

Putting the Nutrients Back

In recent years, hatchery salmon carcasses have been reintroduced to streams all over the Northwest in an effort to restore some of the lost nutrients. This method of nutrient enhancement is not without concern. The distribution of carcasses into the stream environment is limited because of the possibility of spreading disease and the difficulty of accessing remote areas for distribution. Resource managers also recognize the importance of not introducing fish from other areas or watersheds. *The ideal situation is to use local carcasses from local hatcheries raising local fish.*

For years, hatchery fish have been used to make organic fertilizer. Now they are being used to develop a whole new product – fish bricks and fish pellets. The fish bricks or fish pellets are not new, but what they are being used for is - nutrient enhancement to watersheds. These new fish bricks and fish pellets are in a limited amount being introduced to watersheds rather then salmon carcasses. The introduction of marine derived nutrients in brick or pellet form addresses some of the concerns, like disease. Another problem is that many spawning grounds that need nutrients are located in places far away from roads and trails. The fish brick or fish pellet would be easier to pack in - with less weight and the mess of using frozen fish. But you have to remember this only helps a portion of a watershed inhabitancy, where the salmon carcasses feed a broader range.

You may also look at the salmon life cycle as a “primitive form of childcare.” By going out into the ocean, feeding and storing nutrients, then returning to their stream of origin to enrich the habitat, salmon evolved to give their young a better chance for survival. Looking closer at this interconnected web of 137 species, including mammals, birds, reptiles and amphibians, you will find that several species depend on salmon both directly and indirectly - feeding on salmon as well as preying on species that eat salmon. Many insects feed on salmon, and then become food for juvenile salmon.

Nutrients from salmon carcasses even find their way into the trees that shade the streams, keeping the waters cool the way young salmon like it. The trees drop organic matter into the streams, which again indirectly feeds young salmon. In recent years both Oregon and Washington have started seeding hatchery salmon carcasses in the rivers to return some nutrients, but a lot more is needed. It will require a major shift in the way we value salmon - from purely commodities to an appreciation of the ecological role in maintaining healthy watersheds.

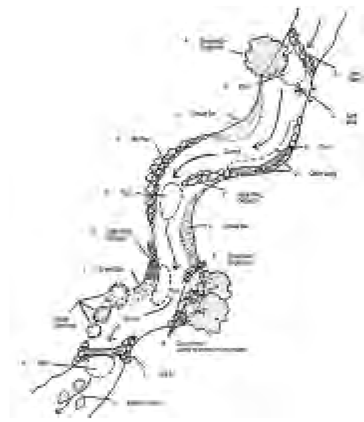
Home Wet Home – An Activity

This activity was adapted from:

The Stream Scene
Watersheds, Wildlife and People
by Patty (Farthing) Bowers et al
Oregon Department of Fish and Wildlife 1990

Key Concepts:

- ✦ Salmonids need certain habitat components to live in a stream.
- ✦ Structures in and near streams have benefits for fish.



Teaching Information:

Students should read the background material provided in the activity, analyze the stream diagram and describe how each item noted develops or provides suitable fish habitat. This activity fosters ideal small group work.

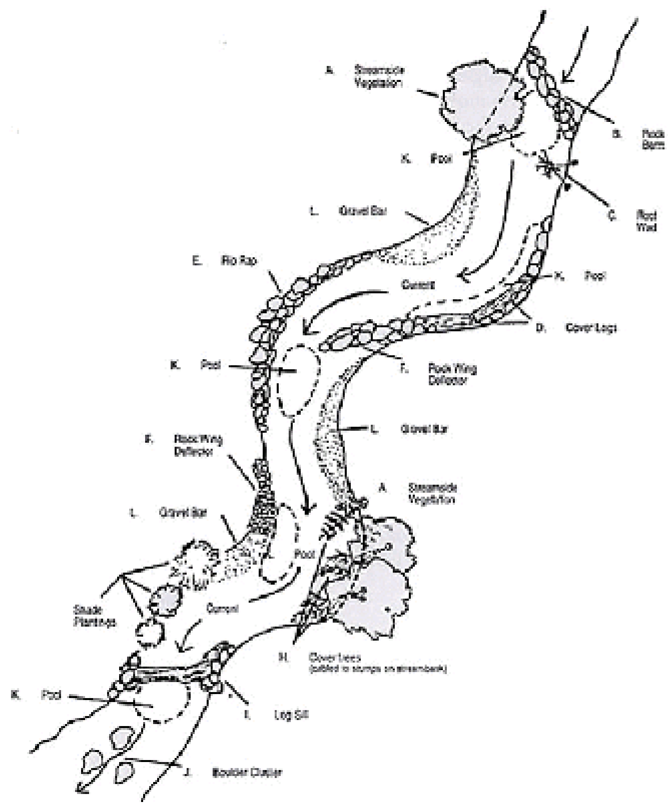
Once students have completed the activity, visit an actual stream where they can identify the stream components used in the activity. Since most hatcheries have streams on or next to the hatchery grounds, this could be done during a hatchery visit.

Materials:

- ✓ Copies of student sheets (Home Wet Home…)

A. <u>Streamside Vegetation</u>
Provides cover in addition to shade for temperature regulation. In autumn, leaves drop into stream and eventually provide food for invertebrates that are eaten by fish.

B. <u>Rock Berm</u>
Slows the water, traps gravel for spawning, and creates pools.



C. <u>Root Wad</u>
Provides shade, cover, and resting areas.

D. <u>Cover Logs</u>
Provides shade, cover, and resting areas.

E. <u>Rip Rap (rocks and vegetation)</u>
Protects banks from erosion

F. <u>Rock Wind Deflector</u>
Redirects water flow, causes gravel deposition, and creates pools or pocket water and resting areas.

G. <u>Shade Plantings</u>
Provides shade for water temperature regulation and food for invertebrates when leaves fall.

H. <u>Cover Tree</u>
Provides shade, cover, and resting areas, and produces spot scouring.

I. <u>Log Sill</u>
Traps gravel for spawning and creates pools and cover.

J. <u>Boulder Cluster</u>
Changes the flow pattern and provides cover; pocket diversity of habitat.

K. <u>Pool</u>
Provides a resting area.

L. <u>Gravel Bar</u>
Provides spawning habitat.

Home Wet Home
Student Activity

Do you know...
Salmon and trout (salmonids) are important to anglers. Salmon are also important to biologists because their presence helps indicate the health of the stream in which they live.

Salmon are one of the first organisms to be affected if their watery home starts to change or if their habitat is unsuitable. Biologists refer to sensitive animals like salmon as “indicator” species.

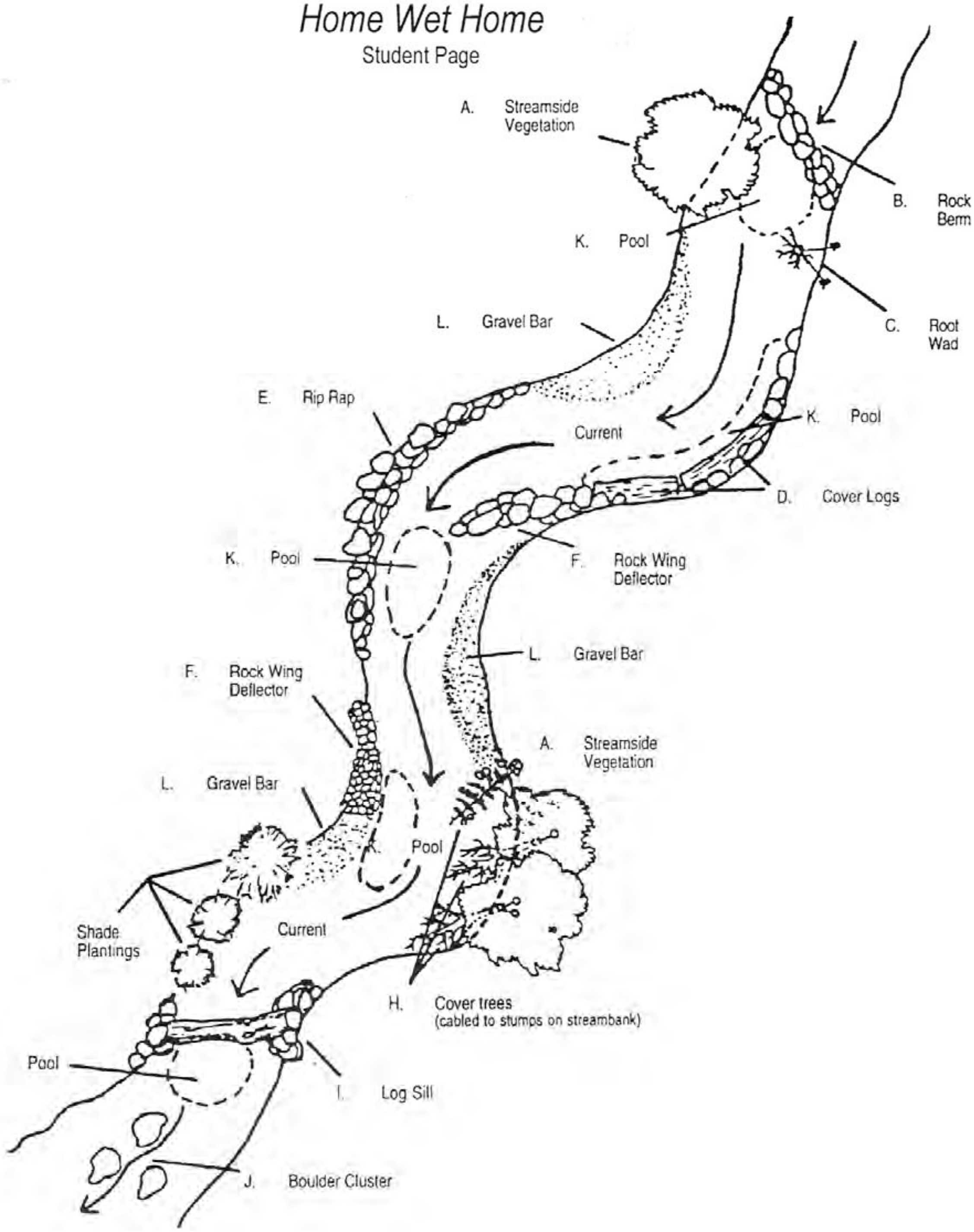
Because salmon are so significant, fish biologists have developed many ways to improve stream habitat to enhance fish survival. In some cases, biologists can produce a fishery where none was previously found.

The ecological requirements of salmon are:
- Cool, clear, well-oxygenated water
- Sections of gravel bottom for spawning
- Occasional pools for feeding and resting
- Adequate food (aquatic and terrestrial insects, the latter usually falling from stream-side vegetation)
- Cover for protection from predators

Now it’s your turn…
The figure on the next page shows several ways a stream can be improved to provide salmon habitat. Each structure has been used to meet the special needs of these sensitive fish. Next to each feature, describe the contribution it will make towards creating a healthy and comfortable environment for fish.

Home Wet Home

Student Page



Riffles and Pools – An Activity

This activity was adapted from:

The Stream Scene
Watersheds, Wildlife and People
by Patty (Farthing) Bowers et al
Oregon Department of Fish and Wildlife 1990

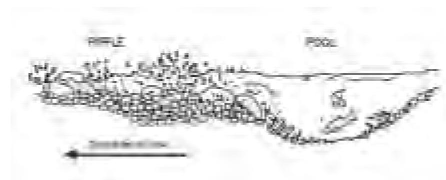
Key Concepts:

- ✦ Riffles and pools are necessary to meet the needs of salmon and trout.

Teaching Information:

Students will apply concepts learned about salmon habitat needs during their life cycle by reading a short informational piece and completing a worksheet analyzing riffles and pools.

Materials:



- ✓ Copies of student sheets (Riffles and Pools…)

Answers:

1. Will the dissolved oxygen concentration be higher at the bottom of the pools or the riffles? *Generally, riffles should have more dissolved oxygen than pools, as a result of air and water mixing in the more turbulent water of the riffles.*

2. Which would give more shelter or protection to salmon eggs, pools or riffles? Why? *Riffles. The gravel usually found in the riffles would protect the eggs. Pools are more likely to have collections of fine sediments rather than gravels.*

3. What happens to aquatic insect larvae as the current enters a pool and slows down? *They settle to the bottom or are eaten by predators (other insects or fish).*

4. Where would be the best place for salmon fry to wait for lunch? Why? *At the head of a pool or tail of a riffle. To be first in line for drifting insects.*

5. Where would salmon fry use the most energy catching food? Why? *On the riffles. It is harder to maintain position in the faster water of a riffle.*

6. Chum salmon fry only spend as much time in the stream as it takes to get to the ocean (one day to three weeks). Coho salmon juveniles live for a year in the stream before heading to the ocean. Steelhead and sea-run cutthroat juveniles live up to three years in the stream before heading to the ocean. If a stream has good spawning habitat, but not much rearing habitat, will it be more likely to support chum or Coho salmon fry? Why? *Chum. Because chum salmon fry immediately begin moving toward the sea; they do not need extensive rearing habitat in the stream.*

7. If a stream has both spawning and rearing habitat, which salmon species might it support? Why? *Coho salmon fry could live there because of the availability of rearing habitat.*

Riffles and Pools
Students Activity

Do you Know...
All Pacific salmon are *anadromous*. They begin their lives in freshwater, migrate to the ocean, and return to freshwater to spawn and die. Salmon are important to Oregon and Washington's commercial and recreational fisheries.

The salmon life cycle begins when eggs are deposited and fertilized in the gravel of cool, clean rivers and streams. Until they hatch, the cold (40° to 65°F) water flowing through the gravel itself protects the eggs from predators.

In late winter or spring, the eggs hatch. The young fish, called *sac fry*, are less than one inch long. They still depend on cold, well-oxygenated water for their survival and stay in the gravel for shelter. During this time they are fed from a yolk sac that protrudes from their bellies. As the yolk sac is used up the fish, now called *fry*, emerge from the gravel in later spring or summer, approximately one to three months after hatching.

The fry of some species head directly for the sea, but others might stay in freshwater for a few months to a few years. Fry depend on streamside vegetation and turbulent water at the beginning of pools for cover. Aquatic invertebrates provide most of the food for salmon fry.

When they are ready to migrate to the sea, they go through *smoltification*, a physiological change, and are known as *smolts*. Smolting prepares them for life in saltwater. Once in the sea they spend up to five years, depending upon species, feeding and growing before they are ready to return to fresh water.

Salmon return to spawn in the same stream where they hatched. No one knows for certain how they find their way back to the same stream, although one theory is that they can smell or actually taste the water chemistry of their home stream. When they enter fresh water, salmon stop feeding. Their journey upriver is made on the energy stored while living in the ocean.

Salmon spawning beds are generally found in the shallow headwaters of a stream and other suitable areas in the mainstem of streams. Weeks or months after they have reached the gravel beds, the female digs a nest, or *redd* where she deposits up to 5,000 eggs. The male fertilizes the eggs by covering them with milt, a milky substance that contains the sperm. The female finishes the spawning process by covering the eggs with gravel. After spawning, the salmon's life is finished. Within a short time it dies and the carcass drifts downstream, decaying and contributing its nutrients to the stream from which it originally came.

Note: Trout, with the exception of steelhead and some cutthroat, are not anadromous. However, they are closely related to salmon and have similar needs during their time in fresh water.

Now it's your turn...

Think about the last time you were at a stream. Let's review some of the things you might have observed or remember about good fish habitat.

- What is dissolved oxygen? Why is it important to streams and fish?

- What are pools? What are riffles? What kind of habitat do they provide for fish? Since salmon spawn in gravel, and gravel is usually found in riffles, riffles are often called "spawning habitat." The amount of gravel and riffles in a stream (if of good quality) determine the number of salmon that can spawn there. The places in a stream that provide a place to eat, a place to rest and a place to hide are called "rearing habitat."

- Stoneflies and other aquatic insect larvae live on, around and under rocks in the bottom of a stream. Some are shredders feeding on decomposing leaves. Others are scrapers, grazing on algae growing on the rocks. Still others are predators that eat other invertebrates. To move to new rocks these aquatic insects detach themselves and drift downstream. Because they are carried by the current, most are found where the current is strongest. Salmon fry eat these larvae (or floating sandwiches) as they drift past.

- Look carefully at the drawings.

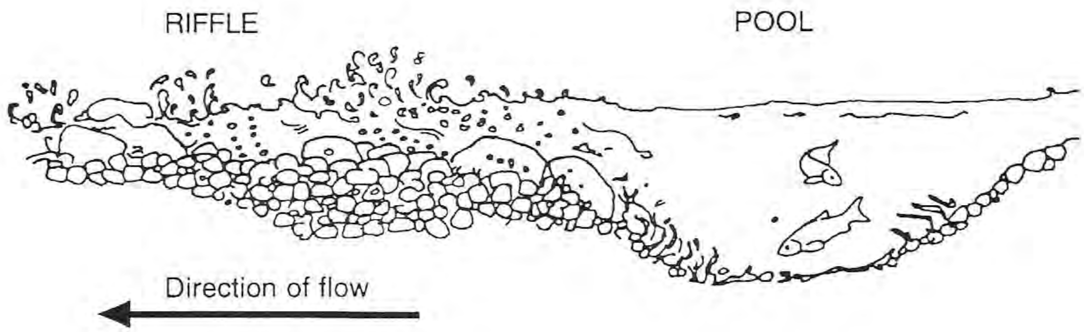
- Answer the questions based on your own experience and the introductory information in this exercise.

Questions on Riffles and Pools

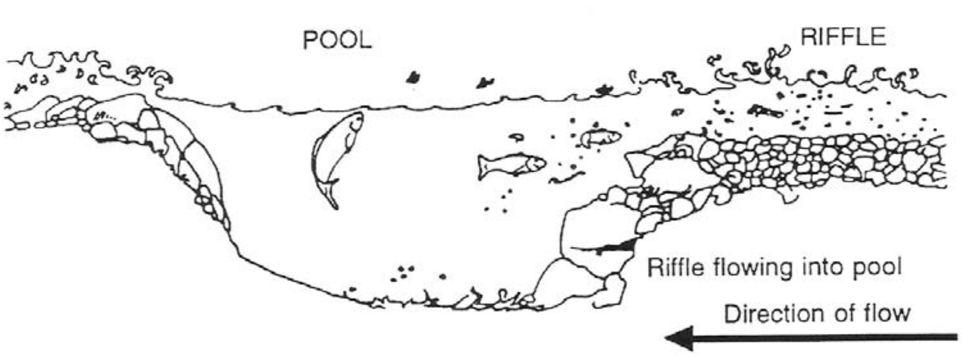
1. Will the dissolved oxygen concentration be higher at the bottom of the pools or the riffles? Why?

2. Which would give more shelter or protection to salmon eggs, pools or riffles? Why?

Refer to this diagram as you answer questions 1 & 2.



Refer to this diagram as you answer questions 3 – 5.



3. What happens to aquatic insect larvae as the current enters a pool and slows down?

4. Where would be the best place for salmon fry to wait for lunch? Why?

5. Where would salmon fry use the most energy catching food? Why?

6. Chum salmon fry only spend as much time in the stream as it takes to get to the ocean (one day to three weeks). Coho salmon juveniles live for a year in the stream before heading to the ocean. Steelhead juveniles live up to three years in the stream before heading to the ocean. If a stream has good spawning habitat, but not much rearing habitat, will it be more likely to support chum or Coho salmon fry? Why?

7. If a stream has both spawning and rearing habitat, which salmon species might it support? Why?

Lesson 2 – The Salmon Life Cycle

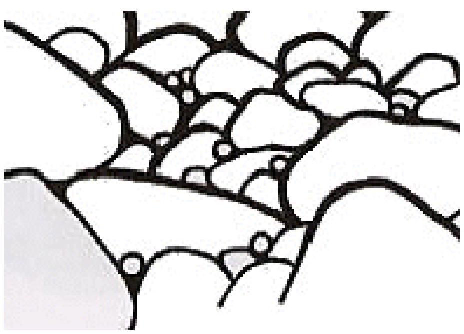
Purpose: This lesson is designed to explore the life cycle of Pacific Salmon, comparing hatchery and wild.

Activities:

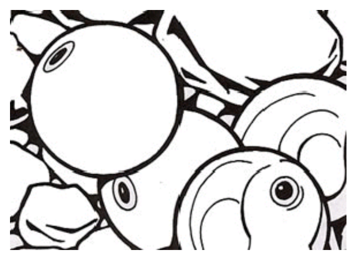
A Salmon's Incredible Life Cycle

It begins with a downstream journey from the fresh water where they are born, to the ocean where they will live for most of their adult life, and then back upstream again, to the exact location where they began three to seven years earlier.

Female salmon lay their eggs in many of the streams and rivers connected to the Columbia Basin. Depending on the species, the female can lay anywhere from 1,500 to 7,000 eggs in a nest (redd) she has created by fanning a shallow depression in the stream bottom with her body. The male fertilizes the eggs and then both will brush gravel over them for protection.

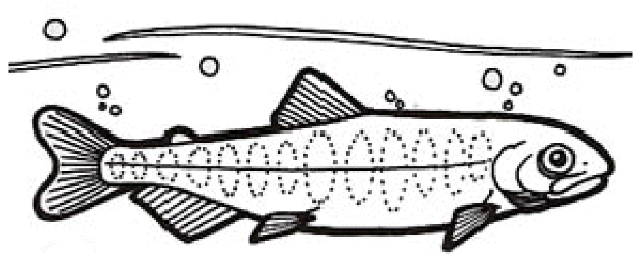


Now the eggs are protected from sunlight, strong currents and hungry animals and insects. For the next four weeks or so, the eggs remain hidden in the gravel.



Near the end of four weeks, the eggs begin to change. Inside each living egg, a head, eyes, and a body begin to take shape.

It will be another four weeks or so before the little fish hatch and become alevins or sac fry --looking more like a worm than a fish. These tiny fish depend on a yolk sac that will provide them with nourishment until they are mobile enough to emerge into the stream and find their own food. They will first feed on tiny plants and insects. This phase of their lives they are
known as fry.



At this stage they are ready to migrate to the ocean. They also start to undergo a physiological transition which will allow them to move from freshwater fish to saltwater fish. Only about 10 percent of the fry make it to this stage and are called smolts. Smolts are especially vulnerable. Living in shallow pools near the edge of the stream where the current is slow. They are already quick at this stage - a good thing because as they feed, they can also be easy food for trout and other fish, ducks and herons.

The smolts that complete the journey downstream spend several weeks in estuaries where the river meets the ocean, feeding on small fish and shrimp. Eventually, they disappear into the ocean where they grow to adulthood.

After two to five years, the adult salmon are ready to migrate upriver to spawn. Starting the cycle all over again.......

The journey upriver is a difficult one. Salmon do not eat during this time, but live on fat stored in their body.

Obstacles encountered upstream are many and varied. Dams, waterfalls, anglers, bears, uncertain stream conditions, and habitat degradation are among the most common challenges for the salmon in the Columbia River Basin ecosystem.

Ocean Migration

In general, juvenile fish migrate downstream during spring and early summer. Throughout the freshwater rearing stage, which varies from species to species, the juvenile fish receive a succession of cues which may assist them in returning to the natal spawning grounds. During their journey to the ocean all young salmon face the same biological hazards: starvation, predation and disease. They also have the same requirements or needs: food and shelter. For this requirement they will spend time in the estuary where nutrients from the ocean are brought to the river mouth area. Estuaries are the zone where fresh water and saltwater mix. The length of time spent in the estuary is very species - specific.

The pacific migration is a route taken by migratory salmon during their arduous ocean journey before returning to breed in the Northwest. How far a salmon travels in the ocean and the direction it goes can vary. The extent and direction of the salmon's travels depends on time and size when they enter the ocean and the marine conditions they encounter. The growth rate in the ocean is very rapid. Many salmon travel along with the ocean currents in circular routes. Some wander as far as 2,000 miles from their stream. Others stay closer to home. The salmon grow to adults on rich seafood diets including small fish like herring and anchovies. The Chinook salmon, for example, can grow up to five feet long and weigh from 22 to 100 pounds.

Migration makes it possible for salmon to benefit most from favorable weather conditions; they feed in the northern waters of the Alaskan coast. This pattern is called return migration - the most common type of migration by salmon.

The migration of salmon usually refers to their movement between fresh water and saltwater homes. Some salmon migrate thousands of miles, while others may travel less than a hundred miles. This movement has long been a mystery to humans. Through natural selection, migration evolved as an advantageous behavior. Salmon of the Columbia and Snake Rivers migrate north to feed where space is substantial. Food supply is considerably better in many northern areas and migrant species are usually assured of adequate space and ample food upon arrival. It begins when the salmon enter the ocean by turning toward their hereditary feeding grounds. For some it is north of Alaska. Others will feed in the deeper waters off California.

Salmon can be food for bigger animals like tuna, seals, dolphins and whales. But even in the ocean a salmon has ways to help it escape these predators. They feed mostly at night when they are harder to see. Their color also helps to hide them. Seen from above they look dark like the deep ocean. Since the water looks white or silvery from below, they have silver, shimmering bellies.

Time spent at sea is variable according to species, ranging from one or two years for Coho to four or five years for a Chinook. When the time comes, a little understood combination of genetic memory and sense of smell bring them back to their natal streams or hatcheries to spawn.

The Return

As the salmon approach maturity they begin a movement to coastal waters. At first, they may find their way across the oceans using currents, stars and the earth's magnetic forces. As they leave the ocean pastures and head closer to land, they leave the company of other salmon and begin their solitary journey home. Each salmon is seeking its home or natal stream. Distinctive home stream odors assume great importance. Studies show that the sense of smell is the significant factor in homing. Every stream is unique. The young salmon is able to detect immeasurable traces of element present in their environment. Odors from the rocks, plant life and other aquatic organisms all have an everlasting influence on the young salmon. The young fry absorb the key elements of its stream. They retain this sense of having-been-there-before. Visual cues are of secondary importance.

The adult runs, or migrations of salmon populations, occur from April to November. Chinook migrate in spring, summer and fall.

Salmon returning to their place of birth will generally not spawn in alternate locations. The long journey to their ancestral spawning grounds is a remarkable feat. The trip upstream can present many obstacles. Both natural and man-made hazards face the fish. Swimming against the current, the salmon may encounter waterfalls, dams, fallen trees, low water flows due to drought, adverse water conditions and predators. If the salmon encounters an insurmountable obstruction along the journey to their home stream, they will die attempting to overcome it. If their path is clear, they travel back to the exact place where they were hatched, no matter how small the stream may be. Salmon have been programmed to return to the same tributary of the river and even the same stream and gravel in which their parents spawned.

Estimating Fish Populations – An Activity

Key Concepts:

✦ Students make math calculations with different colors of beads to learn a technique biologists use to estimate the total size of a population of fish.

Objective:

Students will be able to:

1. Describe the mark/recapture method used to estimate fish populations.
2. Explain why it is important to be able to accurately predict population numbers.

Materials:

- ✓ Two colors of beads that are roughly the same size and shape.
- ✓ One large jar for each team of students.
- ✓ Calculator

Background:

Biologists and wildlife managers can make better management decisions if they know the total population size of a group of fish. Determining the number of fish spawning in a small clear-water tributary is relatively easy. Biologists can set up weirs or counting towers and simply count the fish as they pass by. Determining the total number of salmon traveling through the vast, muddy waters of the Columbia River drainage is a much more difficult task. In these situations, biologists sometimes use a method to calculate population called mark/recapture.

Biologists use nets, fish wheels, or some other method to capture salmonid. They insert a numbered plastic tag in the fish's back near the dorsal fin, then release it back into the river. At a point farther upriver, biologists use the same method to recapture fish. Here, they keep track of the total number of marked and unmarked fish caught. With this information, they can do the following calculation.

$$\text{Estimated Population} = \frac{MC}{R}$$

M = Fish caught and tagged in the marking event.
C = Total fish recaptured.
R = Total recaptured fish that were also tagged.

Method:

For example, in the marking event, you catch and tag 100 salmon. In the recapture event, you catch a total of 100 salmon. Of these, 10 have the plastic tags. Using this formation you do the following calculation:

$$\frac{\text{100 Fish Caught and Tagged} \times \text{100 Total Recaptured Fish}}{\text{10 Recaptured Fish that had Tags}}$$

$$\frac{100 \times 100}{10} = \frac{10{,}000}{10}$$

Or, there are approximately 1000 fish in the total population.

Procedure:

Count out 1000 red beads and place them in a large jar before the activity. (Less than 1,000 will be too small for accurate calculations) Have the students count out 100 blue beads to represent the fish tagged in the capture event. Add these to the jar and shake it well.

Pour the mixed beads out onto a tray and have the students count out 100 beads without looking at them. This will represent the total fish caught in the recapture event. Then, have the students count out the number of tagged fish caught in this sample (the blue beads). Plug these numbers into the equation to determine the total population of fish. Have the students count the actual number of beads to see how close their calculations came. Discuss the possible causes for any discrepancies.

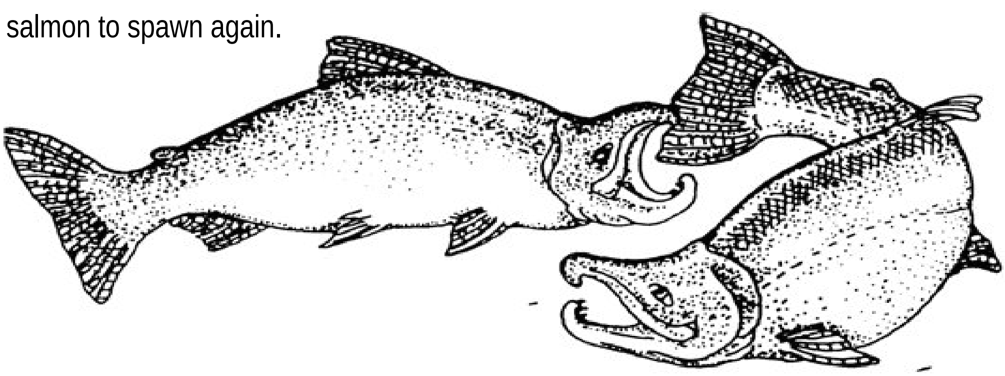
Form the students into teams. Have each group retry this experiment with an unknown number of beads in each jar. Have teams experiment with larger and smaller samples sizes to see who can make the most accurate prediction of the sample size. Discuss the results.

Marking Techniques

MARKING TECHNIQUE	ADVANTAGES	DISADVANTAGES
Fin Clipping	inexpensive; easy to see; applicable to many sizes of fish; can identify groups, easy to apply	may negatively effect fish; no information for individual fish; requires handling each fish; few combinations of markings
Jaw Tag	inexpensive; easy to see; durable tag; can carry individual code number	can negatively effect fish's growth; can only be used on medium & large fish
Coded Wire Tag	can use on small to large fish; doesn't effect fish's swimming; many codes available	fish must be killed to recover tag; relatively expensive; each fish must be handled
Radio Tag	can follow movement of individual fish; no other technique can provide the same information	special equipment needed to hear signals; tags are expensive; only used on large fish
Visual Implant Tag	can be coded for individual fish; information recovered without killing the fish	need trained people to notice it; may cause negative skin reaction and eventually become difficult to read
Passive Integrated Transponder (PIT) Tag	unique 10 digit code read while inside the fish with a detector-decoding system; tags last ~ 10 yrs	tag area may not heal properly; needle injection required for insertion; expensive to use
Disk Tag	easy to see; can code for groups or individuals; lasts the lifetime of the fish	difficult to apply correctly; time-consuming application
Paint	can be highly visible; quick and easy to apply; can color-code groups	makes fish more visible to predators, which effects survival; cannot distinguish letters or numbers
Freeze Brand	can identify groups; little injury to fish; does not effect fish's swimming; relatively simply application	group information only; limited available codes; becomes difficult to read over the fish's lifetime
Otolith Patterns	fish not exposed to chemicals, injury, or stress of handling; potentially limitless number of coded patterns	fish must be killed to retrieve information; commonly used only on hatchery fish; requires special equipment

Salmon Story Problem – An Activity

Using the math you've learned in school, fill in the correct numbers in the missing spaces. If 10 salmon lay 5,000 eggs each in a stream, there are _____ eggs. One-half of these eggs do not get fertilized. This leaves _____ developing eggs. A new road is built alongside the stream leaving lots of loose soil. A rain storm carries some of the soil into the stream. It falls on and kills 2,000 of the eggs. Now there are _____ eggs. These eggs hatch into small salmon and begin their journey to the ocean. People spray lawn and garden chemicals in their yards. These are carried into the steam and kill 5,000 salmon. Now there are _____ fish. Predators such as larger fish, sea gulls and seals catch 10,000 more salmon. There are now _____ fish. Another 5,000 are caught by people fishing. This leaves _____ fish. Some of the remaining salmon swim close to an oil spill in the ocean and 2,000 die. There are now _____ fish. Some hungry bears catch 500 fish as they return to spawn. Now there are _____. A careless person pours old anti-freeze from his car into this stream. It kills a 3 mile stretch of the stream and 450 fish die. This leaves _____ salmon to spawn again.



Home Sweet Home – An Activity

Key Concepts:

- ✦ Prior to this activity, students could learn about the life cycle of the anadromous salmon and the importance of flowing water to their migration patterns.

Objectives:

1. Develop an awareness of fish life cycles and migration.
2. Appreciate the necessity for clean, flowing water in our streams and rivers.

Materials:

- ✓ 6 film canisters filled with cotton saturated in 6 different essential oils, such as: cinnamon, cloves, eucalyptus, apple, orange, anise (you may want more canisters depending on the size of your class). One canister can even be scentless. The lid and bottom of each canister is coded with a number that matches the essential oil on a separate, written key. For each canister code, write the corresponding code numbers on several 3x5 cards – the number of cards depends on the class size. (For variety, write local river names on the cards).
- ✓ Blindfolds for the "salmon" students.

Background:

After maturing, salmon return to fresh water in order to reproduce. Although it is not fully understood how they manage to navigate the many bodies of water, it is believed that they have a built-in homing device that enables them to smell their home water address. As juveniles, they imprint this smell. And as adults, they are able to find this smell once again.

Methods:

Warm Up Exercise

Discuss with the class the life cycle of salmon and how important water is to their habitat. Have them compare how their home habitat and life cycle compare to that of salmon. Ask them to list some river and stream water addresses near their school or home. How far is it to the ocean? Would they need to get past any barriers such as dams to reach home? Discover with the students some possible journeys salmon species may make to other places in the Pacific Northwest.

The Activity:

1. Tell the students they are going to play a salmon migration game. They are going to pretend to be adult salmon and try to find the smell of their water address in which to spawn. Ask them what they think is the purpose of this activity.

2. Assign six students to be the “water address,” or “rivers.” (You can do this by counting off or having them pick numbers). Give each of them a (closed) film container with the corresponding coded 3x5 cards and have them stand together in the activity area. (They must keep their water address identity a secret).

3. Have the remaining students, or “salmon” move to the opposite side of the area. Stand them in a row facing the “water address” and blindfold them. Tell the salmon students that they are now going to get a whiff of their home water address from their river.

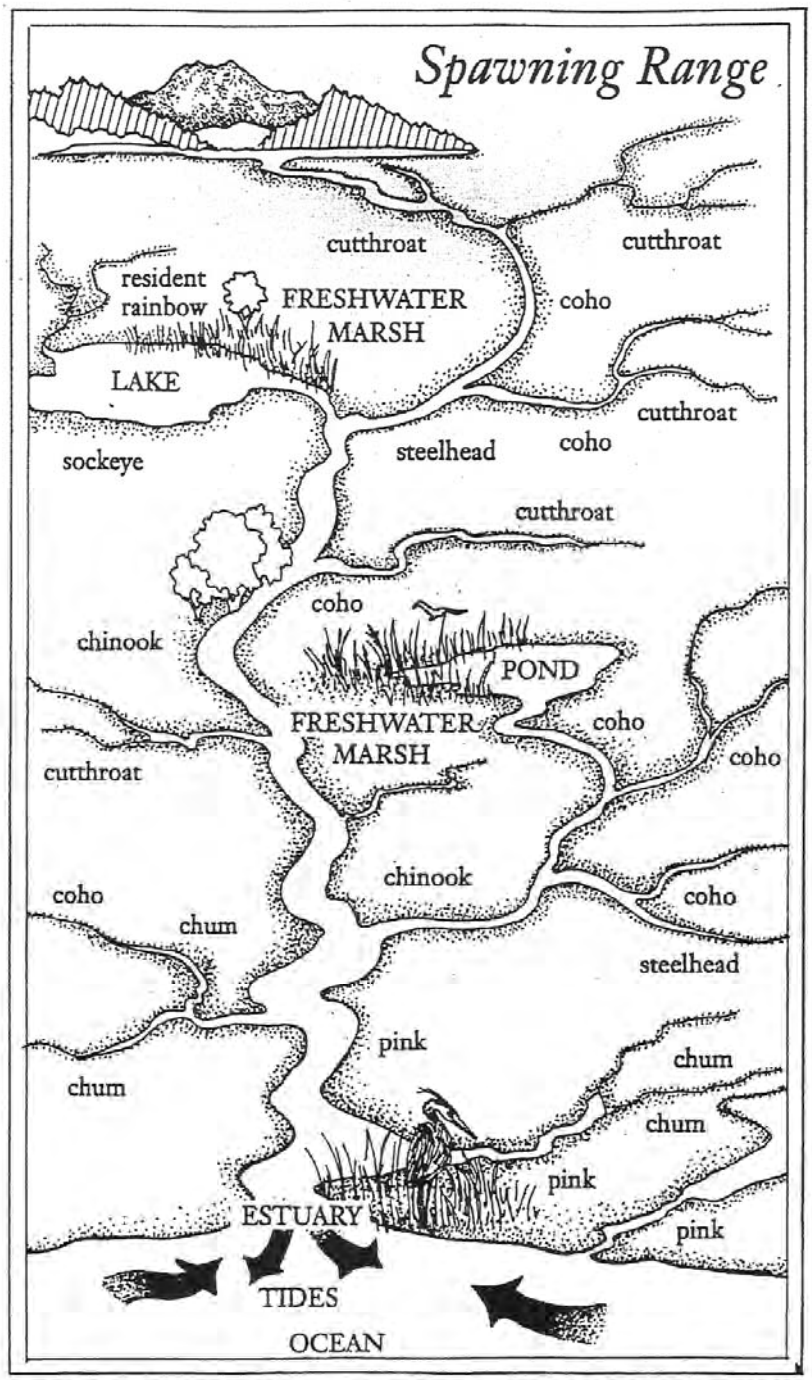
4. Send each river/water address student (one at a time) over to the fish and let a fish smell their opened canister keeping their scent a secret. After the fish has smelled their scent, have the river student place a corresponding 3x5 card in the blindfolded student’s hand. The rivers should do this until all of their cards are used up, picking their fish at random. All the rivers will then return back to their side of the activity area and form a row, again facing the salmon.

5. After all the salmon have smelled their water address they can take off their blindfolds and form a line. Now, they can walk (one at a time, single file) past the row of rivers while smelling each opened canister. If the fish students think they have smelled and found their water address they line up behind the proper river student.

6. When all the salmon have found their home address, have them compare the coded 3x5 cards with the coded numbers on the film canister. Are they the same?

Evaluation:

- Design a story or mural of the fish life cycle.
- Pretend they are a salmon migrating back to a nearby river or stream and write a descriptive story of everything they smell, taste, see and hear.
- Create a skit about being a migrating salmon.



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Lesson 3 – Anatomy of a Fish

Purpose: This lesson is designed to introduce students to salmon, an endangered species of the Pacific Northwest, to encourage a sense of connection between the students and salmon and more specifically to introduce the students to the salmon anatomy.

Activities:

Classroom Salmon Dissection

Background Information:

Many of the schools which are involved in our Salmon in the Classroom program have been able to expand their studies in many ways. One activity that has been well received by teacher and student is the dissection of a salmon.

This is a lesson in comparative physiology/anatomy.

Before beginning:

Before the dissection begins, prepare all the materials in a convenient area, and pass out the drawing of a salmon. This drawing includes the fins, gill covers, lateral line and other details.

Take time to consider the physical arrangement of the room. Keep in mind that some children may find this activity somewhat stressful, so try to make everyone comfortable with their participation and their involvement in the activity. Try to arrange the room in such a way as to allow students to be close if they wish, yet be able to move in and out according to their curiosity. If the children feel fixed in one location, the possibility exists that they may also feel unable to escape from the situation if it disturbs them, and this may have unfortunate results. A touch of humor is very appropriate in order to take the edge off the activity.

It may be inappropriate to pass the parts around from student to student. Imagine what might occur if the part doesn’t make it all the way, and it ends up in someone’s pocket! Instead, it may be better to get a volunteer to help ensure that parts stay with the fish. This method could also be a relief for those kids who want to participate, but don’t wish to get to close to the action. Try to use parents when ever possible.

Much of the dissection is done with the hands. It will be quite messy and hands will need a good washing afterward to rid them of blood and slime, rubber gloves may be a desirable item.

Materials required for a fish dissection:

- ✓ Kitchen knives (sharp and flexible)
- ✓ Paper towels
- ✓ Paper plates
- ✓ Newspapers
- ✓ Magnifying glass (optional)
- ✓ Plastic bags (for waste)
- ✓ Tweezers
- ✓ Dissecting picks
- ✓ Scissors (small)
- ✓ Soap and water (for washing up)

Parts of the Fish

Head The head contains the eyes, nostrils, mouth, gills. The area in front of the eyes above the mouth is called the snout. The position of the mouth varies among species. Fish absorb oxygen from the water. The water is taken in through the mouth, flows over the gills and then passes out through the gill openings. The gills are protected by a cover, called the opercle or gill plate. Fish can have teeth in the jaws, mouth and pharynx.

Body The area just behind the opercle is called the pectoral or chest region. The humeral area, or shoulder lies above the base of the pectoral fin. The belly extends from the pectoral fins to the anus.

Tail The tail is that part of the fish behind the anus. The slender section between the base of the tail fin and the anal or dorsal fin is called the caudal peduncle, or commonly, the wrist.

Structures and Their Functions

Eyes As in humans, fish eyes serve a variety of purposes - to seek out food, to avoid predators and other dangers and perhaps even to navigate in the ocean. Fish do not have eyelids. They are constantly bathed in water and do not need tears.

Nostrils Salmon have a well developed sense of smell and use this ability to seek out their home streams for spawning. In some cases this scent is also helpful in avoiding predators. Fish breathe through their gills, not their nostrils.

Lateral Line Fish do not have ears, as such. In part, low frequency sounds are detected in the water through a system of small holes along each side of a fish called the lateral line, which is connected to a delicate system of nerves.

Mouth Fish use their mouth to catch and hold food of various types, but their food is not chewed before swallowing. In addition, the mouth is a very important part of the breathing process. Water is constantly taken in through the mouth and forced out over the gills.

Gills Fish gills are composed of two basic parts, the gill covers and the gill filaments. The gill covers protect delicate filaments and together with the mouth force water containing oxygen over the gills. The gills are probably one of the most important organs of the body of the fish. They are delicate but very effective breathing mechanisms. Gills are far more efficient than human lungs, because they extract 80% of the oxygen dissolved in water, while human lungs only extract 25% of the oxygen in the air.

Gills are thin walled structures, filled with blood vessels. Their structure is arranged so that they are constantly bathed in water. The fish takes in the water through its mouth. The oxygen dissolved in the water is absorbed through the thin membranes into the fish's blood. Carbon dioxide is simultaneously released from the blood into the water across the same membranes.

Fins Salmon have two sets of paired fins (pelvic and pectoral) and four single fins (dorsal, caudal, anal, and adipose). Except for the adipose and caudal fin, all the others are basically used to balance the fish in the water. The adipose is a small, fleshy fin which serves no known purpose. The most important fin is the caudal. It acts like a rudder, and combined with the very strong body muscles the fish, is their only means of propulsion. The caudal fin is used by female salmon to dig the redd where they deposit their eggs.

Scales The bodies of salmon are protected by scales which grow in regular concentric patterns and can be used to determine the age and life history of the fish. Over the scales is a layer of mucous (slime) which further protects the fish from disease organisms and helps it slide through the water more easily.

Air Bladder A membranous sac filled with gas, situated in the body cavity of fish, ventral to the vertebral column, used to control buoyancy.

Esophagus The gullet, or esophagus, carries food from the mouth to the stomach.

Gall Bladder The gall bladder is a sac in which bile is stored. Found in the lower part of the alimentary canal extending from the pyloric end of the stomach to the anus.

Kidney These organs remove waste from the blood and produce urine.

Liver A digestive, storage and excretory organ.

Ovaries The female reproductive organs which produce eggs.

Pyloric Caeca An appendage in the form of a blind sac, connected with the alimentary canal, in which digestion takes place.

Spleen The organ in which white blood cells are produced and red blood cells are destroyed, in vertebrates.

Stomach Sac-like digestive organ receiving food from the esophagus and opening into the intestine.

Heart A hollow, muscular organ, the heart circulates blood through the body.

Testes The male reproductive organ in which milt is produced.

Vent The external opening of the alimentary canal. Urine, feces, eggs and milt exit here.

External Anatomy

Slime-why is a fish slimy?
- to slip away from predators such as bears
- as an anti-abrasive to slip over rocks
- lubricant to enable easy swimming through the water
- an "envelope" or "living plastic bag" as a protection from fungus, parasites and disease.

Identify the external anatomy.
- mouth, eyes, gills, nostrils, vent, lateral line.

Identify both single and paired fins:
- Caudal fin, anal fin, pelvic fin, pectoral fins, dorsal fin, adipose fin (unless it is a hatchery fish, in which case the adipose fin may have been clipped to identify it). Clipped hatchery fish will also have a tiny steel pin, or coded-wire tag, about the dimension of a day's growth of a man's whisker, embedded in the nose cartilage.

What are the fins for?
- For swimming and steering. The muscles of the entire body of the fish are used for propulsion, and even if the fish had no fins at all it could still make progress through the water; however it would not be able to right itself well.

How are the fins attached?
- To muscle tissue, not to the skeleton.

What are the scales for?
- As "armor plating". Remove a scale for later observation under a microscope or hand lens.

Did the fish always have as many scales? Are there more now than when it was little.
- Fish have the same number of scales all their lives. The fish stacks up "plates" in order to grow the scale. This can be seen under magnification as rings. It is similar to a tree ring, with the difference being that the rings develop as food is available, and the groups of rings coincide with the seasons. An experienced biologist can determine the age of a fish by looking at the rings.

What do you think happens when a scale is shed?
- Scales are regenerated to fit into the missing space, and so these scales will have a clear center, since it does not have the "plates" of previous growth stacked above.

Do all fish have the same scale arrangement?
- The arrangement and placement of rows or scales is a positive species identification. Each type of fish has a different arrangement.

What is the lateral line for?

- It emits low level vibrations, somewhat like sonar. It functions something like an organ of touch, something like an organ of hearing, and something like an organ of seeing. It helps fish find their way when they cannot see, such as at night, or when the water is muddy.

How does a fish breathe?

- The gulping action demonstrates how water is drawn in through the open mouth, the mouth and the throat closes, and the water is forced out past the gills. Gills extract oxygen from the water. Cold water, if saturated with oxygen and holding as much as it can, may have 13 parts of oxygen for every million parts of water.
- To demonstrate what 13 parts per million (ppm) is, imagine that you have a million marbles, of which 13 are white oxygen marbles, and the rest are plain water marbles. If you were to drop one marble per second into your pocket, how long would it take you to reach a million? 12 days! Imagine how large your pocket must be.
- At the end of 12 days of marble dropping, you would then drop in the 13 oxygen marbles: that shows how efficient gills must be, and how sensitive they are to material in the water. In fact some pollutants cause problems at levels of parts per billion. Using the same analogy, it would take 38 years of marble dropping to get a billion! Fish, and all living things must live within an environment, which is why it must be clean.

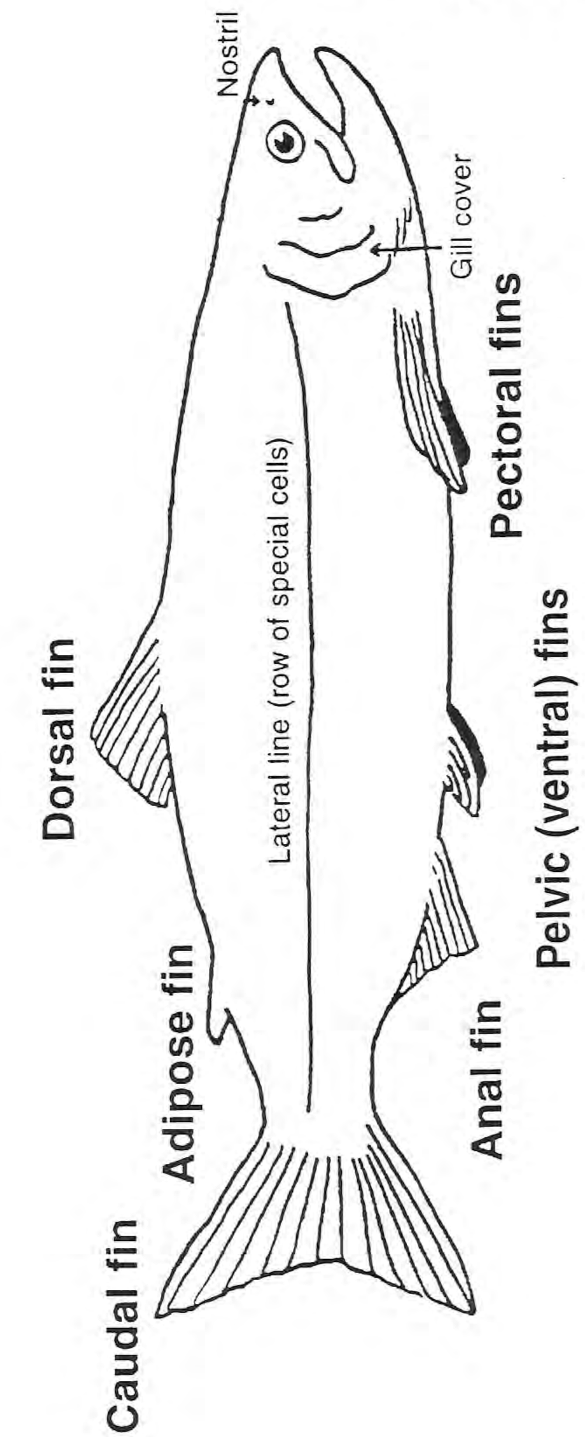
What do the gills look like? How are they used?

- The gills have an extensive blood supply, which accounts for their color. The laminae, or branches of the gills, perform the same function as the small sacs or alveoli within your lungs, in that they act to transfer the carbon dioxide from the body of the fish and absorb the oxygen from the water. The laminae are only two cells thick and present maximum surface area to permit the most efficient transmission of gases. Under a lens, the laminae look like a Christmas tree.

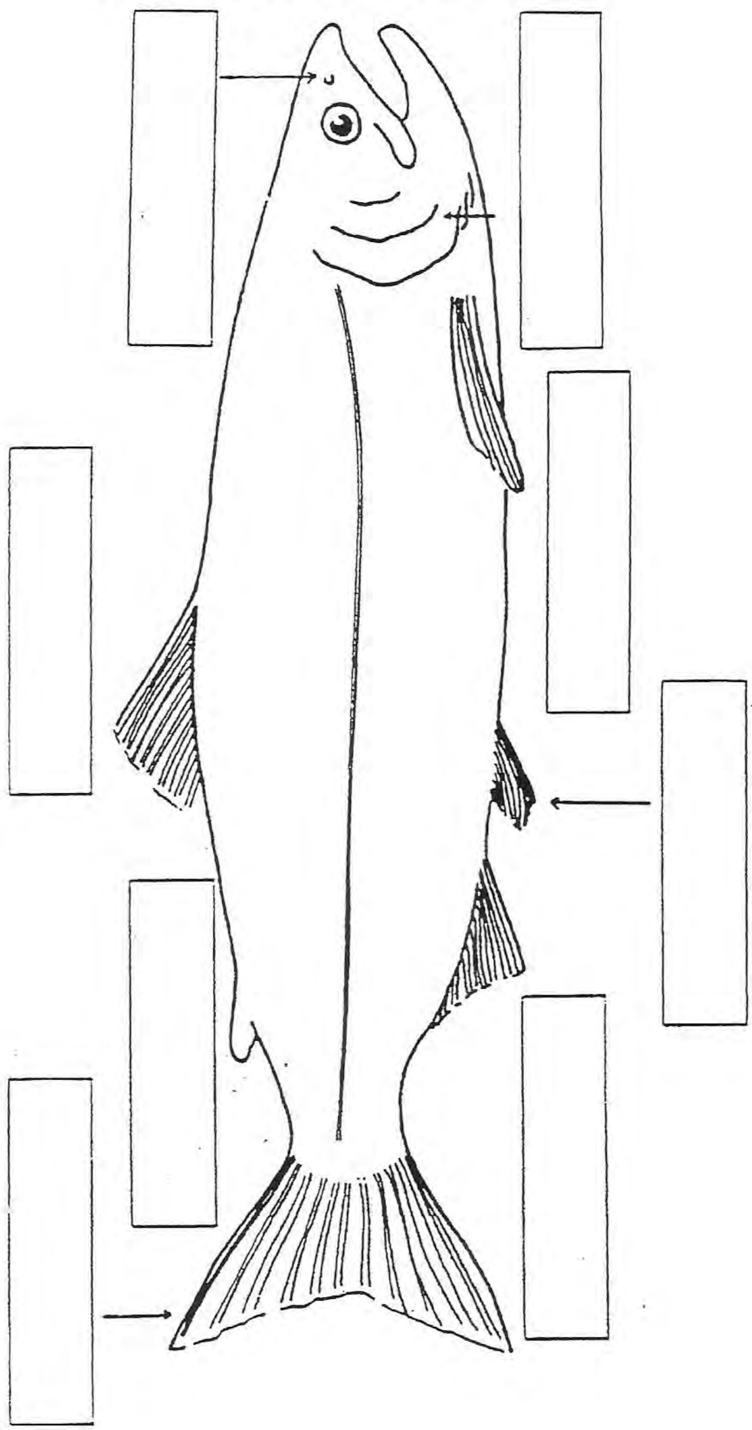
Look at the gill rakers (the spines that guard the opening of the throat).

- The gill rakers prevent food from entering the gill passages, and instead guide it into the throat.

External Anatomy of a Salmon



Label the Parts of a Salmon



Internal Anatomy

When cutting open the fish, what do you expect to see?

- Place the fish on its side, belly away from you, on newspaper. If right-handed, hold the tail firmly with the left hand. It may help to use paper towels to improve the grip. Insert the tip of the knife or dissection shears into the vent and cut forward only as far as the pectoral fins, passing between the pelvic fins.
- A safe cut is away from the body with a truly sharp knife. A knife that is thin and flexible is best.

What is the first thing that you will see?

- If the fish is a mature female, a large portion of the body cavity is filled with eggs. If the fish is ripe and ready to spawn, the eggs will be loose within the body cavity; more likely the eggs are contained within a membrane. Pull out one of the roe sacs by hand and observe the blood vessels contained within the membrane. What are these for?
- A mature Chinook has 3,000-5,000 eggs. The egg provides one half of the genetic information needed in order for fertilization to occur.
- If the fish a mature male, a large portion of the body cavity is filled with the testes. A white bladder of milt will be easily observed. The milt provides the other half of the genetic information needed.

Why are so many eggs needed?

- On the average, and in rough proportions, Chinook salmon lay about 5,000 eggs. Of these, only 15 percent live to hatch in the wild. Of those remaining, only 30 percent will last the first year. Of those, only 4 make it to adult, and only 2 live long enough to spawn.

Looking into the body cavity, you will see a large dark red organ. What is this organ? Remove it with your fingers.

- The liver stores, synthesizes and secretes the essential nutrients that were contained in the food. It plays a part of maintaining the proper levels of blood chemicals and sugars. The gall bladder, which is attached to the liver, contains green bile which in part is used to help digest fats.

Remove the stomach and upper gut. Use your fingers

- It is attached at the throat and, which you cut when you remove the gills, and attached again at the vent. It will come away with the “spaghetti” of the pyloric caeca and the dark spleen attached. It will strip out to the vent.
- The pyloric caeca act like a small intestine, in that they exude the digestive juices needed to break down the food, and absorb the components into the blood stream which passes it on to the liver.
- The spleen acts as a storehouse of blood, to be used if there is an emergency, and to recycle worn-out blood cells.

If the fish has been taken from a river, it is unlikely that there is any food anywhere in the digestive system. Salmon do not eat once they enter freshwater, and it may be as much a 16 weeks from the time that they take their last meal in the ocean and the time that they spawn and die.

- The digestive tract is surprisingly short and simple, and does not have the extensive intestine that mammals have. This is because fish are cold-blooded, and do not require a large amount of energy to be extracted from their food since they do not heat their body by their metabolism.

We have not seen the heart yet-is it where you thought? Carefully continue to belly cut forward to the throat, but only deep enough to cut through the skin. Find the heart and remove it. What does it look like?

- The heart is located where the gill covers come together high up in the throat, and it may be removed with the fingers. It is triangular in shape, and consists of 2 chambers. The white tube is the venal aorta, and it leads the short distance to the gills. Why is it located so close to the gills?

Remove the swim bladder that is attached to the esophagus by stripping it out from the front with your fingers. Would anyone care to demonstrate how the swim bladder can be inflated?

- Most fish are able to adjust the amount of air in their swim bladder so that they are able to stabilize their movement within the pressures of the water. Notice that the swim bladder is just below the spine, which is just below the center line, or the center of balance of a fish. This is why fish float upside down when they die.
- When a fish, such as a salmon, is deep in the ocean, it adjusts the amount of air in its swim bladder so that it can hover comfortably without sinking or rising in the water. If it wants to go deeper in the water, it must release some of this air, something like a burp, in order to hover at lower depth. Some bottom fish, such as a rockfish, are unable to adjust their swim bladders by burping, and this is why when a bottom fish is caught and brought to the surface its stomach protrudes into its mouth: the swim bladder has expanded due to decreased pressure and is forced the internal organs out through their throat.

The dark red line along the back bone is the kidney. Where are your kidneys and what are are they for?

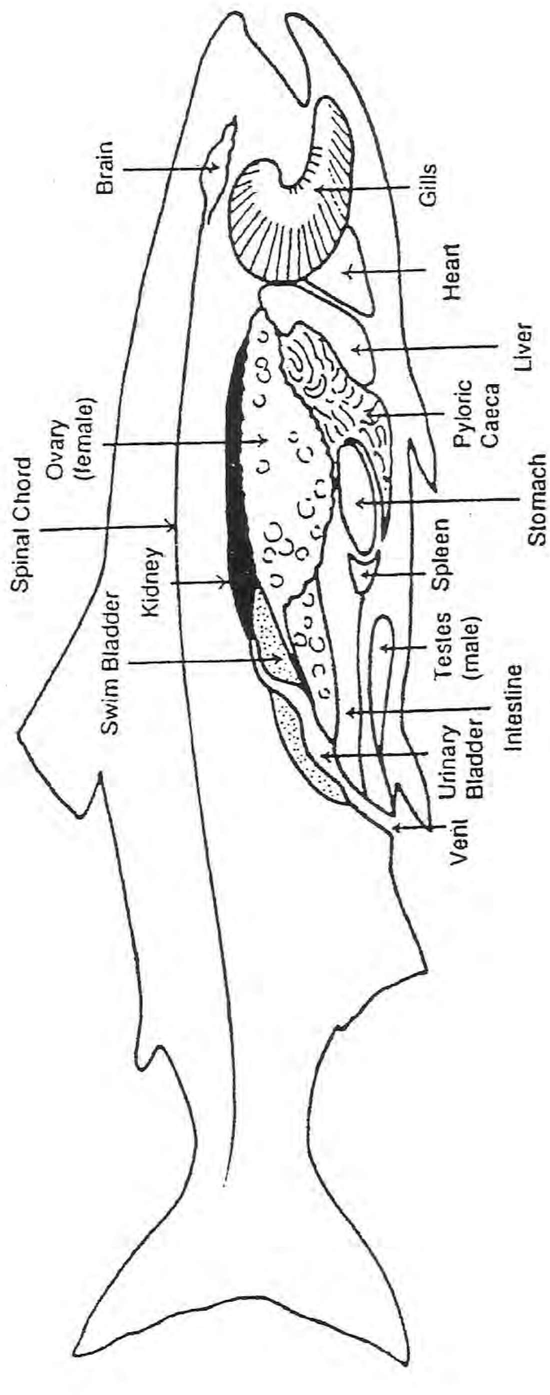
- The forward part of the fish kidney functions to replace red blood cells, and the rearward part filters waste out of the blood. The kidney can be removed by slicing through the membrane along each side, and them scraping with the spoon.

What is left is a fish that is well cleaned!

How Does a Fish Compare to a Human?

Fish	Human
Respiratory System	
Water enters the mouth. It is forced between the gills. Thin membranes absorb the oxygen from the water and carbon dioxide is released.	Air enters the nose. The respiratory system includes the larynx, trachea and lungs. This system provides oxygen for the body cells and removes the waste products (carbon dioxide).
Circulatory System	
The circulatory system carries blood throughout the body. The heart is like a pump. Arteries carry oxygen rich blood from the heart to the body. Veins carry oxygen poor blood from the body back to the heart.	The human circulatory system includes the heart, veins, arteries and capillaries. The blood carries oxygen plus nutrients to the cells and removes waste products. The heart is like a pump which circulates blood throughout the body.
Reproductive System	
Female salmon deposit between 500 - 10,000 eggs in redds and the male fertilizes them with milt. The eggs incubate for about one to four months and hatch as alevins.	The ovaries of the female produce eggs cells. The testis of the male produces sperm cells. The two cells unite and the embryo develops in the uterus of the female.
Nervous System	
The brain and spinal cord of all vertebrates are similar in structure and function. The central nervous system controls all conscious body functions. It includes the brain, spinal chord and peripheral nerves.	
Digestive System	
The alimentary or digestive canals are similar. They prepare food for use, absorb nutrients and eliminate waste.	

Internal Anatomy of a Salmon



Adaptation

What is an adaptation?

An adaptation is a genetically-controlled characteristic that may help organisms survive and reproduce in their environment. Species often evolve similar adaptation to survive in the abiotic and biotic conditions of the ecosystem.

Adaptations may occur to an organism's:

- Behavior
- Body Structure
- Body Processes
- Coloration

For example, if an ecosystem has long cold winters, a species may hibernate (a behavioral adaptation), have thick fur (a body structure adaptation), or have the ability to live in fresh water and salt water (a body process adaptation). Animals that live in a snow environment, like the snowshoe hare, become white in the winter, to give them camouflage from predators (a coloration adaptation). *The characteristics of plants and animals offer great insight to the physical and biological conditions of the ecosystem.*

Examples of Species Adaptation:
PLANTS that experience drought (water or heat stress), like cacti, usually have some or all of the following characteristics:

- Thick, leathery evergreen leaves
- Reduced leaf area
- Deep root systems
- Thick white hair or wax on their leaves

These adaptations help reduce water loss, increase heat loss or reduce the amount of light absorbed by the leaf.

Some aquatic INSECTS, like Mayflies, have adapted to live in fast-moving water. They have:

- Flat bodies
- Claws with hooks

These adaptations allow water to flow over the insects and help them to cling to rocks in a swift current.

Pacific Salmon – Species Adaptations

∞ Salmon have good hearing. Using their lateral line they can distinguish notes that are far too fast for humans to separate.

∞ Salmon are "armor plated." They have scales which regenerate to fit into the missing space.

∞ The "tail fin or caudal fin" is used for movement. Salmon can swim at an estimated 14 miles per hour. Chinook can leap as high as 10 feet.

∞ Their tongues have teeth that are used to catch and hold their prey.

∞ The salmon's sense of vision is highly developed to pursue food and avoid predators.

∞ Salmon do not chew their food. The digestive system has to break down all the food.

∞ Salmon have to work within strict weight limits if they are to be able to swim. They do this with a lightweight skeleton of cartilage.

∞ The salmon has a line of pores running along each side of its body; this "lateral line" detects low frequencies close to the fish.

Aging Trees and Fish – An Activity

Key Concepts:

FOR YOUNGER STUDENTS and OLDER STUDENTS

- By examining a drawing of a salmon scale, students will be able to determine their age.

Objectives:

1. Students will learn about tree growth patterns.
2. Students will be able to age a tree by counting its growth rings.
3. Students will relate growth information to the aging of fish through their scales.

Materials:

- ✓ Tree cross-sections (if available)
- ✓ Enlarged fish scale drawing
- ✓ Copy master (following page)

Background:

Cross-sections of tree trunks reveal the different layers of a tree. Each ring in the trunk of a tree represents one year of tree growth; they are called <u>annual rings</u>. Each year the <u>cambium</u> (cambium is the area just under the bark) forms a layer of light-colored cells in summer. You can 'read' the age of a tree by counting the rings in a cross-section of the trunk. The annual rings in a tree <u>cross-section</u> vary depending on the weather and growing conditions.

Method for Aging Trees:

1. Explain how tree rings are made and what constitutes one ring. Pass out tree "cookies" from the kit to students. Have them decide how old the tree was when it was cut.
2. Each group finds the rings that correspond to the years their classmates were born. Use pins to mark the ring(s), first placing a paper "flag" on the pin to label the date.
3. Use pins to mark other significant dates. For example, how large was the tree when:
   a. Students were in the first grade?
   b. The school was built?
   c. Washington or Oregon became a state?
4. Examine the cross-section for differences in growing conditions during the years the trees lived.

Method for Aging Fish:

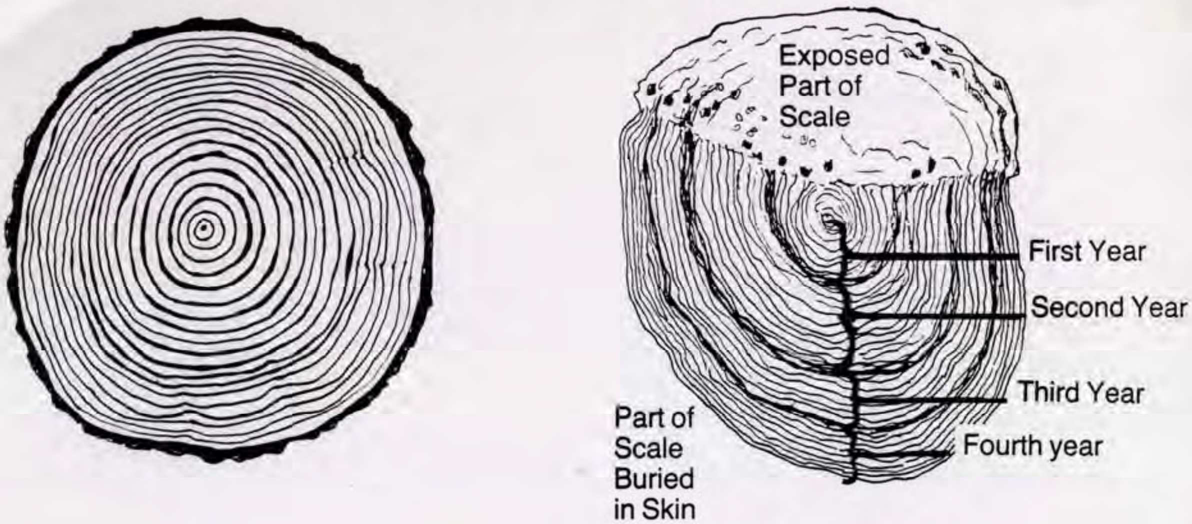
This is where we relate tree rings to the aging of fish through their scales.

1. Split the class into groups of two. (If you have a small class the students could work individually).
2. Give each group one scale to work with, can be xeroxed from the following page. They may need a magnifying glass to see the details of the rings. A photocopy of the scales could be used so the students can write directly on the scale.
3. Students should look for the heavy or dark rings in-between the lighter rings. The heavy lines are called annual rings (the mark of 1 year of life). Just like the cross-section of a tree trunk, the oval scales of the salmon show annually growth rings. Annual rings can be used to learn the age of a tree or fish. During the summer or other times when growing conditions are good, the fish grows quickly and the rings are far apart. In winter when living conditions are not as good, the fish grows slowly so the rings are close together.
4. Ask students to tell about their fish. How old is it? Did this fish have a lot of space between the annual rings or very little? What des that mean? Which part of the scales shows where it was attached to the fish? What part was exposed?
5. Students could create their own scale, drawing the light and dark lines indicating differing growth patterns. Have them explain the reasoning behind what they created addressing some of the same questions in #4 above.

Evaluation:

Students observe the cross-section of a tree and list events which might cause differences in the width of tree rings. They describe how each event might influence the size of the ring.

How is a Salmon Like a Tree:



Cross Section of Tree

Salmon Scale

Just like the cross section of a tree trunk, the oval scales of the salmon show annual growth rings. Annual rings can be used to learn the age of a tree or fish. During the summer or other times when growing conditions are good, the fish grows quickly and the rings are far apart. In winter when living conditions are not as good, the fish grows slowly so the rings are close together. How old is the fish below?

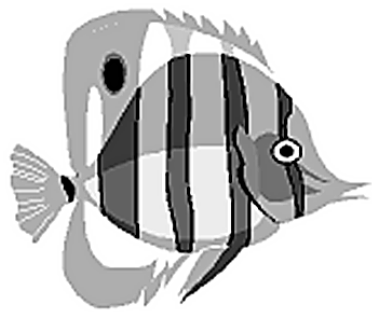
Fashion A Fish – An Activity

Key Concepts:

For younger students:
- ✦ Fish can be classified according to body shape and coloration.

For older students:
- ✦ Fish have adaptations that enable them to survive in their habitats.

Objectives:



1. Students will identify and describe the advantages of fish adaptations.
2. Students will evaluate the importance of adaptations to fish.

Materials:

- ✓ Art supplies (crayons, paint, chalk, colored pencils
- ✓ Pencil and paper
- ✓ Outdoor items for creating habitat (leaves, rocks, seeds, sticks etc.)
- ✓ Adaptation cards (following page)

Background:

Fish have a variety of adaptations, including characteristics of fins, senses, scales, shape and color. These adaptations have evolved so that the fish is better suited to its environment and lifestyle. The purpose of this activity is for students to realize 1) there are advantages for the fishes appearance and 2) recognizing some of the ways in which fish are physically adapted to their environment.

Methods:

Discuss with the students the meaning of habitat and adaptation. You may use the various adaptations listed at the end of this activity. Or, brainstorm a list of fish characteristics, then describe the advantage of the adaptation represented by the characteristic. Tell the students they will each have a chance to design their own original fish - one well adapted to its habitat. Divide the class into 4 or 5 groups. Assign each group one adaptation from the following four categories (you may want to reproduce pages 66 & 67 and have the groups draw their adaptation cards from the categories):

- o Coloration
- o Reproduction
- o Shape
- o Mouth/feeding

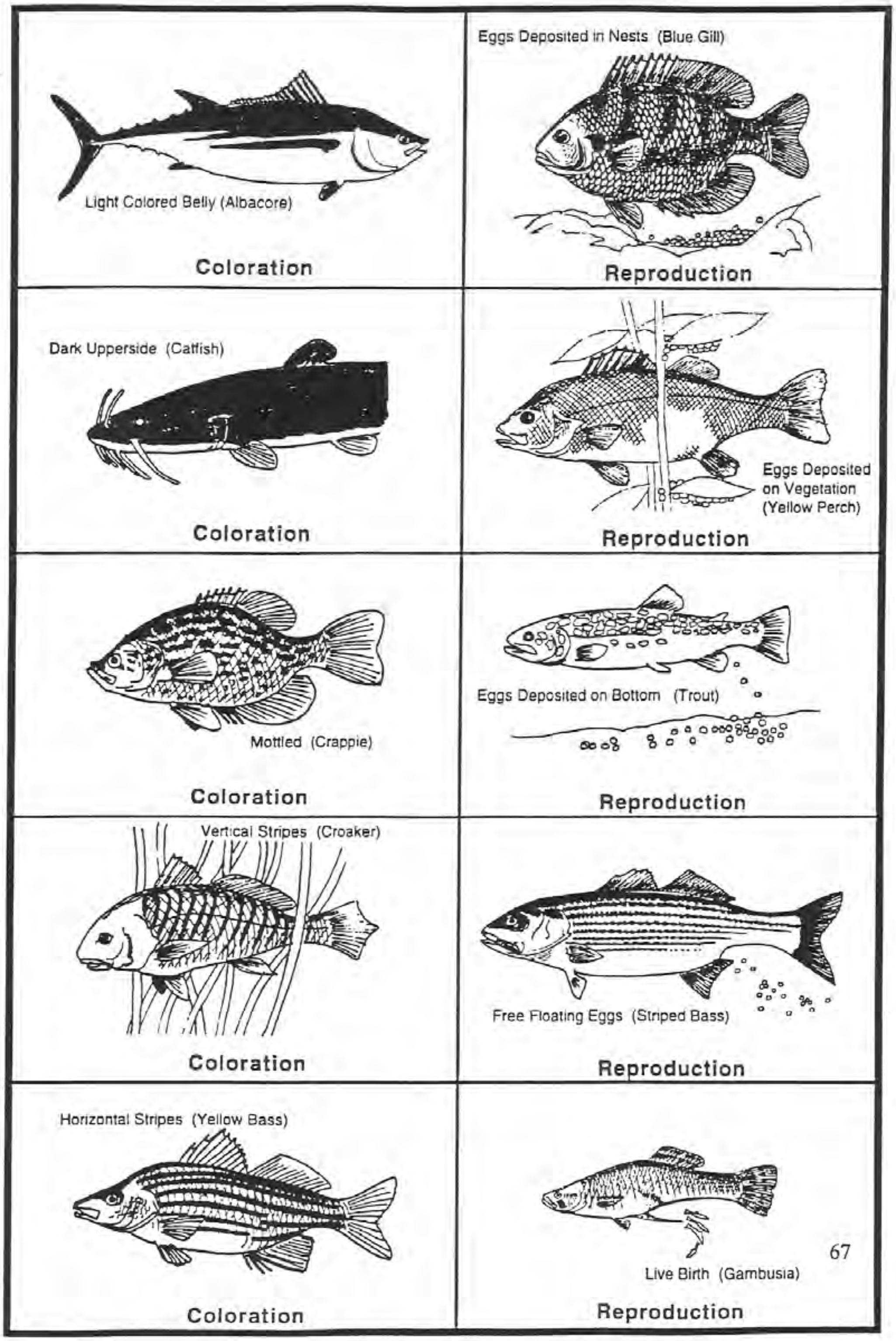
Based on the adaptations assignments (each group will have a type of coloration, a style of reproduction, a body shape and a mouth/feeding style), the students will decide what adaptations are necessary for their fish and write them down before proceeding further. Using their list of adaptations, each group will create their own original fish; for example, by drawing or sculpting it. After creating their individual fish, the group will then create a larger habitat where they will attach their fish. The habitat must be appropriate for the fish they have created. In conjunction with each drawing or sculpture, each student should write a short report which includes the name of the fish and its food source, habitat, and life cycle. Students should also include their lists of adaptations, the reasons for the adaptations, and the advantages provided by the adaptations. Completed project may be submitted to the teacher, presented to the class or displayed in the classroom.

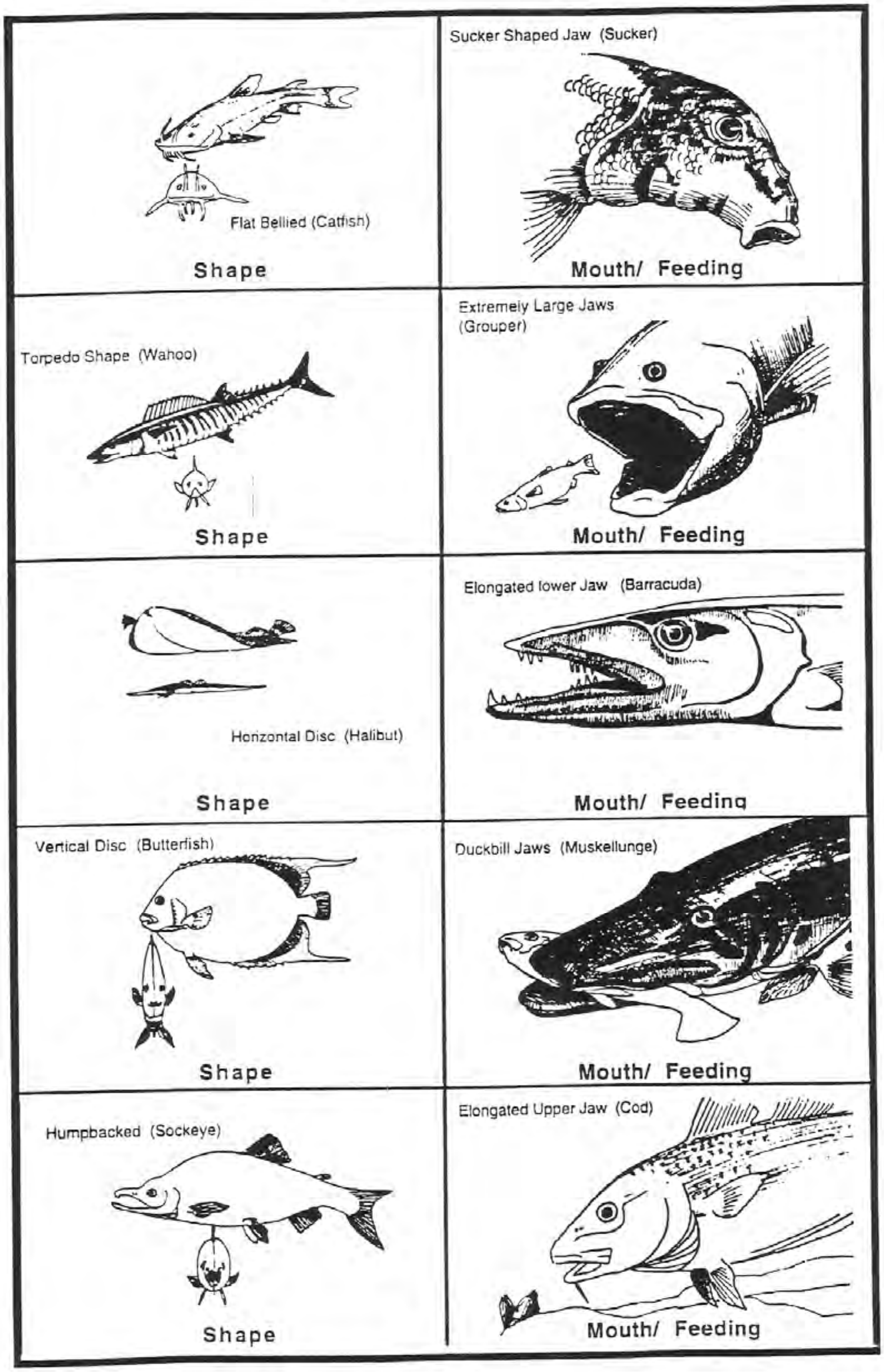
Evaluation:

Name two fish adaptations for each of the following body parts, listing their advantages: mouth, shape, coloration, reproduction. Then describe the advantages of each of these adaptations to the survival of the fish in their habitats.

Fish Adaptations for Different Body Parts

Adaptation	Advantage	Examples
Mouth		
Sucker shaped mouth	Feeds on small plants and animals	Sucker, carp
Elongate upper jaw	Feeds on prey it looks down on	Spoonbill, sturgeon
Elongate lower jaw	Feeds on prey it sees above	barracuda, snook
Duck Bill jaws	Grasps prey	Muskellunge, pike
Extremely large jaws	Surrounds prey	Bass, grouper
Body Shape		
Torpedo shape	Fast moving	Trout, salmon, tuna
Flat Bellied	Bottom feeder	Catfish, sucker
Vertical disk	Feeds above or below	Butterfish, bluegill
Horizontal disk	Bottom dweller	Flounder, halibut
Hump backed	Stable in fast moving water	Sockeye salmon, chub razorback
Coloration		
Light colored belly	Predators have difficulty seeing	Most minnow, perch, tuna
Dark upper side	Predators have difficulty seeing	Bluegill, crappie, barracuda
Vertical stripes	Can hide in vegetation	Muskellunge, pickerel, bluegill
Horizontal stripes	Can hide in vegetation	Yellow and white bass, snook
Mottled coloration	Can hide in rocks and on bottom	Trout, grouper, rockbass
Reproduction		
Eggs deposited in bottom	Hidden from predators	Trout, salmon, most minnows
Eggs deposited in nests	Protected by adults	Bass, stickelback
Floating eggs	Dispersed in high numbers	Striped bass
Eggs attached to vegetation	Stable until hatching	Perch, northern pike, carp
Live bearers	High survival rates	Guppies


Light Colored Belly (Albacore)
Coloration
Eggs Deposited in Nests (Blue Gill)
Reproduction
Dark Upperside (Catfish)
Coloration
Eggs Deposited on Vegetation (Yellow Perch)
Reproduction
Mottled (Crappie)
Coloration
Eggs Deposited on Bottom (Trout)
Reproduction
Vertical Stripes (Croaker)
Coloration
Free Floating Eggs (Striped Bass)
Reproduction
Horizontal Stripes (Yellow Bass)
Coloration
Live Birth (Gambusia)
67
Reproduction


Flat Bellied (Catfish)
Shape
Sucker Shaped Jaw (Sucker)
Mouth/ Feeding
Torpedo Shape (Wahoo)
Shape
Extremely Large Jaws (Grouper)
Mouth/ Feeding
Horizontal Disc (Halibut)
Shape
Elongated lower Jaw (Barracuda)
Mouth/ Feeding
Vertical Disc (Butterfish)
Shape
Duckbill Jaws (Muskellunge)
Mouth/ Feeding
Humpbacked (Sockeye)
Shape
Elongated Upper Jaw (Cod)
Mouth/ Feeding

Gyotaku – Fish Printing! – An Activity

Key Concepts:
Fish are fun to catch. Fish are good to eat. Fish are fun to print.....Waaaaaait a minute! Print a fish? That's right - you can actually make colorful prints of the fish you catch! And now that the fish are biting, it's a great time to try your hand at fish printing. This process allows you to record your catch in an artistic way. You can make a print with most any fish, but those with larger scales and bodies such as salmon, carp, bass, bluegill, rock fish or flounder, will give the best results.

Objectives:
1. Students will be able to classify animals as fish or non-fish.
2. Students will name the external features of a fish.
3. Students will describe functions and adaptations of the external features of a fish.

Materials:
- ✓ Fresh, frozen or rubber fish
- ✓ Newspaper
- ✓ Modeling clay, straight pins
- ✓ ½" stuff bristle brush, small paint brush
- ✓ Water based ink (linoleum block ink is best; liquid tempera paint also can be used)
- ✓ Rice paper, newsprint or other moisture-tolerant paper (since rice paper is expensive, you might prefer to start with newsprint. After you gain experience you might want to try making a print on a tee-shirt.)

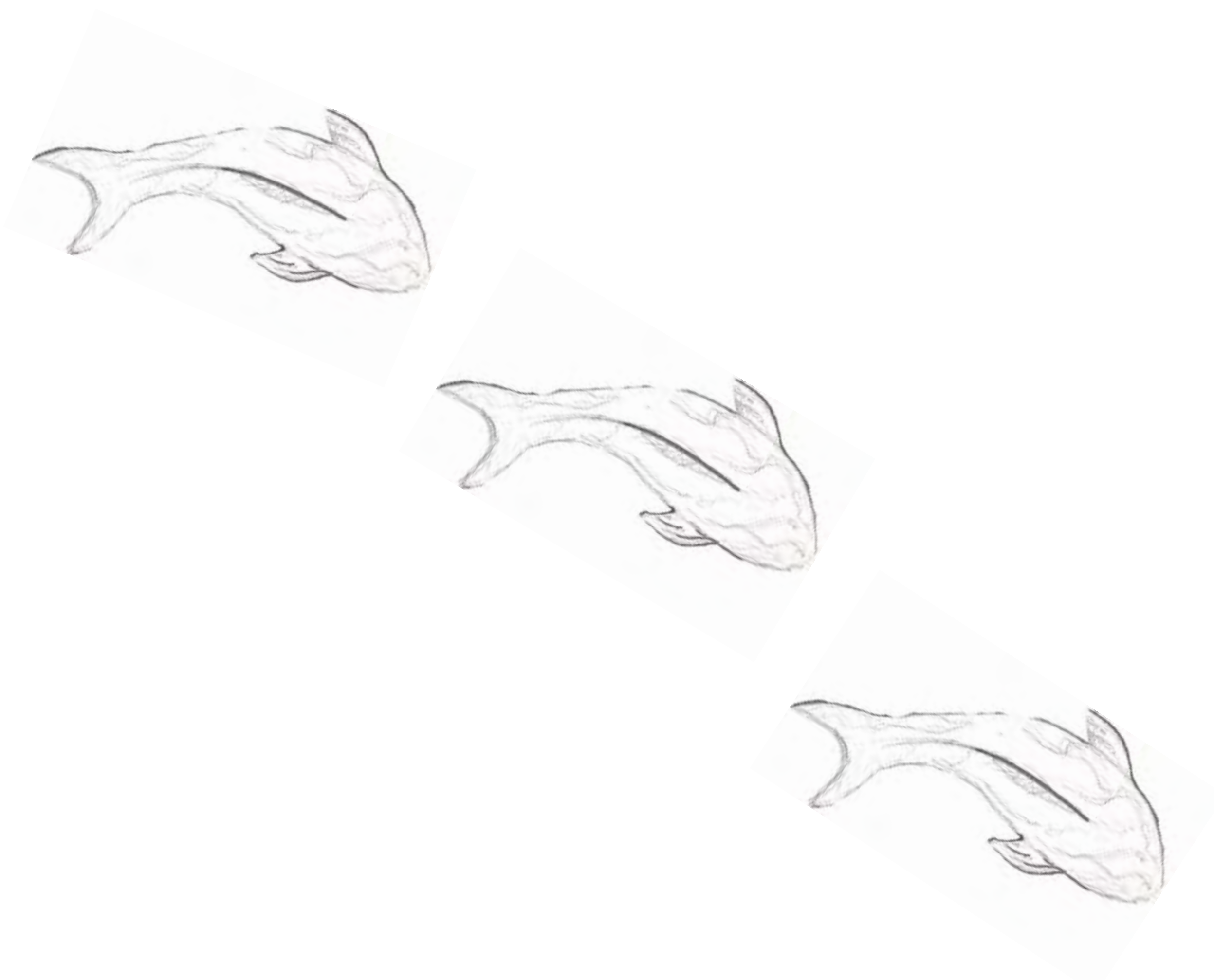
Background:
The art of fish printing is called gyotaku (pronounced ghio-ta'-koo) has been used in Japan for more than a century to record catches of sport fish. The Japanese technique is also used by scientists.

Methods:
1. Use soap and water to clean the outside of the fish as completely as possible. The cleaner the fish, the better the print. Dry the fish well.
2. Place the fish on a table covered with newspapers. Spread the fins out over some clay and pin them in this position. Allow the fish to dry further.
3. Brush a thin, even coat of ink or paint over the body and fins. Leave the eye blank.
4. Carefully place a piece of rice paper or newsprint over the inked fish. Use your fingers to *gently* press the paper over the surface of the fish. Be careful not to change the position of the paper or a double impression will result. Also, do not press too hard, or it will all blur together. *You will get better detail if you press lightly!*
5. Remove the paper from the fish quickly, lifting up one end and peeling it off. Often the second or third print from one inking or painting comes out the best.
6. Use a small brush to paint the eye on the finished print.

Lesson 4 – People & Salmon Through Time

Purpose: This lesson is designed to review human impacts and explore connections between people and salmon both past and present.

Activities:



People and Salmon Through Time

The earliest archaeological evidence of human habitation in the Columbia River Basin dates to 10,000 B.P. (Before Present Time). The earliest groups lived by fishing, hunting large mammals and gathering plant foods. Cultures in the proto-historic and historic periods varied greatly along the river. On the lower Columbia groups lived in large multi-family long houses, while on the middle and upper river sections, people moved seasonally and lived in smaller groups. Native fishers took salmon at Willamette Falls on the Willamette River and at Kettle Falls on the upper Columbia. Celilo Falls on the middle river was the most important native fishery. Thousands gathered there during the spring and summer fish runs to harvest Chinook salmon and trade. In the early 19th century, Pacific Fur Company trader Alexander Ross called Celilo "the great emporium or mart of the Columbia."

The Columbia River first appeared on European maps in the early 17th century as "River of the West," when a Spanish maritime explorer Martin de Auguilar located a major river near the 42nd parallel. Cartographers often labeled the "River of the West" as an estuary to the mythical Straits of Anian, or the Northwest Passage and located it anywhere from the 42nd to the 50th parallel. The first confirmation of its location came in 1775 when Bruno do Hezeta described a river estuary at the Columbia's correct latitude. In May 1792, American trader Captain Robert Gray sailed across the bar in the first documented Euro-American visit to the river. British explorer George Vancouver sent Lt. William Broughton up the river more than 100 miles in October 1792, and Broughton produced the first detailed map of the lower river. Meriwether Lewis and William Clark explored the river in 1805 - 1806 for the United States. Northwest Company fur trader David Thompson made the first map of the full river in 1811 - 1812. After the War of 1812, England and the United States jointly occupied the Columbia River Basin territory.

Britain's Hudson's Bay Company established a fur-trading authority in the region and built a headquarters post at Fort Vancouver in 1825. Britain's Hudson Bay Company trappers and traders spread throughout the Columbia River Basin and beyond, bringing furs back to Fort Vancouver for shipment to England. Americans returned to the region as settlers during the 1840's, when over land migrants came to the Columbia and Willamette River valleys on the Oregon Trail. In 1846, the Oregon Country south of the 49th Parallel became United States territory by treaty with Great Britain. Oregon achieved statehood in 1859, Washington and Montana in 1889, and Idaho in 1890.

During the late nineteenth century, capitalists developed natural resource and transportation industries on the Columbia. From 1860 to 1883, Portland's Oregon Steam Navigation Company dominated steamboat transportation on the lower and middle river. R. D. Hume established the first salmon cannery on the Columbia in 1866, and by 1883 forty canneries operated on the river, packing 634,000 48-pound cases for export. During the period 1880-1900, orchardists established operations at Hood River and Wenatchee on the Columbia and along the Yakima and Okanogan Rivers. Engineering projects on the river began with navigation canals at Cascade Locks in 1896 and at the Dalles-Celilo in 1915.

Twentieth-century alterations on the Columbia River dwarfed the early dredging and canal building. In 1932, private power companies completed Rock Island Dam on the middle river. In 1933, the federal government began work on the Bonneville Dam on the lower river and Grand Coulee Dam on the upper river. By 1975, eleven dams stood on the main stem, with many additional dams on major tributaries. The hydroelectric resources contributed directly to waging World War II. Electricity from the Columbia River powered aluminum plants, shipyards, and the development of the plutonium atomic bomb at Hanford Engineering Works near Richland, Washington. The hydroelectricity generated on the Columbia has stimulated significant industrial growth in the Pacific Northwest since World War II.

Native American Teachings

Based on Cedar Tree Teachings of elders of the Pacific Northwest Tribes and the text
Look to the Mountain by Dr. Gregory Cajete of Santa Clara Pueblo

The following is a brief outline of deep principals upheld by many traditional cultures that are transferable to contemporary society. The terms used by contemporary ecologists are also indicated.

SEVENTH GENERATION TEACHINGS - Considers our responsibilities in terms of both our future and our past. We honor our ancestors back at least seven generations when we make an important decision that affects our society. This means we take their way which worked well for so long into account when we plan a new road or teaching process. It doesn't mean we can't change but that we change carefully.

We honor our descendants not only because they carry the future but because we will be their ancestors and we are responsible for how they will live. This means we leave wetlands and regenerate deforested slopes so our great-great-great-great-great grandchildren thank us for our decisions. This is called "intergenerational equity" by ecologists.

LISTENING IS PARTICIPATING - Paying attention is considered the beginning of all knowledge. Traditional teachers will point out to children that the Creator gave us two ears but only one mouth, so we listen at least twice as much as we talk. Children are taught to consider that everything has wisdom and that if we learn the skills of listening we can hear the voices of the animals and plants and mountains. Listening is not what happens when we tell children to shut up. Rather it is what happens when we give them the capabilities to open up. Ecologists call this sensory integration.

WE ARE A GIFT TO EACH OTHER - In a consumer society the goal is to acquire more than is used so there is a surplus that creates wealth. In a society based on sharing the individual is aware of her or his responsibility, giving in equal value to what is received. This can be as simple as keeping toxic chemicals out of local waters or as difficult as asking the basic questions of mutual interdependence.

WE ARE ALL ON A JOURNEY TOGETHER - We grow and change in much the same way other living beings do. This "Link of Life" both supports us and challenges us. If we learn where we are meant to go from other living beings we also learn how to behave in this interspecies adaptation.

WITH CAREFUL WORK WE CAN RESTORE OURSELVES TO BALANCE - Much of Native American environmental activity is ceremonial. This is conscious community action that acknowledges the basic harmony of the natural world and the unique ability human beings have to get out of balance with that existence. The two steps are to recognize when we are not connected and then restore ourselves to stability.

The Importance of Storytelling

Adapted from:
Pacific Northwest Salmon & Watersheds

People have always tried to understand the world around them and the way that it came to be. People in all cultures try to explain their surroundings based on the information available to them.

Stories are one way that we can answer these questions about ourselves and our environment. They could explain the origins of the people, the animals and their environment, or they could contain messages about how people should behave as a part of the world. These stories could then be used to pass ideas from one generation to the next. Storytelling is therefore an integral part of traditional Native American culture.

Storytelling is a communal experience, requiring both tellers and listeners. To make sure that the audience is paying attention to the story, a storyteller may use any number of tactics to include the audience in the story. They may expect response words or answers to questions. For example, whenever a storyteller says, “Ho?” the audience is expected to respond with, “Hey!” Also, songs known by the people might be incorporated into story.

Another common storytelling technique is the Story Circle. Use of the Story Circle varies from everyone in the circle telling a long traditional story to passing a story stick in silence from one person to the next. The circle is important because it serves as a symbol for the cycle of life. A circle is similarly important when telling stories.

Stories are considered to be living things, capable of evolving as necessary. Native American Indian people consider them to be one of the greatest gifts that humans have been given. For this reason, they were and are treated with a great deal of respect. Some stories could be only told by certain people and at certain times of the year.

Because stories are so important, people who were particularly good storytellers were very well respected by others. Stories could be shared as dramatic performances. The teller might use tone of voice or gestures to indicate certain characters. The teller, often an elder, might travel around sharing the stories with people in more than one lodge during the storytelling seasons.

The Secret of Flowing Waters – A Story

Adapted from:
A Salmon Homecoming Story-based Curriculum for Primary Environmental Education
Tribal Communities of the Pacific NW, the NW Indian Fisheries Commission and the Seattle Aquarium

The journey we salmon make down the river where we are hatched is full of risks and adventures. We are lucky to travel with all our brother and sister fingerling salmon. The journey we make circling the ocean is something of a mystery. We keep it that way. This is our salmon secret. To learn about it your must put on your salmon eyes.

The elders tell stories about our ancient village, far over the western horizon. If we go there during our time in the ocean, it is an important part of our journey. Sometimes it seems, from our home creek to our legendary island, we never stop traveling. We must love moving more than almost anything.

We salmon learn how to move from water. It teaches us how to flow downstream. It also gives us the strength to swim against the current, when we need to. Testing our energy against the rush of a river is how salmon dance. When we don't have a stream to swim through, we become lazy.

So salmon know a great deal about flowing. We know that when a lot of water falls, in rain, we are in for flooding. Then, the rivers rise up and fill their lowlands. After such a heavy rain, we may need help restoring our stream banks and waterways. Particularly important to us is the restoration of our gravel redds, or nests.

When our nests are disturbed, we can't live there. It is as if somebody went into your bedroom and turned your bed upside down, forcing you to sleep on the ceiling. If our cold, shaded pool is rebuilt, replanted, or restored it is like falling into a deep, comfortable quilt is for you. We are not so different, except you don't care as much about flowing.

We also love how water drops down a mountain. You call that a 'cascade.' When a fast downhill flow connects us with our redd, we love thrashing up the rushing water. Going upstream, going to our nest, is our great challenge. There is nothing like zipping through fast water, for a homebound fish.

One more thing about flowing; the river goes through many places. It starts up in the melting snow and rocky slopes and ends in low valleys, swamps and finally its mouth, where it enters the salt water. Imagine flowing water as a giant circle, with evaporation rising from streams and lakes. Then the rain falling is how the circle comes back to Earth and closes. Imagine our salmon journey as a great circle, like the water. We go from the watershed to the ocean and back again, over a period of three to five years.
On the way we learn many things. The river tells us stories about others who also need its water. This helps us feel we are part of the whole land the river covers. We learn about the bears and water beetles who share the flow with us. We enjoy the endless movement we flow with.

This is the secret of flowing water. When we go with it we are carried to the sea. But when we go against the flow, we help keep the great circle alive.

Eye of the Beholder – An Activity

Key Concepts:
A salmon, by any other name, would still smell as sweet! Well, at least it would still smell like a salmon.

Objectives:
1. Students will become aware of and appreciate various attitudes towards salmon by comparing descriptions of salmon from scientific and cultural points of view.
2. Students will recognize several types of relationships people have with fish through further investigation and role playing.

Materials:
✓ "The Natural Order of the Chinook" (page 75)
✓ "Supernatural History of Chinook" (page 76)

Methods:

1. Divide the class into groups of 4-6 students.
2. Distribute "Supernatural History of Salmon" to half of the group, and "The Natural Order of Chinook" to the other half of the group.
3. Students read handouts and then discuss what they read within the group.
4. Each group should then compile a list of salmon characteristics based on the handout they received. (Half of the lists will contain "supernatural" or cultural traits, while the other list will relate to "natural" or historic observation.)
5. As a class, develop two lists of salmon characteristics: "natural" and "supernatural" Compare and contrast these lists.

Evaluation:
Have students describe three different points of view people have towards salmon.

The Natural Order of the Chinook Salmon

This is a story of decline, and one of resilience. Neither the salmon nor the men and women whose way of life is shaped by its complex life-cycle, will expire without a fight. The Pacific Salmon represents a miraculous evolutionary adaptation to fresh and salt water environments, commencing when the females deposit their eggs for male fertilization in the gravel beds of coastal streams and rivers. After the eggs hatch, the Chinook salmon travel down river to estuaries where they feed and gain strength prior to entering the sea. The cycle continues when millions of salmon return to spawn.

It all sounds simple, but this reproductive cycle is a risky proposition. Natural predators take a toll, and streams must be sufficiently clear of obstruction to permit migration. If the salmon succeed in their arduous upstream journey, they require a narrow range of water temperature and quality conditions in addition to clean river beds.

For centuries, the abundance of aquatic resources enabled the Native Americans of the north Pacific coast to enjoy a high level of economic prosperity. Salmon had a central place in the trading and cultural practices of Indians who trolled from canoes, employed nets and harpoons and built sophisticated weirs to harvest the annual runs. Drying and smoking techniques were used to preserve the catch, and a complex system of rights was developed to regulate access to the resource.

Supernatural History of Chinook Salmon

Chinook salmon; spring salmon; tyee; king salmon; blackmouth; springer; quinnat.

Many Pacific Northwest Native American stories share the theme of the Salmon People. Salmon People live in villages under the sea, where they walk and talk just like ordinary humans. Once a year, Salmon People put on their silvery scaled robes and transform themselves into the fish seen swimming upriver. After the migration and spawning, Salmon People return to their undersea home until the next year.

Many stories warn that migrating Salmon People follow a leader, who must be treated with respect. For some tribes, this leader is Fog Woman, who hovers over the water. Others suggest that the leader is the first salmon caught by a tribal member. Traditionally, tribes held special ceremonies to honor this first salmon. Although the details vary from tribe to tribe, the ceremony usually included returning this first salmon, or its bones, to the river. The first salmon was returned to the water to tell other Salmon People how much the tribe respected them. It was believed that Salmon People would not travel upstream to provide food if they were not shown proper respect.

The Path of the Salmon People – An Activity

Adapted from:
A Salmon Homecoming Story-based Curriculum for Primary Environmental Education
Tribal Communities of the Pacific NW, The NW Indian Fisheries Commission and the Seattle Aquarium

How the Rain Moves Through the Watershed

The salmon nations made the return journey from their village far out to sea because a promise was made by the human beings by the elder and the children. What was the promise? To allow the continual movement of the five helpers through the watershed so the salmon could come home.

Let us imagine what it is like when everything flows freely. Brother Rain Helper knows how to teach this but everything in the world flows. Gravity causes things to flow downward. We don't sit up in a chair. We sit down in a chair. When the salmon move through the flow it is because they know they can keep going to reach their goal.

Generations of Salmon People are certain of their progress up a particular corridor of the watershed. Each of the six nations of salmon likes a different kind of water flowing. For example:

CHINOOK salmon which are very large choose big rivers. They like long journeys against the flow leaping up amazing waterfalls and taking as long as six months to reach their spawning grounds. Of all the Salmon People, Chinook most enjoy everything to be full of energy. Females lay up to 5000 eggs in fast-flowing water. Probably their choice of powerful flowing water has been why they have grown so strong themselves.

COHO salmon like all kinds of water. Unlike the Chinook they choose quiet side streams, calm channels and the most insignificant of winter creeks. What might seem a tiny waterway can still be a marvelous place for Coho nests. If they have a choice the Coho will always take the middle flow looking for water that is neither too fast nor too slow.

CHUM and PINK salmon don't travel far from the sea. Chum are the opposite of the adventurous Chinook. They choose coastal channels with low flows and if there are any local springs to bring oxygen to their eggs they will just make their nest in the lowest of flows. Pink salmon go a little further upstream and like slightly faster water, but both Chum and Pink fry (baby fish) spend their early schooling in the estuaries and beach swamps before they go out to sea. This is where they learn to adjust to salty water.

SOCKEYE salmon ride any river as long as it ends in a lake. They spawn in flow that comes from inlets or even near gravelly shorelines of lakes so their young can grow up in the lake. Sockeye like to swim around and around in circles before they take off on their journey to the ocean, maybe so they can create their own flow.

STEELHEAD another salmonid fish, make the longest journey of all. They can enter a great river like the Columbia any time of year. They spawn from late winter almost to summer. Some Steelhead travel as far as the Snake River, sharing their nests with mountain trout, way up in the Idaho wilderness.

Now that we know a little about how each salmon enjoys the fast or slow flow of water, what are some things that stop the movement of Brother Water Helper through the watershed? Remember this also keeps the six nations from reaching their nests and completing their circle of life. All of these are problems human beings can help the salmon people solve.

These are a few examples of what keeps the water from flowing as the salmon want it to flow. There are far too many blockages to put in this short story.

Dams are how we control flooding and get electricity. The lakes that build up behind dams can be used to store water or send it to farms. Unfortunately, dams slow the flow. The great migrations of the salmon from their nests to the sea or back upriver can be stopped by dams. Sometimes we can build fish ladders and help the fish make their run. Sometimes we can control the flow in a way that makes it easier for salmon to migrate. Always, we can conserve water and electricity so there is more water for fish to swim in, and always we should be sure that dam turbines are screened so they don't kill baby fish swimming down river. Sometimes dams can even be removed to free the flow.

Cities and towns are built for people to live in. This is very comfortable for us but we pave over the watersheds and instead of flow we have storm water runoff. This means that the rain that falls on a city does not go into the soil or the roots of trees and the branches of bushes. Instead the rain goes into sewers and reaches the sea full of poisons and garbage. Sometimes we can restore the watershed like in a city park. The best thing is for us to be very careful of any new construction or conversion of forest land, wetlands or green belts into developed property. Then we will always remember how to keep the water flowing as it wants to.

Farms divert the flow to fields and animals such as cows and sheep. The water goes through irrigated land picking up fertilizer and pesticides before running back to the main river. Sometimes we channelize (or straighten) streams and rivers to make more land available for farming or ranching, and sometimes we dike river banks to keep them from overflowing in times of flood. This can destroy salmon habitat, too. We can help by fencing streams so cattle don't break down the banks when they go to the creek for a drink. We can help by controlling herbicides and pesticides we put on the crops so we don't accidently poison the flow. We can also help by keeping streams and rivers in their natural condition, so the water flows the way it was meant to. Then when rain and rivers go through the crops we eat they will be part of the flow and keep us fed and deep us healthy.

We don't think of Forests as stopping the flow because we have seen with our salmon eyes how the trees drink the rain and then send it slowly downhill with gravity to join the stream. But log jams can stop the flow, keeping salmon from going upstream or down. Clear cutting, taking out every tree from a particular place in the forest, can hurt the soil, eroding it and sending water full of mud into the salmon channels.

Life along the stream banks can be ruined when we log right up to the edge of the river. Trees and brush are needed along streams to slow the flow of rain. They also help keep the water cool, the way fish like it. They provide protective cover for fish, and other wildlife, and provide natural nutrients to the water. They also provide habitat for insects, an important food source for the salmon. We can help the flow by logging selectively; taking out only the trees we need from one part of the woods and then going to another place. We can leave at least 200 yards of trees on either bank of the river to keep the salmon nests and nurseries pure. We can replant many more trees than we cut down. We can remember how important the trees are to keeping the water flowing clean.

Can you think of other ways to keep water flowing clean and fresh through forests, farming and cities?

From the mountainside to the sea, the pull of gravity and the pressure of the river corridor keeps the water moving as it should. Different salmon like different currents but there is not a bit of the flowing water that does not help the circle of life as long as we remember our responsibility to keep the way open so the journey of the salmon keeps moving as it has for so many generations.

Lesson 5 – Impact

Purpose: This lesson introduces students to the factors that change or impact salmon and their habitat.

Activity:

History of Fishing on the Columbia River

Paul Kane was born in Ireland in 1810, but moved with his family to Canada when he was eight years old. He studied painting at Upper Canada College and after working in Detroit, Michigan and Mobile, Alabama he went to Europe for two years to study art.

Having developed an interest in western Indians, Kane arranged to visit their territories, leaving Toronto in May 1846. He went as far west as Fort Vancouver on the Columbia and over to Victoria and returned in October 1848.

First Fishers of the Columbia

His field sketches and watercolors are an important record of a period before photography. Returning to Toronto, he spent six years making a series of 100 large oil paintings from his work.

This trunk full of sketches and paintings gives us a glimpse into the past of the Columbia River and its people. They showed the many ways the Native Americans fished for salmon and other species of fish. Spears were used to catch fish from canoes, river banks, and platforms built out over the river. In his paintings the fishermen stood on rocks beside the river, poised to thrust their spears when they saw a fish swim by. If you look very closely, you can see that the spears have three points, or prongs. There were many types of spears and harpoons. A good fisherman knew just what type of weapon to use in different conditions such as deep swift water, shallow water with a rocky bottom, or deep ocean water, for example.

What's the difference between a spear and a harpoon? Hilary Stewart, author of the book Indian Fishing, provides this explanation:

> *"While a large, struggling fish impaled on a fixed spear point could break the shaft or point, or free itself by thrashing about, the detachable harpoon head allowed the fish to move in the water without putting direct strain on the gear, while its struggles imbedded the barbs well into the flesh."* (p. 65)

Traps or weirs documented by Kane were just one of the methods the Indians of the Northwest used to catch fish. Sturgeon, trout, echelon (a tiny, anchovy-like fish) and especially salmon, was the staple food of their diet. There were so many fish in the river that a fisherman might catch as many as 100 fish in a day! At this rate he soon caught enough fish in a month or two to feed his family through the winter. Some of his catch could also be traded to people who did not live near the rivers where the fish swam. Although Paul Kane observed the weir in his painting, archaeologists still sometimes find the remains of these structures in streams and rivers throughout the Northwest.

The method which attracted the most attention between early explorers and trappers was the dip net, a device that was fished in fast waters. The net was hung on a four-foot diameter hoop attached to a thirty-foot pole. The net was made to slide on the hoop so as to close into a bag with the weight of a salmon. It was usually fished blind, which means the fisherman could not see the fish. Dipping platforms were built over eddies. The swirling water caused the bag of net to flare. When the fisherman felt something, strike his net, he rapidly pulled the net straight up out of the water.

Just as there were many ways to catch fish. There were also many ways to prepare them for eating. Kane showed the fish cut into fillets and hanging from racks to dry in the sun. Large quantities of fish were dried in this way and smoked by hanging from the rafters over the hearth of a plank house or smoke house. When completely dried, the fish could be pounded into a powder and hen packed into woven baskets. Sometimes holding up to 100 pounds of powdered fish, these baskets were traded to inland people or stored away to be eaten during the winter. Other methods included roasting, boiling, or steaming in an earthen pit lined with leaves.

A Native American population of 50,000 caught an estimated 18 million pounds of Columbia River salmon each year. This figure is based on an average daily consumption of one pound of salmon per person.

The Inexhaustible

The treaties of 1855 allowed both Native American and settler to fish in common for salmon. In the early 1860's, the Columbia Rivers' resources seemed inexhaustible and capable of serving the needs of both groups. It wasn't long before some settlers saw more than subsistence in the salmon; they envisioned riches that could be gained from trade and commerce. The early efforts at marketing salmon - shipments of barrels of salted salmon to Hawaii, the Atlantic Coast and Europe-were not particularly successful, because salmon did not keep well on long journeys' and spoiled before reaching their destinations. Salmon harvests boomed with new and improved canning processes which enabled long distance transport and long term storage of salmon.

Hapgood, Hume and Company introduced salmon canning on the Pacific Coast in 1864 on the Sacramento River, but moved to the Columbia River in 1866 because of over fishing, hydraulic mining and stream obstructions which depleted the salmon runs. Their new canning operation began with 4,000 cases packed and sold at an average of $16 per case. As early as 1872 the total pack reached 250,000 cases, the price per case having declined to $9. Success, however, does not go unrecognized, and many more canners came to share in the profits. By 1883, there were 55 salmon canneries operating on or near the Columbia River.

It is important to note that the drop in price per case was due to the success of canned salmon. Canning salmon and locating markets for the product increased the pressure on the Columbia River's salmon resource. The success also attracted cannery men and fisherman from around the world to the Columbia. Soon canners and fishermen were competing for a portion of the pack available which was on a decline. Cannery men knew in 1883 - 1884 that they had saturated the market. They tried, but failed in attempts to limit production and establish agreements between canners. The problem was- no one wanted to be limited on production based on their current capacity. The key to success in this market was innovation and anyone with the inventiveness to expand determined whether or not they stayed in business.

So how did they do it? When the early settlers began to fish for salmon, they introduced many methods already in use around the world. Gill nets, fishwheels and hand or horse drawn seines had been used with a great deal of success on the East coast to catch Atlantic salmon. Fishwheels were water-powered machines which scooped salmon out of the river and dumped them into a box. They were placed in swift water in the path of migrating salmon. Samuel Wilson built the first fishwheel on the Columbia in 1879. By 1899, there were 76 fish wheels in operation. The Seuferts' No. 5 wheel on the Columbia River caught 4,625,776 pounds of salmon in 31 years of operation, averaging 149,218 pounds per season, or about 75 tons. 1n 1913, one fish wheel caught 70,000 pounds of salmon in one day. Fishwheels were outlawed in Oregon in 1926 and later the citizens of Washington were next to make gear changes. Initiative 77, passed in 1934, eliminated all fixed gear, fishwheels, traps, seines and set nets.

Horse and hand seining was another way used to catch salmon. Fishermen put seines, special types of nets, in the river. Horses were used to pull the seines closed, trapping salmon inside. The horses pulled the seines to shore where the salmon were taken from the nets. Ernest Woodfield was the Sand Island Foreman for the Columbia River Packers Association. On July 31, 1912, his Sand Island seine took 20,000 pounds in one haul. A record day was August 22, 1921, when 60,000 pounds were caught in one haul. You can see this method worked very well. Horse drawn seines were outlawed in the 1950's.

Hatcheries and Fish Culture

By the early 1870's, farsighted canners began experimenting with artificial propagation and establishing hatcheries. In response to a request from a group of Columbia River canners, Congress asked Livingston Stone of the U.S. Bureau of Fisheries to travel to the Columbia Basin in 1877 to locate a site for a hatchery station on that river system. In 1877 he established the region's first artificial propagation operation on the Clackamas River.

Early fish culture development on the Columbia was erratic. The U.S. government operated the Clackamas River hatchery until 1880 when it left the site, only to return in 1889 when it took over operations from the Oregon State Board of Fish Commissioners, which had run the site for two years. Between 1880 and 1887, the only hatchery in Oregon was run by canning operator R. D. Hume on the Rogue River.

Many of the early efforts to establish fish stations failed, owing to a lack of knowledge concerning the life cycle of the salmon. The State of Oregon, for example, opened several stations in the early 1900's only to close them a few years later because state officials had built in the wrong locations. After several initial failures, however, Oregon took the lead in developing artificial propagation in that state and funded the operations with state money.

Fish culture activity intensified between 1887 and 1894, and salmon populations increased by 1890. However, this success was difficult to duplicate and fish populations did not increase significantly until 1915. Fish canners, demanding to know why the runs continued to decrease, eventually blamed the early release of the salmon fry by hatcheries. In response, the Oregon Fish and Game Commission in 1915 developed "the improved hatchery system," which included the use of feeding ponds to hold the young fish until they were large enough to survive the rivers. This new system was more expensive to operate, but led to an increase in the fish runs between 1917 and 1918.

Degradation of Habitat

Over harvesting of anadromous fish populations in the late 19th and early 20th centuries was an immediate, highly visible reason for the decline in the resource. A less obvious cause involved the destruction of habitat in the Columbia River Basin. As early as 1894, the U.S. Fish Commission reported that placer mining near Caldwell, Idaho had significantly reduced salmon runs on the Upper Boise River. In 1933, the Oregon State Game Commission claimed that "there is no question but that the pollution of the tributaries of the Columbia is a menace to the salmon industry." For decades, farming, grazing, mining, and lumber operations had contaminated the Columbia and Snake Rivers. These activities sometimes resulted in the construction of barriers that blocked spawning grounds. They also eroded the soil, which settled on the gravel of streambeds, hindering the reproduction of anadromous fish.

Irrigation also contributed to the loss of habitat in the Columbia Basin. Owing to the diversion of the rivers, many tributary streams dried up during low-water periods. The building of unscreened diversion canals and small dams for agricultural production further hindered the migration of anadromous fish. Canals drew fish on to fields, where they lay stranded.

When construction began on large-scale multipurpose dams in the 1930's, salmon populations had already diminished. Decades of intensive harvesting and destruction of habitat had taken their toll. Many Americans of the early 20th century had inherited a perception that natural resources in the Pacific Northwest remained unlimited. - and even scientists had little understanding of the consequences of intensive use of the Columbia River and its fish. During the 1930's, the dams came to represent the hopes and high expectations that the arrival of the transcontinental railroad inspired a half a century earlier. In the midst of the depression, hydroelectric projects brought jobs to a region suffering from economic collapse and extensive unemployment. For farmers attempting to cultivate the arid lands east of the mountains, dams meant irrigation on a scale that remained beyond the funding capabilities of individuals or small companies. The construction of dams also brought improvements in navigation and flood control.

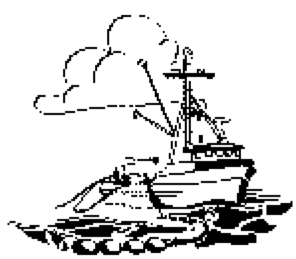
Most important, it was the promise of cheap electricity that would attract the aluminum industry to the shores of the Columbia. During the 1940s, the Boeing Company, initially dependent on spruce, looked to the new aluminum industry for raw materials for the construction of aircraft. By 1944, Boeing had employed nearly 50,000 workers in the Seattle area. Cheap electricity also encouraged the development of the Hanford Complex in central Washington. Historically, Pacific Northwest residents had remained dependent on logging, farming, mining, and fishing. Hydroelectric projects stimulated economic and population growth. Without the dams along the Columbia and Snake rivers, the region would be a very different place today.

What Has Caused the Declines?

Background:
Declines in Northwest salmon and steelhead populations have led to several listings under the federal Endangered Species Act (ESA). There are a lot of opinions as to whom or what might be the cause of salmon decline in the Northwest. Some of the things that people agree on as factors responsible for these declines: habitat, harvest, hatcheries and hydro. Once called the Four H's are now referred to as the contributors.

Habitat Destruction:

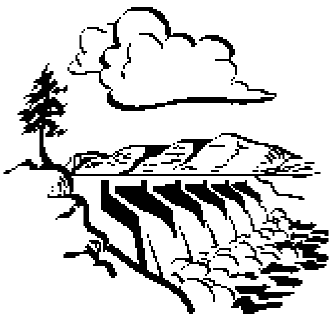

Agriculture, urban development, mining and forest practices can generate large amounts of sediment that cover spawning gravels necessary for juvenile salmon survival. The fresh water habitat used by salmon has been severely altered by the increasing human presence in the Northwest. Logging and related road building can increase erosion and cause streams to become filled with too much silt. Logging can also result in the removal of stream side trees which reduces stream cover and can increase summer water temperatures and decrease winter temperatures to critical levels. This can also reduce the amount of wood available to streams. Large woody debris (logs, trees and root wads) help create pools and accumulate gravel needed for spawning.



Fish Harvest
As adults, salmon are caught in both salt and fresh water. Over harvesting of adults salmon by sport and commercial fishers for food and sport, have been a major factor in the decline of some stocks such as the Columbia River Coho. Hatchery stocks typically can sustain a harvest rate of about 90 percent. However, in a mixed-stock fishery of wild and hatchery salmon like the Columbia River, wild stocks are harvested at a rate beyond their ability to sustain themselves over time. Recent changes in harvest management, however, are focusing on reducing the catch of weak populations of salmon by targeting commercial and sport fishing on more abundant runs, and reducing illegal harvest.

Hatcheries


Most salmon produced in the Northwest are reared in hatcheries. These hatcheries are operated by state and federal agencies and other cooperative partnerships to supplement natural stocks and provide salmon for sport and commercial harvest. A hatchery can increase the survival rate of eggs to juvenile salmon and, at least for a time; result in additional adult fish for harvest. However, hatcheries have contributed to problems faced by the wild salmon. Hatchery fish have had demographic, ecological and genetic impacts on wild salmon populations and may have caused problems related to the behavior and health of wild salmon. When hatchery fish stray into other watersheds they make contact with wild salmon and sometimes cause the following problems: **Competition** between hatchery and naturally produced fish for food or space at mainstem dam fish passage facilities, in mainstem reservoirs, in the estuary, and in the ocean. Although still unproven, **disease** may be transferred from hatchery fish to wild fish and visa-versa. Through years of adaptation, wild fish have developed greater resistance to local diseases and the ability to time their migration and spawning to take advantage of optimal river conditions. **Predation** caused by hatchery fish or non-salmonids on naturally produced fish. Straying of hatchery fish into natural spawning grounds and **Harvest** of naturally produced and hatchery fish in mixed-stock ocean and river fisheries.



Hydro Operations

Hydro projects and other dams have blocked access to about half of the historical salmon habitat in the Columbia River basin. The Northwest dams range in size and number from major dams on the Columbia and Snake rivers to countless small irrigation dams on tributaries. Used for hydro power, flood control, irrigation or domestic water supplies, dams can cutoff entire basins to fish migration. They can also change runoff patterns, water quality and loss of habitat where rivers become lakes favoring different kinds of fish. They can make salmon more susceptible to predators that gather at the base of the dams.

A number of solutions have been used or proposed, including fish ladders, barging salmon around dams, and drawing down water levels behind dams to increase river flows and bypass hydroelectric turbines.

Human Impacts on a Watershed

Water development projects on the Columbia River have altered the temperature conditions, which may at certain times or localities, create unfavorable situations to particular life stages of Chinook and Coho salmon. Migration and survival of adult fish have been linked to critical temperature limits. Exposure of ripe adults and eggs to water temperatures in excess of 56°F is commonly assumed to incur greater than normal losses and abnormalities of young salmonids.

The activities of fish are controlled by temperatures in the aquatic environment. Extremes in temperature, whether hot or cold, produce adverse effects in fish. The tolerance of fish to temperature extremes varies with the life stage; whether, egg, fry, fingerling, smolt or adult. In addition to direct effects of temperature on fish, indirect effects due to temperature also occur that can limit fish populations. Such effects include altered food abundance, increased predation, temperature-mediated disease, dissolved oxygen and increase toxicity of various compounds.

Thermal Pollution occurs when the temperature of a surface water body (e.g., river, stream, pond) is raised or lowered beyond its normal range in temperature. A drastic change in the water temperature can be due to either the addition of heated or cooled water to the surface water body, or a change in the amount of solar radiation reaching the water surface. The following are ways we cause thermal pollution

- *Electrical Power Plants* - many industries use water to cool the machinery in their plants. This water is taken from a river, stream or lake. It usually returns to the surface water body at a higher temperature than when it withdrawn.
- *Heated water holds less oxygen* - this leads, indirectly, to an increased oxygen demand in organisms living in the area of the outfall (where the water is returned to the stream). In other words, there is less oxygen in the water (lower Dissolved Oxygen), so organisms have to work harder to get enough oxygen to live (higher oxygen demand) and therefore, have less energy for things like reproduction and avoiding predation.
- *Altered solar radiation* reaching surface water bodies. Surface water bodies absorb heat from the sun rays that reach the water surface. The cutting down of trees along a river bank is one way to change the amount of solar radiation reaching water surfaces.
- *Construction Sites* - these big projects include things like dams or altering stream channels. Since a dam blocks a river or stream and only lets some of the water flow downstream, there is a backup of water behind a dam. This backed up water floods a lot of land behind the dam and creates a lake or reservoir. These large slow-moving bodies of water then act as solar collectors raising the surface water temperature higher then normal. For some fish species, aquatic insects and plants this could spell the end. On the flip side of warmer surface water temperatures these conditions may favor a different kind of fish species, insect or plant. Making salmon more susceptible to larger predators' populations, diseases and a larger abundance of oxygen absorbing plant life.

Slow Motion to the Ocean – An Activity

Columbia River fall Chinook salmon swim all the way from the Spring Creek National Fish Hatchery (NFH) in Washington where they're born down to the Pacific Ocean–a distance of nearly 167 of miles. In spring, young Chinook "smolt up." Their bodies turn silvery in color, and they become restless. Once they are released from Spring Creek NFH where they've lived since hatching and enter the Columbia River it's all downhill. From here to there, it's a float trip.

Doing the Backstroke

If you could look underwater and watch them pass by, you'd see something surprising: The salmon smolts migrate backwards! Instinct tells them to face into the river current and travel downstream tail-first.

Spring Creek NFH times its releases with natures timed migrations, which occurs in the spring, because that is when snow in the mountains begins to melt and swell the rivers. At four inches long, the young Chinook aren't big or strong enough to swim all the way to the ocean. For much of the time they ride the river currents. Chinook smolts used to get to the ocean in a hurry. In spring, the river currents flowed at about seven miles per hour and swept them downstream to the Pacific Ocean in about 10 days.

Today, large dams have turned the Columbia River into a series of lakes. The water flows at only one mile per hour. Now it takes the smolts weeks or more to reach the Pacific. Most of them die before they get there from stress, predation, disease, pollution and other causes.

The Need For Speed

Chinook salmon begin life in fresh water. When they enter the ocean, they're suddenly exposed to salt water. To survive in the new environment, their bodies must go through physiological changes. These changes start to happen when the young fish "smolt up." Nature scheduled the process to take place during the 10 day journey to the ocean. But now, with all the dams slowing down the river current, Chinook cannot reach salt water as quickly and this disrupts the changes. If the trip takes too long, the Chinook will be unable to live in the ocean and will die without ever returning to Spring Creek NFH to spawn.

<u>Words to know</u>

Chinook salmon - The largest of the salmon that live along the Pacific Ocean. An average adult measures thirty-six inches on and weighs about thirty pounds. They stay in the ocean three to four years.
smolt - A young salmon that has turned silvery in color and is migrating to the ocean.
northern pike minnow (squawfish) - A predatory fish species that lives in the Columbia River Basin.
dam turbine - A large propeller mounted in a dam that turns with the flow of water to generates electricity.

Study questions (answer on the back, or a separate page)

1. Young Chinook salmon swim from Spring Creek NFH to the Pacific Ocean. What is the distance they travel?
2. True of false: Chinook salmon smolts travel downstream tail first?
3. When a young Chinook becomes a smolt, it turns bright silvery in color. Does any other change occur?
4. Nature timed the smolt migration to happen in spring. Why?
5. Why is it important for Chinook salmon to reach the Pacific Ocean quickly?

Glossary

<u>adaptation</u>: Adjustment or modification of an organism to changes in the environment.

<u>adipose fin:</u> A small fatty fin found on the top back of salmon and trout between the dorsal fin and the tail (caudal fin). This fin is a key identification feature of salmon or trout.

<u>aerate:</u> Supplying the oxygen; with water it is a process of exposing water to the air usually by churning or breaking the surface of the water, such a waterfalls, riffles, etc..

<u>alevin</u>: Newly hatched fish with yolk sac attached. See sac fry.

<u>algae:</u> Simple plants that grow in water. They range from microscopic size to plants hundreds of feet long.

<u>anadromous:</u> Migratory. A fish that spawns in fresh water and the young migrate to the ocean to grow and again return to fresh water as adults to spawn. (From the Greek words for "up river")

<u>anal fin:</u> Fin located on the bottom and near the back of the fish.

<u>anglers:</u> People who fish. Usually refers to recreational (sport) fishers using a rod and reel.

<u>anthropologist:</u> A person who studies human beings and human cultures.

<u>aquatic:</u> Water-related. Anything that lives in the water.

<u>bar:</u> The area at the mouth of a river where sediments are deposited.

<u>barrier:</u> Barricade; separator; blockage of a route.

<u>benthic:</u> Bottom-dwelling.

<u>brood fish/brood stock:</u> Fish held in the hatchery to produce eggs like one would raise chickens for eggs.

<u>buck:</u> A male fish.

<u>carbon dioxide:</u> A gas (like oxygen is a gas) which is exhaled from animals and absorbed by plants.

<u>carcass:</u> Body of a dead animal; corpse; carrion.

<u>carrying capacity:</u> The number of fish or wildlife that can be supported by a given area of land or water.

<u>cascades:</u> A steep series of small waterfalls. It is the name given to the mountain range that runs through the center of Oregon.

<u>catastrophe:</u> A sudden and tragic event; disaster.

<u>caudal fin:</u> Another name for the tail of a fish.

<u>char:</u> A genus of small-scaled trout (Salvelinus).

<u>commercial fishing:</u> Fishing to sell the catch of fish for the market.

<u>counter-shaded:</u> Offset coloration allowing an animal to be hidden in its environment. Fish usually have darker tops and lighter bottoms, making it difficult to see from above or below.

cycle: A series of events that happen regularly and repeatedly.

debris: Left over material from something breaking down or being broken.

decay: To decompose or rot.

decompose: To break down into smaller parts / elements. Living things that die are decomposed (broken-down) by microscopic organisms.

domestication: To adapt an animal to life in association with humans.

dorsal fin: Dorsal means top. This is the large fin on the top of the back of a fish's back.

ecological: How plants, animals and other living creatures interrelate to their environment.

ecology: The relationship or study of the relationship of a fish or animal to its environment.

eddy: A current of water (also could be air) which runs against the main current.

electromagnetic signals: Small electrical charges based on magnetic properties.

Endangered Species Act: A law that requires special protection for plant and animal populations that are in danger of becoming extinct.

estuary: The area where the tides of the ocean meet a river current.

environment: The total of all the things around you, both physical and biological.

erosion: The natural process of moving soil and rock material from any part of the earth's surface.

evaporate: Change from a liquid or solid to gas.

exploitation: Take for personal use without providing a benefit in return.

extinction: Gone forever.

eyed egg: A fish egg that has developed to the point where the dark eyes of the embryo can be seen through the shell.

fertile: An egg that has the potential to develop and hatch or an animal or fish that can produce young.

fertilize: Mix sperm and eggs. One sperm unites (fertilizes) one egg to create a complete set of genetic instructions (genes).

fingerling: A small fish, up to one year of age. A small fish about the size of your little finger. A stage or size measurement in the growth of a fish.

fishing regulations: Laws that are made to protect fish, and govern how many fish can be caught and under what conditions.

foliage: Plants

food chain: A chain or series of plants and animals where some feed on certain ones and are in turn eaten by others.

forb: An herbaceous plant other than grass growing in a field or meadow.

freshets: A stream created by overflow or runoff.

fry: Recently hatched fish, after yolk sac has been absorbed, and prior to the fingerling stage.

fungus: A type of lower plant (such as mold) that helps decompose organic matter.

gene: The unit of genetic information passed along from generation to generation through mating.

gills: The feathery organs of fish and other aquatic creatures that extract oxygen from the water.

gillnet: Nets that capture fish as they try to swim through the holes in the net. Used mostly by commercial fishers

gradient: Gradual change in coloration, slope, or pressure.

grading: The process of sorting fish by size.

ground water: What that is contained in the soil or ground and is pumped out of wells.

habitat: The place where a fish or animal lives. It must include the necessary food, water, and shelter.

habitation: Occupancy; residence; moving in.

hatchery: Location for raising fish.

heath tray: Tray used in hatcheries to raise eggs to the fry stage.

hen: Female fish.

homing: Ability to return or relocate "home", or a desired location.

hydroelectric facility: A dam; a place where electricity is made by falling water.

ice age: A period in geologic time, over 10,000 years ago, when nearly 1/4 of the earth was covered with ice.

immortal: Unable to die.

imprinting: Behavior in which the first response to a particular stimulus, early in life, becomes a fixed response to the same stimulus thereafter.

incubator: A human-made environment where eggs are placed to hatch.

incubation: The entire process of hatching an egg.

inorganic: Made from material that is not from an animal or plant.

interspace: The area on a fish between the parr marks.

invertebrate: Does not have a back-bone.

juvenile: A young fish or animal that is not mature.

larvae: An immature stage of development in many kinds of organisms.

lateral habitat: The calm water areas along the edges of a stream.

lateral line: A sensitive line along the side of a fish which senses changes in pressure.

leaf litter: Old fallen decaying leaves.

lethal: Deadly; able to kill.

liberation truck: The specially equipped tanker truck that hauls fish to the place they will be stocked.

life cycle: The stages of development from egg to adult.

limiting factor: Factors that reduce the populations of living organisms.

marked fish: A fish that has had a fin clipped off, a dye sprayed on, a tag attached, or a wire implanted so it can be identified at a later date.

mash: Food pellets fed to young fish at the hatchery.

maxillary: The upper jaw bone of vertebrates, including fish.

midge: The larval form of any two-winged fly.

migration: Traveling between seasonal habitats.

milt: A milky liquid from the male fish that contains sperm.

Miocene: The geologic time period between twelve and twenty-five million years ago.

mortality: Death.

navigate: To find one's way on a journey between one place and another.

niche: The role that a fish or animal plays in the plant and animal community. The type of habitat it uses.

nutrients: Natural particles which are used by living organisms.

organic: Of plant or animal origin.

oxygen: A gas essential for life.

parasite: A plant or animal living in or off of another plant or animal, in a harmful way.

parr marks: Vertical lines on young fish which make them harder to see.

pectoral fin: Front steering fins on either side of a fish; corresponds to front leg.

pelvic fin: Lower fin on either side of a fish; corresponds to hind legs.

percolation: To trickle/flow through something.

pesticide: A substance that is poisonous to certain animals considered by humans to be pests.

physiological: Having to do with what goes on inside of a body.

plankton: A tiny animal or plant which floats in water.

pool: A still/clean place of water.

porous: Full of holes and allows liquid to pass through.

predator: An animal that eats another animal.

prey: An animal which is food to another animal.

pristine: Original, pure, uncorrupted.

<u>raceway:</u> A rectangular hatchery pond where water enters at one end and leaves at the other.

<u>rapid:</u> Fast moving churning water.

<u>ray:</u> The main supporting structures for fins of a fish, usually easy to see and count.

<u>rearing:</u> To raise young.

<u>redd:</u> The nest made by salmonids for their eggs.

<u>reservoir:</u> Storage place for water.

<u>respiration:</u> The process of getting oxygen into the blood, either from the air or water. Another word for breathing.

<u>riffle:</u> Fast, shallow waters of a stream.

<u>riparian zone:</u> The vegetated area next to a stream/river.

<u>run:</u> A population of fish that returns from the ocean at about the same time headed for the same place.

<u>run-off:</u> Excess water beyond the normal flow of a stream.

<u>salmonid:</u> Any fish of the salmon or trout group.

<u>sediment:</u> Fine particles of rock and sand that collects along a river bottom.

<u>seine:</u> A net weight at the bottom that hangs vertically in the water and catches fish when its ends are drawn together.

<u>shelter:</u> Cover. A place to hide, raise the young, or get protection from weather or predators.

<u>silt:</u> Tiny, fine particles, such as soil or sand, suspended in and deposited by water.

<u>slime layer:</u> The layer of mucous covering fish that protects it from fungi, parasites, and disease.

<u>smolt:</u> A young salmon or trout that has turned a silvery color and is ready to migrate to the ocean.

<u>solar radiation:</u> Sun's energy with which plants use to grow and produce food.

<u>spawn:</u> The act of egg laying by the female and fertilization by the male.

<u>species:</u> A specific type of animal or plant that can breed and produce offspring only with its own kind.

<u>sperm or milt:</u> Milky substance produced by the male fish to fertilize eggs.

<u>sport fishing:</u> Fishing done for sport or for personal use.

<u>stocking:</u> The process of releasing fish into a lake or stream.

<u>storm drain:</u> Drains from streets and parking lots that channel rain water directly into streams.

<u>stream velocity:</u> The speed and volume with which a stream flows.

<u>streamline:</u> A torpedo like shape that moves easily through the water.

<u>substrate:</u> Bottom material.

<u>terrestrial:</u> Belonging to the earth.

<u>transpiration:</u> An animal or plant giving off a watery vapor.

<u>tributary:</u> A side stream which joins a larger river.

<u>turbulence:</u> Uneven rough flow.

<u>vegetation:</u> Variety of plants growing in an area.

<u>vent:</u> The tube with which the female deposits her eggs.

<u>watershed:</u> The land area where water collects and flows.

<u>weir:</u> A fence or enclosure set in a waterway for capturing fish. Also, a dam or obstruction in a stream to raise the water level or divert its flow.

<u>wildlife:</u> All living animals, including birds, fish, insects, mammals, etc.

<u>yolk sac:</u> Sack attached to a newly-hatched fish containing a balanced diet for its early growth.

<u>zooplankton:</u> Microscopic and other very small animals in water, many of which are larval form

Native Culture Curriculum and Resources

- ❑ Current and Historical Information and Resources
- ❑ Gifts From Our Ancestors Resources and Links (Confluence Project)

Native Culture: Current and Historical Information & Resources

- **Since Time Immemorial Curriculum:** http://www.indian-ed.org/
  Aligned with National and WA state standards; endorsed by the 29 Federally Recognized Tribes of Washington

- **Confluence Project:** http://www.confluenceproject.org/ Non-profit collaboration with Northwest communities, tribes, and local artist focused on education through art and civic engagement along the Columbia River. Includes several art installations (field trip sites), educational programs, and online resources.

- **Confluence in the Classroom Education Program**: A program of The Confluence Project that "connect(s) K-12 classrooms with Native artists and tradition keepers to create meaningful projects about the Columbia River system." Includes using art as catalyst, at least one field trip to a culturally significant sight, and a community project.

- **Gifts From Our Ancestors Resources and Links (see next page):** **http://www.confluenceproject.org/pdf/398/3-Gifts_from_Our_Ancestors_Resources_and_Links.pdf** Resource list to supplement indigenous education in the classroom. Includes topics such as Celilo Falls, tribal perspectives on Lewis & Clark, and regional museums open for field trips

- **Columbia River Inter-Tribal Fisheries Commission: Educational Resources: Presentations & Activities:** http://www.critfc.org/for-kids-home/school-resources/

- **Discovering Lewis & Clark:** http://www.lewis-clark.org/article/2729 Native Life in the Columbia article. Talks about the seasonal rounds on the Columbia River Indians

- **Video: Echo of Water Against Rocks**: https://www.youtube.com/watch?v=oWdxY_5DHq0&list=PLFA1F2D828E5EDF98&index=2&feature=plpp_video Story of Celilo Falls, a cultural hub and fishing site for regional indigenous groups. Interviews and photos of the falls before and after the Dalles Dam. Created by University of Oregon students.

Gifts from Our Ancestors Resources and Links

Confluence Project's Journey Book http://journeybook.confluenceproject.org

Lewis & Clark Tribal Legacies Project http://lc-triballegacy.org/main.php- Digital archive presenting tribal perspective on our shared history

Since Time Immemorial www.indian-ed.org
www.indian-ed.org/curriculum/elementary-school-curriculum/wa-celilo-falls-dalles-dam/

Gifts from Our Ancestors vimeo videos
Day of Discovery https://vimeo.com/61914829
Hood River Valley High School FILM https://vimeo.com/69176309
Artist/ Tradition Keeper videos
- Jefferson - https://vimeo.com/61322401
- Brigette - https://vimeo.com/61308663
- Pat - https://vimeo.com/61318989

Day of Sharing
- Welcome: https://vimeo.com/54993917
- Gathering time: https://vimeo.com/55000779
- Breakout sessions: https://vimeo.com/55041495
- Closing: https://vimeo.com/54960707
- Story Circle exercise: https://vimeo.com/55034877
- Honoring song: https://vimeo.com/54971739

Celilo Falls video: http://www.opb.org/programs/ofg/segments/view/1688

See Through the Water http://www.youtube.com/watch?v=nXFYu7l_rNk

Celilo Falls, Oregon -1956 http://www.youtube.com/watch?v=u7XBFHry4VQ&feature=related

Echo of Water Against Rocks
http://www.youtube.com/watch?v=oWdxY_5DHq0&list=PLFA1F2D828E5EDF98&index=2&feature=plpp_video

Celilo Finished--slide show with narration
http://www.youtube.com/watch?v=NuwXcig95BQ&feature=related

Lillian Pitt on Oregon Art Beat: http://www.opb.org/programs/artbeat/segments/view/220
http://www.lillianpitt.com/culture/traditional_arts.html

Pat Courtney Gold http://www.youtube.com/watch?v=-EpXU6PfMzY

Museum of the American Indian http://www.americanindian.si.edu/environment/Default.aspx

The Oregon Encyclopedia http://www.oregonencyclopedia.org/entry/view/celilo_falls/

Washington State Historical Society http://stories.washingtonhistory.org/LC-columbia/culture/celilo-falls.htm

Museum at Warm Springs http://www.museumatwarmsprings.org/museum/About_Us/about_us

Crow's Shadow Institute Pendleton A hotbed for talented printmakers
http://www.crowsshadow.org/pages/about

Yakama Nation Museum and Cultural Center Links to history of Yakama Nation
http://www.yakamamuseum.com/hyakamahistory.php

She Who Watches tours at Columbia Hills State Park (Horse Thief Lake) Restrictions: 25 people per tour, tours are between April and October, Fridays and Saturdays. Call Washington State Parks in February to reserve a trip for next spring: 509-767-1159.

Lower Columbia River Estuary Partnership http://www.lcrep.org/classroom-and-field-programs-grades-2-12 This is a non-profit group that leads canoe trips so that students may learn about the natural history of the river from the river. The farthest east they go is of Bonneville, however. It's free to teachers and students, and a very popular program. They book out months in advance.

Oregon Historical Society http://www.ohs.org/exhibits/traveling-exhibits/oregon-is-indian-country.cfm Oregon Historical Society program (developed with the tribes) from a few years ago. Go to downloads in lower right corner for brochure and student magazine. http://www.ohs.org/the-oregon-history-project/teachers/lesson-plans/elementary-school/native-american-culture-in-oregon.cfm

Gorge Discovery Center: The Life and Times of Columbia River Salmon /Early Inhabitants of the Columbia Gorge http://www.gorgediscovery.org/educationTourGroups.html

Maryhill Museum: Native People of North America /Meet the Columbia River People Best for Grades 4–12. http://www.maryhillmuseum.org/education.html#schools

Tamastslikt Cultural Institute Pendleton http://www.tcimuseum.com/teachers.cfm

Oregon Historical Quarterly: www.ecotrust.org/nativeprograms/OHQ_Celilo.pdf

The Cathlapotle Plankhouse http://ridgefieldfriends.org/plankhouse/ Chinookan Plankhouse located on the Ridgefield National Wildlife Refuge

Legends by reading level. Vetted by tribes. Project done in 1972 http://apps.educationnorthwest.org/indianreading/index.html

The Dalles Dam and Celilo, http://www.ccrh.org/images/resources/dalles_dam_final.pdf A segment that is focused on resources related to Celilo,http://ccrh.org/resources.php?cat=Celilo%20Falls

A six-page history of Celilo that includes images and documents, written by Katy Barber, http://www.ccrh.org/comm/river/celilo.php

Columbia River Inter-tribal Fish Commission http://www.critfc.org/text/celilo.html

Images of Celilo:
http://www.google.com/search?q=Celilo+falls&hl=en&sa=G&prmd=imvns&tbm=isch&tbo=u&source=univ&ei=2uiVTufQM8jniAK RrumpDQ&ved=0CEcQsAQ&biw=1061&bih=527

Celilo Images: http://www.flickr.com/photos/osucommons/sets/72157613334873669/

Essay by Elizabeth Woody http://www.salmonnation.com/essays/recalling_celilo.html

Marie Watt - Blanket Stories Marie Watt is in New York now, but this video shows her contemporary take on traditional arts. http://watch.opb.org/video/1700784930/
http://mkwatt.com/index.php/content/work_detail/category/blanket_stories_objects/

Journey Book from the Confluence Project http://journeybook.confluenceproject.org/

The First Oregonians, by Laura Berg http://www.native-languages.org/oregon.htm

Nez Perce Trail http://www.fs.usda.gov (National Historic Trail/ Parents/Teachers)

Local Resources

- ❑ Classroom Speakers
- ❑ Field Trip Options
- ❑ Organizations and Contacts in the Area

Topic	Organization	Contact Name	Contact Email
Condit Dam History			
	PacifiCorp	Todd Olson	todd.olson@pacificorp.com
Indigenous and Tribal Education			
	Confluence	Erika Rench	Erika@ConfluenceProject.org
	Yakama Nation Fisheries	Jeanette Burkhardt	jeanette@ykfp.org
	Columbia River Inter-Tribal Fish Commission	Jeremy FiveCrows	croj@critfc.org
Watershed Education			
	U.S. Fish and Wildlife Service	Cheri Anderson	cheri_anderson@fws.gov
	Mid-Columbia Fisheries Enhancement Group	Margaret Neuman	fish@midcolumbiafisheries.org
	CultureSeed, Rivers for All	Heather Kowalewski	heatherkow@gmail.com
	Mt. Adams Institute, Cascade Mountain School	Emily Martin	emily@cascademountainschool.org
	Underwood Conservation District	Tova Tillinghast	tova@ucdwa.org
	Columbia Gorge Ecology Institute	Drew Eastman	drew@gorgeecology.org
	Caitlin Cray, Columbia High School	Caitlin Cray	caitlin.cray@whitesalmonschools.org
Archeology/History			
	US Forest Service (retired)	Cheryl Mack	cmack@gorge.net

Field Trip Name	Contact Name	Contact Email
Native and Cultural History of the NW Park and Husum Area	Jeanette Burkhardt, Yakama Nation Fisheries	jeanette@ykfp.org
Native and Cultural History in the Columbia River Gorge	Confluence, Erika Rench	Erika@ConfluenceProject.org
MacroInvertebrate Sampling	Margaret Neuman, Mid-Columbia Fisheries Enhancement Project	fish@midcolumbiafisheries.org
Water Quality Sampling	Cheri Anderson, U.S. Fish and Wildlife Service	cheri_anderson@fws.gov
Geologic Time in the White Salmon Watershed and Columbia River Gorge	Caitlin Cray, Columbia High School	caitlin.cray@whitesalmonschools.org
Columbia Gorge Water Budget	Caitlin Cray, Columbia High School	caitlin.cray@whitesalmonschools.org
Dam History (see flowline, powerhouse, old lake site, canyon)	Margaret Neuman, Mid-Columbia Fisheries Enhancement Project	fish@midcolumbiafisheries.org
Revegetation, Land Management & Succession: includes scavenger hunt and plant counting	Margaret Neuman, Mid-Columbia Fisheries Enhancement Project and Jeanette Burkhardt, Yakama Nation Fisheries	fish@midcolumbiafisheries.org; jeanette@ykfp.org
Water Table	Tova Tillinghast, Underwood Conservation District	tova@ucdwa.org
Smolt Trap: White Salmon Juvenile Monitoring Project	Jill Hardiman; Ian Jezorek	jhardiman@usgs.gov; ijezorek@usgs.gov
Ecology Field Trips	Drew Eastman, Columbia Gorge Ecology Institute	drew@gorgeecology.org

Additional Condit Dam Resources Not Included Above

- ❑ Condit Dam Video List
- ❑ USGS Presentation "Salmon and Steelhead in the White Salmon River after the Removal of Condit Dam--Planning and Recolonization Efforts"
- ❑ Interview Transcript with Bessie Quaempts, Native American, and Carl Twidwell, Power Plant Operator at Condit Hydroelectric Project
- ❑ Three historical Photographs: White Salmon Boy with Eels, June Hog, Bob Rucker with 2 spawned out Chinook Salmon

Condit Dam Videos

SOURCE: PacifiCorp Website, http://pacificorp.com/condit#

Legacy Film - Condit: There was a dam here

Condit Legacy Film - There was a dam here – Watch all three webisodes in one film. Link for this film is to YouTube.

Condit Dam Final Blast

Watch the final moments leading up to the 12:11 p.m. blast of the Condit Dam tunnel. Video could take a minute to download.
Another view of the reservoir draining using timelapse.
Video of breach includes sound. Video by Andy Maser Films. Andy Maser and Steve Stampfli.

White Salmon Restored: A Timelapse Project

White Salmon Restored: A Timelapse Project - Website by Andy Maser and Steve Stampfli uses timelapse photography to document the deconstruction of Condit Dam and the river restoration to follow.

University of Montana Timelapse of Reservoir

University of Montana Geomorphology Lab - Posted on YouTube
Video 1 - Timelapse photography of draining of Northwestern Lake and reservoir erosion
Video 2 - Timelapse photography of draining of Northwestern Lake and reservoir erosion

The White Salmon River Runs Free: Breaching the Condit Dam

Oregon Field Guide Episode 12 (2013), 20 min
PBS Oregon Public Broadcasting website, http://www.pbs.org/video/2336971141/

In 2012, the 100 foot-tall Condit Dam was removed from the White Salmon River in southeast Washington, making it the largest dam in the world ever removed. The goal was simple: Restore habitat for threatened salmon. This first-ever project tested the ingenuity of those tasked with the massive project. But it may also represent a turning point. In a region built on hydropower, is removing dams for threatened salmon the new norm?

Salmon and Steelhead in the White Salmon River After the Removal of Condit Dam – Planning Efforts and Recolonization Results.

Brady Allen[1], Rod Engle[2], Joe Zendt[3], Frank Shrier[4], Jeremy Wilson[5], and Patrick J. Connolly[1]

[1]U.S. Geological Survey- Columbia River Research Laboratory

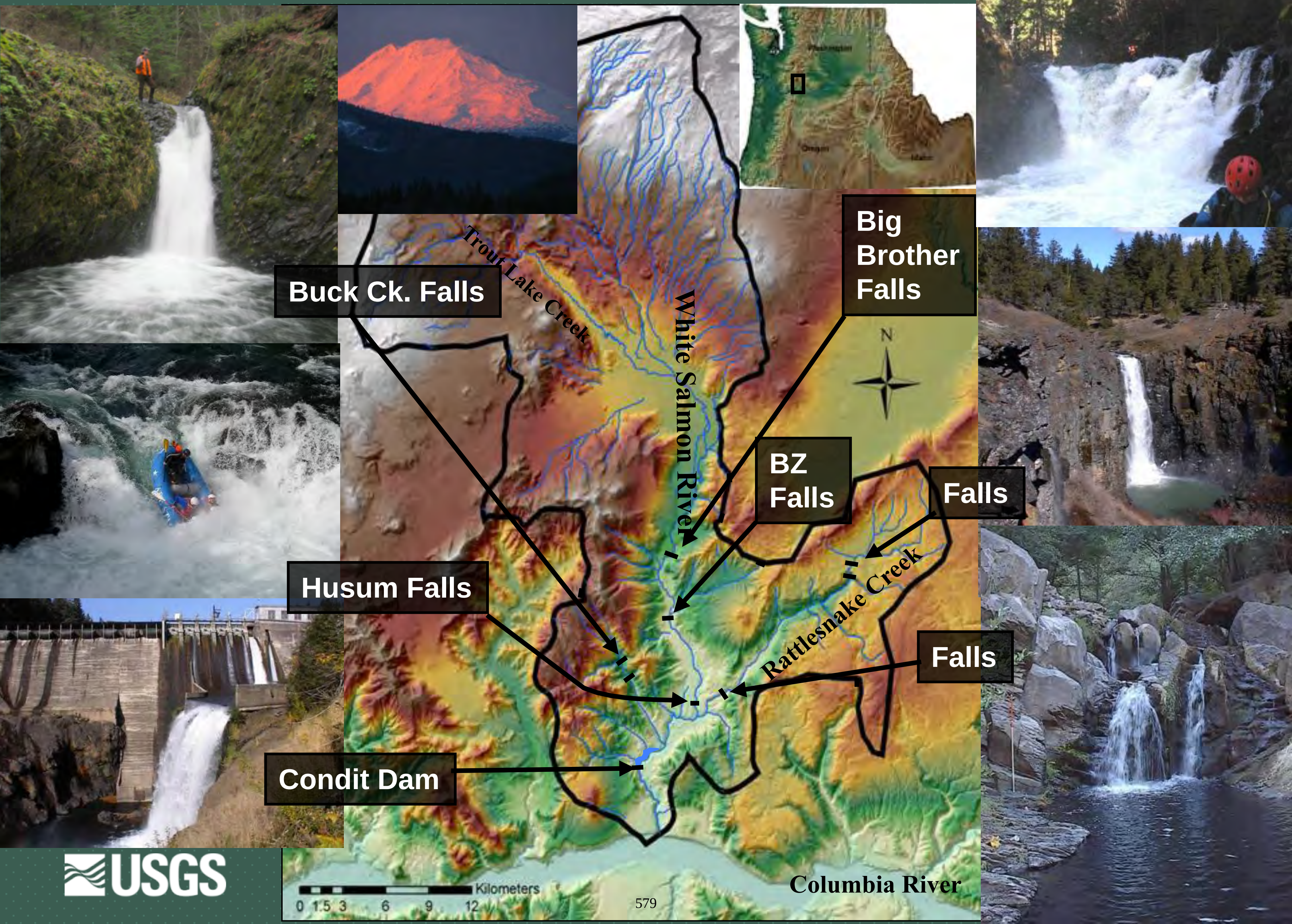
[2]U.S. Fish and Wildlife Service

[3]Yakama Nation Fisheries Program

[4]PacifiCorp

[5]Washington Department of Fish and Wildlife

U.S. Department of the Interior
U.S. Geological Survey


Buck Ck. Falls
Trout Lake Creek
White Salmon River
Big Brother Falls
N
BZ Falls
Falls
Rattlesnake Creek
Husum Falls
Falls
Condit Dam
Columbia River
Kilometers
0 1.5 3 6 9 12

USGS

Condit Dam Facts

- Constructed: 1913; Height: 37.5 m; Width: 143.6 m
  0.37 km2 (92 acre) reservoir
- White Salmon River watershed area: 1,014 km2
- River Discharge: mean 1000 cfs,
  min 400 cfs (30 cfs below dam), max 44,000 (Feb 1996)
- 2.4 million cubic yards (1.8 million m^3) sediment
- Draining took 1.5 hrs at 11,000 cfs (~50 yr flood event)
- Once passable for fish it will open
  14 miles for chinook, 33 miles for steelhead


2010
2011
2011
2012
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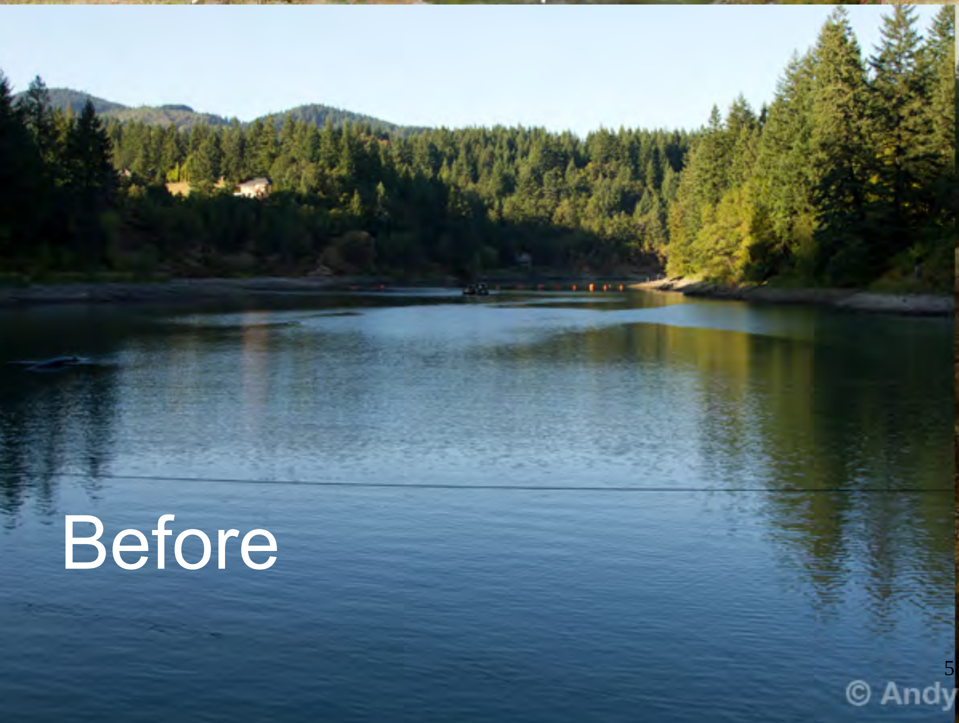

Before
© Andy Maser

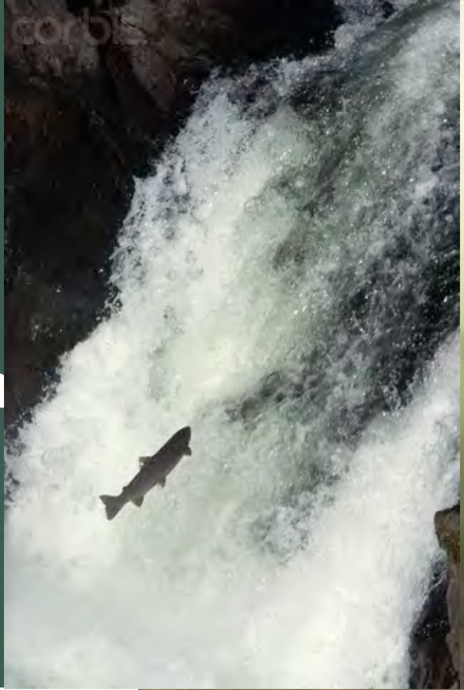

After

White Salmon Working Group

- An update of 1995 fish salvage and reintroduction plan was necessary
- Working group was formed and first met in February 2007
- Information sharing and identification of salvage effort of LCR fall Chinook salmon.
- Coordination of fish salvage and re-introduction planning prior to removal
- Pre and post removal monitoring and evaluation
- Opportunities to work with partners on fisheries and habitat restoration in the basin

Species considered:

- Fall Chinook Salmon
- Spring Chinook Salmon
- Summer and winter Steelhead
- Coho Salmon
- Chum Salmon
- Bull Trout
- Pacific Lamprey




Options considered:

1) No action, natural colonization, re-evaluate in 5-10 yrs

2) Salvage wild fish and outplant above Condit Dam, prior to removal

3) Salvage wild adults, spawn in hatchery, release juveniles in White Salmon River after removal

4) Use adjacent hatchery/wild stock, release juveniles/ adults in White Salmon River after removal

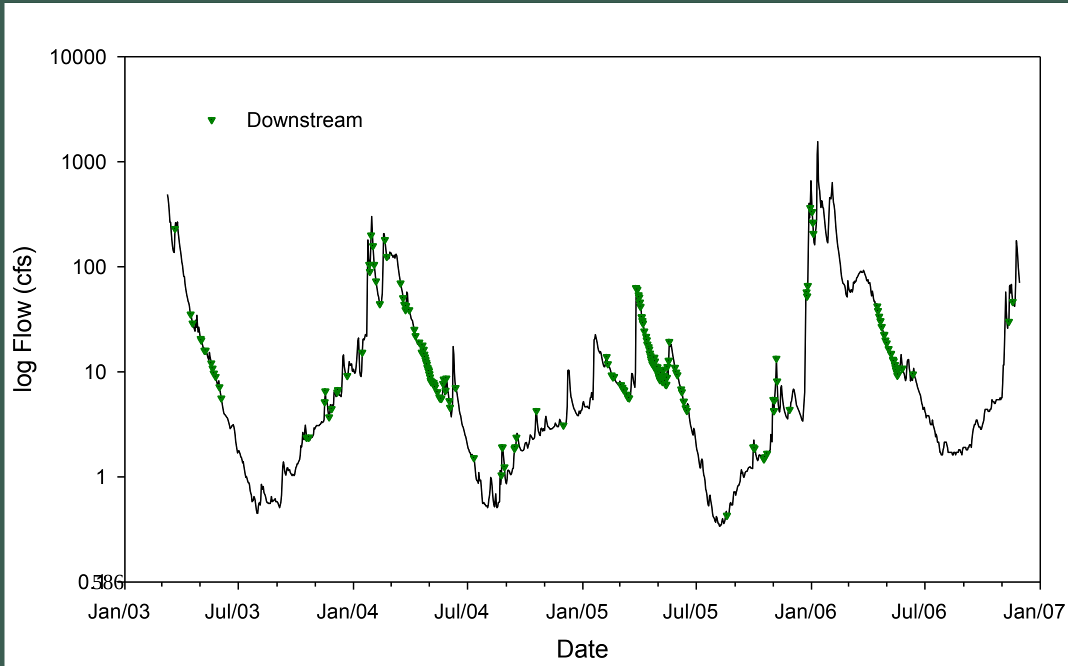
USGS

Assessing fish populations before removal:

1.) Rattlesnake Creek - Habitat, water quality/quantity, isotopes, and fish – species distribution, abundance, growth, genetics, disease, movement (USGS; funded by BPA)

2.) Buck Creek - Habitat, water quantity/quality, and fish – species distribution, abundance, growth, genetics, disease, movement (USGS, YN; funded by PCSRF)

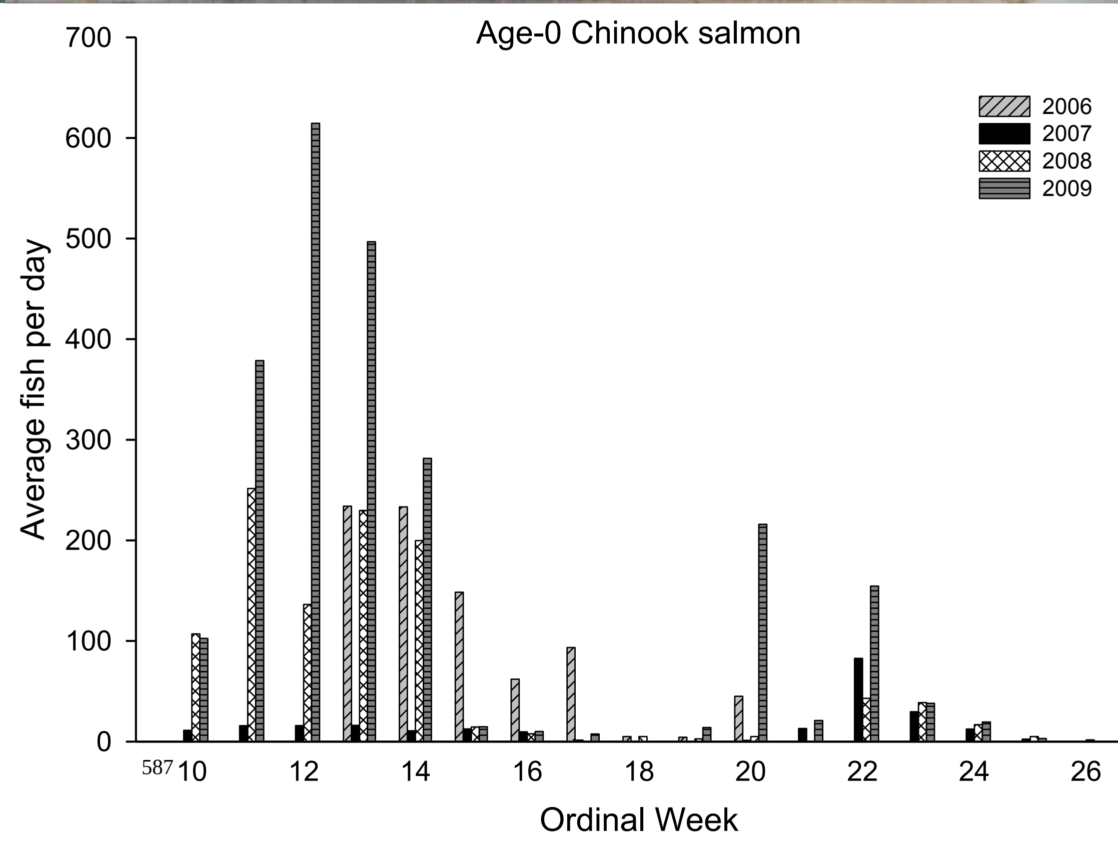
3.) Mainstem - Habitat use and life history characteristics of trout above Condit Dam (USGS; funded by USFS)



Assessing fish populations before removal:

4.) White Salmon River Ecosystem Diagnosis and Treatment (EDT) modeling (USGS, WDFW)

5.) Salmonid production and genetics below Condit Dam (USGS, USFWS)



Assessing fish populations before removal:

6.) Lamprey and mussel occurrence above and below Condit Dam (USFWS)

7.) Bull trout occurrence above Condit Dam (USFWS, WDFW)

8.) Fall Chinook spawner surveys below Condit Dam (WDFW)

9.) Ecohydraulic modeling of Chinook spawning habitat below Condit Dam - before and after (USGS)

Options recommended
by the White Salmon Workgroup

- **Tule Fall Chinook salmon – outplant wild adults in the fall prior to removal, natural colonization to follow, monitor, and re-evaluate in 5 years**

USGS

Options recommended
by the White Salmon Workgroup

Monitor natural escapement, re-evaluate options in 5 years

- Summer and Winter Steelhead
- Spring Chinook Salmon
- Chum Salmon
- Coho Salmon
- Bull Trout
- Pacific Lamprey

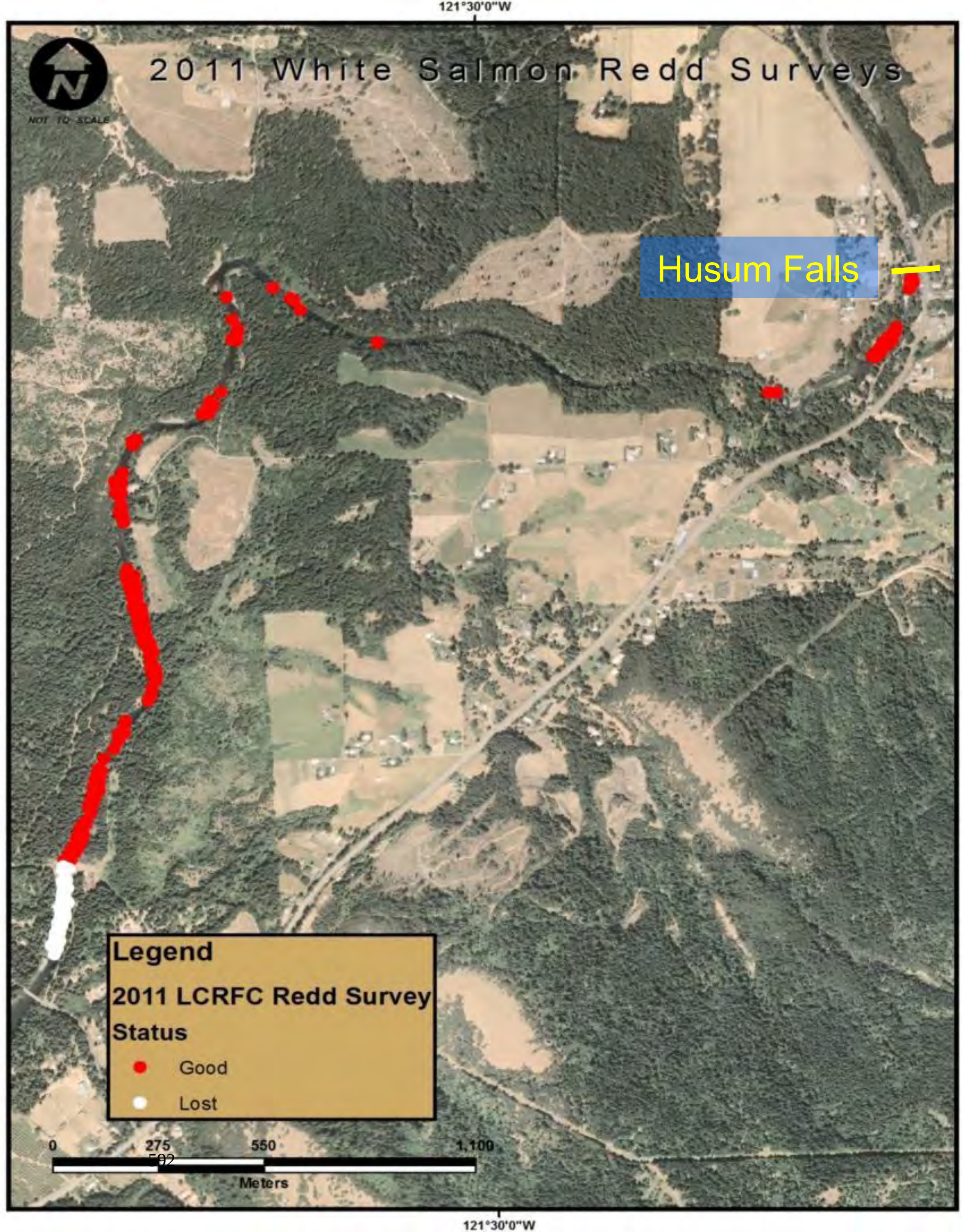
Management actions prior to removal

- **Released sediment will affect fish below dam and LCR Chinook are ESA listed as threatened**
- **PacifiCorp required by FERC to mitigate for loss of LCR fall Chinook salmon**
- **Discussions within the WSWG involved current knowledge and future efforts**
- **Juvenile trapping and genetics directly informed these decisions**
  - **USGS 2006-2009 studies in lower White Salmon River**
- **Two USFWS feasibility studies**
  - **2008 – Capture, transport and reintroduction feasibility study**
  - **2009 - Evaluation of a resistance board weir for fish capture**

USGS

2011 White Salmon Redd Surveys

- Estimated 180 redds from the 299 female fall Chinook transported upstream
- Similar distribution of redds as preliminary study (2008) but some redds washed out in the lower spawning area (white)
- Only documented redds between reservoir and Husum Falls (RM 7.8). No fall Chinook were found above Husum Falls




October 2011
USGS-Tom Batt
November 2011
USGS-Tom Batt
February 2012
USGS-Tom Batt
August 2015
And a river returns

Lower White Salmon River before and after dam breach.

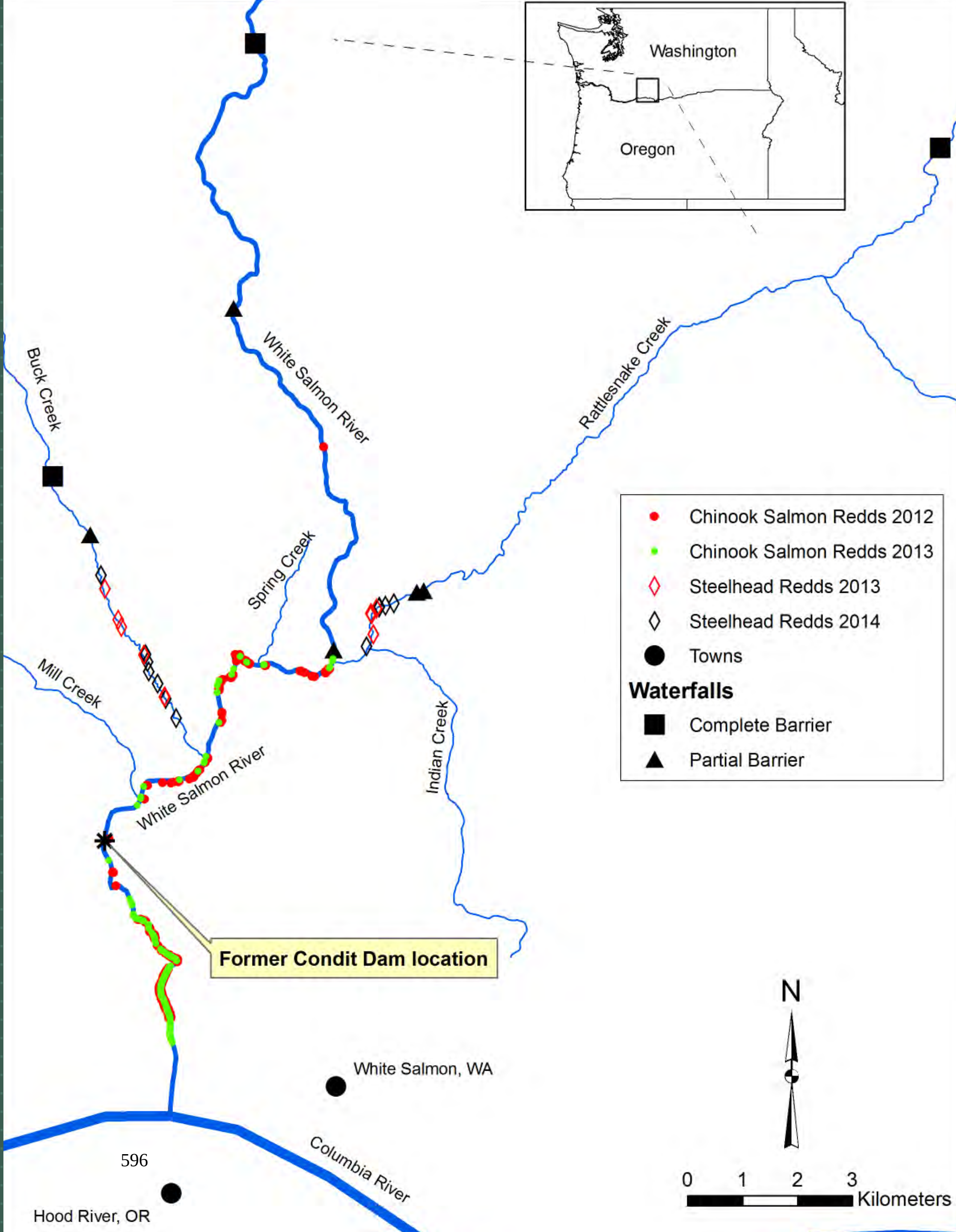
Spawning gravel availability and spawning area greatly increased.

Modeled historical abundance compared with recent escapement estimates and origin of fall Chinook Salmon and Steelhead in 2012 and 2013.. Steelhead redd counts were only conducted in tributaries upstream of the former dam site. NA=estimate not available

Species	Modeled pre-dam adult abundance	Escapement			% Hatchery origin			% Spawning upstream of the former dam site		
		2012	2013	2014	2012	2013	2014	2012	2013	2014
Tule fall Chinook Salmon	745	755	1,232	1,689	7	33	23	11	1	0.5
Upriver bright fall Chinook Salmon	0	1,061	4,251	6,758	29	64	66	15	2	0.6
Spring Chinook Salmon	871	NA	88	216	NA	23	90	NA	43	36
		Number of redds								
		2013	2014	2015	2013	2014	2015	2013	2014	2015
Steelhead	1,137	11	12	16	?	?	?	100	100	100

USGS

Steelhead and Chinook Salmon redds (tule and upriver bright fall Chinook Salmon stocks combined) in the White Salmon River from September 2012 through May 2014.



USGS

MRS. BESSIE QUAEMPTS, CARL TWIDWELL, MYRTLE, OVERBAUGH, ROBERT OVERBAUGH, and CARL TWIDWELL

Bessie Quaempts was 83 years old in 1974.

EDITED BY MYRTLE OVERBAUGH

DATE: MARCH, 1973
Interviewed by Ivan Donaldson

March 1973. We have an interview here today with Mrs. Bessie Quaempts, an original American, whose family lived here for thousands of years, and Mr. Carl TWidwell, who used to be a power plant operator at the Condit Plant. Correct! On the White Salmon River. These two people have knowledge of the runs of salmon into the White Salmon here, some 25 miles above (East) of Bonneville, Oregon. Also in attendance are Myrtle and Robert Overbaugh, and others.

Ivan: Mrs. Quaempts, did you used to see the salmon here on the river?

Bessie: Yes, I used to see cut-throat above Husum.

Ivan: How far above Husum did they go?

Bessie: Up to B-Z Corners.

Ivan: Did they get over the falls?

Bessie: Yes, they try to jump.

Ivan: You saw them jumping there?

Bessie: Yes.

Ivan: Were there a great many of them?

Bessie: Yes, there were a quite a few. My husband used to go and watch there.

Ivan: Would you estimate that there were several hundred each year?

Bessie: Yes, something like that, all the time they go up.

Ivan: What were they, steelhead.

Bessie: Yes, steelhead, chinooks and fall chinooks.

Ivan: How about spring chinooks?

Bessie: Yes, spring chinooks and cut-throat; the Underwoods the year around. All year around.

Ivan: Even in the winter time?

Bessie: Yes in the winter time. We had houses there at the Bonneville Dam -- two houses, one smoke house, one living house. We don't live there no more. My husband died there. He used to work at the hatchery. No highway at the time. Walking the railroad tracks. Man was running it they called him Larson.

Ivan: He was superintendent of the hatchery?

Bessie: Yes.

Ivan: Where was the old hatchery located?

Bessie: Where the new one is now.

Ivan: Where the new one is now, same place? About what year was that?

Bessie: Around 1900.

(The second feminine voice is Mrs. Myrtle Overbaugh, and the male voice is Mr. Robert

Overbaugh.)

Ivan: Did you have many steelhead coming up in the wintertime?

Bessie: Yes. My children used to catch steelhead sometimes, enough to eat. It was a stream, no big water there.

Ivan: Was this above the dam site, or below?

Bessie: By the dam, by the old bridge, you know down there.

Ivan: Just below the dam?

Bessie: Yes, all around the dam. My children used to fish all the time. We used to eat fish in the wintertime.

Ivan: Were they steelhead, or very early chinook?

Bessie: Silverside in the wintertime.

Ivan: Any dog salmon?

Bessie: No. we didn't get dog salmon 'till the fall time.

Ivan: Fall time? But you got some of those.

Bessie: Yes.

Ivan: They ran into the river?

Bessie: Yes.

Ivan: How far up river did they go?

Bessie: I don't now how far up they went, but I see them jump at the dam; up there by Husum. They used to jump in swift water.

Ivan: About 1910 (and later)?

Bessie: I don't know, but it was a long time ago.

Ivan: Were there any suckers or chubs or other fish run above the . . .

Bessie: Used to just stay down there. My children used to fish for white fish.

Ivan: Down below?

Bessie: Yes, down below.

Ivan: Did you come here when you were a young girl?

Bessie: Yes. I learned how to catch fish when I was 10 years old.

Ivan: I haven't learned yet.

Bessie: Yes. We used to live further this way and when I got married, well, I stayed where I am now, by the little place I got now. That's where I stayed. And further back, I used to be there and my grandmother and grandfather used to have house and I stayed there. But when I got married to Mr. Kuniki, I stayesd further back and I stayed and raised by children.

Ivan: And, did the fall chinooks go above Husum Falls?

Bessie: Yes.

Ivan: Did the fall chinooks go above Husum Falls?

Bessie: Because they're clumsey, they don't jump

Ivan: They did not go above the falls? And the water would be low at that time.

Bessie: But red salmon and steelhead and silverside, they go through.

Ivan: Silver's went through also, well, good.

Ivan: Mr. Twidwell, do you have any other comments to add, please come in and I'll come to you specifically soon. I would like to get Mrs. Kuniki's story also. I would like to know how many you would estimate of these, how many, were there several hundred steelhead went upstream?

Carl: I couldn't count. I couldn't count the fish when they jump.

Ivan: But you saw a lot of them?

Carl: I can't count, I couldn't see, night time. They go nighttime, you see. I don't at night time see how many jump over.

Ivan: I know Mr. and Mrs. Overbaugh have told me that they have seen the fish up there, also, but I am trying to learn about how many of them went up. If we could get some impression of this. How about the winter-time Chinook? Were there that many or just a few?

Bessie: Just a few. They just stay around. We never used to go up in the winter time, they stayed down there.

Ivan: Did the spring chinooks, did they do up as far as Trout Lake?

Bessie: I never did see a fish at Trout Lake.

Ivan: The spring chinook?

Bessie: Yes.

Ivan: And also the chinooks?

Bessie: Yes, steelhead.

Ivan: And the steelhead? Did the silversides do any jumping up at the falls?

Bessie: Yes, they used to jump.

Ivan: At the Husum Falls?

Bessie: Yes.

Ivan: Did you see lots of jumps up there?

Bessie: When we watched, quite a few jumps, yes. But I couldn't watch I couldn't count, we just see them we never think to count.

Ivan: You didn't know that I would come along and have a very important historical interview with you later? Did they appear to be real thick in the river?

Bessie: Yes, they were thick down there, then they go up, they scatter.

Ivan: Did you see them think below the falls, at the Husum?

Bessie: Yes, some of them can do it, some of them jump on up.

Ivan: Now we are talking about the spring chinooks?

Bessie: Yes and summer fish.

Ivan: Does this mean June, May and April?

Bessie: I can't remember myself, I can't write it down, that's the only thing I have trouble, I can't write what day, and what month, I can't remember.

Ivan: Did you know Frank Estabrook?

Bessie: Yes, I know.

Ivan: I had a number of interviews with him, but I was not able to buy one of these things, so I had to write it all on paper. Then his hearing got bad, and he couldn't hear me and he couldn't write.

Bessie: That's the trouble I have, I had stroke, all on one side of body, and I can't hear this side, I can hear a little bit this side.

Ivan: You seem to be able to hear me alright.

Bessie: Yes.

Ivan: As my people became hard of hearing, I had to learn how to talk with them.

Bessie: Yes, I had stroke one time.

Ivan: I'm sorry to hear that.

Bessie: When I have stroke, on one side of my body, painful to use it.

Ivan: Did you see many, quite a few, fall chinooks go up to the falls?

Bessie: Yes, they go far down here, stucked and go back.

Ivan: They come back down when they get stuck up there. Where would they spawn?

Bessie: Right here by the bridge, all the way down.

Ivan: You could see them spawning there. Would they spawn out where the dam is?

Bessie: All down this way.

Ivan: Did the spring chinook's spawn down this far, or did they go on up further.

Bessie: They go on up further.

Ivan: Did you ever go up far and see them spawning up there?

Bessie: No.

Ivan: Where did the silversides spawn?

Bessie: I didn't watch them, I didn't think I'd have to tell then.

Ivan: This is very very important, you see I've been trying to save the salmon all my life, 33 years of it, in time to save the Salmon.

Bessie: I was telling her, (Myrtle Overbaugh), I used to see the fish going up, she asked me, someone was telling her, no fish goes up. I see the fish go up. Long time ago. We used to drive up and watch the fish going up.

Ivan: When did the silversides come?

Bessie: Oh they come, some of them stays all winter.

Ivan: And did some of them come with the fall chinooks too?

Bessie: Yes.

Ivan: Did they come the entire fall into the wintertime?

Bessie: Yes.

Ivan: We have heard that there used to be many different runs of fish. Mr. Twidwell, could you add to that, the different runs of fish coming up?

Carl: The only runs that I am familiar with would be the steelhead and the fall chinooks. I never seen any spring chinooks in the White Salmon. This fellow Mr. Bailey that was going to be here, he was under the opinion that there never was a spring chinook in either the Big White Salmon or the Little White Salmon. He went to work for the hatchery in 1912.

Ivan: And the dam was constructed in 1913.

Carl: Yes, 1913, in March.

Ivan: Were you here at that time?

Carl: Yes.

Ivan: Well, that was an interesting time.

Carl: They had a pool,

Ivan: A wagering pool?

Carl: Yes, you could guess for 10¢ on the length of time that it was going to take the dam to fill. I believe the fellow who won the prize was a Russian Kike. Took 25 hours to fill, I think.

Ivan: 25 hours, do you remember his name.

Carl: No.

Ivan: Did you see any coho silvers come up.

Carl: I never seen them but I wasn't too familiar with the different varieties at that time.

Ivan: I certainly wasn't in 1913, I was born in 1912 you see.

Ivan: Did you see any runs of any other fish going past the dam site on up, say, on up to Husum.

Carl: No, not other than the steelhead, the only ones that I remember seeing at Husum.

Ivan: Could you estimate the number?

Robert: Oh, must have been large number of the things cause I remember standing there watching them and you wouldn't have to wait long to see one or two of them jump. I would think there would be some jump every two or three minutes. Of course, you couldn't tell if they made it over the falls or not, you might see the same one jump several times, but there must have been quite a number of them and the fall chinook, this fellow Bailey, he remembered how many eggs they took in the Big White Salmon, in the Fall of 1912, and I thin~ it takes 500 fish to get one million eggs and they took six million eggs, so that would be 3000 chinook salmon.

Ivan: Would you estimate, though, that the original run was destined to go above, say, up to the foot or below Husum Falls, beyond this region where we are right now?

Carl: I don't think they ever went, I know they didn't go any further than the racks at the hatchery, they fenced off the whole river and that blocks them from going any further and as far back as I can remember that was the case. Once in a while you would see one come up as far as the powerhouse. Now I'm talking about after 1912. I think Bessie was talking about was probably long before that.

Ivan: I would assume so, but it seems logical to me that if these fish came up and they were stopped by the racks they might have progressed on up some distance further.

Voice: Some of them sorted through once in a while. Once in a while there would be one of them get through, them occasionally they would find a hole in the racks and a whole bunch of them would come through.

Ivan: Up to the dam?

Carl: As far as the tailways, below the firehouse, and they would go clear on to the dam too. Most of them would stop at the tailways.

Ivan: Originally, there were no falls there where the powerhouse or tailways is located, the fish could go on through that region?

Carl: Oh yea, there were no falls there.

Voice: There was an area there they called the Big Eddy, and people, white people, used to fish there, considerable. I think the Indians used to camp there and fish but I'M not sure of that. I know there are lots of arrowheads to be found around on the hill side.

Ivan: Well, these people have been around here a long time.

Answer: Yes

Ivan: Do you have any knowledge, or any hearsay knowledge, or first-hand knowledge of seeing fish up near the area of Trout Lake? Mr. Silas has told me that he has seen them at least Steelhead up there that far. I have had another interview with him by pen so, so I have knowledge of this. Do you have knowledge of that?

Carl: No, I never saw any salmon, either steelhead or fall chinooks above Husum Falls. There probably was some, I heard that they were seen quite often as far as B-Z Corners, but I never did see them.

Ivan: Mrs. K. did you ever get up around Trout Lake and see any of the Steelhead up there?

Bessie: No.

Ivan: How about you Mrs. Overbaugh?

Myrtle: I never did.

Voice: Going to Trout Lake fishing or anything like that was like going to Europe now.

Ivan: That was a long, long. Are you speaking about the time before 1912?

Voice: Yea, before that.

Ivan: When did you come to this region Mr. Overbaugh?

Robert: I was born here, 1893.

Ivan: I was going to say, it must be before 1912.

Robert: The fall chinook run, before the hatchery put the racks in, I wouldn't be surpised but that they went as far as Trout Lake. Because the fall run of chinooks get up to the Glenwood hatchery, I saw some big ones in there last year.

Ivan: The Glenwood Hatchery is on the Klickitat is it not?

Robert: Yes

Ivan: Yes I know they go up there so I would suspect the fall chinook's penetrated. I don't really want to pin you down, but do you estimate, you mentioned a figure of 3000 a while ago, do you think there were other times before the white man came that there were as many as 3000 fall chinooks went above the present area where we are now?

Robert: Oh, I imagine that in the days before the fish wheels that you told about in your book that there were lots more than there was in . . .

Voice: Down here in the river, you couldn't, they were just thick, the river was full of them:

Ivan: Fall chinook.

Voice: The fall run, whatever they were

Robert: Of course, they had the racks in and they couldn't get any further, that is the reason they were so thick.

Ivan: This would indicate that this is indicative of something that was in abundance, certainly. Were these big fall chinooks that came up there?

Bessie: Yes, just down here.

Ivan: How big would you estimate?

Bessie: Wide

Ivan: Wide as two hands?

Bessie: Yes.

Ivan: How long?

Bessie: Usually in the fall they kill them right there, the big ones

Ivan: Were they about the same size as they spawn out now?

Bessie: Yes, I used to cut a lot of them a long time ago, now I can cut only one or two. They give me three or four, I cut them for my own use. I used to get about 50 a day, at a time, when my husband was working there, in the stream.

Ivan: In the stream as a hatchery man?

Bessie: No, my husband used to work there for the man spawning fish. He used to work year-around there, fall and the wintertime, and pick the eggs. The little fishes swimming there and let them go.

Ivan: And the hatchery people used to give you the fish after they got through with them.

Bessie: Yes, all the time, they took just eggs. Now today they send the fish from hatchery down to Cooks. They don't give us anything this year, nothing.

Ivan: I thought the little White Salmon fish went to you people.

Bessie: Not any more, for many years now they not open and cut'um down here, they cut, Underwood, they cut it at Cooks, and we can't get it, we can't drive down there. For a long time ago, my husband used to ____ I've got the pictures of it — fish and spawn and of tiny eggs.

Ivan: Could you give me an estimate of the number of silversides that came up?

Bessie: No, I couldn't say how many there is. It used to be I say them, but I can't say how many.

Ivan: Did the river look full? Was the river kind of black with fish?

Bessie: Yes. (Blank on tape for a minute)

Bessie: . . . I told him to make a copy and give me one and he never did.

Ivan: Was he a young man?

Bessie: Yea, he came to my house and he took.

Ivan: Was his name Dawson?

Bessie: Yea, I think so.

Ivan: Oh, well he will get you one. I've sent a letter to him today, but I'll write to him again and remind him.

Bessie: I want copy.

Ivan: He will, he will.

Ivan: I received a letter from him just yesterday and when I answer it I'll tell him that you would like to have a copy of the tape, Mrs. Overbaugh, would you like to have a copy too? We will have a copy of this made for you too, Mrs. Overbaugh.

Bessie: They ask me where I come from, I said from down Hood River and all the way down and all the way to Celilo, spear fish, no tails, my father was son of no tails and my grandfather side I had my people clear to Celilo. We used to fish Celilo, clear down to Cascade Locks. My grandpa was living there.

Ivan: Did your people used to dip net?

Bessie: They used to dip net down there.

Ivan: At Cascade Locks?

Bessie: Yea

Ivan: And at Celilo?

Bessie: Yes, same at Celilo, up from the, further up from The Dalles. My grandpa died right there.

Ivan: At Celilo

Bessie: No, by that side of dam, Dalles Dam.

Ivan: You mean he drowned?

Bessie: No, he broke something in his stomach, lifting rocks, fixing scaffold, he died.

Ivan: Oh, that's too bad.

Voice: Rigging a scaffold.

Bessie: Yea, a long long time ago when I was young yet. I told them, I told that man on the river, I come over and fish and go back while my grandma's alive. When my grandma died, well I stayed down here. Here, Underwood, year-around. Now my house float away out through the dam, now today they don't want to build me a house so I can live in at Underwood.

Ivan: Mr. Overbaugh, you had some observations on this river, I heard you talking about working the logs down the river, the log runs.

Robert: Yea, my father worked at that for several years. I worked at it some too. But, during their leisure hours they would fish.

Ivan: For what fish.

Robert: Steelhead, and trout.

Ivan: This was above the dam site?

Robert: Well, all along. Yea, above and below both. They traveled back and forth along the river there you know. Kept the logs going down.

Ivan: Where did the logs come from?

Robert: Camp Five, 14 miles North of the present place. It's up above B-Z Corners.

Ivan: Was this Pine or Fir?

Robert: It was Fir.

Ivan: You recognize that the fact that the logs were rafted down through here establishes this as a navigable stream?

Robert: Well the logs come all the way down from Trout Lake even, they had a big spach down up there, you remember that. They would dam up the water and then they would fill the river full of logs and open the dam and let them wash through. When the dam is now, there used to be a big jam over there for 1/2 mile long.

Ivan: They would get jammed up?

Robert: Would get jammed up and they would have to shoot them out with dynamite and they had winches along the side where they would hook on to them and pull them loose.

Ivan: What time was this, in the early spring?

Robert: That would be before the dam was in, now let's see. 1907, 1908, 1909.

Ivan: It was the 1900's then ?

Robert: Well, it was in the 1900's. I would say around 1909 and 1910 along in there I believe.

Ivan: Then you were 17, 18 years old.

Robert: Yes.

Ivan: When you fished for the steelhead here.

Robert: Yea, there were steelhead all along the river at that time.

Ivan: And what comments do you have about the fall chinooks. Did you see them going up the fall.

Robert: I seen the fish jump at the falls, but like he said when they put that fence down here below, some of the older ones, or some of them would get through, but when they got up there they would probably be held down here for quite along while. By the time they got up there they were getting old and tired and when they got up there they couldn't jump those falls. That's the reason those bigger heavier fish never jumped the falls or went up further. As far as I know except the steelhead and maybe the other runs of the salmon, but I'm talking about the fall run of the big old boys.

Ivan: This means that they used to put these racks in before the dam was built.

Robert: Yea, I don't know where that was started, do you Carl have any idea?

Carl: It was about the turn of the century.

Robert: As far as I can remember.

Carl: Maybe before that.

Ivan: When they started the racking operation down there on the White Salmon.

Robert: That was the Cooks, then, they got the salmon out of the Big White Salmon for the eggs as well as the Little White Salmon.

Ivan: In other words, the hatchery low down on the Little White Salmon River.

Robert: That was the original.

Ivan: That was the original site, took their eggs from both the Little White Salmon and the Big White Salmon River.

Robert: Yes.

Ivan: Is it true in the name of this stream that it might have come from albino salmon, the name White Salmon.

Robert: I don't think so, I think it was from the color of the meat, of the fall chinook, they are pretty bleached out when they get up this far. They are just about ready to spawn and they have just about had it.

Ivan: What knowledge do you have Mr. Overbaugh of the fish going above Husum falls? Steelhead, coho's or others.

Robert: The only thing that I know about those is what I have heard. Guy Jones tells me that he used to catch them all the way up as far as B-Z Corners. In those days I never went fishing up there, because that was miles and miles in those days, had nothing but a cow trail to get up there on.

Ivan: Is Mr. Jones living?

Robert: No.

Ivan: Mr. Jones told you that he used to catch steelhead and fall chinooks as far as B-Z Corners.

Robert: He said the fall chinooks went up as far as the falls.

Ivan: They went only as far as the falls? Then B-Z Corners is how much further?

Robert: Probably 3½ miles. The Jones boys were great fishermen. They knew the river better than anyone.

Ivan: Angling or dip netting?

Robert: Angling, fly fishing mostly. Mr. Jones said that down in the Husum area the salmon was so thick, he could get all he needed by hitting them with a club.

Ivan: Tell me something about the quantity of timber that used to be floated out of the stream, Mr. Overbaugh, would you estimate.

Robert: Millions of board feet. At one time I've seen, you have too Carl, seen that river jammed up for say 1/2 mile.

Carl: At one time there was a jam in the river, probably 500 feet above where the dam is now, they estimated there was 20 million feet in that jam.

Ivan: Did they get it out by blasting it out in high water?

Carl: Yea, they had, like Bob said, they had what they called a capstan then in the bank and they would pull the key logs out and there would be a few go through and they would get hung up again, they would haul out these key logs again and a lot of times they would have to shoot these key logs with powder, then a few would go through had hang up again. It would take a couple months to get those jams through every spring.

Ivan: Every spring, during high water time. They would have been jammed up from the year before or just during the spring run, they got jammed up and they would have to work them loose on that particular spring season.

Robert: They would usually break them loose every year.

Ivan: They didn't let them lie over for a summer and a winter.

Robert: No, I don't think they ever left them layover, they would clear them out every spring.

Ivan: Mrs. K., did you have high water every year?

Bessie: In the summer, yea, in the summer the water comes way up high.

Ivan: The flood season? How much higher would the river rise in the flood season than it would in the fall?

Bessie: It would always raise up to about where it is now. Where the low water is now there at Underwood. The high water would be about where it is now.

Ivan: Surely, you have a flow value of this stream. This is public record, I suppose, I don't thin, we have to go into that one.

Robert: Oh, the water would kinda back up in there, I suppose it was on account of the fill, the railroad probably held it from going out naturally.

Ivan: This would then be after 1907?

Robert: It would be after that.

Ivan: The railroad went in after 1907?

Robert: The railroad must have had something, don't you think Carl? Holding that high water back?

Carl: I don't think so, cause from the time the railroad was put in until probably 1914 there was a trestle.

Robert: Yea, until they filled it with dirt.

Carl: Then later they filled that trestle in and that was a dirt fill or a rock fill.

Robert: Way down there on the Little White Salmon that used to be a trestle all the way across.

Carl: That is darn near two miles.

Bessie: Hard to call it. What they used to call Underwood and what they call Cooks, River, its hard to call it, Indian word.

Female: What they used to call Cataract?

Bessie: They call Cooks and Underwood.

Female: Did they call it Cataract?

Bessie: Well no, they call Underwood different than they call Cooks. Cooks they used to call it Skullkoma, and different they used to call this Underwood

River. Call Nomnick, this river and that river down there. And I always heard differently on Council and they started to call different name but I had my mind that that's what they used to call.

Ivan: What was the name of the Klickitat River?

Bessie: I can't thing of that one.

Ivan: If you think of the name of the Klickitat River would you tell, Mrs. Overbaugh, please.

Bessie: Sometime I'll think of it, I'll find out. But I know these two places, what they used to call.

Myrtle: What did you call the Little White Salmon again?

Bessie: Nomnick.

Voice: That's the big White Salmon.

Bessie: Yea, this the Underwood, now they call different.

Ivan: What did you call the Cascade Rapids down there at Cascade Locks.

Bessie: They used to call different, but I, I knew the places but My uncle used to fish Cascade Locks and my grandpa used to fish where the dam is. By the cemetery, where the dam is, where you go through under the tunnel. My grandpa is buried here.

Ivan: What was his name?

Bessie: Wakamet.

Ivan: Oh yea, Chief Wakamet.

Bessie: Yea, that was my grandpa, my grandma's brother.

Ivan: I see.

Bessie: I sit back quiet, I listen people talk, Big White Salmon, Cooks, Little White Salmon, and I had it is my mind what used to called. My grandma and my grandpa. (Mrs. Quaempts means that when she was very young, she listened to her grandparents discuss the names.)

Ivan: How did your people, you original Americans, how did you catch the fish out of the White Salmon River.

Bessie: They give us fish, my children, they use a fish hook.

Ivan: With a fish hook?

Bessie: Yea, but when the hatchery there they used to give um to us. That was the only way we used to get. There used to be big dam there, where the fish they get stuck and they drive up and they get the fish. My husband used to fishing, I've got a picture up at the house. You know that spawning fish.

Female: How did you get them up at Husum?

Bessie: With fish hook, heavy fish hook.

Female: Did you ever hit them with a stick?

Male: If they caught them they do. Oh, I guess they used to, they run up the Rattlesnake Creek, and they used to kill them with clubs there and in Indian Creek.

Ivan: Is that a creak below B-Z Corners? Or Below the Husum?

Answer: Below the Husum, just below the falls.

Ivan: Did your people use any dip nets in this river?

Bessie: No not up this way, but we do at Celilo and all the way down, but not up here, just fishing line. The fishes there, spear.

Ivan: Oh, you use spear?

Bessie: Yea, my husband used a spear. I got my spear up at the house, I don't know, it's somewhere, but you would stick and spear them.

Ivan: Oh, this is important.

Bessie: Yea, my husband used to do that.

Ivan: This was before the dam was built.

Bessie: Yea, it whole, big hole, but we used to cut um, when they quit spawning there well my husband used to spear them. That's how he used to get it.

Ivan: How did you catch them in the winter time after the spawning season was over?

Bessie: Fishing Line.

Ivan: What did they use as bait?

Bessie: Oh, dry salmon eggs, we used to dry salmon eggs. We used to throw nothing, dry salmon eggs.

Ivan: You used them as bait?

Bessie: Yea.

Ivan: And the steelhead would take them?

Bessie: Yea.

Ivan: Did any other fish take bait? In the winter time now?

Bessie: White fish, just like sucker, little fishes, salmon eggs catch um, on a fish line. My boy all the time he used to catch um.

Ivan: Did you use the white man hooks?

Bessie: Yea, white man hook. But this was spear, my husband used a spear. I had one up there I don't know what Johnnie done with it. I had one spear there at the house.

Ivan: That would be an interesting thing in this museum here. You better find it Bessie.

Voice: I know in the early days, we used to go down and we would take a big salmon hook, we would put it on a long pole and we would grab them that way.

Ivan: Snag them?

Voice: Down there on the railroad tracks and we would tie a big three pronged hook onto a rope and throw it out there and jerk, and we would get five or six of them.

Ivan: That was illegal, Bob.

Ivan: You tell me that you would do such an illegal thing?

Bessie: We wanted some fish, we didn't have no bridge, we couldn't get across the river even.

Ivan: Did any spring chinooks that would wonder on in here, did they ever take the hook?

Bessie: Just like white people, who fish in the falls all the time, some of them would catch them, some of them would spear them, enough to eat. We ever know how to fix them. We never know how to fix red salmon, we never sell them. Nobody sell red salmon before. Now today they gill net them and they sell the fish. We never sell red salmon to the cannery. Now today they sell them, my son catches them all the time.

Ivan: Oh! You son is a fisherman now?

Bessie: He sells them, only one, you know Johnnie.

Ivan: Does he dip net?

Bessie: He gill net.

Ivan: I just wondered if he did some of that dip bessieng up on the Klickitat?

Bessie: Yea, he does. He gots scaffold down there. He has place down there, he has scaffold down there like table. He fishes there, he gets quite a few there. He fishes there, he gets quite a few there.

Ivan: Is that family property, that particular site?

Bessie: Yes, my husband's aunt's place was all the way there a long time ago.

Ivan: Is that Annie? North of Lyle?

Bessie: Yes.

Voice: I knew her well, she used to work for my grandfather.

Bessie: I know some people only thing I can't write. Cannot know what year, what day of month, nothing. I'm just dumb.

Ivan: We need to establish about these different races. Mr. Bailey had other impressions so I'll have to interview him very carefully. We have now established that the steelhead certainly went up there and the fall chinooks and maybe some other races.

Voice: Probably years ago.

Voice: Long, long ago.

Voice: Bluebacks never run, I never heard of them in the White Salmon. Unless you consider Trout Lake a spawning lake, and I doubt if the sockeye would be able to live in that.

Voice: There were other lakes a lot easier to get to in those days.

Ivan: Did any of the Columbia River Blueback, Sockeye, July Fish — did they come into the Klickitat?

Bessie: No, they never come, I never saw the, but I saw them out in the river. They come into the Klickitat River.

Ivan: Do they come into the Klickitat?

Bessie: Yes, and all around down here.

Ivan: Do they come into the low part of this particular river?

Bessie: Yes, down on the main river. I saw them sometimes and they get caught. But I never did see them down here on the Underwood River. But steelhead, silversides and fall chinook, I see them right there.

Ivan: Mrs. K., we need to discuss, if we can, the spring chinooks. Those fish if they came would be here in April and May. Did you have many of chinooks at that time?

Bessie: Sometimes there is lots, sometimes not quite. Not as much as there would be. Lots of people they catch them.

Ivan: We'll send up the tapes the tapes to Mrs. Overbaugh, and do you have a cassette you can borrow and play them back? Actually, the Fort Vancouver Regional Library, they had 6, 8, or 10 of them down there the other night when we were down there when we were down there for the Library Board meeting. Maybe some of those will be available for playing. Did you know that you are now a member of the Fort Vancouver Regional Library Board?

Myrtle: No.

Ivan: Yes you are. But we are very busy now trying to get enough funds to establish library services in Klickitat County. So I guess I ought to be working for you now. But if we can't get one of those machines, we can use this machine to play back on.

Ivan: Mr. Twidwell, do you have any more comments that we could add to this, I probably don't think of all the questions that I should ask?

Voice: I should probably add that all the time that I worked at this plant out hereabout 25 years in all, I never saw a dead fish in the tailways. that is, small fish returning to the ocean, going through the turbines, I never saw a dead one in the tailways. We used to watch for them too.

Voice: We would see them in the pipe line once in a while.

Voice: Live ones.

Ivan: When I came up here to do this experimentation, up here on your serge tower, your big buildings, there were a lot of fish living in there, healthy fish.

Voice: Yes, and I used to violate like Bob did and catch fish in there.

Ivan: Well, they couldn't get down otherwise unless they went down through.

Voice: I know there was a lot of them come down the pipeline, the hatchery would dump them in the lake in the spring. In the fall, when they had the urge to go to the ocean why they would get fouled up in our drinking water supply and we had to screen over it and we would have to clean it out quite often. That was the size fish we was catching, those little guys that was on there way back. I'm sure they went through the turbine, but I never saw a dead one, maybe is ground them up so you couldn't see them.

Ivan: Mr. Twidwell, I would like you to describe the original fish ladder that was built for the adults, for the adults to get up stream, at the dam down here please.

Voice: Well it was installed when they built the dam.

Ivan: Of wood.

Voice: Yes, of wood. Had cross pieces every few feet.

Ivan: Would you say every four feet?

Voice: Possibly

Ivan: Weirs' every four, five or six feet, what would you say?

Voice: I would say about four. There was a hole through each one for the fish to swim.

Ivan: Did you have an overflow at all?

Voice: Over the weir — the sides of these ladders was higher than the weirs, and it would slop over each weir and there was only one resting place or tank for them, it started down stream, probably for a distance of three hundred feet and them there was a resting tank and a right angle turn. They went into the river from there. They where the fish entered the thing was right under the spillway and real high water would wash the end of the thing off. It was replaced a couple times and then they finally discontinued it for some reason.

Ivan: How wide was the ladder, sir?

Voice: About four feet.

Ivan: And made of 2” material or 4”?

Voice: 2” tongue and groove stuff.

Ivan: How deep were the pools?

Voice: The sides of the things were probably 2½’ and the weirs were probably about two feet high.

Ivan: Did any fish ever ascend the ladder.

Voice: Oh yea, you bet they did, they used it to beat the dickens.

Ivan: Now this is very significant.

Voice: I wasn’t in on it myself but some of the other employees used to shut the water off in the thing and get their fish supply. So I know the fish used it. You used to see the fish use the ladder and go into the lake.

Ivan: I’ve seen that happen other places too.

Voice: Yea.

Ivan: Were these steelhead or were these fall chinooks?

Voice: It was steelhead I remember seeing.

Ivan: And as Mr. Bailey commented about any fall chinooks ascending the ladder?

Voice: No, I don't think Mr. Bailey was around the dam any. He spent his time down in the hatchery.

Ivan: I see. What time of the year did these fish ascend in your memory?

Voice: Early Spring.

Ivan: Like those going over John Day now? Jim. There are getting tired and going up river to spawn. They have remained in the river all winter without food and now they go up to spawn. Would you care to estimate in those two or three years would you care to take a wild guess of the number that went up?

Voice: I would think that in the spring run, that was steelhead, would be considerably less than the fall chinook run that we established at 3000 salmon in 1912. But there was hundreds of them I know that.

Ivan: But you don't recall any spring chinook?

Voice: No.

Ivan: I hope I don't offend you by my questioning, but we have, if it is going to be history well.

Voice: Anything I said here is common knowledge anyway.

Ivan: Did you see any other fish ascend the ladder, such as white fish, suckers, or chubs.

Voice: No.

Ivan: And the ladder just rotted away after it was used-for several years?

Voice: At the end the thing was washed out and discontinued it stood there for several years and was dismantled and burned.

Voice: Didn't they rebuild out of concrete, Carl?

Voice: No, just the lower end of it was washed out, they rebuilt with concrete.

Voice: Oh, I see.

Voice: But, they spillway was too much for it.

Ivan: Jim, do you have any questions?

Voice: I can’t think of any.

Ivan: It’s kinda hard here with this tape running to think of things. Did you see any cohos make any attempt to ascend in the fall?

Voice: No, I didn’t

Ivan: Any fall steelhead. See we have a run of fall steelhead together with our fall run of salmon.

Voice: Yea I know, but I don’t know whether they used it or not. It was only the spring run that I remember.

Ivan: And these were the steelhead.

Voice: Yea.

Ivan: Were these big fish, did they average 2 feet or 18 inches, what would be your guesstimate of it?

Voice: I think 30 inches would be a large one, average 24 maybe. Nice size fish. Real bright fish.

Ivan: No injuries?

Voice: No, no, I never saw any injuries.

Ivan: This is significant too, because we do count, we do observe a number of injured fish these days.

Voice: Yea. Net marks you mean?

Ivan: Yes, net marks and those that have obviously been cut by propellers and injuries that we just can’t access. We don’t know the origin. There are bruises, we certainly see this.

Ivan: One interesting thing Mr. Twidwell said, please go on . . .

Voice: You spoke about putting salmon through the turbines here at White Salmon. I saw that experiment performed at the Yale Dam on the Lewis River. The fish were about six inches long that they liberated and they came through the turbines which the head is a little higher then the one at white salmon the same type wheel. And, I didn't, wasn't in on the experiment, only as a bystander, and saw the things come through into the tailways and a lot of them were injured. I never saw any of them that were cut, in any way, they would swim into the little eddies and we used to catch them and they were large enough to fry and their injury looked like a broken back. When you would fry the things, there would be a little dark spot along the backbone and I imagine their back was broken. That was the only injury that I noticed.

Ivan: Did you see any eyes popped out of their heads?

Voice: No. Only this injury to the back.

Another Voice: This wheel out here is a little faster than the ones down below?

Voice: No I think the speed was awful close to the same, the head was the same.

Ivan: I know it is public record what the head is on this darn and the rpm, but can you recall that from your memory?

Voice: Roughly 125 feet of head and the speed of the turbines, I think was 60 pm's.

Ivan: Did you have any cavitation on those blades at all?

Voice: Yea.

Ivan: And you would have to take them out and rebuild them and reweld them would you?

Voice: Would weld them right in place.

Ivan: Oh, with the arc welding?

Voice: Yea

Ivan: What did you do before the arc welding came into prominence?

Voice: Wheels were put in in 1913 and they just let them cavitate until the arc weld did come in and of course when they put the things in originally they had two units and the load was light and they only used one at a time and a lighter load I suppose caused less cavitation than a full load. Anyway they stood it until the arc welding come in.

Voice: Yea, I was in on some of that work.

Ivan: Was this cast iron? Were the turbines cast iron or bronze?

Voice: Cast iron? No, cast steel

Ivan: Those runners that they took out of the Walterville Power plant down on the McKenzie looked beautiful, they were bronze or brass, runners and all the people building boats wanted to take them so they could make their boat fittings.

Voice: The Powerdale Plant just across the river on the Hood River uses that type wheel.

Ivan: Brass or bronze?

Voice: Bronze.

Ivan: Do they still use it?

Voice: Yea.

Ivan: Have they had to replace it?

Voice: Yes, I worked over there and replaced them several times.

Ivan: Did they put in a new runner them or just rebuilt it?

Voice: They had a spare we would take the one off and send it to the shop to have it repaired and built up.

Ivan: This would be done by a welding process no doubt?

Voice: Yes, we always had it done at The Dalles.

Ivan: Francis wheels again, over there?

Voice: I don't remember, but I would say about 200 feet.

Ivan: We have done a good deal of this passing fish through turbines at Shasta Dam for two years and two years at Cushman Dam on the Olympic Peninsula, three years at the Big Cliff Dam out East of Salem, and anyone, and we found that when we operated the turbines at maximum efficiency the maximum sigma value, our mortality was the least. But if we overloaded the turbines or ran the wicket gates at 40% opening then we would get into more trouble. Some of those dams operating at 40% wicket gate opening they might get up to say 49% mortality. Most of these, but not all of the, were with caplin wheels, certainly those at Shasta were not caplin.

Voice: Caplin was used mostly with a low head, I guess.

Ivan: Yes, I would say generally under 100 feet.

Voice: Survival is much better through that type, is that right?

Ivan: We have never really established that. The caplin wheels will kill fish if they are not operated at maximum efficiency, they will have some affect alright. It varies with this efficiency of the turbine. The operation of the turbine. So Mr. Twidwell is sketching the ladder that existed Northwestern or Condit Dam, which name did you use Mr. Twidwell?

Carl: Condit.

Ivan: And we have now a sketch showing the ladder that, with the lower leg extending North toward the base of the dam, the downstream side of the am, then ascending to the South where they met the head box or a turning pool and then ascended in one long tangent, an incline to the top of the dam, which existed for several years, was rebuilt, the bottom end of it was rebuilt several times, and finally abandoned.

Carl: That's correct.

Ivan: And very very few places would you find this knowledge in the history books.

Female Voice: Did you ever make your own dipping nets?

Bessie: Yes.

Female Voice: You used to make them out of the lining of the maple trees.

Bessie: No some stuff in the highland, you break it up like rope.

Female Voice: What island was that?

Bessie: Right across there.

Female
Voice: Across there, Wells Island.

Bessie: Just like grass, Like we break them off and we peal them just like rope. I had some place, I don't know where they are. Soften them up and make strings and make nets, brown things like rope.

Ivan: Was it stinging nettle?

Bessie: I don't know what you call it, but we used to break it and bust it and peal it off like rope and soften it. I had someplace, but I can't think where.

Male
Voice: Was it off a tree?

Bessie: A little bush like, there used to be a bunch there, where that island is. Fix it up and soften it up and fix rope like that.

Ivan: Roll it on your knee?

Bessie: Yea.

Voice: It wasn't willow was it?

Bessie: No, it wasn't willow, just bushes like that.

Ivan: Bushes two feet high?

Bessie: When you peel it off you make like a little rope, soften it up and make net

Female
Voice: If you ever find a little piece, will you save it.

Bessie: Yea.

Ivan: This is important, if we could identify that it would be valuable to us. Could it have been stinging nettle?

Female
Voice: Was it hard to get? Where there stickers on it?

Bessie: No.

Female
Voice: It was smooth, it had leaves on it?

Bessie: No, just long ones.

Female Voice: Was it cattails?

Bessie: I don't know what they call it. Just pick them and peal them off and was like little strings.

Female Voice: In the 1800's the Indians made their dip nets for catching salmon from the inside of the bark of Maple Trees. Make strings of this and Indians lived around here and the Rattlesnake Creek as late as 1910 and 1912, they also had a long house. Do you remember having a flag made of buckskin hanging at the top of your long-house? At Husum? Do you remember that? It might be before your time.

Bessie: No.

Female Voice: No, that's before you, you see. We have to find out about what you made ropes of over there. It's Wells Island across here (White Salmon). That's where she got it. Right across from Underwood.

Bessie: I think they all drowned I don't remember. (Bonneville Dam flooded the area.)

Ivan: I would like to be able to identify that, no what it is.

Bessie: I don't know how to call it. Little brown bush like that and you break them off, then you take that bark off and you soften up. I can't think what they call them. You know white people, I had some at the house and I don't know what I done with them. My grandma used to make string and make net. Gill net. Weave first.

Ivan: Could it have been something like linen?

Bessie: Yea, something like that but fix rope.

Ivan: I know that your people used to make nets out of native wild linen.

Bessie: Yea, I can't think what they call it, but I know I had some. Like you see this brown rope, you know you buy rope and its got little brown bark like? That's the way it was, but I can't think what they are. But we had some. But so many times we burned, we burned twice.

Ivan: Mr. Overbaugh, you have spoken of the logging industry up here, about when did that start, do you have any idea how long before the turn of the century?

Robert: Let me see. It was the Oregon Lumber Company that worked in here wasn't it? Carl? Up there at Camp 5.

Carl: Wind River Lumber Company. Let's see, I came here in 1909 and it was Wind River Lumber Company operating here then. It probably was the Oregon before that.

Robert: Yea, it was probably. But it was all logged off, Camp 5 country, it was all logged off.

Ivan: How far North is that where the logging was done?

Female Voice: It would be at least five miles from B-Z Corners, would it be, around that.

Robert: Yes, what they call Camp 5 it was right next to the road and Camp 1, I believe was next, was across the river was Bear Valley there. Your dad worked there didn't he, Carl? All the old timers worked there.

Female: Bear Valley is 19 miles North of White Salmon

Ivan: Now have we established that this logging took place before the turn of the century?

Robert: Well, it was right at it wasn't it? Pretty close to the turn of the century.

Carl: Well, I wasn't around then, but I would think it was long before the turn of the century.

Robert: Well, it could have been, somewhat before.

Ivan: Was this bull logging, ox logging . . .

Robert: They used horses. I don't know how those logs were put into the river. I know they had some ox logging up at Trout Lake though. But then that mill was up there in Trout Lake. I don't believe they had any steam donkeys at that time or used horses. I know they did use horses some. They did considerable logging there I know. Of course the Mormons were in there on the Little White Salmon River. That was before the turn of the century. That was the Oregon Lumber Company there.

Ivan: Were these large trees? Or were they . . .

Robert: Yea, some of them. Some of them were good size. They were, they didn't cut long logs then like they do now. They were much shorter logs. In fact they would have never have come down the river if they had of.

Ivan: You are aware that sometimes we get acres and acres, 25 and 20 feet deep, of drift wood and rubbish and logs on the up-stream side of the Bonneville Power house. Just acres of it.

Robert: Yea, we have that out here, too.

Ivan: Tell me, has the Condit Dam, the forbay of the dam, silted in to some extent?

Robert: Yea, yes it is, last summer they had the water pulled down 10 feet, lowered 10 feet, and instead of a lake there was a river about half of the distance from the upper end of the lake to the dam. Of course that was always shallow there, and, even though it was half the distance, that wouldn't be half of the area that there is to fill. See, its been in there 60 years now. I imagine that it isn't over 10 percent filled. It was so shallow up there to start with and you get down to the lower end where it is 125 feet deep. That would take quite a little time.

Ivan: Do you ever have any way of telling if any of that stuff cleared out when it gets to the dam do we?

Robert: Yea, yea, they have some kind of a tool that they let down that has little cups, it is a steel rig and it will sink down into the mud and then the mud will stay in these little cups and you pull it up real slow so that it doesn't wash out and gives them a good idea how deep it is. I helped measure it one time and it seems to me that it was about three feet. That was real fine, much finer than the stuff that has filled the upper end.

Ivan: I think that it has come out that we have had a very stable flow in this stream. Do you know how many second feet, whether its an average of 500 or 3000 second feet flow?

Robert: The capacity of the plant is 1500 second feet.

Ivan: 700 cubic feet per second per turbine.

Robert: Yea, and the average load at one time was 10,000 kilowatts per hour for the year. and the capacity was, rated capacity, was 12,000, but we got 15,000.

So the average generation would have been 10,000 would have been 2/3 1500 second feet, wouldn't it.

Ivan: Were there times that you did not have enough water to operate both turbines?

Robert: Yes, long about August, the water would get down so that one turbine would use all the water in the river. That's when we used to shut one down for overhaul. And it would get so that some years that instead of generating 7500 kilowatts we would get down to 6,000. That was about as low as it got I think.

Ivan: Do you train your own operators here on the scene? Or do you bring in operators in from other plants?

Robert: We do it both ways. Some of the operators are young college grads and others are local people that started in oiling or working at other maintenance jobs and worked up to operators.

Ivan: We have the operating school, they teach them through ICS correspondence school using the text books from ICS and got their training right on the s cene at John Day Dam.

Robert: That isn't new, because I did the same thing 50 years ago.

Ivan: It seems like a pretty good method, a practical method.

Robert: It worked, after a fashion.

Ivan: But they had a rather formal school at Bonneville for many years, rather intensive classwork. I see that they have gone away from that.

Robert: I knew they had that a long time.

Ivan: Those people at Bonneville were trained practically, but it was a more formal classwork training.

(break in tape)

Ivan: The first bridge across the White Salmon then was logs strung across from bank to bank in the chasm a very narrow canyon, with planks then stretched across the logs.

Robert: Yes, that's right. The road then went out into Underwood Flats.

Ivan: That is to the West.

Robert: Let's see the company built that other road didn't they.

Carl: Yes the present road. The first one went higher up on the hill and come out at the flat at Underwood.

Ivan: To Underwood.

Carl: Yea.

Ivan: Did they have a road at that time over to Little White Salmon?

Robert: Well, they had some kind of a road, I don't know if you would call it a road or a cow trail, but, it was a road in the early days that crossed over to Little White Salmon. I couldn't say how early that was built.

Ivan: When did they build the second bridge.

Carl: That was in 1910 when they started construction of the dam.

Ivan: They built the second bridge at that time. find the bridge down below the dam now is the third one?

Carl: The one that is in there now is.

Ivan: That is the narrow steel one, is it not?

Carl: Yea, the second bridge that the Power Company build was a wooden bridge and was getting in kinda bad shape and I believe they was taking the steel bridge down at Wind River so they moved it up here and replaced the old wooden bridge.

Ivan: When was the steel bridge, the present one, when was it placed in there? Would you estimate?

Carl: I would think about 1945.

Ivan: I see. Mrs. K. did you ever go huckleberry picking back there in this hills?

Bessie: No, since I got the operation, it been three years now, I have not gone in the woods.

Female: You have gone though?

Bessie: Yea, but before I used to go camp there.

Ivan: Oh, you would go camp there.

Bessie: Yea, camp there, pick huckleberries and go home.

Ivan: And you put then in jars?

Bessie: Yea, put them in jars, boil it, seal it tight and bring them home already canned. This time now I can't see, I can't pick 'um.

Ivan: That's too bad, cause it's fun to go out there and pick them alright.

Voice: At first, they used to dry their berries out there on drying logs.

Bessie: Yea, used to dry them.

Female: Did you ever do that Bessie?

Bessie: Yes, used dry them, my girl, she want to do that, we used to put sack like that, put log, make fire, work it back and forth for 20 gallon at a time.

Ivan: 20 gallons at a time? And you would use the reflected heat from the fire?

Bessie: From the fire, it dry all day.

Ivan: Build a fire against a log?

Bessie: Yea, build a fire against a log, and my berries right there, we used to, we used to just like that, just move it round, back and forth, been a long time ago.

Voice: They had to do that in those days, because they couldn't take them out and save them. There were no roads, of course after the cars started running then they could go in with a car and then they could can their berries.

Bessie: A screen, put white cloth, and dry this way, fire there on the bottom. My children, long time ago, make fire under then1and just keep them moving around.

Female: A long time ago did you go any further than Dead Horse Meadows?

Bessie: To Little Goose Lake.

Female: That is as far as you could go in a hack.

Bessie: Yea, horseback.

Female: Yea, but did you go on to Twin Buttes there on horseback.

Bessie: No,

Female: A lot of them did then, of course.

Bessie: Use to go up just on horseback.

Ivan: Would you camp at Little Goose Lake?

Bessie: Yea, used to put our wagons there. On up to Twin Buttes on horseback.

Ivan: Were there any fish in the lake then.

Bessie: I don't know if there were fish that time.

Female: No, not there.

Ivan: I see.

Female: But Big Goose, of course, has fish.

Bessie: Yea, we dry berries, later we put screen and dry berries on top of that. But long time ago by the log. That's what you want, you know, my girl down here, I give her huckleberries and show her how we used to do them.

Ivan: Did you or any of your people used to pick cranberries?

Bessie: No, we just pick berries and dry berries, that's all we did. When my children got to be big children we pick 'um and we can 'um , and bring 'em back.

Carl: What can you tell me about the size of Trout Lake and how deep it was before the white man altered the circumstance very much.

Robert: I don't think it ever was too deep.

Ivan: 5 feet, 6 feet, 10 feet,

Robert: In the channel it was probably about 20 feet deep. That is down through the channel. But the lake itself would be, I would say, 5-8 feet probably.

Wouldn't you?

Female: Oh, I would say 10 in places, cause I've been swimming in it years ago, and I thought it was awfully deep.

Ivan: What did you mean by the channel, where the main flow went through it?

Robert: Yea, where the creek come down from up above.

Ivan: What creek, Trout Creek?

Robert: Yea, Trout Creek, it runs into the lake, that lake would be a mile long in high water, wouldn't it?

Female: Yes.

Ivan: How wide?

Robert: About 1/2 mile.

Carl: I saw it first in 1912 then there was probably 1/2 mile across and 1½ miles long.

Robert: Yes.

Carl: Open water, now that has all grown up to willows and reeds. You would have a hard time finding a 1/2 acre open water now.

Robert: There is water there now but it is weeds, reeds, and brush.

Ivan: Were there trout there in the early days that you heard about?

Robert: We heard about them, but we didn't do any fishing in those days. We lived too many miles away from Trout Lake. 30 miles is too far to go fishing, with only horse power to get you there.

Ivan: You went up there Mr. Overbaugh.

Robert: Yes. A few years later when we had a car, we used to go to the lake and Trout Creek. We used to wade down as far as the old hotel there and by the time we got down there we would have our basket full of trout. Nice big ones.

Ivan: 12-14 inches?

Robert: Some of them, but we would have our basket full by the time we would get down.

Ivan: Were these native rainbow?

Robert: Yea, if I remember right, that's been years ago.

Ivan: Or did anybody ever call them cut-throat?

Robert: I can't remember.

Ivan: Were their suckers, chubs and dance in the river, in the stream, in the lake or not?

Robert: I don't think so.

Carl: I don't think there is even now. I fished there several times and never did catch anything but eastern brook, and rainbows.

Ivan: Eastern brook were probably introduced I would suspect.

Carl: I imagine.

Robert: If you go out there and you catch a dozen trout, you are doing well. I know a boy that I went up with, Dan Paulson, went over on Trout Creek once and he caught 104 trout one afternoon. That's the way the fishing was up there in the early days.

Ivan: How did you catch them, flies or bait?

Robert: Whichever they seemed to be hitting the best. Grasshoppers, worms, and flies.

Ivan: Were you a fisherman Mr. Twidwell?

Carl: Oh, somewhat, I do lots of fishing, but don't catch many fish. Oh, since I work with fish down here I just haven't gone fishing very much.

Robert: Myrtle and I used to go trout fishing up along the river quite often when we were younger. We would slide down the pole into the canyon.

Ivan: Where does the river come out of the steep canyon? Does it come out up above or is it a narrow canyon all the way up?

Robert: Well, it, the canyon starts, you mean at the upper side?

Ivan: Where does the canyon start? Five miles south of Trout Lake?

Robert: Yea,

Ivan: It starts cutting down through the lava at that place.

Ivan: Has man altered the apperance of the lake at all?

Robert: I would say not.

Ivan: He has not filled it in at all.

Robert: No.

Ivan: What then has caused the willows to and the reeds to fill up.

Robert: Well, it must be the silt just kept coming down. I really couldn't say for sure, I really couldn't say how that did happen.

Bessie: : ___________

Robert: I think it must have been deeper at one time but the silt probably kept washing down and filling it in faster than it run out probably and that's probably why those reeds grow in there. I imagine.

Carl: I imagine, the outlet is over bedrock and I suppose its been a long long time filling up and after it got so near the surface well then the reeds started to grow.

Ivan: Its reeds, willows and bull rushes?

Carl: Willows and bull rushes mostly.

Ivan: Are there any muskrats in the area?

Carl: I never noticed any.

Ivan: Any beaver?

Carl: I don't know.

Robert: There have been a few beaver around.

Carl: I never happened to see them there.

Robert: I've seen them along the trail, by the lake, and other places, too.

Ivan: Oh, so this is Trout Lake, that is quite an extensive body of water.

Robert: Yea, it don't look like that now.

Ivan: We have a picture here, given to me by Mrs. Overbaugh, which shows Mt. Adams in the background across a rather extensive body of water called Trout Lake. Looks like a rather fine lake at that time. When was this picture taken?

Robert: 1908, I think.

Ivan: This is a valuable historical record. The photo given us, shown to us, demonstrated to us by Mrs. Overbaugh, showed that the lake is beginning to fill with reeds on the sides, the edges now,

Robert: Some of the natives in Trout Lake have cleaned that Lake out a little bit. The Forest Service helped, too.

Robert: They made some kind of a reed cutter.

Ivan: They cut out the reeds but did they take out any silt?

Robert: No, just in one little place. The reeds were coming clear up to the top of the water and they made some kind of a mower to cut those off.

Ivan: An underwater mower. Why for fishing, or boating or both?

Robert: Just a small place to fish I guess.

Ivan: The only place to fish now is such an open area. Is this lake privately owned or is it Forest Service land?

Robert: It is in the forest area.

Myrtle: Is it privately owned, who owns it?

Robert: Probably two or three different farmers own it.

Ivan: Mrs. Quaempts. did you have any experience with fish wheels?

Bessie: No.

Ivan: They did not have fish wheels in this area.

Bessie: No. Not up there, just at the Dalles.

Ivan: Did you ever catch any shad here in this part of the river, the lower part of the river.

Bessie: My son gets it . . . they just take eggs out of them.

Ivan: Did you ever eat shad?

Bessie: No.

Ivan: Flesh, you're spoiled, you will eat only salmon, huh?

Bessie: Huh.

Ivan: Too many bones in those shad.

Bessie: He cuts open he gets eggs.

Ivan: Did sturgeon evencome into the lower part of the White Salmon?

Bessie: No, he catches them in the big the big river. Johnnie, he does.

Ivan: How does he catch them, with gill nets?

Bessie: Yea, they get tangled up.

Ivan: Big ones?

Bessie: Yes, some of them big, some of them small. He don't keep them the small ones. He lets them go.

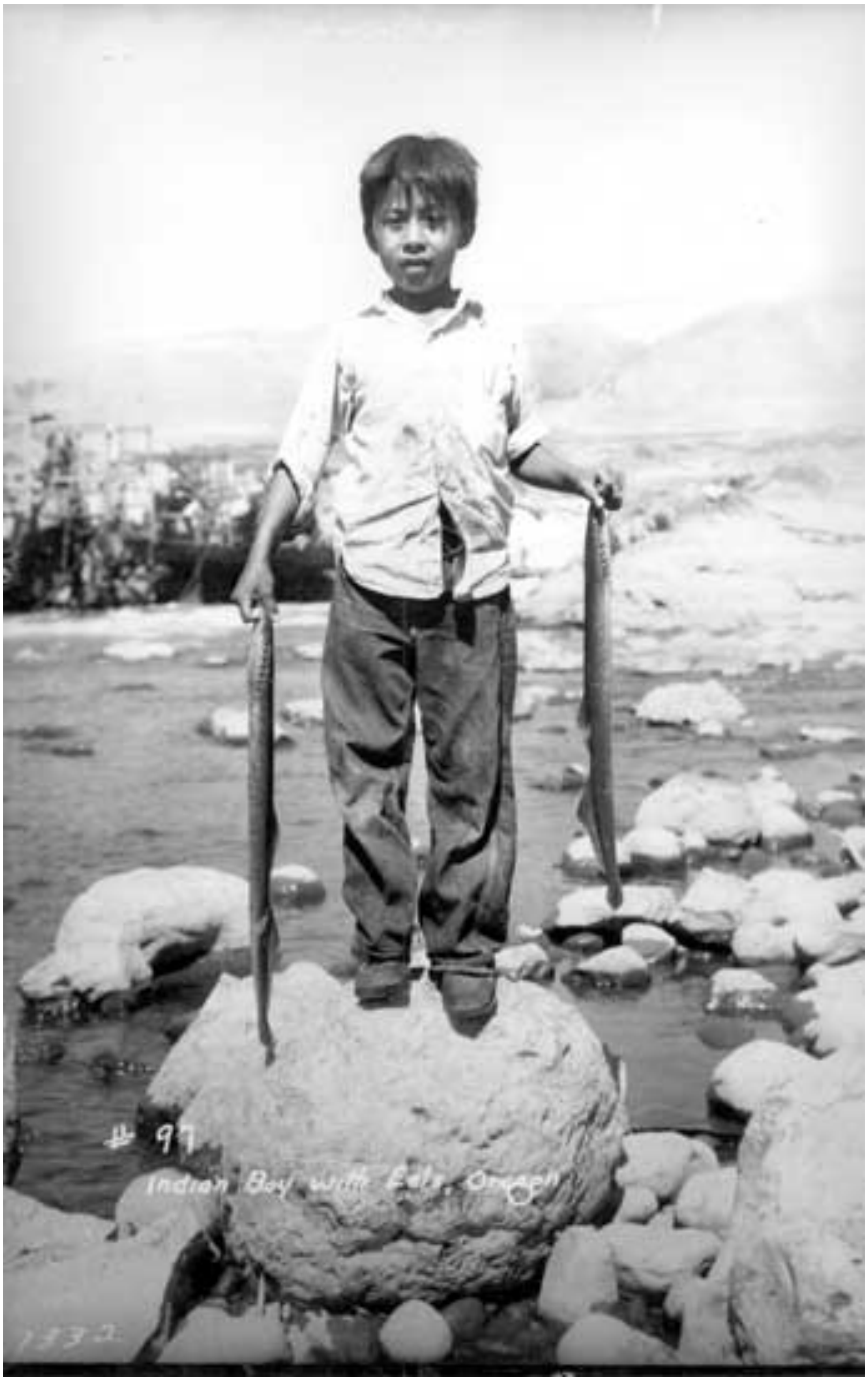
Ivan: What was your name for the sturgeon? Native American name?

Bessie: They called me Indian Macon (my own spelling). It's hard to call it.

Myrtle: Did you always call salmon, salmon?

Bessie: Yes.

Ivan: This is very good information because you never see that in the books at all. We will have to defer our interview until we can get Alex Silas someday feeling better and Mr. Bailey and Mr. Twidwell and Mr. and Mrs. Overbaugh and Mrs. K. together again.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