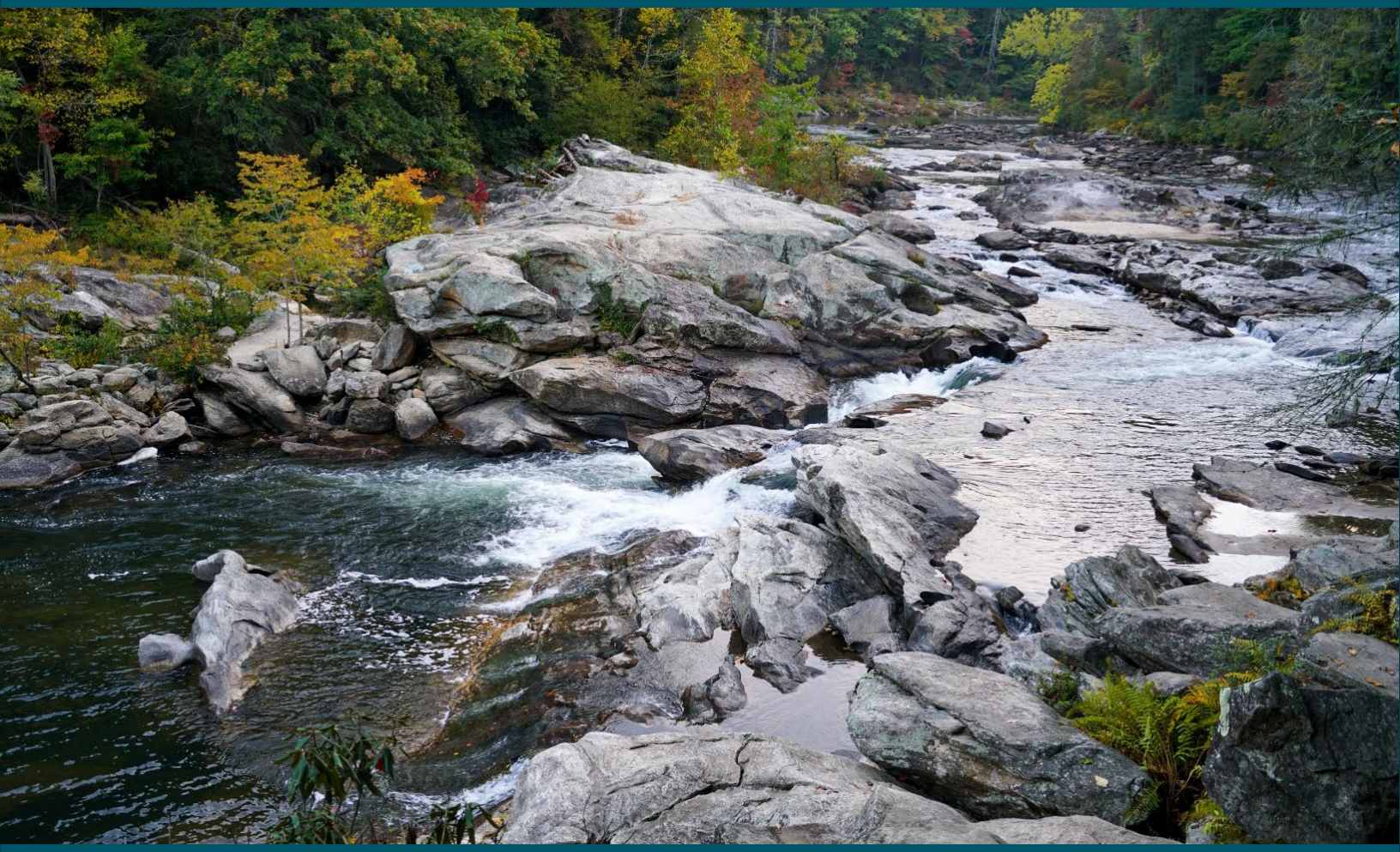
Practitioner's Guide to Hydropower Dam Removal

OCTOBER 2023



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ACKNOWLEDGEMENTS AND DISCLAIMER

American Rivers published this Practitioner's Guide to Hydropower Dam Removal.

Written by Katie Schmidt, Anthony A. Lapham Fellow at American Rivers. Brian Graber and Colleen McNally-Murphy served as advisors and editors.

American Rivers staff, the Hydropower Reform Coalition Steering Committee, and external partners reviewed the document and collectively contributed over a century of knowledge.

The generosity of the Lapham family made this document possible. We are grateful for their support.

This Practitioner's Guide is intended to provide a public benefit. It does not represent the legal opinion of American Rivers or the Hydropower Reform Coalition and is not intended as legal advice for licensing.

LAND ACKNOWLEDGEMENT

We recognize that the land and rivers where we work are the homelands of Indigenous communities who have been stewards of the land for thousands of years. We recognize the historical and ongoing injustice of the theft of Tribal lands, and we strive to respect the values of these Tribes and support their efforts for land and water protection. We recognize that many hydropower developments have negatively impacted Indigenous communities, by depleting native fish runs, damming sacred rivers and sites, and disrupting the communities' relationships with rivers.

We recognize this acknowledgment is a first step, and we commit to continued listening, deepening our knowledge and practices, and expanding authentic relationships with Tribal Nations and Indigenous communities in the coming years. We hope that this document can support the restoration of both rivers and relationships through the removal of obsolete structures and uplifting the voices of Indigenous communities in the management and future of the land and water.

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COVER PHOTO
CHATTOOGA RIVER, GEORGIA
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GLINES CANYON DAM REMOVAL
ELWHA RIVER, WASHINGTON
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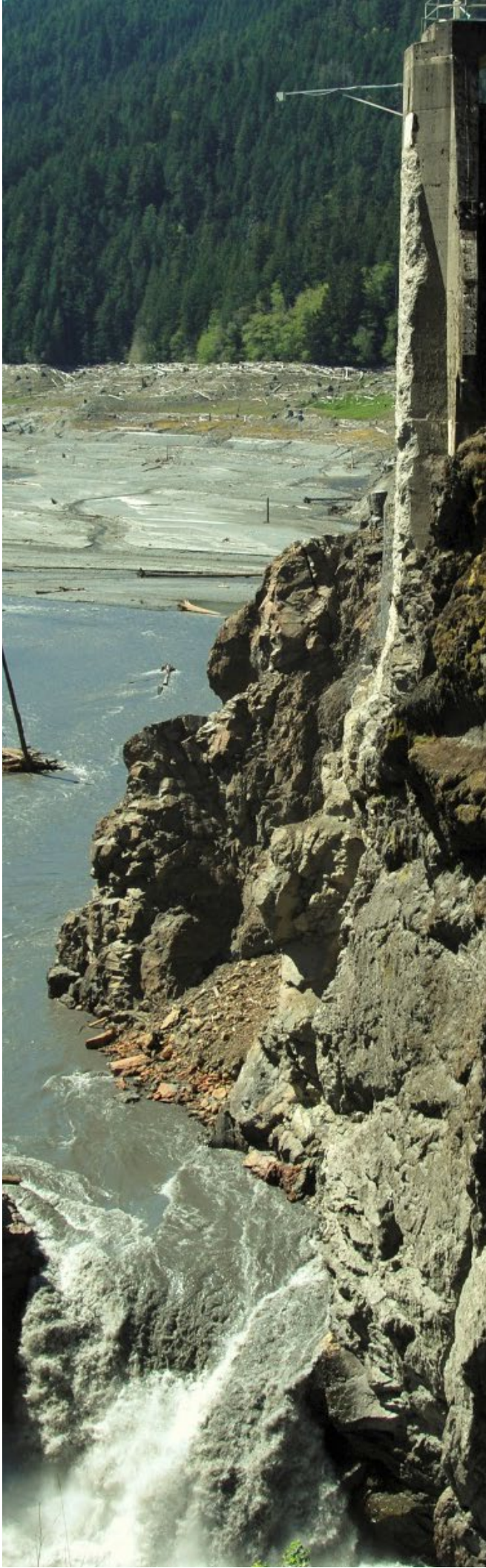

AMERICAN RIVERS

American Rivers is a premier national organization that is championing a national effort to protect and restore all rivers, from remote mountain streams to urban waterways. Healthy rivers provide people and nature with clean, abundant water and natural habitat. For 50 years, American Rivers staff, supporters, and partners have shared a common belief: Life Depends on Rivers[SM]

Rivers provide our drinking water, grow our food, and sustain our spirits. Today, our rivers are at risk as never before from climate change, pollution, drought, flooding, and loss of natural habitat. Nothing short of our health and safety are at stake. American Rivers works alongside communities that are hardest hit as we champion a movement to protect and restore the rivers on which we all depend.

HYDROPOWER REFORM COALITION

The Hydropower Reform Coalition protects, enhances, and restores America's rivers, watersheds, and communities affected by hydropower operations. Founded in 1992, the Hydropower Reform Coalition is a diverse consortium of more than 160 national, regional, and local conservation and recreation organizations dedicated to protecting and restoring rivers affected by hydropower dams, ensuring public access to these lands and waters, and reforming the federal licensing process to ensure public participation and to improve the quality of the resulting decisions.

The Coalition's combined membership represents more than 1.5 million people across the country. Working together, the Coalition has protected or restored thousands of river miles, thousands of acres of watershed land, and countless opportunities for boating, fishing, and other recreational experiences.

ROGUE RIVER, OREGON
TIM PALMER

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COPCO 1 DAM
KLAMATH RIVER, CALIFORNIA
DANIEL NYLEN

AUTHOR NOTE

Removing a hydropower dam requires a monumental effort. Only forty-six federally regulated hydropower dams have been removed, less than three percent of the two thousand and twenty-five dam removals that have occurred in the United States.

As hydropower dams across the country are aging and their owners are evaluating the future of these projects, many owners are deciding to remove dams and restore the rivers on which they operated. This practitioner's guide has been developed to assist stakeholders working with dam owners and licensees to navigate the license surrender, decommissioning, and removal of federally regulated dams.

This guide covers the critical elements of the policy and practice of removing hydropower dams, defined here as dams regulated by the Federal Energy Regulatory Commission (FERC). The research methods used to develop this guide included examining all past removals of FERC-regulated hydropower dams by interviewing individuals involved, compiling documents from the FERC docket, and analyzing reports published on these removals. Interviews with staff from FERC, state and federal agencies, stakeholders across the nation, Tribes, and utility owners were conducted to inform both the guide and case studies on individual projects.

The guide has two main elements: the body of the document and the case studies in the appendix. The body of the document focuses on the general process, while the case studies present real world examples. The decommissioning and removal of a FERC-regulated hydropower dam entails years of process and regulatory hurdles contributing to an average timeline of more than five years. Research shows the relicensing process is the most common time when dam owners or licensees decide to remove a dam. Of the thirty-four licensed hydropower dams that have been removed, twenty-three were initiated during the relicensing process. An additional twelve license-exempt FERC-regulated hydropower dams have been removed.

The twenty-one case studies include successful removals of a wide range of projects. Each case study is designed as a standalone report and is formatted as such. These are intended to inform practitioners of the breadth of hydropower dam removals.

This document brings together the dam removal expertise of American Rivers, the hydropower licensing expertise of the Hydropower Reform Coalition, and the knowledge gained from previous hydropower dam removals to inform future removal projects.

As of October 2023, FERC oversees 992 licensed conventional hydropower projects and 389 license-exempt projects that are not conduits, comprising over 1,700 dams. Many of these projects are old, uneconomical, and cause greater harm to the environment and social justice than can be justified by the amount of power they generate. Now is the time to engage with licensees of these projects and impacted communities to work towards restoring river health by removing as many obsolete projects as possible.

I hope that this guide can serve you as you work to remove ecologically harmful dams that have become financial liabilities or public safety hazards. We need to protect and restore the rivers that we rely on.

Katherine Schmidt

Anthony A. Lapham River Conservation Fellow
American Rivers, 2021-2023

1. INTRODUCTION

This Practitioner's Guide is for those involved in removing dams regulated by the Federal Energy Regulatory Commission (FERC), including environmental organizations, natural resource agencies, licensees, dam owners, Tribes, and stakeholders. Removing a hydropower dam is a unique branch within the world of dam removal due to the complexity of hydropower licensing and regulation. The guide examines the license surrender and decommissioning process for hydropower projects regulated by FERC, specifically decommissioning that includes dam removal. While there are hydropower dams that are owned and or operated by federal agencies, their regulation and removal is a separate process that is not covered in this guide. This guide has been developed with the collaboration of American Rivers and the Hydropower Reform Coalition and its Steering Committee. It is a public document available to anyone removing a FERC-regulated hydropower dam.

The guide is organized to give an overview of why licensees or dam owners have decided to remove their dams, followed by details on how to navigate the FERC license surrender and decommissioning process for a hydropower dam removal. The primary FERC processes covered in this document are relicensing, license surrender, and decommissioning. Detailed case studies on selected projects can be found in Appendix C. Each removal is unique, and it is the goal of this document to convey the process involved and the lessons learned from case studies to inform future hydropower dam removals.

The following is a clarification on terms used in this guide: FERC regulates non-federal hydropower dams by issuing either a license or an exemption from licensing to the entity operating the project. These are collectively referred to as “FERC-regulated dams” with specifications on licensed vs. exempt projects where necessary. The licensee of a project may own the dam, or it may be owned by a separate entity. For any removal the dam owner and licensee must consent to removing their project. Much of this document references the licensee and will call out specifics on dam ownership where necessary. Some projects may contain multiple dams, powerhouses, and other associated structures, while other projects may consist of just one dam and powerhouse. This guide uses the terms “project” and “dam” interchangeably.

1.1. How to Use This Guide

This guide is designed to be approachable to those who are navigating the removal process for a FERC-regulated hydropower dam. The reader should familiarize themselves with the FERC licensing process and the basics of dam removal. The first half of this guide covers the critical elements of the dam owner decision-making process on dam removal, and the second half covers hydropower regulation. The Guide may be read from front to back, only sections that are most relevant, or using a keyword search. The case studies are designed to be standalone documents and a keyword search may be helpful in determining which case study is most relevant.

The guide’s focus is on acquiring FERC approval to remove a regulated dam. This guide is complementary to the following guides available from the Hydropower Reform Coalition (HRC), American Rivers (AR), and FERC that cover hydropower licensing more broadly and the design and engineering components of dam removal:

- *Citizen Guide for Effective Participation in Hydropower Licensing,* by the Hydropower Reform Coalition: https://hydroreform.org/resource/citizen-guide-for-effective-participation-in-hydropower-licensing/
- *Hydropower Primer*, by the Federal Energy Regulatory Commission: https://www.ferc.gov/sites/default/files/2020-05/hydropower-primer.pdf

- *Removing Small Dams: A Basic Guide for Project Managers,* by American Rivers: https://www.americanrivers.org/wp-content/uploads/2016/05/NatlDamProjectManagerGuide_06112015.pdf

1.2. The Role of Hydropower

Throughout history, hydropower played a significant role in community development across the United States. Small dams powered mills and brought electricity to remote towns while the large dams of the western U.S., such as the Grand Coulee Dam on the Columbia River in Washington, helped to fuel the aluminum production that ultimately helped win World War II. Hydropower has continued to play a role in the national power grid and will do so for the foreseeable future. As of 2021, hydropower provided approximately 6.3% of the nation's power, representing 31.5% of renewable energy generation (Figure 1-1).[1] This role must be balanced with understanding and mitigating the impacts from hydropower on ecosystems and communities.

The hydropower relicensing process presents an opportunity for public engagement in the operation of hydropower dams. Because these projects operate on public waterways, they are accountable to state and federal regulations and are subject to public input. FERC-regulated dams are required to meet dam safety standards, water quality standards, and environmental regulations, or mitigate for unavoidable impacts from operation. When a project comes up for relicensing, it is an opportunity for the licensee to consider license surrender and project decommissioning instead of seeking a new license.

The costs of owning and operating a hydropower project are high and include operation, upkeep, mitigation, and liability. Surrendering the project license or exemption and removing the dam

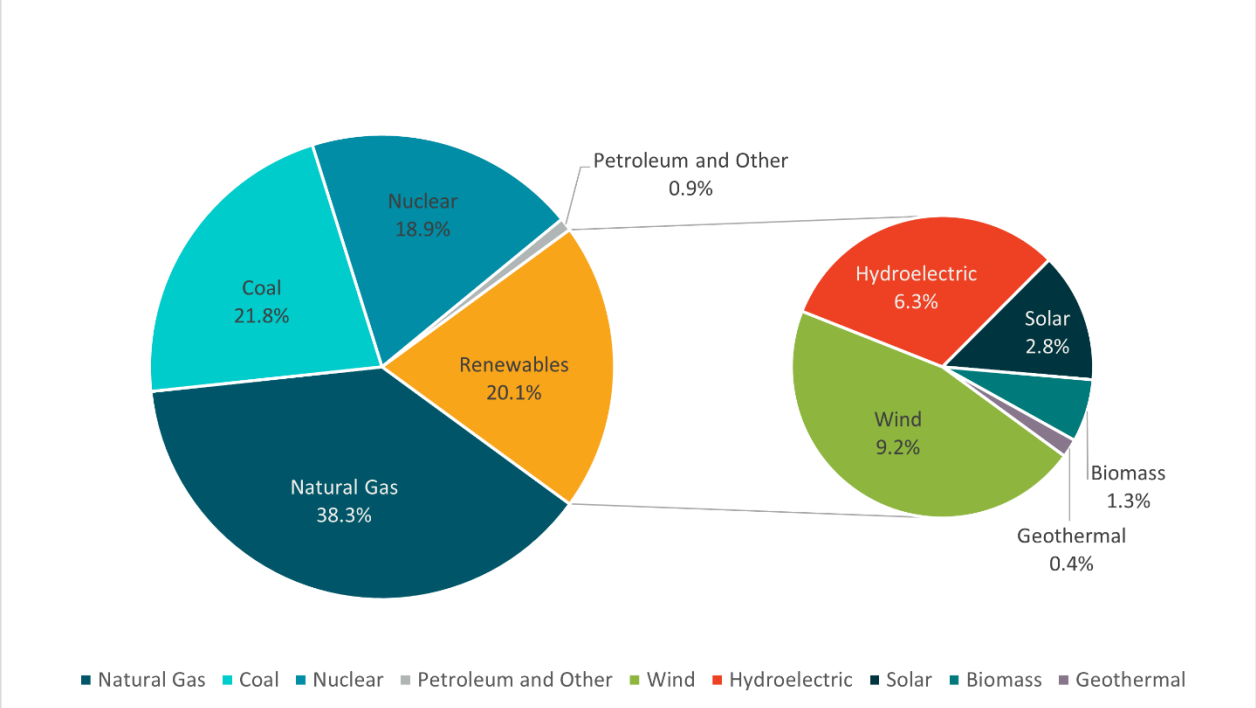

Figure 1-1. U.S. Electricity Generation by Major Energy Source for 2021. *Generation in billion-kilowatt hours for 2021: Coal: 899, Natural Gas: 1,575, Nuclear: 778, Petroleum and Other: 37, Hydroelectric: 260, Biomass: 55, Geothermal: 16, Wind: 380, Solar: 115. Data source: U.S. Energy Information Administration,* Monthly Energy Review, *Table 7.2a, January 2022 and* Electric Power Monthly, *February 2022, preliminary data for 2021.*

[1] U.S. Energy Information Administration, *Hydropower Explained,* https://www.eia.gov/energyexplained/hydropower/

relieves the licensee and dam owner of these expenses. The process and timeline for removing a dam can be unclear due to project-specific site conditions and varying requirements by FERC and other regulators. This complexity and uncertainty has led to some cases where project owners have opted to stick with the known cost of operating a project at a loss instead of facing the unknown costs of decommissioning and potential dam removal. This document seeks to clarify this process where possible.

1.3. Why Dam Owners Choose to Remove Dams

While most hydropower dams continue to serve a societal purpose by generating power, many others – both publicly and privately owned – have reached the end of their useful life or operational costs exceed the revenue from generation (economically marginal). Those dams can become public safety risks, impact fish and other aquatic life, and can be costly liabilities to their owners. Many of those dams are not profitable or require expensive repairs and upgrades that push dam owners and licensees to consider removal.

Removing both powered and non-powered dams is now a common practice and a good option for dam owners or licensees who determine that the expense of ownership is too great relative to the benefits provided by their dams. According to American Rivers' data through 2022, 2,025 dams have been removed around the country, the majority of those in the last 25 years.[2] Most projects are initiated to remove uneconomical, obsolete, or unsafe structures, and are completed with the consent and partnership of dam owners.

Removing dams, particularly those that have become outdated or unsafe, can be an economical and effective solution for eliminating dam owner liability and improving river health. Removing a dam can enhance public safety, quality of life, and economic development in communities. Dam removals can also increase property values, protect people and property from flooding, and boost flowing water recreational opportunities by restoring the natural function of rivers.

CREATING JOBS:
Removing a dam is an intensive infrastructure endeavor providing construction, engineering, scientific, planning, and other jobs. Dam removal projects support 12 to 15 jobs per $1 million invested. Long stretches of free-flowing river also have the potential to provide economically valuable recreational opportunities including boating and fishing, along with associated economic stimulus from travel, lodging, food, and equipment.[3]

In many situations, removing dams can increase climate resilience of river species. Dam removals can improve water temperatures, increase dissolved oxygen, eliminate conditions conducive to the growth of algae and toxic cyanobacteria, restore native riverine habitats, and allow aquatic species to migrate upstream and downstream to different habitats necessary for their life cycles. Because many reservoirs emit methane, dam removals may reduce those emissions in the long term by returning an ecosystem to a free-flowing river that is not a source of anthropogenic methane.[4,5]

Dams are a major cause of species decline in U.S. rivers, from migratory fish like salmon, river herring, and sturgeon, to nonmigratory fish like darters, and other aquatic species such as

[2] American Rivers, *Dam Removals Continue Across the U.S. in 2022,* https://www.americanrivers.org/2023/02/dam-removals-continue-across-the-u-s-in-2022/
[3] Value of Water Campaign, *The Economic Benefits of Investing in Water Infrastructure,* https://thevalueofwater.org/media/new-analysis-finds-closing-investment-gap-water-infrastructure-would-create-13-million-jobs
[4] Environmental Protection Agency, *Research on Emissions from U.S. Reservoirs*, https://www.epa.gov/air-research/research-emissions-us-reservoirs
[5] Levasseur, A. et al. (2021). Improving the Accuracy of Electricity Carbon Footprint: Estimation of Hydroelectric Reservoir Greenhouse Gas Emissions. *Renewable & Sustainable Energy Reviews*, 136 (2021) 110433. https://doi.org/10.1016/j.rser.2020.110433

FORT HALIFAX DAM REMOVAL
SEBASTICOOK RIVER, MAINE
AMERICAN RIVERS

freshwater mussels. Removing dams is a proven approach to restoring healthy conditions for native river species, with documented results showing increases in fish and other aquatic species populations. For example, river herring populations in the Northeast, smallmouth bass in the Midwest, mussels in the Southeast, and salmon in the West have all increased in response to dam removals.[6,7]

The removal of hydropower dams can be especially beneficial as these are often constructed on the mainstem of rivers, lower in the watershed, and can completely cut off the upper reaches of the watershed from migratory species. Species moving downstream through turbines are often injured or killed, and removing these projects eliminates this threat. Their removal can also restore geomorphic functions such as sediment transport, a natural process that can improve downstream habitat, protect streambanks, and, for structures close to the mouth of the river, the deltas that provide both habitat and shoreline protection.

In addition, Tribal water, fishing, and cultural rights were not adequately considered when dams were built decades to centuries ago. Removing dams that have infringed upon those rights is a step towards equity and justice. Several dam removals have been led by or involved Tribes to restore and protect rivers and the resources they provide.[8] Native American Tribes were the first stewards of the land, and they have a rich history and relationship with rivers across the nation. Healthy, free-flowing rivers are important culturally and can help provide water and food sovereignty for Tribal Nations.

In areas where hydropower dams have been removed thus far, communities and ecosystems alike have benefited. As the case studies in Appendix C highlight, additional benefits have included the restoration of endangered species and protection of habitat, reduction in flood risk for communities, enhanced river-based recreation such as fishing and whitewater paddling, and revitalization of downtown areas with urban rivers.

1.4. The Importance of Now

The most effective time for a stakeholder to advocate for and a licensee to consider hydropower dam removal is during the relicensing process or when approaching a relicensing. Between 2023 and 2038, over 500 project licenses will expire.[9] Of these, nearly 400 are small projects with a generating capacity of less than 10 megawatt (MW) of power. The U.S. Hydropower Market Report

[6] NOAA Fisheries, *Successful Fish Passage Efforts Across the Nation,* https://www.fisheries.noaa.gov/insight/successful-fish-passage-efforts-across-nation
[7] McCombs, Erin. *Dam removal and freshwater mussels: effective restoration and prioritization through case studies.* https://scholarworks.umass.edu/fishpassage_conference/2014/June10/46
[8] Boardman Dam Hydro Project, P-2979, Boardman River, MI; Brown Bridge Dam Hydro Project, P-2978, Boardman River, MI; Condit Hydroelectric Project, P-2342, White Salmon River, WA; Dillsboro Hydroelectric Project, P-2602, Tuckasegee River, NC; Elwha Hydroelectric Project, P-2683, Elwha River, WA; Childs-Irving Hydroelectric Project, P-2069, Fossil Creek, AZ; Glines Canyon Hydroelectric Project, P-588, Elwha River, WA; Great Works Hydroelectric Project, P-2312, Penobscot River, ME; Hogansburg Hydroelectric Project, P-7518, Saint Regis River, NY; Milltown Project, P-2543, Clark Fork River, MT; Sabin Dam Hydro Project, P-2980, Boardman River, MI; Sullivan Creek Hydroelectric Project, P-2225, Sullivan Creek, WA; Veazie Hydroelectric Project, P-2403, Penobscot River, ME.
[9] FERC, *Expected Relicense Projects FY 2022 – FY 2036*, available at https://ferc.gov/licensing

found that small projects have significantly greater relative operations and maintenance costs than larger projects – the cost per kilowatt hour for a project of 10 MW or less is six times higher than a plant of 100-500 MW.[10] Licensees and dam owners are aware of the economics of their projects. A 2020 survey of hydropower licensees found that 30% of dam owners are considering decommissioning and removal instead of relicensing, listing economics as a primary reason.[11] This wave of relicensing is an unprecedented opportunity to engage with licensees, support their decision-making, and advocate for river restoration through the removal of obsolete and uneconomical hydropower dams.

MIDDLE FORK NOOKSACK DAM REMOVAL
MIDDLE FORK NOOKSACK RIVER, WASHINGTON
BRETT BAUNTON

[10] DOE Water Power Technologies Office, *U.S. Hydropower Market Report 2021,* https://www.energy.gov/sites/prod/files/2021/01/f82/us-hydropower-market-report-full-2021.pdf
[11] Kleinschmidt, *Ear to the River*, https://info.kleinschmidtgroup.com/eartotheriver-results

2. DAM REMOVAL DECISION MAKING

For any dam removal, the dam owner must give consent to remove the dam.

There are several reasons for a dam owner or licensee to decide to remove a hydropower dam. Coming to this decision is often more difficult than the actual dam removal. This section covers the dam owner decision-making processes. The dam owner and licensee may be separate entities or the same, and both must agree on removing a dam. In this section of the guide, they are used interchangeably.

Figure 2-1 Decision-Making Drivers of License Surrender (Inner Circle) and Dam Removal (Outer Circle). *To navigate this sunburst chart, start at the inner circle (drivers of license surrender) then move to the outer circle to see the drivers for dam removal within each license surrender driver. Projects listed N/A had only a part of the project (1-2 dams) removed without having a full license surrender. The count is the number of dams that fall into categories of the outer circles. Forty-six FERC-regulated hydropower dams have been removed and are represented in this figure.*

Figure 2-1 shows the decision-making drivers for hydropower license surrender and dam removal. The drivers shown derive from research into previous hydropower dam removals and interviews with individuals that were involved in the process. The reasons, or drivers, given for surrendering a license are isolated from the reasons for removing the dam. At times they are the same, at times they are different, and overall, they are relatively fluid assignments.

Most hydropower dam removal projects take years of collaboration and patience to navigate decision-making, project planning, site analysis, project design, stakeholder engagement, aligning funding resources, and an often-lengthy regulatory process. For further information on designing and managing the dam removal itself, American Rivers has an abundance of resources available online.[12] A good guide to start with is noted in Section 1.1.: *Removing Small Dams: A Basic Guide for Project Managers.*[13]

2.1. Dam Removal Elements and Process

In addition to licensee consent, active hydropower licensees need approval from FERC to remove a project in part or in full. In the case of removing the entire project, the license or exemption needs to be surrendered. If only part of the project is removed, such as one dam is removed from a project that has multiple dams, the license will need to be amended to reflect the changes. Figure 2-2 represents the overview of the elements and process for hydropower dam removal.

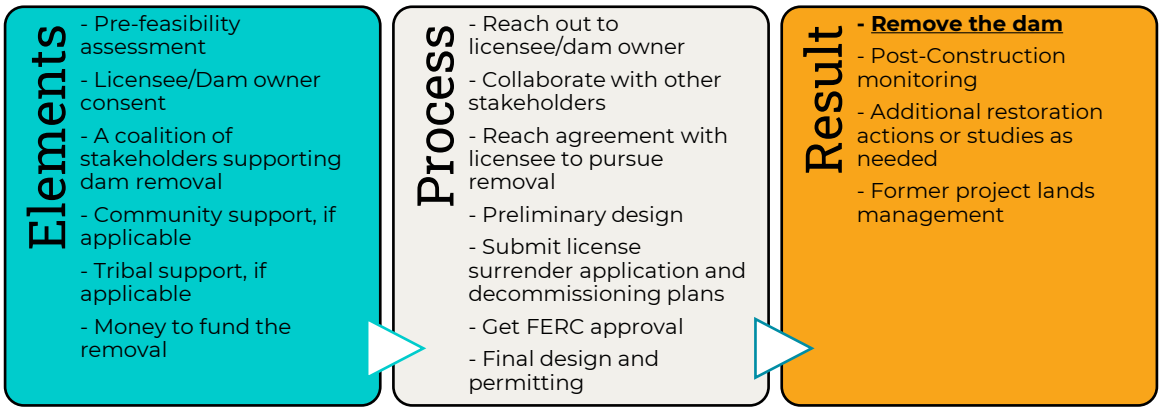

Figure 2-2 Hydropower Dam Removal Elements and Processes

For stakeholders interested in dam removal, it is important to assess whether dam removal is an option that the dam owner or licensee is willing to consider. In the pre-feasibility assessment, learn as much as possible about the dam(s) and the project, including the history and current operations. If the dam serves purposes in addition to hydropower, these may need to be replaced when the dam is removed. By identifying potential issues and challenges early on, stakeholders can be better prepared to engage with dam owners and address the complexity of issues that are likely to arise throughout the process.

Obtaining licensee and dam owner consent is by far the most critical step in removing a dam. Many of the following examples and Appendix C case studies focus on how licensees came to the decision to remove their dams. Support for dam removal from stakeholders and the community can help the licensee through this process.

The following decision-making paths are divided into drivers and approaches (Figures 2-3 and 2-4). The drivers are the reasons that the licensee seeks dam removal, and the approaches are the

[12] American Rivers, *River Restoration Training Resources*, https://www.americanrivers.org/river-restoration-training-resources/
[13] American Rivers, *Removing Small Dams: A Basic Guide for Project Managers*, https://www.americanrivers.org/wp-content/uploads/2016/05/NatlDamProjectManagerGuide_06112015.pdf

primary points at which stakeholders or Tribes begin to work with the licensee. These categories often overlap and are not exhaustive of all potential dam removal mechanisms, but they represent the vast majority of hydropower projects removed thus far.

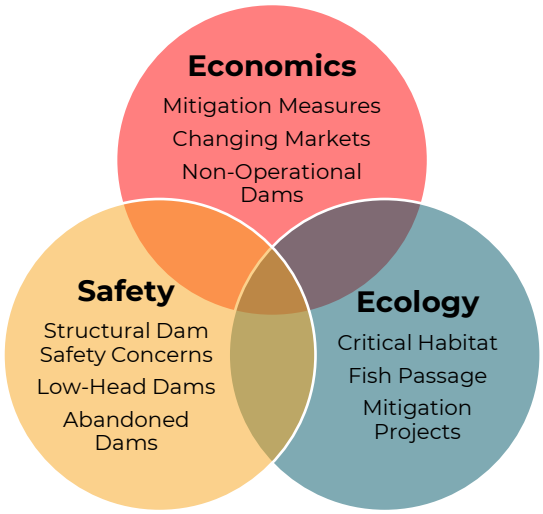

Figure 2-3 Drivers of Hydropower Dam Removal

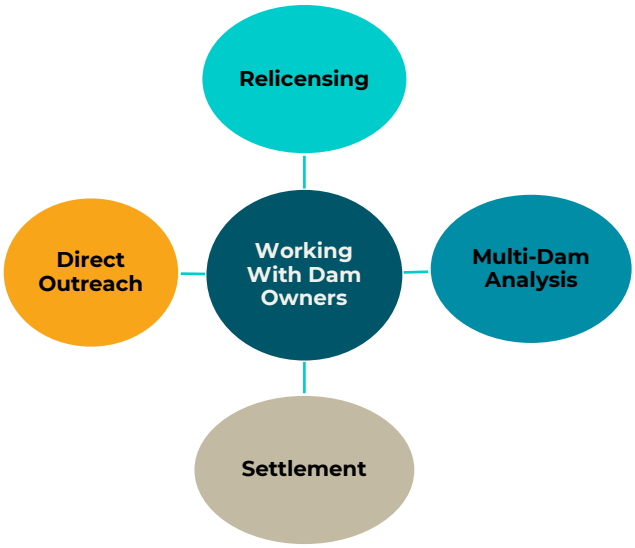

Figure 2-4 Approaches to Working With Dam Owners

2.2. Dam Removal Drivers

Drivers are what compels the licensee to remove their dam and most projects have multiple drivers that overlap and strengthen the motivation for dam removal. During relicensing, necessary safety upgrades and potential conditions of the new license have contributed to many licensees deciding to surrender the license and remove their project. The three main categories of drivers are economics, safety, and ecology.

2.2.1. Economics

Economics is the primary driver of most dam removals and may act in tandem with multiple driver subcategories. Of the hydropower dams removed, twenty-four cited economics as one of the reasons for surrendering the license.[14] FERC received thirty-three license surrender applications between 2010 and 2019 that cited economics as the primary reason for surrendering their projects.[15] The Department of Energy Hydropower Market Report is a good reference to use when considering project economics.[16]

2.2.1.1. Mitigation Measures

Hydroelectric projects must take steps to mitigate for direct unavoidable environmental impacts due to continued operation throughout the life of the project. When the costs of mitigation measures outweigh the economic benefits of operating the hydropower project, these can become economic drivers of dam removals. During relicensing, additional mitigation measures may be required to obtain a new license. These may include fish passage, environmental flow management, water quality management, sediment management, temperature conditioning,

[14] See Appendix A.
[15] DOE Water Power Technologies Office, *U.S. Hydropower Market Report 2021,* https://www.energy.gov/sites/prod/files/2021/01/f82/us-hydropower-market-report-full-2021.pdf
[16] Ibid.

habitat improvement, recreation, or other site-specific requirements. Stakeholders may work with the licensee, FERC, and federal agencies to ensure that project impacts are appropriately mitigated. Comments to the FERC docket and resource studies help to document the sustained impacts and required mitigation (Section 5.4. The FERC Docket). Measures to improve dam safety are discussed in Section 2.2.2. Dam Safety and measures to address fish passage are discussed in Section 2.2.3. Ecology.

Because hydropower dams often alter natural flow patterns, environmental flow management is another mitigation consideration for hydropower operations. Environmental flows refer to the magnitude, frequency, duration, timing, and rate of change of the flows on the river.[17] Peaking projects, which primarily generate when electricity prices are highest, and that do not have ecologically appropriate rates of change (ramping), are highly disturbing to the environment with surges or drops in water levels over short periods of time. The environmental impacts and safety concerns of peaking practices are more commonly addressed now than in the past. Hydropower projects that divert water out of the river using bypass channels are also increasingly required to have minimum flows for the riverbed downstream of the project, which can lead to less production capacity in times of low flows. Environmental flow mitigation measures may include run-of-river operations, minimum instream flows, periodic sustained higher flows to restore geomorphic processes or provide important biological cues, recreational flows, aesthetic flows, and reduced ramping where water levels are allowed to be altered to prevent species from getting stranded or people from drowning.

Water quality is another potential impact of project operations. Hydropower reservoirs act as heat sinks and commonly have higher water temperatures and reduced oxygen, resulting in conditions for methane production (methanogenesis). Temperature and oxygen issues negatively impact native aquatic life in the reservoir and downstream reaches, depending on how water is released from the reservoir.[18,19] Large reservoirs also create thermally-stratified layers of water with cold temperatures at the bottom of the reservoir and higher temperatures near the surface. Depending on how the project is operating, unnaturally cold or warm water is released below the dam, again impacting native species that depend on predictably variable temperatures throughout the year. Changes in project operation to improve water quality can include altering the location that water is released from the reservoir or installing upgrades that alleviate downstream water quality impacts to temperature or dissolved oxygen. These changes in operation can be costly in terms of capital investment or lost capital due to spilling water that could otherwise be used to generate power.

One dam removal has explicitly cited water quality and environmental flows as part of the reason for removal. The Wildcat Dam in California, part of the Battle Creek Hydroelectric Project, was removed as part of a larger effort to improve environmental flows, water quality, and fish passage.[20] This project is set to remove an additional four dams for these purposes over the next several years.

2.2.1.2. Changing Markets

Changing energy markets have resulted in hydropower decreasing in value, particularly with regionalization of the energy grid, and many projects are struggling to remain profitable. The Hydropower Market Report demonstrates that while the details vary by region across the nation,

[17] Poff, N. L., Allan, et al. (1997). The Natural Flow Regime. *BioScience, 47*(11), 769-784, https://doi.org/10.2307/1313099
[18] NOAA Fisheries, *How Dams Affect Water and Habitat on the West Coast,* https://www.fisheries.noaa.gov/west-coast/endangered-species-conservation/how-dams-affect-water-and-habitat-west-coast
[19] Levasseur, A. et al. (2021). Improving the Accuracy of Electricity Carbon Footprint: Estimation of Hydroelectric Reservoir Greenhouse Gas Emissions. *Renewable & Sustainable Energy Reviews*, 136 (2021) 110433. https://doi.org/10.1016/j.rser.2020.110433
[20] Battle Creek Hydroelectric Project, P-1121, Battle Creek, CA.

STRONACH DAM,
PINE RIVER, MICHIGAN
AMERICAN RIVERS

the overall trend is that hydropower prices decreased from 2006 to 2018.[21] This is particularly true for small projects that provide baseload power and have limited capacity to regulate production in response to rapidly changing demand needs on the grid. The report found the following operations and maintenance costs based on capacity: $6/kW for very large plants (>500 MW), $20/kW for large plants (100–500 MW), $42/kW for medium plants (10–100 MW), and $122/ kW for small plants (<10 MW).[22] These factors contribute to the economic drivers to remove smaller projects.

An economic analysis will assist in determining where a project stands within the changing market and if dam removal is a reasonable option. The licensee may complete this analysis independently, and stakeholders can request information from the licensee or stakeholders can complete their own analysis. Records of project revenue along with operation and maintenance costs may be publicly available, or the licensee may be willing to share that information. Project generation history is usually available through the FERC eLibrary, and actual generation can be compared to authorized capacity to establish a baseline for project operations and if there is capacity to generate additional power.[23] Several factors limit hydropower generation including fluctuating water availability, especially in drought-stricken areas; sediment build-up in the reservoir; the functionality of the dam, including the need for costly dam safety upgrades for those projects with aging infrastructure; turbine/generator efficiency; and market demand on power. Changing energy markets coupled with expensive relicensing requirements and often limited generation capacity or flexibility can render a project uneconomical and lead the licensee to seek license surrender and dam removal.

Project owners of smaller, economically marginal projects may propose license surrender and decommissioning, then remove the dam after the license has been surrendered. This alleviates unknown costs associated with dam removal plans getting approved by FERC, which larger companies may have the capacity to finance. The Ward Mill Dam in North Carolina is an example of this two-tiered process (Section 2.2.3.1. Critical Habitat).[24]

In New Jersey, The Nature Conservancy (TNC) approached the licensee of Columbia Lake Dam on Paulins Kill and offered to assist with an economic analysis of the project.[25] TNC's analysis showed that the expenses associated with relicensing requirements would cause the project to not see a return on the investment in the foreseeable future, and the licensee decided to surrender their license. TNC worked with American Rivers and the State of New Jersey to remove the dam after the license was surrendered.

In Maine, one of the most well-known hydropower dam removals, the Edwards Dam on the Kennebec River, had a strong economic driver for removal.[26] The project had a power agreement to sell at above market prices and that agreement expired around the time that the project was under consideration for relicensing. If the licensee had to sell at the market rate, the project would have operated at a significant loss. This driver was in addition to ecological drivers that also motivated dam removal.

[21] DOE Water Power Technologies Office, *U.S. Hydropower Market Report 2021,* https://www.energy.gov/sites/prod/files/2021/01/f82/us-hydropower-market-report-full-2021.pdf
[22] Ibid.
[23] FERC, *eLibrary*, https://elibrary.ferc.gov/eLibrary/search
[24] Ward Mill Hydroelectric Project, P-9842, Watauga River, NC.
[25] Columbia Dam Hydroelectric Project, P-8396, Paulins Kill, NJ.
[26] Edwards Dam Hydroelectric Project, P-2389, Kennebec River, ME.

2.2.1.3. Non-Operational Dams

Regulated hydropower projects need to remain operational to maintain licensure.[27] Despite this requirement, sixteen hydropower projects were non-operational prior to their removal. The licensee of a project that is not generating power or generating minimal power may decide to pursue removal, or stakeholders may advocate for removal as an alternative to maintaining the structure. If the licensee has multiple power projects, examining their energy portfolio may help strengthen the reasoning for removing non-operational projects, especially if that energy source can be replaced by other sources within their portfolio. Public information on project generation may be available through the FERC eLibrary or the website of the licensee.[28]

Stronach Dam on the Pine River in Michigan was a non-operational hydropower dam owned by Consumers Energy and was part of the license for Consumers' Tippy Project on the Manistee River.[29] Under the terms of a 1992 Settlement Agreement for relicensing 11 hydropower projects on the Au Sable, Manistee, and Muskegon Rivers, Consumers agreed to remove Stronach Dam as part of the mitigation for unavoidable impacts from the continued operation of the other projects.[30] Removal was completed in 2003.

On the Chattahoochee River, the City Mills Dam and Eagle and Phenix Dam stopped generating power in 1992 and 2002, respectively.[31,32] The licenses were still active and were voluntarily surrendered in 2010 and the dams were removed within three years for economic development and environmental benefits.[33]

The Hogansburg Dam on the Saint Regis River in upstate New York is an example of a dam that was operational but had low functional capacity.[34] The reservoir was filled with sediment and allowed for minimal generation, and low flows prohibited year-round generation. The project was losing $100,000 each year and would have required significant investment to become fully operational.[35] When its operational limitations became apparent, the St. Regis Mohawk Tribe intervened to advocate for river restoration through dam removal. They became the co-licensee, and the project became the first removal of a federally regulated dam by a Native American Tribe.[36]

2.2.2. Dam Safety

Dam safety is a concern for all dam owners and downstream communities. Nearly half of all FERC-regulated hydropower dams have a high hazard potential classification, meaning that failure could result in loss of life. The average age of a hydropower dam is 95 years old, the oldest being 223

[27] 18 C.F.R. § 6.4.
[28] FERC, *eLibrary*, https://elibrary.ferc.gov/eLibrary/search
[29] Tippy Hydroelectric Project, P-2580, Pine River, MI.
[30] *Consumers Power Company*, 68 FERC ¶ 61,032 (1994). Order on Offer of Settlement.
[31] City Mills Hydroelectric Project, P-8519, Chattahoochee River, GA.
[32] Eagle and Phenix Mills Hydroelectric Project, P-2655, Chattahoochee River, GA.
[33] *Eagle and Phenix Hydro Company, Inc., Uptown Columbus, Inc.* 135 FERC ¶ 62,201 (2011). Order Accepting Surrender of License and Exemption.
[34] Hogansburg Hydroelectric Project, P-7518, Saint Regis River, NY.
[35] *Erie Boulevard Hydropower, L.P.; Saint Regis Mohawk Tribe*, 155 FERC ¶ 62,243 (2016). Order Accepting Surrender of License and Dismissing Application for Subsequent License.
[36] David, Tony. *Hogansburg Dam Removal Restores More Than Fish Passage*. https://www.nywea.org/Clearwater%20Article%20Documents/HogansburgDamSp19.pdf

HARVELL DAM
APPOMATTOX RIVER, VIRGINIA
AMERICAN RIVERS

years old. [37,38,39] Removing a dam provides a permanent dam safety solution and is often more economical than necessary repairs or upgrades.[40]

2.2.2.1. Structural Dam Safety Concerns

Dam owners/operators must maintain structural integrity and project functionality to ensure the project can operate safely. Structural components and hydro-mechanical equipment degrade over time and will eventually require costly rehabilitation or replacement. The design life of most dams is 50 - 100 years, and most concrete dams will start to show signs of aging by 50 years.[41] Nine removed hydropower dams cited safety as the primary or supporting driver for removal.[42]

FERC requires regular safety inspections including during the relicensing process.[43,44] It may be pertinent for stakeholders to review that these inspections are being done in the manner outlined by FERC guidance. Project upgrades for safety may be mandated to protect both the integrity of the dam and downstream communities.

With increasing precipitation and modern safety standards, increasing spillway capacity is a common upgrade need that can be more costly than license surrender and removal. Several licensees cited insufficient spillway capacity as a contributing factor to safety concerns and the decision to remove the project. Of the dams removed for safety, all were due to compromised structural integrity and were removed before any serious damage occurred. There have been several high-profile hydropower dam failures in recent years including the Oroville Dam in California, the Spencer Dam in Nebraska, and the Edenville Dam in Michigan.[45,46,47]

The Mussers Dam on Middle Creek in Pennsylvania was deemed unstable and unsafe after a safety inspection.[48] FERC ordered the dam to be replaced and when the licensee recognized that was uneconomical, they moved forward with license surrender and removal.[49]

A unique safety case is the Milltown Dam on the Clark Fork River in Montana.[50] The sediment behind the dam was contaminated from mine runoff to the point where the groundwater was

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[37] High Hazard Potential is a classification standard for any dam whose failure or mis-operation will cause loss of human life and significant property destruction. FEMA, *Rehabilitation of High Hazard Potential Dam (HHPD) Grant Program,* https://www.fema.gov/emergency-managers/risk-management/dam-safety/rehabilitation-high-hazard-potential-dams
[38] *See* 18 C.F.R. § 12.3(b)(13) for all hazard potential definitions.
[39] U.S. Army Corps of Engineers, *National Inventory of Dams,* https://nid.usace.army.mil/#/, Data filter: Federal Agency Involvement Regulatory: Federal Energy Regulatory Commission.
[40] Lawson, Megan. (2016). Dam Removal: Case Studies on the Fiscal, Economic, Social, and Environmental Benefits of Dam Removal. *Headwaters Economics.* https://headwaterseconomics.org/wp-content/uploads/Report-Dam-Removal-Case-Studies.pdf
[41] Perera, D., Smakhtin, et al. (2021). Ageing Water Storage Infrastructure: An Emerging Global Risk. *UNU-INWEH Report Series*, (11). https://doi.org/10.53328/OSYL1281.
[42] See Appendix A.
[43] FERC, *Engineering Guidelines for the Evaluation of Hydropower Projects*, https://www.ferc.gov/industries-data/hydropower/dam-safety-and-inspections/eng-guidelines
[44] *See* 18 C.F.R. § 12.40 (c). A comprehensive assessment must be completed every ten years and a periodic inspection must be completed within five years of the previous comprehensive assessment.
[45] Alvi, Ifan, *Case Study: Oroville Dam (California, 2017*), https://damfailures.org/case-study/oroville-dam-california-2017/
[46] France, John, et al. *Independent Forensic Team – Final Report: Investigation of Failures of Edenville and Sanford Dams.* https://damsafety.org/MI-Final-Report
[47] Baker, Mark, *Case Study: Spencer Dam (Nebraska, 2019)*, https://damfailures.org/case-study/spencer-dam-nebraska-2019/
[48] Mussers Dam Project, P-3706, Middle Creek, PA.
[49] *American Hydro Power Company,* 60 FERC ¶ 61,237 (1992). Order Approving Breach of Dam and Decommissioning of Project Works.
[50] Milltown Project, P-2543, Clark Fork River, MT.

impacted and drinking water became unsafe. The area became a Superfund site, and the dam was ultimately removed by the Environmental Protection Agency (EPA).[51] In addition to the water quality issue, multiple large ice dams that broke free upriver and hit the dam had shifted the dam over the years and contributed to the compromised dam structure.

2.2.2.2. Low-Head Dams

Low-head dams are frequently a safety hazard for people recreating near the dam. Low-head dams are structures that span the width of the river from bank to bank and have water continuously flowing over the crest of the dam.[52] They are typically smaller dams that are 25 feet high or less.[53] The water flowing over the dam creates a recirculating hydraulic wave at the base of the dam that can trap and drown anyone caught in it, regardless of craft or flotation device. There have been over 1,400 recorded deaths across the country from these types of dams.[54] Many hydropower projects include a low-head dam.

In North Carolina, the Milburnie Dam was a small 15-foot-high dam that had a generation capacity of less than 1MW.[55] The recirculating water at the base of this low-head dam killed at least fifteen people.[56] Removing this project permanently removed a public hazard.

2.2.2.3. Abandoned Dams

Abandoned dams become safety hazards because they lack a responsible party. A FERC-regulated project may become abandoned if a) the licensee applies to abandon their project, or b) FERC issues an order of implied surrender due to prolonged inaction from the licensee.[57] In the first scenario, stakeholders may intervene to prevent licensees from abandoning their dams.[58] Stakeholders may work with state and federal agencies to demonstrate the need for dam removal instead of dam abandonment.[59] Plans for decommissioning and removal need to be approved by FERC while the project is under their jurisdiction and FERC can hold the licensee accountable for following through with these plans.

Once outside of FERC jurisdiction, an abandoned dam falls into the jurisdiction of state dam safety offices that often lack the capacity to take on additional work.[60] These dams can fall to the wayside and pose a threat to public safety. If a responsible party is identified who can approve of a dam removal, these dams can be removed outside of the FERC process. Additionally, in the event a licensee abandons a dam on Federal lands, the landowner becomes responsible for removing project facilities, which is an added cost for taxpayers.

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[51] HRC, *Undoing the Harm*, Restore: A Special Publication by the Hydropower Reform Coalition, https://hydroreform.org/wp-content/uploads/2020/10/RESTORE.pdf
[52] American Society of Civil Engineers, *National Inventory of Low Head Dams,* https://www.asce.org/communities/institutes-and-technical-groups/environmental-and-water-resources-institute/national-inventory-of-low-head-dams
[53] *See* Water Resources Development Act of 2022, Section 8122, Pub. L. No. 117-263, 136 Stat. 2395 (2022).
[54] American Society of Civil Engineers, *National Inventory of Low Head Dams,* https://www.asce.org/communities/institutes-and-technical-groups/environmental-and-water-resources-institute/national-inventory-of-low-head-dams
[55] Milburnie Hydroelectric Project, P-7910, Neuse River, NC.
[56] Restoration Systems, *Milburnie Dam Media Kit,* https://milburniedam.com/wp-content/uploads/2017/10/MilburnieDam-MediaKit-Final-2.pdf
[57] FERC, *Hydropower Primer: A Handbook of Hydropower Basics*, https://www.ferc.gov/sites/default/files/2020-04/HydropowerPrimer.pdf
[58] FERC, *How to Intervene,* https://www.ferc.gov/how-intervene
[59] American Rivers, *Ecology of Dam Removal,* https://www.americanrivers.org/resource/ecology-dam-removal/
[60] American Society of Civil Engineers, *ASCE's Infrastructure Report Card – Dam Infrastructure,* https://infrastructurereportcard.org/wp-content/uploads/2020/12/Dams-2021.pdf

CONDIT DAM REMOVAL
WHITE SALMON RIVER, WASHINGTON
MELISSA SHAVLIK

In Washington, the Mill Pond Dam on Sullivan Creek was a project that had not operated in decades.[61] The owner sought to abandon the project and leave the dam in place and FERC initially agreed. On rehearing, however, FERC ruled that the owner was responsible for removal and an agreement was reached where another licensee in the basin financed removal of the project as mitigation for another project.[62,63]

In Virginia, the licensee of the Harvell Dam on the Appomattox River repeatedly violated their license and FERC moved forward with implied surrender, resulting in the abandonment of the project.[64,65] The project was removed twelve years after generation ceased due to complex ownership issues and getting approval and funds for removal.

In Wisconsin, the Grimh Dam on the Couderay River was an abandoned hydropower project that was caught in a long legal battle over removal.[66] The licensing process required updates that rendered the project uneconomical. The licensee had tried to find a buyer to take over the project, but the economics kept it from being sold. When the licensee moved forward with a formal abandonment, FERC approved it without requiring removal, and the dam fell under the jurisdiction of the Wisconsin Department of Natural Resources (WDNR). WDNR wanted to remove the project but faced local opposition for aesthetic and recreational reasons and started a legal battle that postponed removal for an extra five years.[67]

2.2.3. Ecology

There are multiple ecology-based drivers for removal. Based on research conducted on the removed projects, twenty-eight projects cited ecology as one of the reasons for dam removal.[68]

While a need for installing improved fish passage is a common and expensive ecological factor in dam removal decisions, several more factors can contribute to the decision. These may include needs for habitat restoration, habitat connectivity for non-migratory aquatic species, flow restoration, improved water quality, and climate resilience. An examination of these factors usually requires a strong coalition of stakeholders working together with the licensee.

2.2.3.1. Fish Passage

Fish passage requirements can have a strong influence on the fate of dams. These requirements are an important part of hydropower balancing public needs with project operations. Effective fish passage can cost millions, which, combined with other project costs, can make a project uneconomical. Fish passage requirements have contributed to nine dam removals in combination

[61] Sullivan Creek Hydroelectric Project, P-2225, Sullivan Creek, WA.
[62] HRC, *Mill Pond Dam P-2225*, https://hydroreform.org/hydro-project/mill-pond-dam/
[63] *Public Utility District No. 1 of Pend Oreille County, Washington*, 122 FERC ¶ 61,249 (2008). Order Granting Rehearing in Part, Denying Rehearing in Part, Affirming that Existing License is Valid, and Finding that Licensing is Required.
[64] Harvell Hydroelectric Project, P-8657, Appomattox River, VA.
[65] *Virginia Hydrogeneration and Historical Society, L.C.,* 142 FERC ¶ 62,212 (2013). Order Terminating License by Implied Surrender.
[66] Grimh Dam, UL-92-5/P-11600, Couderay River, WI.
[67] Ayres, *Grimh Dam Removal,* https://www.ayresassociates.com/project/grimh-dam-removal/
[68] See Appendix A.

with related economic issues. Several more projects have been removed to improve fish passage where economics was not cited as a contributing factor.

Fish passage effectiveness must be evaluated during every relicensing. If fish passage is not installed or is not functioning, stakeholders can request that fish passage is a requirement of relicensing by submitting comments to the docket (Section 5.5. Filing Comments on Licensing Proceedings). Supporting evidence on the need for fish passage such as specific species impacted, documentation of historic runs of these species, how habitat loss caused by the project has limited viability of the species, and river miles reconnected through dam removal will strengthen the comments. Documentation of how a healthy fishery on a free-flowing river can support the local economy can be useful.

The U.S. Fish and Wildlife Service (FWS) and the National Oceanic and Atmospheric Administration's National Marine Fisheries Services (NOAA Fisheries) can prescribe fish passage requirements for inclusion in a FERC license pursuant to Section 18 of the Federal Power Act (FPA).[69] These prescriptions usually require support and information from Tribes and stakeholders, who then will need to hold FERC accountable to enforce them. Once FERC incorporates these requirements in the new license conditions, the licensee may choose dam removal over the fish passage requirements. The licensees of the Bull Run Project in Oregon and the Condit Dam in Washington both chose dam removal instead of installing required fish passage. [70,71]

Fish passage improvements at downstream barriers, whether through dam removal or fish passage installation, can change the requirements for upstream projects. The Saccarappa Dam on the Presumpscot River in Maine was removed after a downstream dam installed fish passage and anadromous species were able to migrate to the base of the project.[72]

As of the publication of this document, fish passage is typically only considered for migratory species and not for the full assemblage of aquatic species. However, most aquatic species need to be able to move up and downstream for different life stages, seasonal habitats, and refuge from droughts and floods. Dam removal is the only method that can achieve passage for all species. In the future, mollusks, amphibians, and other important aquatic biota may be more strongly considered in dam impact assessments as populations of aquatic species continue to decline, leading to additional dam removals.

2.2.3.2. Mitigation Projects

Dam removal can be used as mitigation for the environmental impacts of development or other projects. When a development project requires a permit from the U.S. Army Corps of Engineers (USACE) to impact streams and wetlands, they must mitigate for unavoidable impacts by improving or restoring streams and wetlands elsewhere.[73] Some states may also use mitigation as a tool in their regulatory processes. Mitigation dam removals can take three forms: direct mitigation by a developer or owner; using dam removal as a mitigation bank; or a dam removal can be funded by in-lieu fee mitigation funds (Section 3.3. In-Lieu Fee Mitigation Funds).

Mitigation banking is achieved by a mitigation banker completing a large restoration project to generate credits that can be sold to developers.[74] Mitigation bankers work with USACE to ensure that the project meets a set of restoration requirements.[75] USACE typically determines that the

[69] 16 U.S.C. § 811.
[70] Bull Run Hydroelectric Project, P-477, Sandy River, OR. Marmot Dam and Little Sandy River Dam.
[71] Condit Hydroelectric Project, P-2342, White Salmon River, OR.
[72] Saccarappa Project, P-2897, Presumpscot River, ME.
[73] *See* 33 C.F.R. § 332.3.
[74] TNC, *Environmental Markets and Stream Barrier Removal,* https://www.nature.org/content/dam/tnc/nature/en/documents/2017_Stream_Barrier_Removal_and_Mitigation_Report.pdf
[75] EPA, *Mitigation Banks under CWA Section 404,* https://www.epa.gov/cwa-404/mitigation-banks-under-cwa-section-404

mitigation bank needs to be an ecologically appropriate distance from where the credits are sold, often within the same sub watershed. Two hydropower dams have been removed in North Carolina as mitigation banks, Carbonton Dam and Milburnie Dam.[76,77] In both cases the projects were no longer generating electricity and the licensees or dam owners were approached by a mitigation banking company that paid for the removal of the dams. Since then, the North Carolina guidance was rescinded, and the state has yet to come to another agreement on crediting dam removals for mitigation.[78]

PURPLE WARTYBACK FRESHWATER MUSSEL SHELL
PAINT ROCK RIVER, ALABAMA
ERIN SINGER MCCOMBS

Several dams have been removed to mitigate the impacts of other hydropower projects. Each was a unique process and included support from stakeholders who helped identify dam removal as a solution. In Washington, the licensee of the Boundary Project was required to mitigate for their impacts when the project came up for relicensing.[79] Around the same time, the licensee of the nearby Mill Pond Dam was directed to come up with a plan for dam removal, but could not afford the cost of removal.[80] A stakeholder who had been monitoring both projects connected the two licensees and proposed that the licensee of the Boundary Project remove the Mill Pond Dam as mitigation. Both licensees agreed, and Mill Pond Dam was removed shortly after. In North Carolina, a licensee with several projects up for relicensing removed one of their projects, the Dillsboro Dam on the Tuckasegee River, as mitigation for relicensing six other projects, with two settlements to cover this and additional environmental provisions.[81] In Idaho, a licensee removed the Cove Dam on the Bear River as mitigation for relicensing other projects on the river, an action that provided benefits for native cutthroat trout while also enhancing power production at the hydropower project immediately upstream.[82,83,84]

2.2.3.3. Critical Habitat

Critical habitat is determined by the presence of threatened or endangered species or the potential use of the area by these species.[85] FWS and NOAA Fisheries oversee the designation of critical habitat and can help to determine if the project area qualifies. In addition, some habitat may not receive a federal *critical* designation, but is important for other designations. For example, the river may support at-risk species, state-level threatened or endangered species, or be a unique habitat in need of protection. The effort and expense of protecting and restoring important habitat has led licensees to choose decommissioning and dam removal.

In Arizona, the utility owning the Childs-Irving Hydroelectric Project in the Verde River Basin was pursuing relicensing when the intervention of community and environmental groups advocating for the removal of the two dams swayed the utility to consider removal instead of relicensing.[86]

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[76] Carbonton Hydroelectric Project, P-3155, Deep River, NC.
[77] Milburnie Hydroelectric Project, P-7910, Neuse River, NC.
[78] TNC, *Environmental Markets and Stream Barrier Removal,* https://www.nature.org/content/dam/tnc/nature/en/documents/2017_Stream_Barrier_Removal_and_Mitigation_Report.pdf
[79] Boundary Hydroelectric Project, P-2144, Pend Oreille River, WA.
[80] Sullivan Creek Hydroelectric Project, P-2225, Sullivan Creek, WA.
[81] Dillsboro Hydroelectric Project, P-2602, Tuckasegee River, NC.
[82] Grace/Cove Hydroelectric Project, P-2401, Bear River, ID.
[83] Bear River Hydroelectric Project, P-20, Bear River, ID.
[84] Idaho Rivers United, *Bear River dam and hydropower project slated for removal*, https://hydroreform.org/wp-content/uploads/2020/12/Cove-Press-Release.pdf
[85] NOAA Fisheries, *Critical Habitat,* https://www.fisheries.noaa.gov/national/endangered-species-conservation/critical-habitat
[86] Childs-Irving Hydroelectric Project, P-2069, Fossil Creek, AZ.

The utility decided to decommission both projects for environmental benefit, fully removing the Fossil Creek Dam and partially removing the larger Fossil Creek Diversion Dam; the lower 14 feet of the dam was left in place to prevent invasive aquatic species from reaching the critical habitat upstream of the dam.[87]

Ward Mill Dam on the Watauga River in North Carolina was a small family-owned project that was voluntarily removed by the licensee.[88] There are several overlapping drivers and approaches for this project, but the removal was driven by the licensee's desire to restore the river and improve habitat. The project is included in this section because its removal opened up habitat for the eastern hellbender, a very large aquatic salamander of special concern.[89] Dam removal proponents approached the licensee leading up to the relicensing of the project. Despite successfully navigating the relicensing process and being offered a new license for the project, the licensee family decided they did not want to operate and maintain the dam for a full license term, and they decided to remove the dam. The dam was intentionally removed outside of FERC jurisdiction as the licensee was committed to dam removal and wanted to expedite license surrender and decommissioning by not including removal in the decommissioning plan.[90] This eliminated the environmental assessments required by FERC as part of a decommissioning plan. A shorter process was followed to permit dam removal with state and federal regulators after the license was surrendered. The licensee worked closely with non-profit organizations to secure funds, remove the dam, and restore the site. While this project is currently unique, it may be a model for the removal of small hydropower projects although it comes with risks associated with not having the regulatory oversight of FERC.

2.3. Working with Dam Owners

There are many opportunities for stakeholders and dam owners to work together to identify options for the future of hydropower dams. Dam owners may reach out to stakeholders for assistance if they are considering dam removal. While dam owners are the subject matter experts of their projects, stakeholders can bring in expertise such as navigating the FERC license surrender and decommissioning process, navigating state and federal permitting processes, applying for and managing grants for dam removal, and managing dam removal projects.

2.3.1. Direct Outreach to Licensee or Dam Owner

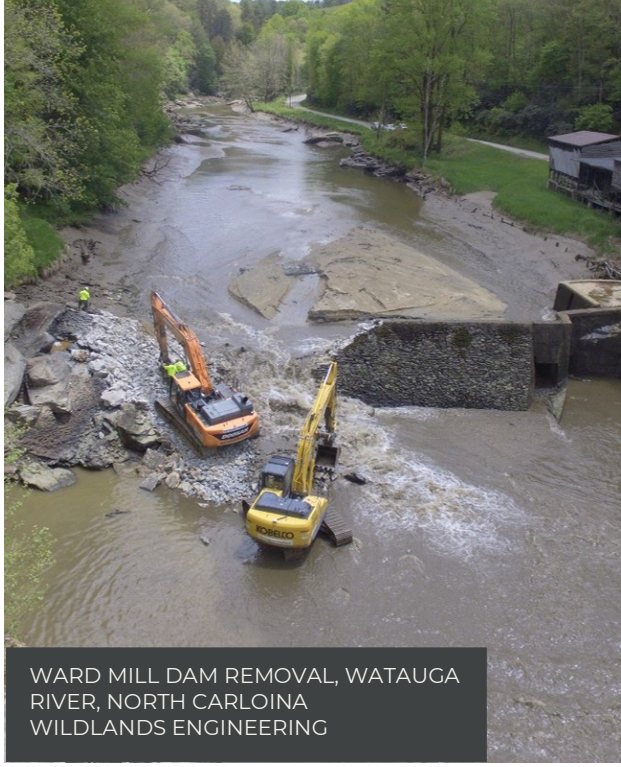
The relicensing period is not the only opportunity for stakeholders to reach out to the licensee or dam owner to discuss the concept of dam removal. This could occur if a project's license is not up for relicensing soon or is exempt and therefore never up for relicensing; the project has been identified as a priority for restoring aquatic species passage; the project has not been operational; or the project is a safety hazard to the community. The project history, role in the community and economy, and environmental impact should be researched prior to outreach. Considering the costs and benefits of removal to the community may be useful to aid in decision-making.

The Columbia Lake Dam was identified as a top priority for removal, as it was the first barrier on the Paulins Kill in New Jersey. TNC reached out directly to the licensee to do an economic analysis and discuss dam removal (also noted in Section 2.2.1.2. Changing Markets).[91] After seeing the economic analysis of the project and anticipated expenses of relicensing, the licensee voluntarily

[87] *Arizona Public Service Company,* 109 FERC ¶ 61,036 (2004). Order Approving Surrender of License and Removal of Project Works, and Dismissing Application for New License.
[88] Ward Mill Hydroelectric Project, P-9842, Watauga River, NC.
[89] U.S. Fish and Wildlife Service, *Eastern Hellbender,* https://www.fws.gov/species/eastern-hellbender-cryptobranchus-alleganiensis-alleganiensis
[90] American Rivers et al. *Borrowing the River's Power: A Tale of Dams in North Carolina's High Country.* https://storymaps.arcgis.com/stories/c33a5f837a45419eb7e2eb98dfd1d40c
[91] Columbia Dam Hydroelectric Project, P-8396, Paulins Kill, NJ.

surrendered their license, and TNC removed the dam with the assistance of American Rivers and the state.

The removal of three hydropower dams on the Boardman River in Michigan was initiated when the licensee, Traverse City Light and Power, was faced with FERC-ordered safety upgrades, the costs of which would not be recovered through power generation.[92] The licensee and dam owners, Grand Traverse County and Traverse City, then approached resource agencies, Grand Traverse Band of Ottawa and Chippewa Indians, and Michigan Hydro Relicensing Coalition for assistance in navigating the FERC license surrender and de-commissioning process. A Settlement Agreement was reached in 2006, which FERC accepted, and the three hydropower projects were removed from 2012 to 2018.[93]



WARD MILL DAM REMOVAL, WATAUGA RIVER, NORTH CARLOINA
WILDLANDS ENGINEERING

In North Carolina, when the Ward Mill project came up for relicensing, stakeholders reached out to the licensee to discuss dam removal, which the licensee ultimately decided to do.[94] The Fossil Creek Dam in Arizona was also removed after direct outreach to the licensee, including the discussion that this dam was part of an older, uneconomical project within a large energy portfolio.[95] Both of these projects are also in Section 2.2.3.1. Critical Habitat.

2.3.2. Relicensing Process

Dam removal decisions commonly result during the relicensing period. Twenty-three hydropower dam removals came about during or leading up to the relicensing process. The expenses of maintaining a project coupled with the conditions of bringing a project up to current safety and environmental standards can render a project uneconomical. The licensee may decide that surrendering the license and removing the project is the more financially feasible option.

Stakeholders may get involved early in the relicensing process to advocate that all project impacts are considered and to ensure their comments are taken under consideration by FERC.[96] Comments accompanied by supportive evidence can provide FERC with information to require stronger license conditions (Section 5.5. Filing Comments on Licensing Proceedings). Stakeholders may advocate for dam removal if the licensee cannot meet these conditions.

The FERC website provides lists of all hydropower projects currently licensed, those up for relicensing in the next 5-15 years, and those projects that have submitted a notice of intent to relicense.[97] For an overview of relicensing, see Section 5.3. Relicensing a Project, for full details on the process, see the HRC Citizen Guide for Effective Participation in Hydropower Licensing.[98]

Many of the dam removal examples from section 2.2. were completed when the project came up for relicensing or in anticipation of expenses associated with relicensing. This includes the

[92] Boardman Dam Hydro Project, P-2979, Boardman River, MI; Brown Bridge Dam Hydro Project, P-2978, Boardman River, MI; Sabin Dam Hydro Project, P-2980, Boardman River, MI.
[93] *Traverse City Light and Power,* 114 FERC ¶ 62, 274 (2006). Order Approving Conditional Surrender of License and Exemptions.
[94] Ward Mill Hydroelectric Project, P-9842, Watauga River, NC.
[95] Childs-Irving Hydroelectric Project, P-2069, Fossil Creek, AZ.
[96] FERC, *WorkshOPP on "Tips for Powerful Comments,"* https://www.youtube.com/watch?v=P12Y7FeUcJw&ab_channel=FederalEnergyRegulatoryCommission
[97] FERC, *Licensing*, https://ferc.gov/licensing
[98] HRC, *Citizen Guide for Effective Participation in Hydropower Licensing*, https://hydroreform.org/resource/citizen-guide-for-effective-participation-in-hydropower-licensing/

Columbia Lake Dam, Condit Dam, Cove Dam, Dillsboro Dam, Edwards Dam, Hogansburg Dam, Mill Pond Dam, Stronach Dam, the Bull Run project, and the Childs-Irving project.[99]

Other examples include:

Two dams from the Mokelumne River Project in California were removed as part of a settlement when the project was relicensed.[100] West Panther Creek Dam and East Panther Creek Dam were removed, and the overall project capacity was increased.[101]

When the licensee of the Edwards Dam in Maine filed to relicense the project, river restoration advocates produced extensive documentation on the impacts of the dam and the economic importance of a restored river.[102,103] This information contributed to FERC's decision to deny a new license and order the dam to be removed instead.[104]

2.3.3. Assessing Multiple Dams in a Watershed

An analysis of the impacts and economics of multiple dams within a watershed can help identify candidates to prioritize for removal. This is typically started by stakeholders who collaborate with licensees to balance licensee needs with the needs of the river. Collaboration can occur through analysis of impacts of dams or projects operated by different licensees in the basin, a single licensee who owns multiple projects in the basin, or a single licensee with a project that includes multiple dams in the basin. Owners of adjacent non-hydropower dams may also be included in the collaboration. A multi-dam analysis can be conducted at any point in the lifetime of the license and is most effective leading up to and during relicensing when licensees, stakeholders, and agencies are closely reviewing hydropower projects. This approach is also consistent with the language of the Federal Power Act requiring FERC to make determinations that are "best adapted to a comprehensive plan for improving or developing a waterway or waterways" that include enhancement of fish and wildlife.[105]

Improved fish passage can be a driver for the multi-dam analysis approach. On the Penobscot River in Maine, a massive river restoration effort addressed multiple projects to restore fish passage to the lower portion of the watershed. The Penobscot River Restoration Trust purchased three hydropower dams, removed the Great Works and Veazie Dams, and installed a state-of-the-art bypass channel around the Howland Dam[106,107] The Trust also coordinated with the licensee to improve fish passage and increase the net power generation at the licensee's remaining dams.[108]

Also in Maine, the Kennebec River Management Plan examined existing hydropower dams in the Kennebec watershed and developed a plan in collaboration with licensees to address the need for

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[99] Columbia Dam Hydroelectric Project, P-8396, Paulins Kill, NJ; Condit Hydroelectric Project, P-2342, White Salmon River, WA; Grace/Cove Hydroelectric Project, P-2401, Bear River, ID; Dillsboro Hydroelectric Project, P-2602, Tuckasegee River, NC; Edwards Dam Hydroelectric Project, P-2389, Kennebec River, ME; Hogansburg Hydroelectric Project, P-7518, Saint Regis River, NY; Sullivan Creek Hydroelectric Project, P-2225, Sullivan Creek, WA, Mill Pond Dam; Tippy Hydroelectric Project, P-2580, Pine River, MI, Stronach Dam; Bull Run Hydroelectric Project, P-477, Sandy River, OR, Marmot Dam and Little Sandy River Dam; Childs-Irving Hydroelectric Project, P-2069, Fossil Creek, AZ, Fossil Creek Dam.
[100] *Pacific Gas and Electric Company,* 97 FERC ¶ 61,031 (2001). Order Approving Settlement Agreement and Issuing New License.
[101] Mokelumne River Project, P-137, East Panther Creek and West Panther Creek, CA.
[102] Edwards Dam Hydroelectric Project, P-2389, Kennebec River, ME.
[103] Seven thousand pages of documentation were provided. This helped to inform FERC's decision at the time, however, documentation in future comments can and should be more succinct.
[104] *Edwards Manufacturing Company, Inc.; City of Augusta, Maine*, 81 FERC ¶61,255 (1997). Order Denying New License and Requiring Dam Removal.
[105] Conditions of a license generally, 16 U.S.C. § 803(a)(1) (1992).
[106] Great Works Hydroelectric Project, P-2312, Penobscot River, ME.
[107] Veazie Hydroelectric Project, P-2403, Penobscot River, ME.
[108] Natural Resources Council of Maine, *Penobscot River Restoration Project,* https://www.nrcm.org/programs/waters/penobscot-river-restoration-project/

fish passage.[109] This plan was implemented after the removal of the Edwards Dam, which was the lowermost Kennebec River dam, and required either improved fish passage or dam removal at the upstream projects by a certain date.[110,111] This resulted in two additional removals thus far, Fort Halifax Dam and Madison Electric Dam.[112,113]

Dams that were removed by a licensee with multiple projects within the same basin include the Dillsboro Dam and the Cove Dam.[114,115] The Dillsboro Dam on the Tuckasegee River in North Carolina was removed to mitigate for impacts of nearby projects operated by the licensee. On the Bear River in Idaho, a licensee had multiple projects come up for relicensing at the same time and they decided to remove the Cove Dam while relicensing the rest under the same license.[116,117]

Licensees of projects with multiple dams may identify one or more dams that are less productive and would require costly environmental upgrades if they were to remain in place. In California, the Wildcat Dam was the first of five to be removed within the Battle Creek Hydroelectric Project.[118] Also in California, both East and West Panther Creek Dams were removed from the Mokelumne River Project and a third was breached, while the rest of the project was relicensed.[119] Each of these examples shows how dam removal can be part of a package that benefits licensees while improving environmental outcomes.

2.3.4. Settlement

A settlement agreement is a useful tool that is encouraged by FERC to resolve disputed items. It can also be used to outline agreements on actions of licensees, including dam removal. Settlements are commonly used in hydropower dam removal proceedings. See Section 7. Settlements to Resolve Disputes.

2.3.4.1. Pursuing, or Not Pursuing, Lawsuits to Remove Dams

Litigation against a licensee has not been an effective strategy when advocating for dam removal. In fact, there are no known cases where litigation has resulted in dam removal, despite some effectiveness of litigation in advocating for non-removal mitigation or other aims. While lawsuits can be successful in other issues related to dam operations, it often results in a greater divide between parties and can derail removal discussions. As much as possible, try to work with the licensee and present dam removal as a solution for all parties.

[109] Maine Department of Marine Resources, *Kennebec River Management Plan,* https://www.maine.gov/dmr/sites/maine.gov.dmr/files/docs/Final%20Amendment_12_22.pdf
[110] Ibid. "Requiring fish passage on a schedule beginning in 1999 at four mainstem dams in the Kennebec River (Lockwood, Hydro Kennebec, Shawmut, Weston), three in the Sebasticook River (Fort Halifax, Benton Falls, Burnham), and one in the Sandy River (Madison Electric Works)."
[111] Edwards Dam Hydroelectric Project, P-2389, Kennebec River, ME.
[112] Fort Halifax Project, P-2552, Sebasticook River, ME.
[113] Sandy River Hydroelectric Project, P-11433, Sandy River, ME.
[114] Dillsboro Hydroelectric Project, P-2602, Tuckasegee River, NC.
[115] Grace/Cove Hydroelectric Project, P-2401, Bear River, ID.
[116] Bear River Hydroelectric Project, P-20, Bear River, ID.
[117] HRC, *Restoration of the Bear River, Idaho*, http://hydroreform.org/wp-content/uploads/2020/06/BearRiver_FINAL_1_0.pdf
[118] Battle Creek Hydroelectric Project, P-1121, Battle Creek, CA.
[119] Mokelumne River Project, P-137, East Panther Creek and West Panther Creek, CA.

3. FUNDING SOURCES FOR DAM REMOVAL

Many funding sources exist for dam removal projects, but some sources may only be available to nonprofit or public entities. Most sources provide funds for ecological restoration, while some provide funds for dam safety or other goals. Dam removal funding sources generally fall into three main categories: the licensee or dam owner, grants, or mitigation funds. Public funding may be available in the form of grants, cooperative agreements, mitigation funds, or direct appropriations/legislation.

The cost of removing a dam is highly variable.[120][121] The full price tag of a dam removal may include scientific studies, concept designs, engineering design, permitting, construction, and restoration design as well as site-specific considerations. Figure 3-1 shows the costs of hydropower dam removals but note that reported costs vary depending on what is included. Some may include just the engineering design and construction while others include everything related to dam removal including multi-year restoration studies. Prepare for additional contingency funding when budgeting to manage unexpected costs that arise during the project. Liability is another financial consideration of particular importance to many licensees. Construction liability is held by contractors working on projects, while other forms of liability must be handled through insurance policies for the project owner.

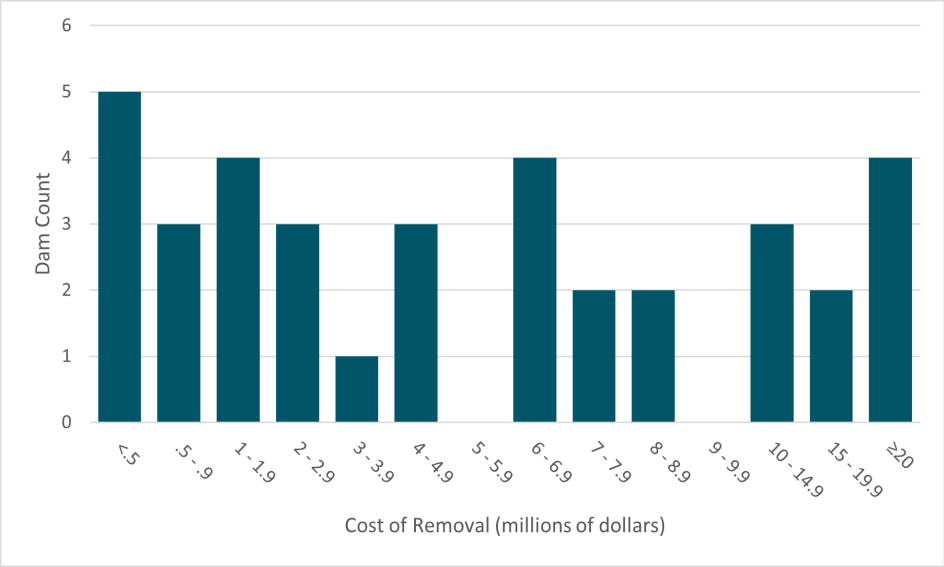

Figure 3-1 Reported Costs of FERC-Regulated Hydropower Dam Removal (Costs from 1973-2021, not adjusted)

3.1. Licensee-funded Projects

The licensee may have the funds to cover the costs of dam removal. Project costs may also be covered by ratepayers through cost recovery if approved by state public service commissions (utilities) that typically regulate privately owned hydropower dams that are under FERC jurisdiction and are providing electricity to the public.

Financial assurances are a potential future source of funding for licensees to remove dams. In 2021, FERC proposed requiring financial assurance measures in hydroelectric licenses.[122] Financial assurances could include bonds, an industry-wide trust fund, or insurance policies. Such measures are intended to ensure that a licensee has the capability to carry out license requirements and maintain its projects in a safe condition. In its Notice soliciting public input, FERC noted there are projects that are non-operational or out of compliance with their license conditions, and where

[120] *See* Duda, Jeffrey, et al. *Patterns, drivers, and a predictive model of dam removal cost in the United States.* https://doi.org/10.3389/fevo.2023.1215471
[121] *See* Duda, Jeffrey, et al. *Dam Removal Cost Estimator.* https://wrises.shinyapps.io/DamRemovalCostPredictiveModel/
[122] Federal Register, *Technical Conference on Financial Assurance Measures for Hydroelectric Projects; Supplemental Notice of Technical Conference*, Docket Number: RM21-9-000.

licensees have stated that they cannot afford to operate or maintain their projects or implement required environmental or safety measures. These projects can pose public safety hazards in the event of a dam failure or breach, as demonstrated by the failure of the Edenville and Sanford dams near Midland, Michigan in 2020.[123] If adopted by FERC, financial assurance requirements could also ensure that there are adequate funds from project owners for decommissioning and dam removal.

3.2. Grants

Where the licensee does not have the funds to cover dam removal costs, many grant options are available from government and private foundation sources. In addition to grants, advocates should consider opportunities for direct appropriations for specific projects. American Rivers hosts a list of funding sources for dam removal and river restoration.[124] In addition, the U.S. Fish and Wildlife Service and NOAA Fisheries have funding opportunities, some of which may be used for dam removal.[125,126]

3.3. In-Lieu Fee Mitigation Funds

In-lieu Fee mitigation funds are collected from permittees of development projects in lieu of the permittee developing a direct mitigation strategy.[127] The funds must be used on projects that are an ecologically appropriate distance from where the development is taking place. USACE hosts a database of third-party mitigation programs, and the National Fish and Wildlife Foundation works with permittees to put mitigation funds into appropriate projects to benefit impacted habitats.[128,129]

3.4. Liability During Dam Removal

In any dam removal, there needs to be clarity on which parties will hold risk and liability associated with the project. Risks include cost overrun, delay, regulatory non-compliance, and damages to third parties or natural resources. The dam owner holds some of these risks, and this could be a sticking point for owners or parties interested in dam removal.[130] Some of the challenging aspects of liability are sediment management, sediment contamination, and site safety. These challenges should be discussed early in the process with recognition that engineers and contractors hold liability for many project aspects rather than the owner. In some cases, dam removal entities have secured commercial liability insurance. Transfer of projects to another entity with greater capacity to manage risks is also an option.

[123] Independent Forensic Team, *Final Report: Investigation of Failures of Edenville and Sanford Dams,* https://damsafety.org/MI-Final-Report
[124] American Rivers, *Funding Restoration Projects,* https://www.americanrivers.org/river-restoration-funding-sources/
[125] U.S. Fish and Wildlife Service, *Fish Passage Portal*, https://interagency-bil-fish-passage-project-1-fws.hub.arcgis.com/
[126] NOAA Fisheries, *Habitat Restoration at NOAA*, https://www.fisheries.noaa.gov/video/habitat-restoration-noaa
[127] U.S. Army Corps of Engineers, *In-Lieu Fee Programs,* https://www.nae.usace.army.mil/Missions/Regulatory/Mitigation/In-Lieu-Fee-Programs/
[128] U.S. Army Corps of Engineers, *RIBITS: Regulatory In-lieu Fee and Bank Information Tracking System,* https://ribits.ops.usace.army.mil/
[129] National Fish and Wildlife Foundation, *Programs,* https://www.nfwf.org/programs
[130] The non-operational hydropower Enloe Dam on the Similkameen River in Washington has been considered for dam removal, but the PUD would only agree to removal if another entity assumed liability of the project. *See* Okanogan County PUD, *Enloe Dam*, https://www.okanoganpud.org/environmental/enloe-dam-project

4. TAKING ACTION TO REMOVE DAMS

The following section compiles lessons learned from hydropower dam removals into actionable items. The process is often long and benefits greatly from collaboration between involved parties. Regular phone calls, in-person meetings and site visits, documentation of discussions, and openly sharing information help to move projects forward. Discussions at the river by those communities disproportionately impacted by the dam can be particularly powerful.

4.1. Get Involved in Licensing and Monitor the Docket

Stakeholders can get involved in the licensing process at any point and is most impactful in the years leading up to and during relicensing. Subscribe to the FERC docket of the project of interest as soon as possible to stay abreast of the issues.[131] Submit clear, compelling, and concise comments to the FERC docket early to document and establish your interest on the administrative record (Section 5.5. Filing Comments on Licensing Proceedings).

4.2. Work with Agencies and Political Leaders

Working closely with partners at state and federal agencies is critical to the success of removing hydropower dams. Reach out to regional representatives from natural resource agencies and start building a relationship early in the process. Section 6.3.4. Agency and Tribal Consultation lists potential agencies. In addition to their expertise, the agencies may have grants that can go towards removal. Licensees with projects on federal lands will need to work with the land management agency to determine how to restore the lands during project decommissioning.[132]

Get to know the local, regional, and national political landscape as it relates to energy and the environment.[133,134] Politics and individual politicians can play a significant role in the success or failure of a dam removal. Reach out to representatives at different government levels to discuss the project and solicit their support. Comments submitted to the FERC Docket may be modified and shared with political offices.

4.3. Collaborate with Tribes and Stakeholders

Collaborative relationships are another essential element for dam removal success. When working with both partners and opposition, practice active listening, clear communication, and setting clear expectations. Strong partnerships between affected governments and stakeholders are necessary to complete projects. Reach out to potential partners to begin dam removal discussion early in the process.

4.3.1. Tribal Engagement

Tribal involvement in dam removal can be a form of restorative environmental justice. For many Tribes, the construction of a dam has been yet another injustice upon them by displacing villages, drowning sacred sites, dishonoring treaty rights, and impacting their access to fishing and its associated social, economic, and cultural values representing a vital economic and cultural

[131] FERC, *WorkshOPP on "Tips for Powerful Comments,"* https://www.youtube.com/watch?v=P12Y7FeUcJw&ab_channel=FederalEnergyRegulatoryCommission
[132] FERC, *How to Surrender a License or Exemption*, https://www.ferc.gov/administration-and-compliance/how-surrender-license-or-exemption
[133] GovTrack. *Congressional Districts Map.* https://www.govtrack.us/congress/members/map This website includes an overview of each member of Congress along with their voting history, bills sponsored, enacted legislation, and a link to their official website.
[134] Congress.gov, *State Legislature Websites,* https://www.congress.gov/state-legislature-websites

resource. Support Tribes for how they want to be engaged in the process. This may be through a seat at the table or through a separate government-to-government consultation process. Tribal leadership and involvement can also contribute to the public's understanding of the cultural value of the river and help gain public support for removal.

As a sovereign nation, a Tribe is not a stakeholder. Proceed with respect when working with Tribal Nations.[135] Remember that Native peoples are not a monolith, and each Tribe has their own history, culture, customs, values, and approach to engaging in natural resources policy. Learn more about the individual Tribe before reaching out to them and try to understand their history with the river and the construction of the dam.[136]

4.3.2. Stakeholder Partnerships

Strong partnerships between stakeholders are integral. Reach out to potential stakeholders to begin dam removal discussion early in the process. Build time into the schedule and budget, to build trust and relationships. Each group will have individual strengths to bring to the table, including the ability to fundraise, finance, and publicize the project. Sharing the load of responsibilities can be burdensome in the absence of good communication and trust between groups.

4.4. Engage with the Community

Talk to the community to address concerns they may have about dam removal.[137] Start community outreach and engagement early. Identify power distribution among the community and sit down with key individuals for one-on-one conversations about the project to gain their support. Reach out to all potentially impacted landowners as well.

Address potential fears about removal preemptively and appoint a point of contact who will be available to answer concerns and questions of community members. Lay out what to expect during and after the removal process and how the site will change over time. This may include artist renditions of the restored river, non-technical fact sheets, and town hall meetings or open houses on dam removal.

4.5. Designate a Project Manager

Designating a project manager is immensely beneficial to coordinate the dam removal, including the license surrender and decommissioning process.[138] A project manager works with the licensee and involved groups to provide leadership and oversight to the project throughout the process. They coordinate efforts and ensure that all necessary steps are being taken. The project manager will guide the group, maintain the institutional knowledge of the project, and be the face of the removal efforts. This person may be hired from a consulting firm or come from an involved group or Tribe.

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[135] Resources to be a better ally to Tribes include *Reclaiming Native Truth:* https://rnt.firstnations.org/; *Collaborations in Indian Country:* https://hydroreform.org/resource/collaborations-in-indian-country/; *Racial Justice Glossary:* https://waconservationaction.org/resources/racial-justice-glossary/; *Equity Diversity and Inclusion Resources:* https://www.rivernetwork.org/resource/equity-diversity-inclusion-resources/

[136] U.S. Department of Housing and Urban Development, *Tribal Directory Assessment Tool*, https://egis.hud.gov/TDAT/

[137] *See* Fox, Colleen et al. (2016). You kill the dam, you are killing a part of me: Dam removal and the environmental politics of river restoration. *Geoforum,* (70) 93-104. https://doi.org/10.1016/j.geoforum.2016.02.013

[138] American Rivers, *Removing Small Dams: A Basic Guide for Project Managers*, https://www.americanrivers.org/wp-content/uploads/2016/05/NatlDamProjectManagerGuide_06112015.pdf

5. OVERVIEW of HYDROPOWER REGULATION

The majority of hydropower dams are non-federal and regulated by FERC through a license or license-exemption. As of 2023, there are over one thousand active licenses or license-exemptions for projects across the United States, see Figure 5-1.[139,140] According to the National Inventory of Dams (NID), there are 1,729 dams associated with these projects.[141] Licenses for hydropower projects are issued for a term of 40 years, at the end of which the licensee must apply for a new license or apply to surrender their license.[142]

Hydropower projects utilize rivers, which are a public resource, and as such they are subject to regulation and public review and involvement. Several state and federal agencies are involved in licensing proceedings to protect public interests. The list of federal agencies can include NOAA Fisheries, FWS, National Park Service (NPS), Bureau of Land Management (BLM), Bureau of Indian

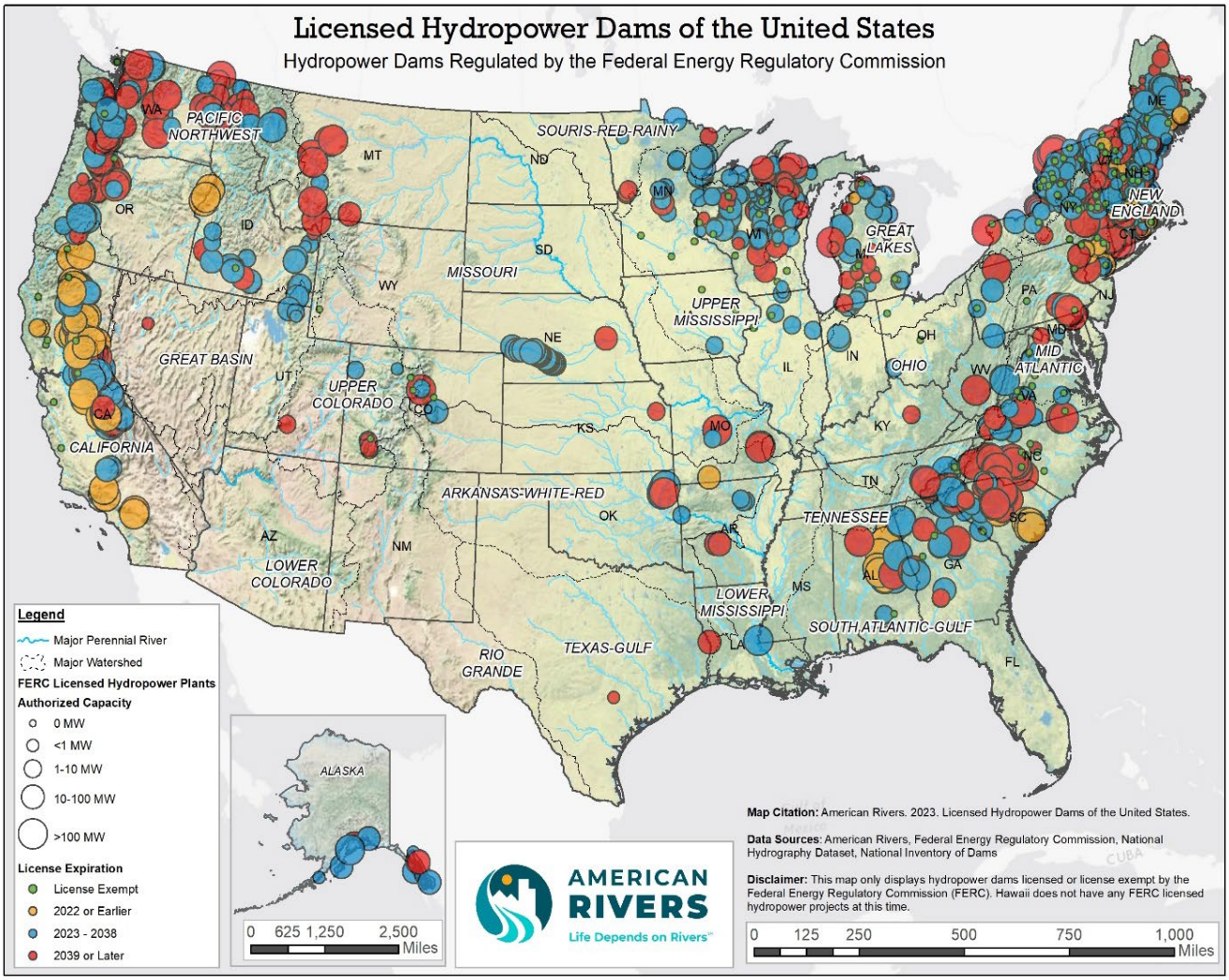

Figure 5-1 Licensed Hydropower Dams of the United States

[139] FERC, *Complete List of Active Licenses*, available at https://ferc.gov/licensing
[140] FERC, *Active Exemptions*, available at https://ferc.gov/licensing
[141] U.S. Army Corps of Engineers, *National Inventory of Dams*, https://nid.usace.army.mil/#/ Data sorted by dams with a purpose of "hydroelectric" and the federal agency involvement regulatory is "FERC."
[142] *Policy Statement on Establishing License Terms for Hydroelectric Projects*, 82 FR 49501 (2017). The default license term is 40 years. Some projects may qualify for a longer or shorter term.

Affairs (BIA), Bureau of Reclamation (BOR), United States Geological Survey (USGS), U.S. Forest Service (USFS), EPA, and USACE. For details on the role of each agency, see the HRC's *Citizen Guide for Effective Participation in Hydropower Licensing,* pages 6-11.[143]

Forty-six hydropower dams have been removed in the United States that were at one point regulated by FERC.[144] Many other former mill power dams have been removed but are not included in this analysis because they were not regulated by FERC.[145,] FERC-regulated hydropower dam removals make up less than 3% of the total dam removals in the nation. The licensee, dam owner, FERC, state and federal resource agencies, Tribes, environmental groups, and others involved must navigate regulations, permitting, planning, engineering, financing, and political considerations to successfully remove a hydropower dam.

5.1. What is the Federal Energy Regulatory Commission?

The Federal Energy Regulatory Commission, FERC, is an independent agency within the Department of Energy and is responsible for administering the FPA.[146] The Federal Water Power Act was passed in 1920, developing the Federal Power Commission and giving it authority to license and regulate non-federal hydropower.[147] The Federal Power Act was first passed in 1935 and Part I incorporated the Federal Water Power Act.[148,149] The Federal Power Commission was ultimately replaced by FERC.[150] FERC has up to five commissioners who vote on each licensing decision, and the FERC Office of Energy Projects manages the licensing proceeding.[151] The Commission is the only authority that may issue a license for the construction, operation, and maintenance of a non-federal hydropower project.

The Office of Energy Projects has three hydropower divisions that oversee the licensing, dam safety, and administration and compliance of hydropower projects.[152] The Division of Hydropower Licensing reviews license applications and makes recommendations to the Commission on authorizations and is organized into six geographic regions.[153] The Division of Hydropower Administration and Compliance oversees compliance with rules and regulations and is divided into four branches: Land

BOUNDARY DAM
PEND ORIELLE RIVER, WASHINGTON
RICH BOWERS

[143] HRC, *Citizen Guide for Effective Participation in Hydropower Licensing,* https://hydroreform.org/resource/citizen-guide-for-effective-participation-in-hydropower-licensing/
[144] See Appendix A.
[145] American Rivers, *Dam Removal Database*, https://figshare.com/articles/dataset/American_Rivers_Dam_Removal_Database/5234068
[146] FERC, *Hydropower*, https://ferc.gov/industries-data/hydropower
[147] Congressional Research Service, *The Legal Framework of the Federal Power Act*, https://crsreports.congress.gov/product/pdf/IF/IF11411
[148] Ibid.
[149] 16 U.S.C. §§ 791-823d.
[150] 42 U.S.C. § 7101.
[151] HRC, *Citizen Guide for Effective Participation in Hydropower Licensing*, https://hydroreform.org/resource/citizen-guide-for-effective-participation-in-hydropower-licensing/
[152] FERC, Hydropower Primer, https://www.ferc.gov/sites/default/files/2020-04/HydropowerPrimer.pdf
[153] FERC, *Licensing*, https://ferc.gov/licensing

Resources, Engineering Resources, Environmental and Project Review, and Aquatic Resources.[154] The Division of Dam Safety and Compliance oversees inspections and safety of hydropower projects and has headquarters in Washington, DC and five regional offices.[155] Each of these divisions can play a role in a license surrender and dam removal.

FERC's Hydropower Licensing webpage includes several useful resources under the "Quick Links" column including spreadsheets on active licenses, active exemptions, expected relicense projects, and pending licenses, relicenses, and exemptions.[156]

5.2. What is a FERC License?

A license is a binding regulatory document permitting the use of public waters for energy generation. It may be issued to the dam owner or to another entity leasing the dam for power generation. FERC issues the license, oversees license compliance, and may revoke the license in the case of a persistently non-compliant licensee. A FERC license may be issued for a conventional hydropower project, pumped storage hydropower, or hydrokinetic projects, as well as non-hydro energy projects and transmission lines.[157] This document only focuses on conventional hydropower projects.

Throughout the license term, the licensee is obligated to maintain the safety and structural integrity of the project, comply with environmental regulations, and follow other license conditions. Resource agencies are engaged throughout the licensing process to ensure that the project is set up to operate in a manner that protects the public interests and the environment.

Environmental considerations in hydropower licensing were mainly limited to the Endangered Species Act until 1986, when the FPA was amended to require projects to consider more than just the generation of hydropower.[158,159] FPA section 4(e) now requires FERC to give "equal consideration to energy conservation, the protection, mitigation of damage to, and enhancement of, fish and wildlife (including related spawning grounds and habitat), the protection of recreational opportunities, and the preservation of other aspects of environmental quality."[160]

FPA section 18 includes an additional environmental provision allowing FWS or NOAA Fisheries to prescribe the construction and operation of fish passage at a project.[161] FWS has jurisdiction over freshwater and terrestrial species while NOAA Fisheries has jurisdiction over marine wildlife and diadromous fish, though there is some shared jurisdiction of certain diadromous species.[162]

5.2.1. FERC Exemptions from Licensing

FERC may issue Exemptions from Licensing (license-exemptions) to certain small hydropower projects that are considered by FERC to have minimal impacts. The two categories qualifying for exemptions are (1) small projects of 10 MW or less that use an existing dam or natural feature such

[154] FERC, *Administration and Compliance*, https://ferc.gov/administration-and-compliance
[155] FERC, *Dam Safety and Inspections*, https://ferc.gov/dam-safety-and-inspections
[156] FERC, *Licensing*, https://www.ferc.gov/licensing
[157] Definitions of hydropower projects from the Federal Energy Regulatory Commissions' *Hydropower Primer*, https://www.ferc.gov/sites/default/files/2020-04/HydropowerPrimer.pdf. Conventional hydroelectric project: converts the potential energy of water impounded by a dam to electricity; pumped storage hydropower: utilizes an upper reservoir and lower reservoir and generates power by releasing water from the upper reservoir to the lower reservoir during peak hours and pumps it back to the upper reservoir during off-peak hours; marine and hydrokinetic projects use waves, currents, or tides to generate electricity.
[158] 16 U.S.C. §§ 1531-1544.
[159] *See* 16 U.S.C. § 797(e).
[160] Ibid.
[161] *See* 16 U.S.C. § 811.
[162] HRC, *Citizen Guide for Effective Participation in Hydropower Licensing*, https://hydroreform.org/resource/citizen-guide-for-effective-participation-in-hydropower-licensing/

SPRING CHINOOK
AMERICAN RIVERS

as a waterfall or (2) conduit exemptions that generate power in existing conduits.[163] These projects are subject to state and federal regulation, and, in contrast to the normal FERC license, the license-exemption has no expiration. This guide includes the first category of exempt projects under the definition of FERC-regulated hydropower projects. These small projects often operate with low profit margins, and economic challenges have driven nine of the twelve dam removals of exempt projects.

5.3. Relicensing a Project

Relicensing is the most opportune time for stakeholders to get involved in project operations and conditions, as it is often a once-in-a-generation opportunity to advocate for interests aside from solely power generation. Projects operate under the terms and conditions of their current licenses, which are not automatically updated when new laws and regulations are enacted. As a result, many older licenses up for renewal are facing environmental mitigation requirements for the first time.[164]

Relicensing a hydropower project is a multiyear endeavor involving many stakeholders. The licensee must inform FERC whether they intend to relicense their project at least five years before the license expiration date.[165] They must then complete a comprehensive suite of studies documenting project impacts and submit an application for a new project license within two years of expiration. The study process presents an opportunity to build an evidentiary record on the public record about the dam's impacts that can be used to inform a discussion on dam removal. Following the study process and submission of the license application, FERC issues a public notice of the application and allows motions to intervene to establish standing in the proceeding, as well as public comments from all interested parties including the licensee, state and federal agencies, Tribes, conservation groups, property owners, and other vested interests. If the licensee does not intend to relicense their project, they must submit an application to surrender their license, which is covered in more detail in Section 6. License Surrender and Decommissioning Process.

As noted in Section 2, many hydropower dam removals have occurred because mandatory conditions included in the new license render the project uneconomical. These conditions may include upgrades for safety or environmental mitigation actions such as fish passage. In a 1995 policy statement FERC explicitly stated their authority, as well as that of NOAA Fisheries and FWS, to impose conditions that may render the project uneconomical, stating that it is not "unreasonable if, as a result of imposing the condition, the project is no longer economically viable."[166] Federal courts have further agreed with FERC's position that it is institutionally unqualified to make business judgments about the long-term economic viability of hydroelectric projects, and FERC is under no obligation to issue a license that renders the project economically viable.[167]

[163] FERC, *Exemptions from Licensing,* https://www.ferc.gov/licensing/exemptions-licensing
[164] FERC, *Licensing*, https://www.ferc.gov/licensing
[165] *See* 18 C.F.R. § 5.5. Notice of intent to relicense a project must be filed 5-5.5 years before the expiration of the original license.
[166] *See Policy Statement on Project Decommissioning at Relicensing,* 60 Fed. Reg. 340 (Jan. 4, 1995).
[167] *City of Tacoma, Washington v. FERC, 460 F. 3d 53 - Court of Appeals, Dist. of Columbia Circuit 2006.*

5.4. The FERC Docket

When a project is issued a license or license-exemption, it is given a project name and a project number. The project name may or may not be the same as or similar to the name of the associated dams. The project number is a unique identification number issued by FERC and should be used when communicating about the project. For hydropower projects, the project number begins with "P-" and is followed by up to five numbers.

FERC maintains a public electronic library of all filed documents and comments related to their regulated projects. The collection for each project is called the docket, and the dockets are housed in the FERC eLibrary.[168] Stakeholders can use FERC Online to subscribe to a specific project's docket and receive email notifications about new filings including all licensee submissions, reports, information submitted by Tribes and resource agencies, responses to information requests, public comments, and all other filings on the public record that form the basis for decisions.[169,170] This is the most efficient way to monitor an active project and stay informed of how participants in the process are engaging in real time. You can also use the FERC eLibrary to search previous filings to the docket over the past several decades.[171]

5.5. Filing Comments on Licensing Proceedings

Filing comments to the docket is one of the most important ways to get involved in the licensing process. FERC's project decisions must be based on substantial evidence, which is collected through the docket. If you have information that you want FERC to consider in making a decision it must be filed on the docket. Comment periods can be as short as 20 days; act quickly to get comments submitted within this window and reviewed by FERC for consideration.

Stakeholders and Tribes can file comments to express support or opposition to steps that FERC or the licensee are taking or proposing. Comments are more likely to be considered if they include documentation, such as scientific studies that support the need for better habitat that can only be achieved through dam removal.[172] The HRC Citizen Guide and the FERC Office of Public Participation (OPP) have additional resources on writing and submitting comments.[173,174]

The top five tips from the OPP on submitting comments:

1. Organize yourself.
2. State your objectives quickly.
3. Support your points.
4. Be specific about impacts.
5. Know FERC's role. [175]

[168] FERC, *eLibrary*, https://elibrary.ferc.gov/eLibrary/search
[169] FERC, *Your Guide to Electronic Information at FERC*, https://www.ferc.gov/sites/default/files/2020-04/elec-info-guide.pdf
[170] FERC, *FERC Online*, https://ferconline.ferc.gov/FERCOnline.aspx
[171] FERC, *eLibrary Quick User Guide,* https://www.ferc.gov/ferc-online/elibrary/elibrary-quick-user-guide
[172] Heinz Center, *Dam Removal: Science and Decision Making,* https://semspub.epa.gov/work/01/273439.pdf
[173] HRC, *Citizen Guide for Effective Participation in Hydropower Licensing,* https://hydroreform.org/resource/citizen-guide-for-effective-participation-in-hydropower-licensing/
[174] FERC, *How to file a Comment*, https://www.ferc.gov/how-file-comment
[175] FERC, *WorkshOPP on "Tips for Powerful Comments"* (English/Español), https://www.ferc.gov/news-events/events/workshopp-tips-powerful-comments-englishespanol-02232023

6. LICENSE SURRENDER AND DECOMMISSIONING PROCESS

This section was written primarily for licensees, exemptees, and groups working with them to complete the license surrender application.

In order to relinquish a license or license-exemption for a hydropower project, the license or exemption needs to be surrendered or transferred to another entity, pending FERC approval.[176] License surrenders can occur at any time; however, many occur around the time of relicensing if the licensee decides not to seek a new license.[177] License surrender applications must include a decommissioning plan for the project. [178] This Guide focuses on license surrenders and this section details decommissioning, the license surrender process, and the license surrender application. Surrendering an exemption from licensing is the same process as license surrender.[179] For information on license transfers, see the FERC Division of Hydropower Administration and Compliance Handbook or the HRC Citizen Guide for Effective Participation in Hydropower Licensing.[180,181]

License surrender does not necessarily lead to project removal. If the licensee has decided to surrender their license, stakeholders can work with the licensee to develop a decommissioning plan that includes dam removal. FERC may issue an order that the decommissioning plan include dam removal in order to meet safety and environmental requirements. Projects that are going to be surrendered where the dam and reservoir will no longer serve a critical purpose should be removed. Stakeholder assistance is often necessary for dam removal to occur.

6.1. FERC Policy on Project Decommissioning

Decommissioning means removing the project's ability to generate power. This can vary from removing the power generating components and leaving the dam in place to removing the project in its entirety and restoring the area to pre-project conditions.[182] This wide range of possible options can leave the licensee with significant uncertainty. The uncertain expense of surrendering a license or exemption and decommissioning a project has led some licensees to continue operating their projects at a loss instead of facing the unknown costs and timing of decommissioning. Improved clarity, timelines, and expectations can help licensees more accurately weigh their decision to continue operating or to decommission their project.

In 1995, FERC issued a monumental policy statement affirming its authority to deny a new license when the old license expires and to require the licensee to decommission the project in whole or in part.[183] The policy statement also concluded that the Commission has authority on which project features should be removed during decommissioning, beyond the standard removal of turbines and generators.[184,185] While most projects are relicensed upon application, the policy

[176] FERC, *How to Surrender a License or Exemption,* https://ferc.gov/administration-and-compliance/how-surrender-license-or-exemption
[177] See Appendix A.
[178] 18 C.F.R. 6.2.
[179] FERC, Division of Hydropower Administration and Compliance, *Compliance Handbook,* https://www.ferc.gov/sites/default/files/2020-04/ComplianceHandbook.pdf
[180] Ibid.
[181] HRC, *Citizen Guide for Effective Participation in Hydropower Licensing*, https://hydroreform.org/resource/citizen-guide-for-effective-participation-in-hydropower-licensing/
[182] FERC, *How to Surrender a License or Exemption,* https://ferc.gov/administration-and-compliance/how-surrender-license-or-exemption
[183] *Policy Statement on Project Decommissioning at Relicensing*. 60 Fed. Reg. 340 (Jan. 4, 1995).
[184] HRC, *Citizen Guide for Effective Participation in Hydropower Licensing*, https://hydroreform.org/resource/citizen-guide-for-effective-participation-in-hydropower-licensing/
[185] This was a pivotal change from the initial water power laws of the 1920s that envisioned hydropower projects to operate in perpetuity. The mindset then was focused on protecting the local source of power; this was before modern technology allowed for larger projects and for power to be transported longer distances.

statement reinforced FERC's authority to make a determination on the license and the fate of the project.

The Edwards Dam on the Kennebec River was the first dam where FERC ordered removal against the wishes of the licensee. FERC determined that the ecological, economic, and community benefits of the river outweighed the hydropower production of the project, stating "We believe that the public interest in this proceeding lies in our denying the license application and requiring the licensees to remove Edwards Dam."[186] A settlement was reached with stakeholders and the license was transferred to the State of Maine, who voluntarily surrendered the license and removed the dam.[187] See the case study on the Edwards Dam for further details.

6.2. The License Surrender Process

Each project has different requirements for license surrender based on the project components, state and federal regulations applied to the location, and what the licensee intends to do with the project after it is surrendered. Both the surrender application and the surrender process are project-specific, with FERC dictating requirements on a case-by-case basis.

In general, the license surrender process will follow the steps outlined in Figure 6-1:

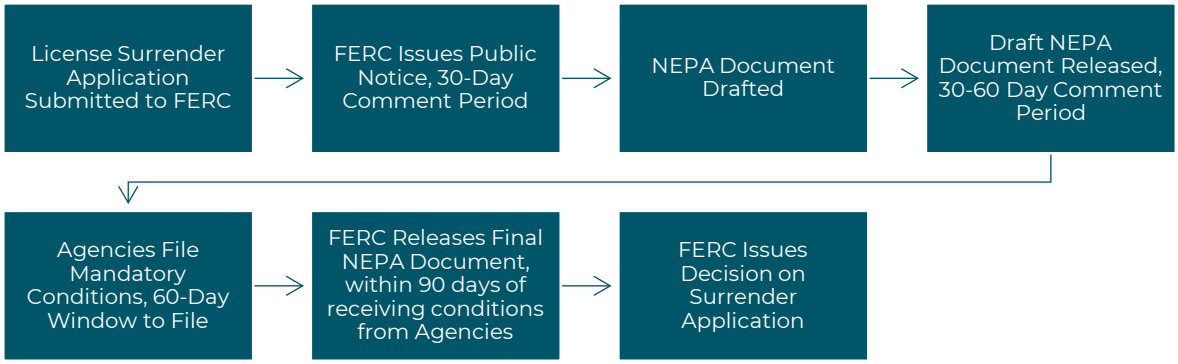

Figure 6-1 License Surrender Process Overview

After closing an initial 30-day comment period, FERC will review the surrender application and comments in the docket. This review will lead to a decision on whether a National Environmental Policy Act (NEPA) document (an environmental assessment (EA) or environmental impact statement (EIS)) will be required.[188] If FERC decides that a NEPA document is required, they will decide whether to publish a draft with a 30 to 60-day comment period or proceed straight to publishing a final document. After the NEPA document is released, it may take additional time for FERC to render a final decision on the fate of the license or exemption. FERC may also issue a

[186]. *Edwards Manufacturing Company, Inc.* 81 FERC ¶ 61,255 (1997). Order denying new license and requiring dam removal.
[187] *Edwards Manufacturing Company, Inc,* 84 FERC ¶ 61,227 (1998). Order approving settlement, transferring license, and amending fish passage requirements.
[188] The NEPA document is necessary if the decommissioning plans include ground disturbing activity, such as a dam removal. If no changes are to occur, NEPA documents are not required. *See* 18 C.F.R. § 380.4(a)(13).

scoping document for larger projects, but this is not common. Once FERC approves the surrender application, the licensee must comply with all terms of the license and surrender application before the license is officially surrendered.

6.2.1. NEPA Documents

NEPA documents, also referred to as environmental documents, are published as required by NEPA to analyze the environmental impacts of a project.[189] An EA or EIS will describe the proposed actions and, if an EIS, must comprehensively evaluate a range of alternatives with an analysis of the direct, indirect, and cumulative impacts of each alternative.[190] The document will conclude with a recommendation on which alternative is preferred to meet the goals of the project, informed by the data collected in the NEPA process. An EA is a shorter document and is usually used for projects with smaller impacts. An EIS is more comprehensive and generally reserved for projects with larger impacts.[191]. Stakeholders may request that FERC conduct an EIS as it is a much more robust analysis than an EA.

LOWER EAST ROSEBUD CREEK, MONTANA
MIKE FIEBIG

An EA may be published as a draft or in final form, whereas an EIS is always published as a draft first. The publication of a draft allows for a comment period, typically 30-60 days, during which stakeholders can review the document and submit comments to the docket.[192] Agencies must file modified mandatory conditioning within 60 days of the close of comments.[193] After the comment period closes, comments will be reviewed, and a final environmental document will be published within 90 days of agencies filing mandatory conditions.[194]

6.2.2. License Surrender Application Decision

Once comment periods have closed on the license surrender application and environmental documents, FERC will decide the fate of the license or exemption and issue an order. The order will include the conditions for surrender that the licensee must meet while the project is under FERC jurisdiction. FERC may determine that the surrender is not complete until dam removal and restoration is completed and documented.

6.3. License Surrender Application

Licensees of hydropower dams regulated by FERC must submit an application to surrender their license or license-exemption.[195] The application needs to include a decommissioning plan and

[189] Environmental Protection Agency, *National Environmental Policy Act Review Process*, https://www.epa.gov/nepa/national-environmental-policy-act-review-process
[190] 40 C.F.R. Part 1502.
[191] Ibid. An EIS is required when "a proposed federal action is determined to significantly affect the quality of the human environment."
[192] *See* 18 C.F.R. § 5.25.
[193] Ibid, section (d).
[194] Ibid, section (e).
[195] FERC, *How to Surrender a License or Exemption,* https://www.ferc.gov/administration-and-compliance/how-surrender-license-or-exemption

address dam safety and environmental concerns. [196,197] There is a minimum 30-day comment period following public notice of a completed surrender application, after which the Commission will decide to put together an EA or EIS or go straight to a decision on the fate of the license.[198,199]

The License Surrender Application has four main elements: the Decommissioning Plan, the Environmental Impact Description, the Project Description, and a summary of the Resource Agency Consultation, see Figure 6-2. These are described in greater detail below.

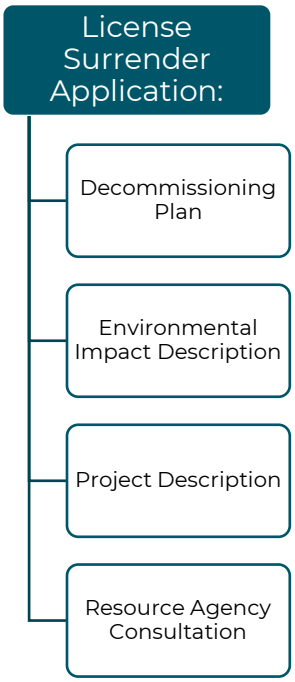

Figure 6-2 License Surrender Application Elements

6.3.1. Decommissioning Plan

The decommissioning plan must include a detailed plan of what will happen with the project. If the licensee decides to surrender the project in place, this could be relatively simple: remove the turbines and generators, disconnect the project from the grid, and potentially draw down the reservoir to the flow line. For dam removal, the plan will need to include details on how the dam and associated structures will be removed.[200] The decommissioning plan should also cover current and potential future safety concerns, and FERC's dam safety office will also review the proposal. Timelines are encouraged to be included in the application; removals are typically targeted to be completed within five years of approval of the surrender application.

For projects on federal land, decommissioning plans need to include the restoration conditions that the land managing agency requires of the licensee.[201]

A useful license surrender example to reference is the Mill Pond Dam removal in Washington State.[202] Here is the general description of the decommissioning plan; the full plan and application for license surrender is in the FERC eLibrary:

> *Within five years of FERC's issuance of the License Surrender Order, including authorization for the decommissioning of Mill Pond Dam, PUD shall remove Mill Pond Dam and the associated log crib dam, manage sediment, restore the stream channel, implement site restoration measures for the Affected Area, and conduct short term monitoring… The Affected Area shall include the stream channel, floodplain, and upland areas, from immediately downstream of Mill Pond Dam to Outlet Creek, and shall include any areas impacted by restoration or construction activity.* [203]

[196] 18 C.F.R. § 5.25 (e).
[197] FERC, Division of Hydropower Administration and Compliance, *Compliance Handbook*, https://www.ferc.gov/sites/default/files/2020-04/ComplianceHandbook.pdf
[198] *See* 18 C.F.R. § 6.1.
[199] If the decommissioning plan does not include dam removal, comments to the docket may be submitted asking the licensee to consider it. FERC prefers that dam removal is considered earlier, instead of waiting until after the surrender application is submitted, but this is not always possible.
[200] FERC does not have a checklist for what to include in decommissioning plans that include dam removal. Most plans include but are not limited to how the dam will be removed, sediment management plans, plans for the fate of the powerhouse, and associated other structures, and any restoration efforts. This may require the licensee to consult with an engineering firm to develop a removal plan to submit as part of the application.
[201] 18 C.F.R. § 6.2.
[202] Sullivan Creek Hydroelectric Project, P-2225, Sullivan Creek, WA.
[203] FERC, *Application for Surrender of License: Sullivan Creek Hydroelectric Project, FERC No. 2225*. FERC Document No. 20100402-5048. Project No. 2225.

MILLPOND DAM REMOVAL
SULLIVAN CREEK, WASHINGTON
THOMAS O'KEEFE

6.3.2. Environmental Impact Description

An EA be completed for any substantial changes to a project, including dam removal.[204] An environmental impact description within the EA covers the anticipated impacts of decommissioning plans to the baseline status.[205] Specific subjects in this section may include, but are not limited to, hydraulic conditions, sediment management, biological impacts, and recreational impacts. A sediment management plan is especially important to evaluate the composition of sediment and how best to manage it particularly in cases of potential contamination or where sediment quantities may exceed a river's sediment carrying capacity. Both issues have been successfully managed at many dam removal projects but need to be adequately assessed prior to removal.

The licensee may also decide to do an official draft EA suitable for permitting and submit it with their application. FERC may use this as the official draft EA, or, more often, they will reference the draft provided by the licensee but ultimately will develop their own EA or EIS.

An Endangered Species Act Consultation may be required in tandem with the license surrender process. Informal consultations may begin early in the process, and it may take about a year to file with NOAA and/or FWS.[206,207]

6.3.3. Project Description

The project description, analogous to the licensing project description, needs to cover all components of the project.[208] This includes the dam(s), powerhouse(s), diversion channels and flumes, and any other structures, such as recreational facilities on the reservoir. The project description usually has a section on the history of the project including when and why the project was first built, when hydroelectric generation was installed, when the license or exemption from FERC was first issued and to whom, any licensee changes over the years, and any project changes that have taken place. The description of the current physical structures needs to be detailed enough that engineers reading the report can have a thorough understanding of the current layout. Detailed maps are often included to show project location along with engineering drawings of the dam, powerhouse, and other structures.[209]

The project description should also include how the project is impacting the waterbody on which it was built. This includes the reservoir size, water level elevation, how the project's discharge alters river hydrology below the dam, and a description of the releases scheduled over the year. For a run-of-river project, this latter section may be very brief. For a peaking hydropower project, however, this may require laying out the seasonal release schedule and explanation. Note that the

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[204] This section must "describe the existing environment in the project area, environmental effects that are expected to occur upon surrender, and any measures that would be taken to mitigate those effects; [and] a schedule for implementing any proposed measures." *See* FERC Division of Hydropower Administration and Compliance, *Compliance Handbook,* p. 35-36, https://www.ferc.gov/sites/default/files/2020-04/ComplianceHandbook.pdf
[205] Baseline status is considered by FERC to be the current project status: dam in place.
[206] NOAA Fisheries, *Consultations: Endangered Species Act Consultations,* https://www.fisheries.noaa.gov/topic/consultations/endangered-species-act-consultations
[207] U.S. Fish and Wildlife Service, *ESA Section 7 Consultation*, https://www.fws.gov/service/esa-section-7-consultation
[208] 18 C.F.R. § 4.41(b).
[209] 18 C.F.R. § 4.39.

description of hydraulic impacts should explain the *current* operations whereas the impacts described under the environmental impacts section are *future* impacts projected to occur after the project is decommissioned.

6.3.4. Agency and Tribal Consultation

Consultation with resource agencies and Tribes is necessary for each license surrender.[210] The licensee or exemptee is responsible for identifying and reaching out to relevant Tribes and agencies. Partners may assist in consultation efforts as well. The extent of the consultations and the agencies or Tribes to involve is project specific and FERC can help identify necessary consultations. These may include, but are not limited to, the following:

- The *U.S. Fish and Wildlife Service* and *NOAA Fisheries:* determine the fish, wildlife, and botanical resources impacted by the project. If the project will impact threatened species and/or migratory species, an environmental impact statement and mitigation efforts may be required.[211]
- The *water quality certifying agency* of the state and any affected Tribes: determine impacts of the proposed dam removal on water quality and the need for certification under Section 401 of the Clean Water Act.[212] Request a pre-permitting meeting to conceptually review the project including sediment assessment and management approaches to develop a joint understanding of the issues and develop a plan that is consistent with needs of both the water quality agency and FERC.
    - Water quality certifications are usually issued by state Departments of Environmental Quality or Environmental Protection or Water Quality. Identify which agency completes certifications under Section 401 of the Clean Water Act in your state.[213]
- Relevant *state resource agencies:* the names of these agencies vary from state to state but may include the Department of Fish and Wildlife, the Department of Conservation and Recreation, Department of Natural Resources, or the Department of Environmental Quality. Determine what species and habitat will be impacted by dam removal and river restoration.
- *State Historic Preservation Offices* (SHPO): Engage with the SHPO early to determine if the project may impact cultural or historic resources.[214] These offices vary from state to state in their operations, capacity, and willingness for a pre-consultation.
    - Some dams may be considered historic structures. Impacts to historic resources have been mitigated in a variety of ways. This can include effective study and documentation of historic resources, historic-grade photographs of project elements, or in some cases, leaving structural elements in place such as a powerhouse or abutment. If needed, stress the importance of the river's long history including how it has served as a cultural resource for thousands of years as a free-flowing body of water to ensure that pre-colonial history is also honored.
    - Some state offices have been officially designated as the non-federal representative for consultation under section 106 of the National Historic Preservation Act. Some states will not engage with the licensee unless they have this designation, while others will engage regardless of status.
- *Tribes* should be consulted if the project impacts current or historic Tribal lands and resources.[215] In the case where there is not a direct impact, it is respectful to consult with

[210] *See* 18 C.F.R. § 4.38.
[211] *See* 18 C.F.R. § 4.41(f)(3).
[212] 33 U.S.C. § 1341.
[213] Environmental Protection Agency, *Clean Water Act Section 401: State Certification of Water Quality*, https://www.epa.gov/cwa-401/clean-water-act-section-401-state-certification-water-quality
[214] *See* 18 C.F.R. § 4.41(f)(4).
[215] 18 C.F.R. § 2.1c.

ALEWIVES
PENOBSCOT RIVER, MAINE
CHEK WINGO

Tribes that historically inhabited or currently live in the area.[216] If they decide to get involved, they will bring a unique and important perspective and may want to assist with dam removal efforts. The Tribe(s) may decide to get involved and seek to work with FERC on a government-to-government basis.[217] See Section 4.3.1. Tribal Engagement for additional information.

- Federal land management agencies need to be consulted if the project is on federal land. The licensee will need to restore the land to a condition acceptable by the agency that manages the land before the surrender becomes effective.[218] These conditions should be laid out in the surrender application.

Documentation of consultations should be included in the license surrender application. If consultation comments are not available, a record of meetings with agencies may be enough if sufficiently detailed. FERC will review the documentation of the consultations. If this section is missing, FERC may reject the license surrender application.

6.3.5. License Surrender Application Submission

Once the license surrender application is submitted to FERC, the Commission will review the document for completeness. FERC may request additional information and can reject the application if necessary. Once the application is complete, FERC will issue a public notice for a comment period of at least 30 days where they will accept motions to intervene, comments, and protests submitted through the docket. See Section 5.5. on Filing Comments on Licensing Proceedings.

[216] *See* U.S. Department of Housing and Urban Development, *Tribal Directory Assessment Tool*, https://egis.hud.gov/TDAT/
[217] Revision to Policy Statement on Consultation with Indian Tribes in Commission Proceedings, 169 FERC ¶ 61,036 (2019).
[218] 18 C.F.R. § 6.2.

7. SETTLEMENTS TO RESOLVE DISPUTES

A settlement is an agreement that parties come to on disputed issues. It is a useful tool for licensees and stakeholders to use in navigating the removal of a FERC-regulated hydropower dam. Settlements are encouraged and supported by FERC to resolve disputes and avoid litigation.[219] They are "binding legal documents between signatories."[220] Dam removal can be included in a settlement and is often a path used to come to a mutual agreement between parties. Half of the FERC-regulated dams that have been removed involved a settlement agreement that called for the removal of the dam.[221] This Guide provides a brief overview on settlements; additional information is available from several sources in the notes below.[222]

7.1. Settlement Process

A settlement agreement must be developed in a timely manner and must be submitted before FERC's final decision on a proceeding, such as before deciding on a license surrender application.[223] Stakeholders and the licensee must start collaborating early to come to an agreement. Once the terms are finalized and FERC has approved the conditions, FERC will include the settlement conditions in their surrender order and the licensee will be held to the terms of the settlement. The surrender order should be reviewed to ensure that pertinent settlement conditions are included.

Any proposed actions in the settlement should be included in the environmental document. If possible, submit the settlement agreement before the draft environmental document is published. The agreement is submitted as an Offer of Settlement, which FERC will review, consider comments from non-settling parties, then decide on approval, disapproval, or modification of the terms.

The Offer of Settlement may be approved by FERC if the settlement meets the same legal standards as a licensing document, is based on substantial evidence, is "fair and reasonable and in the public interest," and is uncontested.[224] If the Offer is contested, FERC will evaluate the evidence presented in the docket and request additional information or make a decision with existing information.[225]

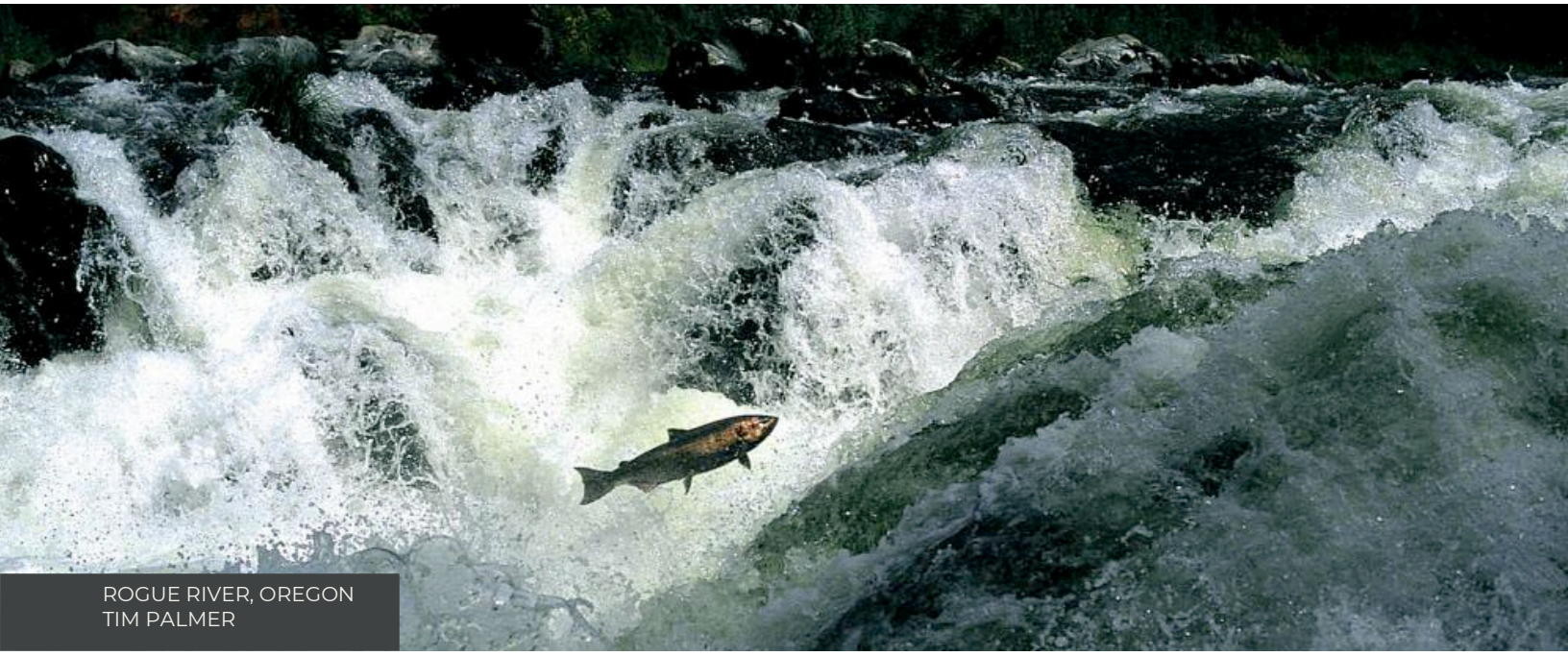
[219] FERC, *How Settlements Resolve Conflicts,* https://ferc.gov/enforcement-legal/legal/settlements
[220] HRC, *Citizen Guide for Effective Participation in Hydropower Licensing*, https://hydroreform.org/resource/citizen-guide-for-effective-participation-in-hydropower-licensing/
[221] See Appendix A.
[222] Resources on settlement agreements: Rule 602 – Submission of settlement offers (18 C.F.R. § 385.602); National Renewable Energy Laboratory, *Negotiating Terms and Conditions: An Overview of the Federal Energy Regulatory Commission Hydropower Settlement Agreement Process,* https://www.nrel.gov/docs/fy18osti/71093.pdf; HRC, *Citizen Guide for Effective Participation in Hydropower Licensing,* https://hydroreform.org/wp-content/uploads/2015/11/Citizen-Guide-w-Cover_2023.pdf
[223]HRC, *Citizen Guide for Effective Participation in Hydropower Licensing*, https://hydroreform.org/resource/citizen-guide-for-effective-participation-in-hydropower-licensing/, pages 111-117.
[224] 18 C.F.R. § 385.602(g)(3).
[225] 18 C.F.R. § 385.602(h).

8. CONCLUSION

Removing dams is becoming a common practice to address uneconomical and obsolete structures and restore rivers to a healthy, free-flowing state. To achieve success, removing a hydropower dam requires commitment and collaboration from many parties. Get involved in the licensing process early and work with the licensee and FERC to ensure that the project progresses. Be a great partner by maintaining open lines of communication, contributing expertise to the process, and making space for stakeholders, interested parties, or governments to come together at the table. Be creative and work with the licensee to find solutions to the problems that will inevitably arise, including funding dam removal.

Free-flowing rivers promote healthy habitat for wildlife, reduce flood risk to communities, provide recreational opportunities, and support cultural traditions. Removing a dam is the fastest, most efficient way to bring a river back to life and restore relationships with the river. Rivers are dynamic systems and start to come back to life almost immediately after a dam is removed.[226] Healthy rivers can contribute to a community's dynamic economy including revenue from recreation and tourism. Dam removal is a permanent dam safety solution and helps secure a river's resilience and future health.

We hope this guide assists you and your team through the dam removal process as you work to restore rivers and protect people and wildlife.



ROGUE RIVER, OREGON
TIM PALMER

[226] O'Connor, J.E., J. J. Duda, and G. E. Grant. (2015). 1000 dams down and counting: Dam removals are reconnecting rivers in the United States. *Science* 348(6234), 496-497. http://dx.doi.org/10.1126/science.aaa9204

Removed FERC-Regulated Hydropower Dams

	Dam	FERC Project #	FERC Project Name	River	State	Year Removed	Dam Age (Yrs)	Dam Height (ft)	Authorized Capacity (KW)	License Fate	Settle-ment	Multi-Dam Removal	Other Dams Removed	Driver for License Surrender*	Driver for Removal*
1	Boardman Dam	P-2979†	Boardman Dam Hydro Project	Boardman River	MI	2017	123	59	1,000	Exemption Surrender	Yes	Yes	Brown Bridge (P-2978); Sabin (P-2980)	Safety	Ecology
2	Brown Bridge Dam	P-2978	Brown Bridge Dam Hydro Project	Boardman River	MI	2012	91	46	725	Surrender	Yes	Yes	Boardman (P-2979); Sabin (P-2980)	Safety	Ecology
3	Carbonton Dam	P-3155	Carbonton Hydroelectric Project	Deep River	NC	2005	84	17	1,000	Surrender	No	No		Economics	Mitigation
4	City Mills Dam	P-8519†	City Mills Hydroelectric Project	Chattahoochee River	GA	2013	185	10	735	Exemption Surrender	No	Yes	Eagle and Phenix (P-2655)	Economics	Economics
5	Columbia Falls Dam	P-4304†	Columbia Falls	Pleasant River	ME	1988	5	9	500	Exemption Surrender	No	No		Economics	Mitigation
6	Columbia Lake Dam	P-8396	Columbia Dam Hydroelectric Project	Paulins Kill	NJ	2018	109	18	530	Surrender‡	No	No		Economics	Ecology
7	Condit Dam	P-2342	Condit Hydroelectric Project	White Salmon River	WA	2011	98	125	14,700	Surrender‡	Yes	No		Economics	Ecology
8	Copco 2	P-14803	Lower Klamath Project	Klamath River	CA	2023	105	120	20,000	Surrender‡	Yes	Yes**	See notes	Economics	Ecology
9	Cove Dam	P-2401	Grace/Cove Hydroelectric Project	Bear River	ID	2006	89	26	7,500	Amendment‡	Yes	No		N/A	Ecology
10	Dillsboro Dam	P-2602	Dillsboro Hydroelectric Project	Tuckasegee River	NC	2010	97	12	225	Surrender‡	Yes	No		Ecology	Ecology
11	Eagle and Phenix Dam	P-2655†	Eagle and Phenix Hydroelectric Project	Chattahoochee River	GA	2012	144	17	4,260	Exemption Surrender	No	Yes	City Mills (P-8519)	Economics	Economics
12	East Panther Creek Dam	P-137	Mokelumne	East Panther Creek	CA	2003	73	12	N/A	Amendment‡	Yes	No		N/A	Ecology
13	Edwards Dam	P-2389	Edwards Dam Hydroelectric Project	Kennebec River	ME	1999	162	24	3,500	Surrender‡	Yes	No		Ecology	Ecology
14	Elwha Dam	P-2683	Elwha Hydroelectric Project	Elwha River	WA	2011	98	108	12,600	License Annulled (Elwha Act)‡,***	No	Yes	Glines Canyon (P-588)	Ecology	Ecology
15	Fort Edward Dam	P-2482	Hudson River Project	Hudson River	NY	1973	75	31	2,850	Amendment	No	No		N/A	Safety

American Rivers Dataset. Removed FERC-Regulated Hydropower Dams. Last Accessed: October 2023.

Removed FERC-Regulated Hydropower Dams

	Dam	FERC Project #	FERC Project Name	River	State	Year Removed	Dam Age (Yrs)	Dam Height (ft)	Authorized Capacity (KW)	License Fate	Settle-ment	Multi-Dam Removal	Other Dams Removed	Driver for License Surrender*	Driver for Removal*
16	Fort Halifax Dam	P-2552	Fort Halifax Project	Sebasticook river	ME	2008	101	29	1,500	Surrender	Yes	Yes	Madison Electric (P-11433)****	Economics	Ecology
17	Fossil Creek Dam	P-2069	Childs-Irving Hydroelectric Project	Fossil Creek	AZ	2008	99	25	6,000	Surrender‡	Yes	No		Ecology	Ecology
18	Glines Canyon Dam	P-588	Glines Canyon Hydroelectric Project	Elwha River	WA	2011	84	210	16,000	License Annulled (Elwha Act)‡,***	No	Yes	Elwha (P-588)	Ecology	Ecology
19	Gold Ray Dam	P-1029	Gold Ray Project	Rogue River	OR	2010	106	38	1,200	Surrender	No	No		Economics	Safety
20	Great Works Dam	P-2312	Great Works Hydroelectric Project	Penobscot River	ME	2012	125	20	7,730	Surrender‡	Yes	Yes	Veazie (P-2403)	Ecology	Ecology
21	Grimh Dam	UL-92-5 P-11600†	Grimh Dam	Couderay River	WI	2011	83	30	306	Implied Surrender	No	No		Economics	Safety
22	Grist Mill Dam	P-4727†	Grist Mill Project	Souadabscook Stream	ME	1998	230	14	200	Exemption Surrender	No	No		Ecology	Ecology
23	Harvell Dam	P-8657	Harvell Hydroelectric Project	Appomattox River	VA	2014	84	9	150	Implied Surrender	No	No		Economics	Ecology
24	Hogansburg Dam	P-7518	Hogansburg Hydroelectric Project	Saint Regis River	NY	2016	87	12	485	Surrender‡	Yes	No		Economics	Ecology
25	Hoosier Dam	P-3586†	Rocky River Project	Rocky River	NC	2018	96	25	230	Exemption Surrender	No	No		Economics	Ecology
26	Idylwilde Dam	P-2829	Idylwilde Hydroelectric Project	Big Thompson River	CO	2013	88	57	900	Surrender	No	No		Economics	Economics
27	Little Sandy River Dam	P-477	Bull Run Hydroelectric Project	Little Sandy River	OR	2008	96	16	N/A	Surrender‡	Yes	Yes	Marmot (P-477)	Economics	Ecology
28	Madison Electric Dam	P-11433	Sandy River Hydroelectric Project	Sandy River	ME	2006	113	15	547	Surrender‡	Yes	Yes	Fort Halifax (P-2552)****	Economics	Ecology
29	Marmot Dam	P-477	Bull Run Hydroelectric Project	Sandy River	OR	2007	95	47	22,000	Surrender‡	Yes	Yes	Little Sandy River (P-477)	Economics	Ecology
30	Milburnie Dam	P-7910†	Milburnie Hydroelectric Project	Neuse River	NC	2017	204	15	640	Implied Surrender	No	No		Economics	Mitigation

American Rivers Dataset. Removed FERC-Regulated Hydropower Dams. Last Accessed: October 2023.

Removed FERC-Regulated Hydropower Dams

	Dam	FERC Project #	FERC Project Name	River	State	Year Removed	Dam Age (Yrs)	Dam Height (ft)	Authorized Capacity (KW)	License Fate	Settle-ment	Multi-Dam Removal	Other Dams Removed	Driver for License Surrender*	Driver for Removal*
31	Mill Pond Dam	P-2225	Sullivan Creek Hydroelectric Project	Sullivan Creek	WA	2017	108	55	N/A	Surrender‡	Yes	No		Economics	Mitigation
32	Milltown Dam	P-2543	Milltown Project	Clark Fork River	MT	2008	100	40	3,400	Surrender‡	No	No		Safety	Safety
33	Mussers Dam	P-3706	Mussers Dam Project	Middle Creek	PA	1992	86	31	340	Surrender	No	No		Safety	Safety
34	Newport No. 11 Dam	P-2306	Clyde River Hydroelectric Project	Clyde River	VT	1996	40	19	1,800	Amendment	No	No		N/A	Ecology
35	Odell Dam	P-6057†	Odell Creek Hydro Project	Odell Creek	OR	2016	33	12	225	Exemption Surrender	No	No		Economics	Economics
36	Powerdale Dam	P-2659	Powerdale Hydroelectric Project	Hood River	OR	2010	87	10	6,000	Surrender‡	Yes	No		Economics	Economics
37	Sabin Dam	P-2980†	Sabin Dam Hydro Project	Boardman River	MI	2018	88	21	500	Exemption Surrender	Yes	Yes	Boardman (P-2979); Brown Bridge (P-2978)	Safety	Ecology
38	Saccarappa Dam	P-2897	Saccarappa Project	Presumpscot	ME	2019	108	12	1,350	Surrender‡	Yes	No		Economics	Ecology
39	Steele's Mill Dam	P-8282†	Steeles Mill Project	Hitchcock Creek	NC	2009	111	15	300	Exemption Surrender	No	No		Economics	Ecology
40	Stronach Dam	P-2580	Tippy Hydroelectric Project	Pine River	MI	2003	91	18	2,000	Amendment	Yes	No		N/A	Economics
41	Sturgeon River Dam	P-2471	Sturgeon Hydroelectric Project	Sturgeon River	MI	2003	84	45	800	Surrender‡	Yes	No		Economics	Economics
42	Union Village Dam	P-8486†	Union Village Dam Hydroelectric Project	Branch River	NH	2014	153	15	75	Exemption Surrender	No	No		Economics	Safety
43	Veazie Dam	P-2403	Veazie Hydro Project	Penobscot River	ME	2013	100	30	16,400	Surrender‡	Yes	Yes	Great Works (P-2312)	Ecology	Ecology
44	Ward Mill	P-9842	Ward Mill Hydroelectric Project	Watauga River	NC	2021	131	20	168	Surrender‡	No	No		Ecology	Ecology
45	West Panther Creek Dam	P-137	Mokelumne River Project	West Panther Creek	CA	2003	73	14	n/a	Amendment‡	Yes	No		N/A	Ecology

American Rivers Dataset. Removed FERC-Regulated Hydropower Dams. Last Accessed: October 2023.

Removed FERC-Regulated Hydropower Dams

	Dam	FERC Project #	FERC Project Name	River	State	Year Removed	Dam Age (Yrs)	Dam Height (ft)	Authorized Capacity (KW)	License Fate	Settle-ment	Multi-Dam Removal	Other Dams Removed	Driver for License Surrender*	Driver for Removal*
46	Wildcat Dam	P-1121	Battle Creek Hydroelectric Project	Battle Creek	CA	2009	99	8	n/a	Amendment	MOU	No		Ecology	Ecology
	Totals:	FERC Projects: 44		Rivers: 41	States: 18		Mean: 103 Min: 5 Max: 230	Mean: 34 Mid: 8 Max: 210	Mean: 3,936 Min: 75 Max: 22,000 Sum: 161,371		Yes: 23 No: 22 MOU: 1	Yes: 14 No: 32		Ecology: 10 Economics: 25 Safety: 5 N/A: 6	Ecology: 29 Economics: 7 Mitigation: 4 Safety: 6

[†]License-exempt project under FERC, twelve total.

[‡]Decommissioning occurred when the project came up for relicensing, twenty-three total.

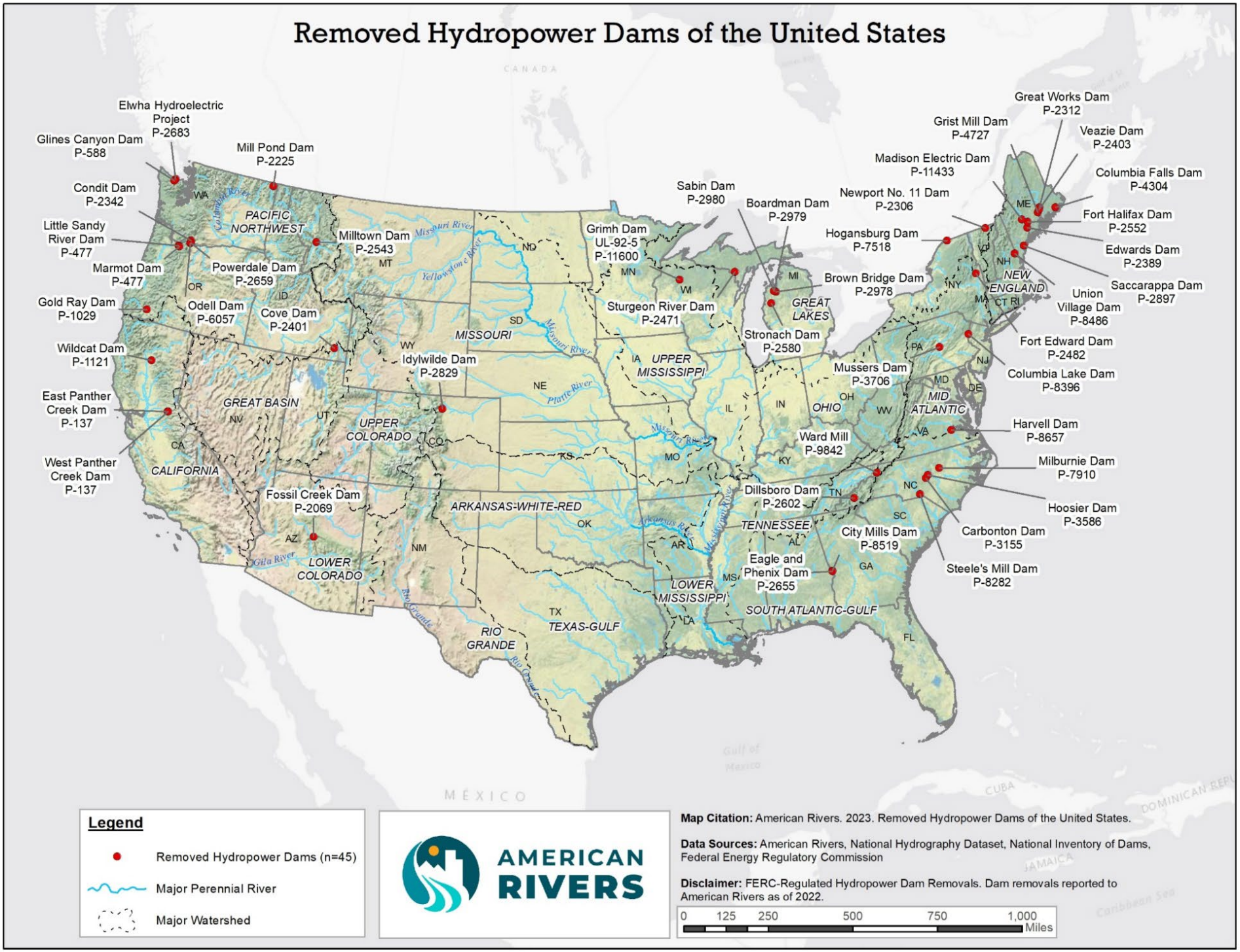
*The drivers for license surrender and dam removal are the primary reasons a licensee took each action. These often overlap and have supporting drivers.

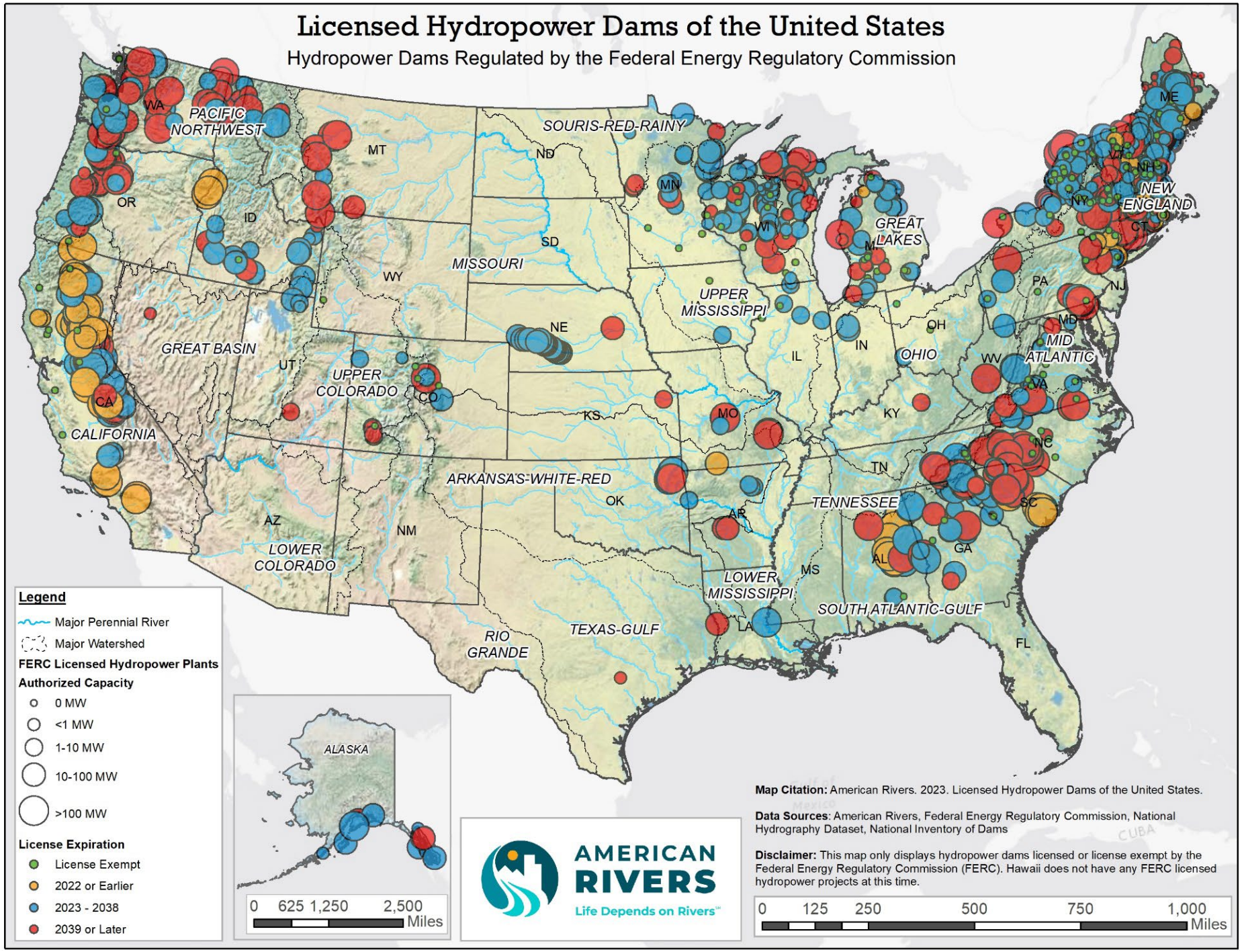
**Three additional dams of the Lower Klamath Project are slated to be removed in 2024: J.C. Boyle, Copco No. 1, and Iron Gate.

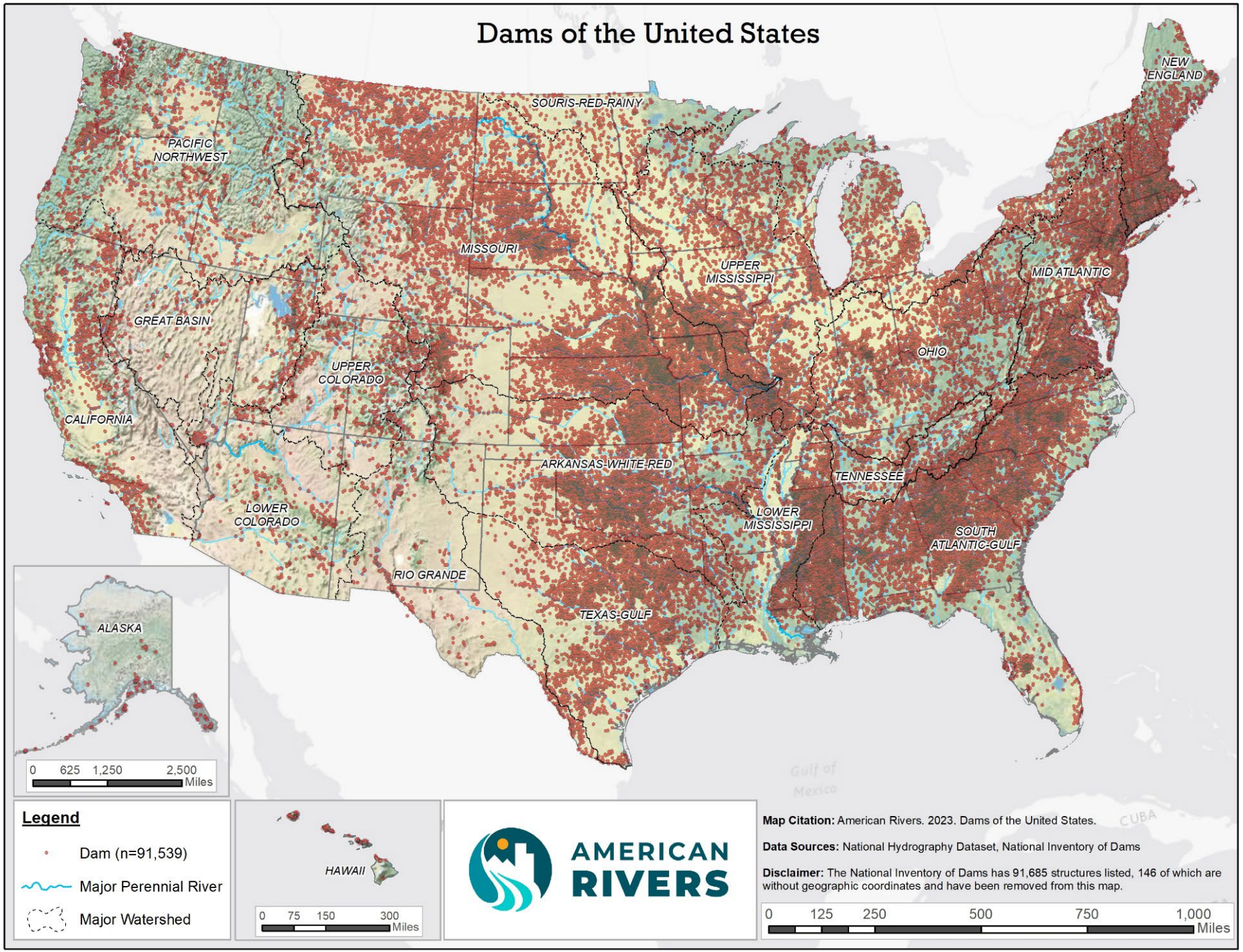
***The license of the Glines Canyon project and license application of the Elwha project were annulled by federal takeover of the projects through the Elwha Act.

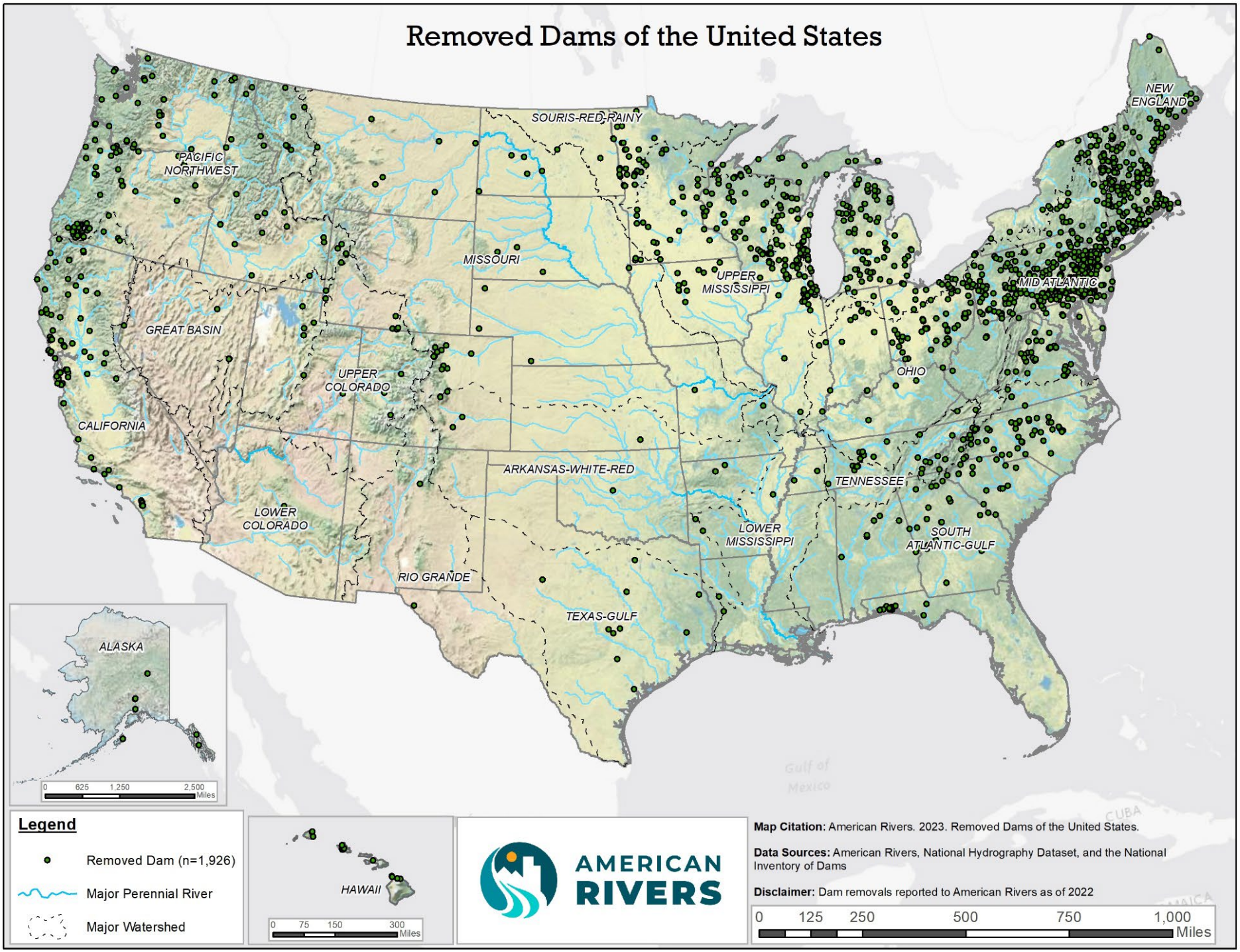
****Fort Halifax Dam and Madison Electric Dam were removed individually under the Kennebec River Resource Management Plan.

American Rivers Dataset. Removed FERC-Regulated Hydropower Dams. Last Accessed: October 2023.


Removed Hydropower Dams of the United States
Elwha Hydroelectric Project P-2683
Glines Canyon Dam P-588
Mill Pond Dam P-2225
Condit Dam P-2342
Little Sandy River Dam P-477
Marmot Dam P-477
Powerdale Dam P-2659
Gold Ray Dam P-1029
Odell Dam P-6057
Cove Dam P-2401
Wildcat Dam P-1121
East Panther Creek Dam P-137
West Panther Creek Dam P-137
Fossil Creek Dam P-2069
Milltown Dam P-2543
Idylwilde Dam P-2829
Grimh Dam UL-92-5 P-11600
Sturgeon River Dam P-2471
Sabin Dam P-2980
Boardman Dam P-2979
Stronach Dam P-2580
Brown Bridge Dam P-2978
Hogansburg Dam P-7518
Newport No. 11 Dam P-2306
Madison Electric Dam P-11433
Grist Mill Dam P-4727
Great Works Dam P-2312
Veazie Dam P-2403
Columbia Falls Dam P-4304
Fort Halifax Dam P-2552
Edwards Dam P-2389
Saccarappa Dam P-2897
Union Village Dam P-8486
Fort Edward Dam P-2482
Columbia Lake Dam P-8396
Mussers Dam P-3706
Harvell Dam P-8657
Ward Mill P-9842
Milburnie Dam P-7910
Dillsboro Dam P-2602
Hoosier Dam P-3586
City Mills Dam P-8519
Carbonton Dam P-3155
Eagle and Phenix Dam P-2655
Steele's Mill Dam P-8282
PACIFIC NORTHWEST
GREAT BASIN
UPPER COLORADO
CALIFORNIA
LOWER COLORADO
MISSOURI
UPPER MISSISSIPPI
GREAT LAKES
OHIO
MID ATLANTIC
NEW ENGLAND
ARKANSAS-WHITE-RED
TENNESSEE
LOWER MISSISSIPPI
SOUTH ATLANTIC-GULF
TEXAS-GULF
RIO GRANDE
Legend
Removed Hydropower Dams (n=45)
Major Perennial River
Major Watershed
AMERICAN RIVERS
Map Citation: American Rivers. 2023. Removed Hydropower Dams of the United States.
Data Sources: American Rivers, National Hydrography Dataset, National Inventory of Dams, Federal Energy Regulatory Commission
Disclaimer: FERC-Regulated Hydropower Dam Removals. Dam removals reported to American Rivers as of 2022.
0 125 250 500 750 1,000 Miles


Licensed Hydropower Dams of the United States
Hydropower Dams Regulated by the Federal Energy Regulatory Commission
PACIFIC NORTHWEST
SOURIS-RED-RAINY
MISSOURI
GREAT LAKES
NEW ENGLAND
UPPER MISSISSIPPI
GREAT BASIN
UPPER COLORADO
CALIFORNIA
ARKANSAS-WHITE-RED
MID ATLANTIC
OHIO
TENNESSEE
LOWER COLORADO
LOWER MISSISSIPPI
SOUTH ATLANTIC-GULF
TEXAS-GULF
RIO GRANDE
WA
OR
CA
ID
NV
MT
WY
UT
AZ
NM
CO
ND
SD
NE
KS
OK
TX
MN
IA
MO
AR
LA
WI
IL
MI
IN
OH
KY
TN
MS
AL
GA
FL
SC
NC
VA
WV
PA
NY
VT
NH
ME
MA
CT
NJ
MD
Legend
Major Perennial River
Major Watershed
FERC Licensed Hydropower Plants
Authorized Capacity
0 MW
<1 MW
1-10 MW
10-100 MW
>100 MW
License Expiration
License Exempt
2022 or Earlier
2023 - 2038
2039 or Later
ALASKA
0 625 1,250 2,500 Miles
AMERICAN RIVERS
Life Depends on Rivers℠
Map Citation: American Rivers. 2023. Licensed Hydropower Dams of the United States.
Data Sources: American Rivers, Federal Energy Regulatory Commission, National Hydrography Dataset, National Inventory of Dams
Disclaimer: This map only displays hydropower dams licensed or license exempt by the Federal Energy Regulatory Commission (FERC). Hawaii does not have any FERC licensed hydropower projects at this time.
0 125 250 500 750 1,000 Miles


Dams of the United States
NEW ENGLAND
SOURIS-RED-RAINY
PACIFIC NORTHWEST
MISSOURI
UPPER MISSISSIPPI
MID ATLANTIC
GREAT BASIN
OHIO
UPPER COLORADO
CALIFORNIA
ARKANSAS-WHITE-RED
TENNESSEE
LOWER COLORADO
LOWER MISSISSIPPI
SOUTH ATLANTIC-GULF
RIO GRANDE
TEXAS-GULF
ALASKA
0 625 1,250 2,500 Miles
HAWAII
0 75 150 300 Miles
Legend
Dam (n=91,539)
Major Perennial River
Major Watershed
AMERICAN RIVERS
Map Citation: American Rivers. 2023. Dams of the United States.
Data Sources: National Hydrography Dataset, National Inventory of Dams
Disclaimer: The National Inventory of Dams has 91,685 structures listed, 146 of which are without geographic coordinates and have been removed from this map.
0 125 250 500 750 1,000 Miles


Removed Dams of the United States
PACIFIC NORTHWEST
SOURIS-RED-RAINY
NEW ENGLAND
MISSOURI
UPPER MISSISSIPPI
MID ATLANTIC
GREAT BASIN
UPPER COLORADO
OHIO
CALIFORNIA
ARKANSAS-WHITE-RED
TENNESSEE
LOWER COLORADO
LOWER MISSISSIPPI
SOUTH ATLANTIC-GULF
RIO GRANDE
TEXAS-GULF
ALASKA
0 625 1,250 2,500 Miles
HAWAII
0 75 150 300 Miles
Legend
Removed Dam (n=1,926)
Major Perennial River
Major Watershed
AMERICAN RIVERS
Map Citation: American Rivers. 2023. Removed Dams of the United States.
Data Sources: American Rivers, National Hydrography Dataset, and the National Inventory of Dams
Disclaimer: Dam removals reported to American Rivers as of 2022
0 125 250 500 750 1,000 Miles

11. APPENDIX C – CASE STUDIES

The following case studies include a selection of hydropower dam removals to complement the guide. Each is formatted as an individual report and may be used by practitioners as such.

Dams that were removed together are presented together. Research on each project included information from the FERC docket, reports, and interviews with individuals involved in the removal project.

It is the intent of these case studies to demonstrate the range of pathways to remove a FERC regulated dam. These studies can be searched by using key words including dam size, generating capacity, agencies involved, and reasons for license surrender and dam removal.

The licensee listed is the licensee at the time of the license surrender or amendment. Any Tribe referred to is unique to that case study.

BOARDMAN RIVER PROJECTS

BOARDMAN DAM
BROWN BRIDGE DAM
SABIN DAM
Boardman River, Michigan
Northeastern Lake Michigan Basin

LAND ACKNOWLEDGEMENT:
Homelands of Ottawa and Chippewa

Project Overview

Three dams, Boardman Dam, Brown Bridge Dam, and Sabin Dam, on Michigan's Boardman River, also known as the Ottaway River, were built in close proximity and all produced hydropower until they were removed in a collective effort. While each dam was an individually licensed project under FERC and were separately owned by Grand Traverse County and Traverse City, they were all leased for power by Traverse City Light and Power. Traverse City Light and Power entered into a settlement agreement to surrender the projects and have the dams evaluated for removal. The license and exemption surrenders were approved in 2006 and the dams were removed from 2012-2018.

Significance of This Removal

This was the largest restoration project in Michigan's history and collectively reconnected 160 miles of river and tributaries while restoring 5.5 miles of river, more than 80 acres of wetlands, and 180 acres of upland habitat.

DAM DETAILS			
Project Name and Number:	Boardman Dam Hydroelectric Project, P-2979 (exempt)	Brown Bridge Dam Hydro Project, P-2978	Sabin Dam Hydro Project, P-2980 (exempt)
Licensee:	Traverse City Light and Power		
Height; Length:	59 ft; 650 ft	46 ft; 1,650 ft	21 ft; 240 ft
Reason for Removal:	Ecology	Ecology	Ecology
Reason for License Surrender:	Safety	Safety	Safety
Project Capacity:	1,000 KW	725 KW	500 KW
Removal Cost:	$10,500,000	$4,400,000	$6,000,000

Removal Decision and Process

The Anishinaabek people, the Grand Traverse Band of Ottawa and Chippewa Indians (GTB), have called this area home for generations. They honor the river as a spirit and were involved in restoring the health of the river through dam removal from the beginning of this project. GTB sentiments regularly communicated and highlighted the cultural significance of the area, elevating key dimensions to the seemingly straight-forward effort in returning the river to a natural free-flowing state. Specifically, GTB offered the notions of kinship, reciprocity, and responsibility in demonstrating an authentic and deep relationship with the river, embodying the importance of keeping a holistic approach forefront in this project. The Tribe

focused on instilling care for both the river and the community and using the dam removals to help bring people together. On top of this, the Tribe served as the non-federal sponsor for the Project Partnership Agreement (PPA) with the U.S. Army Corps of Engineers funding contributions to the project. The Tribe also secured over $4.6M, largely through Great Lakes Restoration Initiative funding administered through the Bureau of Indian Affairs.

This project was a major undertaking for all involved, taking 15 years to complete. Much of the information for this case study is from the Boardman River Restoration site (theboardman.org), and the Michigan Hydro Relicensing Coalition. Traverse City Light and Power leased the three dams for power until 2004, when they ceased generating power and terminated the leases. The Michigan Department of Natural Resources (DNR) and the Michigan Hydro Relicensing Coalition (MHRC) worked with the licensee to surrender the license and license-exemptions and decommission the projects. Because the licensee was not the owner, they could not independently pursue removal. A settlement agreement allowed the Michigan Department of Environmental Quality (DEQ) (now the Michigan Department of Environment, Great Lakes and Energy) to take over regulatory authority when FERC's authority dissolved with the surrender of the licenses. The settlement also established an Implementation Team (IT) and the Boardman River Dams Committee (Committee) to assess the fate of the dams. The establishments of the IT and Committee were a significant contributing factor to the success of this project.

TIMELINE

- 1894: Boardman Dam built
- 1902: Sabin Dam built
- 1921: Brown Bridge Dam built
- 1922: Hydropower first online at Brown Bridge Dam
- 1930: Hydropower first online at Boardman Dam and Sabin Dam
- 1982: FERC exemption issued for Boardman and Sabin projects
- 1984: FERC license issued for Brown Bridge project
- 2004: Traverse City Light and Power stopped hydropower generation at Brown Bridge, Boardman, and Sabin dams and terminated its leasing agreement with Grand Traverse County and the City of Traverse City (dam owners)
- 2005: License (Brown Bridge) and exemptions (Boardman and Sabin) for the three dams surrendered. Settlement Agreement established the multiparty Implementation Team (IT) to assess the fate of the three dams along with Union Street Dam
- 2006: FERC approved license surrenders. The IT commissioned a feasibility study to assess disposition options
- 2009: Dam owners decided to remove Brown Bridge, Boardman, and Sabin dams
- 2012: Brown Bridge Dam removal dam started, completed in 2013
- 2014: Engineering and permitting for Boardman Dam removal and new Cass Road Bridge began
- 2016: New Cass Road Bridge constructed over original channel
- 2017: Boardman Dam removed, permitting underway for Sabin
- 2018: Sabin Dam removed

All three dams were aging, required costly maintenance and upgrades, and lacked adequate spillways for high water events. In addition, the Boardman Dam powerhouse and spillway structures had significant concrete spalling, and the Cass Road Bridge, which was incorporated into the site over the penstock intake for public vehicle transportation, was also losing its structural integrity and was deemed unsafe for certain modes of transit.

The IT and Committee gathered community input and hired a consultant to conduct a 3-year engineering and feasibility study of the four dams. The final outcome was the recommendation to remove all three dams and improve fish passage at Union Street Dam, a nonpowered dam that was furthest downstream. The recommendation was accepted and pursued by both Grand Traverse County and Traverse City in 2009. Funds had to be acquired for the dam removals and river restoration and the Conservation Resource Alliance stepped in as project manager to the IT. The removals of Brown Bridge, Boardman, and Sabin dams were completed in 2013, 2017, and 2018, respectively.

Project funding included grants from over 30 sources, totaling $25 million for design, construction, and associated costs. The U.S. Army Corps of Engineers (USACE) was a primary partner for the Boardman and Sabin Dam removals, providing $8M from an EPA partnership and $4.9M through the Great Lakes Fishery and Ecosystem Program for dam removal and restoration. The Grand Traverse Band of Ottawa and Chippewa Indians was the local sponsor, signing contracts with USACE and providing over $4.6M through grants from the Bureau of Indian Affairs, Great Lakes Fishery Trust, and the Great Lakes Restoration Initiative. Additionally, the Grand Traverse County Road Commission and Michigan DOT provided $3.31M in construction funds and sequenced building the new Robbins Bridge at Cass Road to replace the one-lane crossing over the powerhouse in 2016 so that the 252 ft span bridge could be built in "the dry" a year before dam removal. The bridge was positioned over the historic river channel, where the river returned after the Boardman Dam was removed.

PARTIES TO THE SETTLEMENT

8 parties: Michigan Department of Natural Resources, Michigan Department of Environmental Quality, U.S. Fish and Wildlife Service, Grand Traverse County, the City of Traverse City, Traverse City Light and Power Department, the Michigan Hydro Relicensing Coalition, and the Grand Traverse Band of Ottawa and Chippewa Indians.

EX-OFFICIO IT MEMBERS:

Conservation Resource Alliance, Grand Traverse Conservation District, Grand Traverse County Road Commission, The Watershed Center Grand Traverse Bay, and the Charter Township of Garfield.

There was some community opposition to the dam removals, and the Committee hosted many community meetings and tracked public comments during the engineering and feasibility study phase. In addition, the monthly IT meetings were open to the public where all participants were offered the opportunity to ask questions, share concerns and meaningfully engage in various aspects of informing the decisions on the fate of the dams. In similar fashion, the Committee and IT also worked directly with the landowners along the Boardman Pond as some landowners incorrectly assumed that they would own the bottomlands upon the removal of Boardman Dam and the pond behind it. Working with the county and legal experts, the Committee and IT clarified that the county owned the bottomlands as they were part of the greater 505-acre nature reserve. The adjacent landowners were continuously kept apprised of the project to ensure clear communication.

One notable challenge arose during the removal of Brown Bridge Dam. While lowering the reservoir, a temporary dewatering structure failed leading to an unintentional dewatering of the pond over a 6-hour period, rather than the planned dewatering schedule of 20 days. This

resulted in downstream flooding of local residents residing in the river's floodplain. The IT and construction contractors responded immediately to resolve the situation, including taking actions to stem the flows and working with the impacted landowners during and after the event. This experience led to restructuring the design team and using alternative dewatering methods at the other two dams, both of which were successfully removed without incident.

Key Takeaways

- The Tribe's leadership contributed significantly to both the public's understanding of the cultural value of the river and helped gain public support for removal. The Tribe was a leader in the construction phases of Boardman and Sabin Dam removals, entering into contract with the USACE and helping to meet the local match requirements.
- Public ownership of these dams helped establish community investment.
- Having a project manager at the helm, especially as this took 15 years to achieve, was critical to ensuring success of the project through communication, collaboration, and direction. This also helped with consistency despite personnel turnover in participating organizations and agencies.
- Community engagement was a crucial part of the process, especially as these were publicly owned dams with several private landowners along the banks of one of the former reservoirs.
- The IT's dedication to communication with the public and rapid response to the incident with Brown Bridge Dam helped to ensure that the overall dam removal project continued moving forward successfully.
- Strong partnerships were integral to the success of taking on these very large construction projects.
- Prepare for additional fundraising requirements if a bridge replacement is going to be necessary.

References

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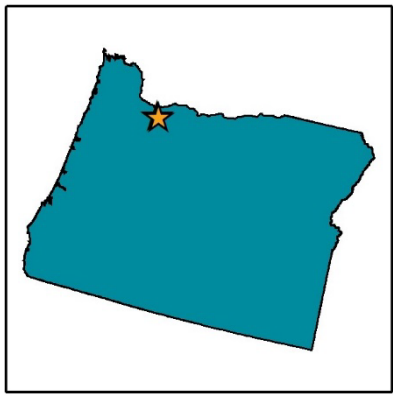
BULL RUN PROJECT

MARMOT DAM
LITTLE SANDY DAM
Sandy River and Little Sandy River, Oregon
Lower Columbia River Basin

LAND ACKNOWLEDGEMENT:
Homelands of the Confederated Tribes of Grand Ronde



Project Overview

The Bull Run Hydroelectric Project consisted of two dams, Marmot Dam on the Sandy River, and the Little Sandy Dam on the Little Sandy River in Oregon. The licensee, Portland General Electric (PGE), was going to need to complete expensive updates for environmental mitigation measures if they pursued relicensing, so they decided to not relicense. In 2002, a settlement was reached that included the removal of the dams, diversions, and associated structures, and the dams came out from 2007-2008.

Significance of This Removal

This was the largest removal of sediment at the time and required an extensive sediment management plan to address the 800,000 cubic yards of sediment that filled the impoundment behind the Marmot Dam.

Removal Decision and Process

The Bull Run Hydroelectric Project was initially a significant power producer for Portland, OR and neighboring areas. The Marmot Dam diverted water from the Sandy River through a tunnel to the Little Sandy River where the Little Sandy Dam diverted the combined flow of the two rivers to the Bull Run Powerhouse. Marmot Dam diverted a significant portion of the Sandy River's flow to provide optimal hydropower generation. This power source was eventually replaced by regional connectivity of the grid, alternative sources of energy, and conservation.

DAM DETAILS		
Project Name and Number:	Bull Run Hydroelectric Project, P-477	
Licensee:	Portland General Electric	
Dam Name:	Marmot Dam	Little Sandy River Dam
Height; Length:	47 ft; 194 ft	16 ft; 114 ft
Reason for Removal:	Ecology	Ecology
Reason for License Surrender:	Economics	Economics
Project Capacity:	22,000 KW	
Removal Cost:	$4,810,000	$7,500,000

PGE began preparing for relicensing Bull Run in 1998, with the impending deadline of 2004. Fish passage at Marmot Dam was inefficient and relicensing would have required significant upgrades. Protection, mitigation, and enhancement measures required by FERC to relicense the dams came to an estimated cost of $20,000,000. PGE decided to not pursue relicensing upon discovering this cost as it rendered the project uneconomical, and they proceeded with surrendering the license.

Initially, the state wanted to keep the dam in place as it prevented hatchery salmon from mixing with wild runs upstream of the dam. At the fish ladder, hatchery salmon were sorted out so that they could not get up to the headwaters with the wild salmon. This was to keep the hatchery salmon from diluting the wild gene pool. The state ultimately agreed to dam removal for the overall ecosystem benefits but plans for addressing the issue of hatchery salmon contributed to a delay between settlement and dam removal. The last out-of-basin hatchery fish were scheduled to return to the river in 2007 and removal was scheduled for that fall.

TIMELINE

- 1912: Marmot Dam and Little Sandy Dam built
- 1974: License for Bull Run issued to Portland General Electric (PGE)
- 1989: Original Marmot Dam timber crib replaced with concrete
- 1999: PGE decided to not relicense the project
- 2002: Settlement reached on decommissioning and removal
- 2002: PGE asked FERC to extend license to operate until 2008
- 2004: FERC granted the surrender, (original license expiration date)
- 2007: Marmot Dam removed
- 2008: Little Sandy Dam removed

PGE had considered walking away from the project, but stakeholders collaborated with them to come to a settlement agreement in 2002 that included project decommissioning and removal. Land was transferred to the Bureau of Land Management who manages the former dam site for recreation and river access. Federal and state agencies were heavily involved with the settlement and implementation, as were environmental groups. PGE agreed to cover the costs of removing the Marmot Dam, Little Sandy Dam, and the associated structures as part of the settlement.

PARTIES TO THE SETTLEMENT

23 parties: Portland General Electric; U.S. Forest Service; National Marine Fisheries Service; U.S. Fish and Wildlife; Bureau of Land Management; State of Oregon; OR Department of Environmental Quality; OR Department of Fish and Wildlife; OR Water Resources Department; OR Division of State Lands; Alder Creek Kayak Supply, Inc; American Rivers; American Whitewater; Association of NW Steelheaders; City of Sandy, OR; The Native Fish Society; Northwest Sportfishing Industry Association; Oregon Council of Trout Unlimited; Oregon Trout; Sandy River Basin Watershed Council; Trout Unlimited; Waterwatch of Oregon; Western Rivers Conservancy.

One of the biggest causes of the delay in starting removal was addressing the sediment behind Marmot Dam. Because of the dam's location in the watershed, large amounts of sediment were trapped behind the dam, approximately 800,000 cubic yards, which was estimated to take up to five years to flush downstream. A natural event of a lahar, a destructive flow of water, volcanic ash, rock fragments, and chunks of ice, coming off of Mount Hood actually helped to push the removal schedule forward – the massive amount of water and sediment filled the reservoir and damaged the drum screens that had been protecting fish.

To address the sediment load, the project team built an upstream cofferdam and bypass channel to divert the water while the concrete dam was removed. A storm rolled in just as they had removed the dam and were ready to notch the cofferdam, assisting in flushing the reservoir. Models helped to

inform where to notch the cofferdam to flush the most sediment, and this helped to keep removal costs down by eliminating the need to haul the sediment out manually. Mobilization of the sediment that was expected to take years ended up taking weeks, with substantial mobilization in the first 48 hours, serving as an example of the incredible restorative power of rivers once barriers are removed.

Key Takeaways

- Stay involved and informed early in the relicensing process.
- Work with state and federal agencies to help hold the licensee accountable.
- Build trust and relationships with other stakeholders, especially when working on a settlement together.
- Have a plan for the sediment behind the dam and use models when necessary to help inform the dam removal plans. In this case, models were conservative and sediment mobilization and recovery happened much more quickly than expected providing valuable data to refine and calibrate future sediment models associated with dam removal.

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CARBONTON DAM

Deep River, North Carolina
Cape Fear River Basin

LAND ACKNOWLEDGEMENT:
Homelands of the Eno, Tutelo, Saponi, Occaneechi, and Shakori Native people

Project Overview

The Carbonton Dam hydropower project operated from 1921 until it was retired in 2004 due to the high cost of operation and maintenance. The dam had been identified by the North Carolina Dam Removal Task Force as an ideal removal project for environmental benefits and public safety. Restoration Systems (RS), an environmental mitigation banker, decided to pursue removing the dam to provide mitigation credits. The license was surrendered, and the dam was sold to RS, who then removed the dam.

Significance of This Removal

This dam was the first hydropower dam removed in North Carolina to provide mitigation credits.

DAM DETAILS	
Project Name and Number:	Carbonton Hydroelectric Project, P-3155
Licensee:	Michael R. Allen
Height; Length:	17 ft; 270 ft
Reason for Removal:	Mitigation
Reason for License Surrender:	Economics
Project Capacity:	1,000 KW
Removal Cost:	$8,200,000

Removal Decision and Process

The Carbonton Dam was identified by a group of state and federal agencies as a top priority for removal because of the public benefits removal would provide. This group, known as the North Carolina Dam Removal Task Force (DRTF), was comprised of the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, North Carolina Division of Water Quality, North Carolina Wildlife Resources Commission, U.S. Environmental Protection Agency, National Marine Fisheries Service, North Carolina Division of Marine Fisheries, North Carolina Natural Heritage Program, North Carolina Division of Coastal Management, and the North Carolina Department of Transportation. The task force identified ten dams as priorities for removal, so long as the owners were willing. Removal of the dam could provide mitigation bank credits that could be purchased by the state, counties, cities, or other private permit applicants impacting streams and wetlands through development. Permits to develop wetlands are issued according to the Clean Water Act and require “no net loss” of the regulated resource. The dams identified by the DRTF, including Carbonton and Milburnie, provided the greatest yield of environmental improvement credits relative to the challenge and anticipated cost of their removal.

Carbonton Dam fragmented habitat for the federally endangered Cape Fear Shiner, a minnow species that lives only on the Cape Fear River and two tributaries, Deep River and Haw River. Removing the dam and restoring the river improved habitat, increased the Cape Fear Shiner population, and provided a significant number of mitigation credits (approximately 80,000).

The dam was an operating hydropower producer when the DRTF identified it, yet it was on the verge of being shut down due to high operation costs along with updated regulation prohibiting the project's harmful peaking operation. Restoration Systems approached the owner, Cox Lake Carbonton Associates, about dam removal, and they agreed to sell the dam and associated land and property. Permitting and assessments were all completed by RS and the dam owner applied to transfer the license to an individual who then sold the dam to RS upon surrender to facilitate removal. FERC approved this surrender and removal plan in 2005 and the dam was removed later that year.

TIMELINE

- 1921: Carbonton Dam built
- 1982: License for Carbonton Dam Hydroelectric project issued
- 2002: North Carolina Dam Removal Task Force formed
- 2004: Hydropower retired
- 2005: License transferred to Michael Allen along with application for license surrender and intent to remove dam (upon approval, Michael Allen sold the dam to Restoration Systems). Dam removed later that year

This removal restored 10 miles of river that had been impounded by the dam and RS monitored the site for five years following removal. The powerhouse remained intact as a historic site and a small park was established by RS at the site.

The guidance on dam removal for mitigation credits led to three successful dam removals in North Carolina: Carbonton, Lowell, and Milburnie. The projects ended up inundating the market to the point that the permitting agencies felt that dam removals were disproportionate compared to other mitigation projects. The crediting guidance, which was drafted by RS and approved by USACE, was rescinded after just a few dams were removed. North Carolina has yet to come to another agreement on crediting dam removals for mitigation.

Key Takeaways

- Dam removals can be mitigation banks under the right circumstances, leading to a profitable project for the bank sponsor and funding a way to restore the river.
- For a dam removal, you may need to get the mitigation banking Interagency Review Team to agree on a specially developed crediting system if it is the first proposal in your state.
- Working closely with USACE and other federal and state agencies was critical to the success of this project.
- Budget for significant time and resources to obtain necessary permits.
- Have a community outreach plan including outreach to landowners along the reservoir, if applicable. Address potential fears preemptively and help people understand what to expect from the removal project and how the site will change over time after removal. Use illustrations if possible.

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CHATTAHOOCHEE RIVER PROJECTS

CITY MILLS DAM
EAGLE AND PHENIX MILLS DAM
Chattahoochee River, Georgia
Apalachicola River Basin

LAND ACKNOWLEDGEMENT:
Homelands of Hitchiti, Cusseta, and Koweta (or Coweta)

Project Overview

The City Mills Dam and the Eagle and Phenix Dam are two separate hydropower projects on the Chattahoochee River between the cities of Columbus, Georgia and Phenix City, Alabama. Both dams were built on the fall line of the Chattahoochee River to harness the power of the steep gradient of the location, with City Mills Dam just upstream of the Eagle and Phenix Dam. While they were owned and operated separately, they were removed in a collective effort.

Significance of This Removal

Two obsolete dams were removed for ecological benefit and economic development through downtown revitalization, including building a whitewater park.

LABOR ACKNOWLEDGEMENT:
Both of the original dams were built by enslaved people.

Removal Decision and Process

Wooden dams were built at the sites of the City Mills Dam and the Eagle and Phenix Dam in the 1800s. The first City Mills Dam was built in 1828 to power a grist mill. It was replaced by a mortared stone hydropower dam in 1907, which operated until generation ceased in 1992 when the associated mill complex was closed. The original Eagle and Phenix Dam was built in 1844 to power textile mills. The project was upgraded to provide power for lighting circa 1880 and continued to produce power through 2002, when one of the powerhouses was struck by lightning and caught fire, eliminating most of the generation capacity. The dams and the license for City Mills were acquired by Uptown Columbus (UC), a local non-profit, with the intent to remove the dams, restore the river, and revitalize the downtown area with a whitewater park.

Over the many decades of the mill operations, pollutants ran freely into the Chattahoochee River, and it was treated as an open sewer. Sewage flowing into the river from a portion of the city

DAM DETAILS		
Project Name and Number:	City Mills Hydroelectric Project, P-8519 (exempt)	Eagle and Phenix Hydroelectric Project, P-2655
Licensee:	Uptown Columbus, Inc.	Eagle and Phenix Hydro Company, Inc.
Height; Length:	10 ft; 850 ft	17 ft, 1009 ft
Reason for Removal:	Economics	Economics
Reason for License Surrender:	Economics	Economics
Project Capacity:	735 KW	4,260 KW
Removal Cost:	$2,000,000	$1,500,000

added to the problem. By the 1980s, after the Clean Water Act was passed and other environmental protections were instituted, the city of Columbus, Georgia initiated a large-scale cleanup of the river. A combined sewer overflow (CSO) abatement project was built. This included a paved trail adjacent to the river known as the river walk. The CSO management project turned public attention to the river and set the stage for downtown revitalization through dam removals and a whitewater park.

TIMELINE – CITY MILLS DAM

- 1828: City Mills Dam built
- 1907: Wood dam replaced by mortared stone hydropower dam
- 1985: FERC exemption from licensing issued
- 1992: Power generation stopped due to mill shutting down
- 2000: Plans were submitted to FERC to sell the powerhouse and build a new structure on the other side of the river
- 2004: USACE filed a Section 206 Environmental Restoration Report on the City Mills and Eagle and Phenix Dams
- 2008: Uptown Columbus, Inc purchased the dam
- 2010: License-exempt status surrendered with intent to remove
- 2013: 350 linear feet of the dam removed; powerhouse and mill buildings repurposed

Dam removal conversations had started in the 1970s and were picked back up in the 1990s when UC spearheaded efforts to remove the dams. UC worked for several years to acquire ownership of both dams and raise funds to remove them and build a whitewater park below the site of the Eagle and Phenix dam.

Both City Mills Dam and Eagle and Phenix Dam were in poor shape when UC approached the owners to buy them. The owners of the City Mills Dam realized the liability of the project and agreed to sell the dam and powerhouse to UC for $250,000 in 2008 and the license exemption was surrendered by UC in 2010. Eagle and Phenix was functional until the lightning strike of 2002 damaged the powerhouse and started losing the company $10,000 each month. The dam was donated in 2003 to UC with the intent to remove it, and the license was surrendered in 2010 alongside the license-exemption for City Mills Dam.

In order to take on such a large removal and to help fund the project, the U.S. Army Corps of Engineers (USACE) was brought in to do a Section 206 Environmental Restoration Report on the dams. Though USACE was not initially supportive of the removal efforts, UC and other stakeholders were persistent and presented ecological and economic studies showing the benefits of removing the dams. USACE was ultimately swayed by the restoration benefits of the project as this was a biologically significant area and one of few opportunities to restore fall line habitat. Dam removal would provide habitat for bass and shad, and would allow the endangered shoal spider lily plant to be re-established.

Uptown Columbus' goal was to enhance economic development by establishing recreational opportunities on the newly opened stretch of river. The drop in gradient of the fall line was significant, creating natural whitewater features. The local community determined that a

whitewater park would enhance these features and help bring in tourism. Before either dam came out, the riverbed below Eagle and Phenix was assessed and prepared for the whitewater park. After the dams were removed, water flowed through the historic path of the river with modified waves to attract paddlers and improve the experience of whitewater rafters. The result was hugely successful, to the point that Columbus hosted the International Canoe Federation Canoe Freestyle World Cup in the Fall of 2022 and the World Championship in 2023. In addition to the ecological and tourism benefits of this removal, the powerhouses and buildings of the two projects have been successfully converted into commercial and residential spaces, providing additional financial benefit from the investment in the project.

TIMELINE – EAGLE AND PHENIX DAM

- 1844: Eagle and Phenix Mill Dam built
- 1880: Dam updated to provide electricity
- 1899-1920: Turbines and generators installed
- 1975: FERC license issued
- 2002: Lightning strike damaged the powerhouse and resulted in minimal generation of power; coincidentally the sole customer went under and stopped buying electricity
- 2003: Dam donated to Uptown Columbus for restoration
- 2004: Licensee submitted request to cease power generation, FERC granted; USACE filed a Section 206 Environmental Restoration Report on the City Mills and Eagle and Phenix Dams
- 2009: License expiration date
- 2010: License surrendered with intent to remove
- 2012: 450 linear feet of the dam removed; powerhouse and textile buildings repurposed

Another factor that played into both the removal of the dams and the present-day whitewater park is the presence of two large hydropower plants just upstream of the restored area. These projects operate as peaking projects, varying the water levels from 800 to 10,000 cubic feet per second, depending on power generation needs. Collaboration with the owner and operator of these dams, Georgia Power, was essential for the timing of the removal process.

Neither dam was fully removed. The Eagle and Phenix Dam had 450 out of 1009 linear feet removed while the City Mills Dam had 350 out of 850 linear feet removed. These partial removals took out most of the in-stream portions of the structures so that flow and functionality of the river were restored.

Funding for this project was made possible by several sources of public and private funds to cover the $24 million price tag. The City of Columbus contributed $5 million, USACE contributed $5 million, NOAA contributed $600,000, and $13.8 million was contributed by donors.

Key Takeaways

- Be persistent, especially when it comes to working with agencies such as USACE. It took about 10 years to get agreement from USACE to proceed with this project.

- Work with stakeholders and get the community involved. Blast days for both dams were highly publicized with many community members coming out to spectate and support the efforts.
- Work with organizations that can help fundraise, finance, and publicize the project. These organizations can be especially helpful in promoting efforts to revitalize rivers going through towns or neighborhoods and reconnecting the community to the river.
- If the project is in a developed area, it may be worth exploring how the powerhouse can be repurposed to help fund restoration efforts.
- Establishing a whitewater park could be another selling point for dam removal as this will bring in tourist dollars and provide the community with another local park. If pursuing this path, work with both the whitewater park engineers *and* biologists to ensure that there are not unintended negative consequences to habitat and fish migration.
- River restoration and economic development were equal drivers of this project. This is a model example of dam removal benefiting a community financially due to access to a free-flowing river.

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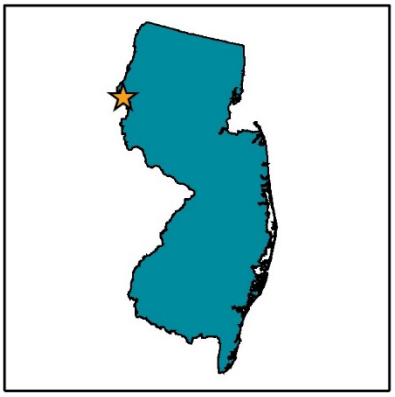
COLUMBIA LAKE DAM

Paulins Kill, New Jersey
Upper Delaware River Basin

LAND ACKNOWLEDGEMENT:
Project is within Lënapehòkink, the original homelands of the Lenape



Project Overview

The Columbia Lake Dam was built in 1909 to provide hydropower for the neighboring community. The dam was owned by the state and was leased by Great Bear Hydro for hydropower. The dam removal was initiated when The Nature Conservancy (TNC) reached out to the licensee. An economic analysis of the project found that relicensing requirements of fish passage and improvements would render the project uneconomical, and the licensee voluntarily surrendered the license in 2016. The dam was removed in 2018.

Significance of This Removal

This was an operational hydropower project whose license was surrendered due to impending expenses and the dam was removed for fish passage.

DAM DETAILS	
Project Name and Number:	Columbia Dam Hydroelectric Project, P-8396
Licensee:	Great Bear Hydropower, Inc.
Height; Length:	18 ft; 330 ft
Reason for Removal:	Ecology
Reason for License Surrender:	Economics
Project Capacity:	530 KW
Removal Cost:	$8,000,000

Removal Decision and Process

The Columbia Lake Dam was on the Paulins Kill, the third largest tributary of the Delaware River, just upstream of the confluence (Kill is Dutch for stream). It had long been a barrier to American shad and American eel migration, along with bisecting habitat for mussels and other aquatic species. TNC did a prioritization study of dams in the Northeast that would provide the greatest ecological benefit if removed. Columbia Lake Dam came in within the top 5% in the region. Because the project was up for relicensing within ten years of this analysis, TNC made the decision to reach out to the dam owner directly in 2014.

Because the dam did not provide fish passage, it was likely that relicensing would require this as a mitigation measure. TNC brought this information to the licensee, Great Bear Hydropower, Inc. (GBH), and discussed the cost-risk analysis of going through relicensing versus pursuing license surrender and removal. The licensee agreed to share their records of taxes and profits of the projects with TNC, and it was immediately apparent that the project was barely profitable. The requirement of installing fish ladders would take a lifetime to recoup the expense of installation. In addition, the Columbia Lake impoundment was filling with sediment, decreasing overall generation capacity. Armed with this information, the licensee agreed to voluntarily surrender the license and remove the generation equipment in 2015.

The dam was operated for hydropower from 1909-1955, when it was sold to the New Jersey Division of Fish and Wildlife (DFW). GBH started leasing the dam and was issued a FERC license in 1986. Around 2015, they sold the lease to TNC for $200,000, with the agreement to surrender the license to FERC before transferring the lease. GBH was also allowed to sell the turbines and hoisting equipment and keep the proceeds.

TIMELINE

- 1909: Columbia Lake Dam built
- 1955: Power generation ceased, and land sold to the New Jersey, Division of Fish and Wildlife
- 1986: Hydropower generation started again; FERC license issued
- 2014: TNC reached out to dam owner, beginning the dam removal process
- 2015: Licensee applied for license surrender
- 2016: License surrendered, hydropower retired, all hydropower elements removed
- 2018: Dam removed

The state was agreeable to dam removal, especially as project lands were part of the DFW's Columbia Wildlife Management Area. TNC worked with American Rivers, the New Jersey Department of Environmental Protection (DEP), DFW, U.S. Fish and Wildlife Service, and Princeton Hydro to complete the project. This was the first dam removal for NJ TNC.

There was little opposition to the dam removal, especially as this was in a wildlife management area. An open house was hosted to discuss the project within the community, and this was followed up with endorsement from the mayor, discussions in township meetings, and one-on-one outreach, all of which helped the community understand the project and the benefits that would come with removal.

The DEP provided $5 million for the project from the Natural Resource Damage settlements of the state, and TNC contributed $1.4 million. Special consideration was given to managing mussel populations during removal.

Another unique aspect of this project was the plan for energy replacement. DFW operates the nearby Pequest Fish Hatchery, which had been using power generated by the dam. Part of the plan for removal included installing solar panels over the fish hatchery ponds to serve the dual purpose of replacing the dam's energy generation at the dam (in excess), mitigating predation and water contamination issues that the hatchery faced. Not every dam removal includes a plan for replacing the generating capacity of the hydropower plant, and this is an excellent case of doing that with a creative dual purpose.

Key Takeaways

- The success of this project was due to collaboration among stakeholders and having a strong champion involved in every step of the process.
- Having the full economic picture of the project, including expected costs of relicensing, can help the licensee determine the economic viability of their project. Stakeholders may ask for this information and if the licensee is willing to share, stakeholders may assist in doing an economic analysis of the project.
- Having money to pay the licensee or owner can help expedite the decision-making process.

- Having the licensee cover all associated costs is possible, but not always timely.
- Make sure that threatened and endangered species are taken into consideration early with removal plans and that the necessary state and federal agencies are consulted, especially to assess the need for and assist with mussel relocation.
- Overall, just because there are obvious challenges, it does not mean that it is not possible.

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CONDIT DAM

White Salmon River, WA
Middle Columbia River Basin

LAND ACKNOWLEDGEMENT:
Homelands of Yakama, Wasco, Wishram, and Klickitat

Project Overview

The Condit Dam was built in 1913 to generate hydropower and it was the first blockage on the White Salmon River, a Columbia River tributary, preventing upstream passage of Pacific salmon and steelhead. FERC issued an Environmental Impact Statement (EIS) in 1996 that required PacifiCorp, the licensee, to install state-of-the-art fish passage if they wanted to relicense the project. Tribes and environmental groups advocated for dam removal, and PacifiCorp ultimately decided it was more economical to remove the dam. Removal was completed in 2011.

Significance of This Removal

This was the largest dam removal in the U.S. at the time. FERC had changed the definition of "baseline" to pre-project conditions (though this was short lived), and fish passage requirements to relicense the project rendered it uneconomical.

DAM DETAILS	
Project Name and Number:	Condit Hydroelectric Project, P-2342
Licensee:	PacifiCorp
Height; Length:	125 ft; 471 ft
Reason for Removal:	Ecology
Reason for License Surrender:	Economics
Project Capacity:	14,700 KW
Removal Cost:	$35,000,000

Removal Decision and Process

The White Salmon River has been an important river to the Yakama Nation for generations. The salmon and steelhead that once filled the river were fished by Tribal members and access to these fish was protected under treaty-reserved fishing rights. Construction of the Condit Dam detrimentally impacted fish populations and simultaneously prevented treaty rights from being honored while also displacing Tribal members living along the river. When the Condit hydropower project came up for relicensing, the Yakama Nation became heavily involved throughout the process, insisting on restoration of the river through dam removal. Taking down the Condit Dam was not just a technical fish passage issue; it also addressed environmental justice. Restoring the river and allowing salmon to return to the Yakama Nation was one step towards righting the wrongs that have been brought upon the Tribe by colonization and industrial development.

The license for the Condit Hydroelectric Project was set to expire in 1993. When the licensee, PacifiCorp, filed for relicensing in 1991, stakeholders started getting involved in the process. Environmental groups wanted to see either better fish passage or dam removal, as the project blocked nearly 40 miles of salmon and steelhead spawning grounds upstream of the dam. Removing Condit would provide access to upstream spawning and restore spawning habitat in the otherwise heavily dammed Columbia Basin. Only one dam would remain between Condit and the Pacific Ocean, and it had operational fish passage.

The Yakama Nation requested a study of the ecological and cultural impacts of the project while American Rivers organized conservation organizations and Tribes to join the intervention efforts. Conservation intervenors raised the fact that removing the Condit Dam would restore connectivity to the entire river. These groups worked with federal agencies that have mandatory conditioning authority to enforce clean water, fish passage requirements, and minimum in-stream flow requirements.

TIMELINE

- 1913: Condit Dam built
- 1968: Original license issued
- 1991: Licensee filed for relicensing
- 1992: Yakama Nation submitted a request for study of the ecological and cultural impacts of project
- 1996: FERC issued EIS requiring state-of-the-art fish passage
- 1999: Settlement reached, license extended to 2006 and removal plan outlined
- 2009: Licensee settled with Klickitat County on CWA Cert
- 2010: Supplemental EIS submitted; License surrender and decommissioning plan accepted by FERC
- 2011: FERC issued final dam removal order and the dam was removed
- 2019: Licensee completed the decommissioning report and license surrender is accepted by FERC

PacifiCorp was not interested in dam removal at first. Although the reservoir was filling with sediment causing generation capacity to decrease, consistent year-round flows in the river allowed for reliable year-round production. Dam removal was ultimately chosen instead of costly fish passage and in-stream flow requirements.

The intervenors participated heavily in ensuring a thorough EIS from FERC. When the EIS was published in 1996, it required the installation of state-of-the-art fish passage to mitigate for the impacts of the project. This requirement was monumental, as it was the culmination of efforts to get the EIS in the first place *and* to challenge FERC's definition of "baseline" when measuring impacts. In relicensing, the "baseline" of the project is considered to be the current status of the project (e.g., the dam in place and current hydropower operations). Changing this baseline would initiate an analysis of environmental impacts, but if operations were staying the same for the new license, FERC did not require an analysis of impacts (because they did not see the baseline as being changed). Environmental groups have long pushed for "baseline" to mean pre-dam status of the river, so when the environmental impacts are measured, it is against the free-flowing river, not the presently dammed and damaged river. This change in definition of baseline helped lead to the fish passage requirement in the EIS, though this was short lived, and FERC has returned to their original definition of "baseline".

Environmental groups and Tribes advocated for dam removal as an alternative to the "as-is" condition and were successful despite this being early in the nation's dam removal movement. It is significant that while this process was happening with the Condit Dam, FERC was examining their own authority to require a dam removal, which they confirmed they had through a 1995 policy statement. FERC gave PacifiCorp the option to install fish passage and increase in-stream flows or remove their dam, thereby not testing their authority by outright calling for the removal of the dam.

PacifiCorp reviewed the fish passage requirements and determined that removal was the cheaper option. In hindsight, this seems like a straightforward conclusion, but it actually took American Rivers hiring an expert civil engineer with experience in dam removals to break down dam removal costs, as FERC initially deemed removal to not be financially feasible. Once the expert report was submitted, PacifiCorp was willing to come to the table to discuss a settlement. In 1999, a settlement was reached to extend the license to 2006 (then later 2008) to generate funds for dam removal, which PacifiCorp agreed to pay for and initiate by 2006. There was a lot of back and forth in the years between 1999 and the dam removal in 2011 due to some local opposition, concern about the impacts of the removal on the clean water certification, and permitting delays. In addition, PacifiCorp tried to get out of their obligations by asking for more fish studies over several years, proposing off-site mitigation in another basin, and finally trying to pursue trap and haul instead of removing the project. This required dedication and determination as well as funds and time from the environmental groups and the Yakama Nation to fight each of these efforts and hold PacifiCorp to the settlement agreement. FERC issued an order approving final dam removal plans in 2010 and deconstruction began in 2011.

PARTIES TO THE SETTLEMENT

23 parties: 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, PacifiCorp, American Rivers, U.S. Department of the Interior, American Whitewater Affiliation, 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, the Washington Wilderness Coalition, and the Columbia River Intertribal Fish Commission.

Klickitat County led local opposition, threatening litigation in their attempt to stop the dam removal. They and others argued that the sediment that would be released with removal would impact water quality and water infrastructure, and they threatened to challenge the CWA 401 certification of the plans. PacifiCorp ended up settling with the county directly, paying $1 million to have the county withhold their challenge of the certificate. The concern over water quality was only considered over a short period of time, right after the dam removal, when the river would carry higher than normal amounts of sediment as the reservoir flushed. Despite this temporary increase in suspended sediment, dam removals improve long-term water quality by increasing oxygenation levels in the water, better sediment distribution, and natural water temperatures.

The water quality and sediment issue took time to review, and developing the removal plans and obtaining all necessary permits took several more years. When the plans were all finally in place, FERC issued a dam removal approval order in 2010 and removal commenced the next year. Restoration and monitoring efforts continued for several years, and the final project report and license surrender was accepted by FERC in 2019.

Key Takeaways

- Yakama Nation did not back down from requesting that the Condit Dam be removed, and their voice and activism was vital. Tribal involvement can add another layer of

cultural significance and a very important perspective if the local Tribe(s) is willing and able to be involved in the process. While removal of a dam solely for the preservation of culturally sensitive areas has not happened yet, removing a dam to restore access to historic fishing grounds and restoring those historic fish runs brings an important cultural lens to the project.

- Treaty-reserved fishing rights were another element in this project and should be uplifted and honored in future dam removals.
- Get involved early in the relicensing process and include as many stakeholders as possible to help advocate for dam removal. Some of those stakeholders should be local or within the basin so that the intervention does not come off as an "outside job."
- Working with NOAA was critical in this project as they prescribed the state-of-the-art fish passage needed for salmon, ultimately driving PacifiCorp's decision to remove the dam.
- Involving local representatives can be helpful, especially if they understand the economic and environmental benefits of dam removal. Opposition from one representative is part of the reason it took so long for the project to move forward.
- Make sure that all constituencies are informed, if not involved, especially homeowners along the reservoir.
- Develop a solid plan for sediment management. Because of the amount of sediment in the Condit reservoir, U.S. Army Corps of Engineers regulators had to approve the plans.
- Reduce risk for litigation with CWA certification by clarifying long-term water quality benefits.
- PacifiCorp was the licensee for the projects at Cove Dam and Condit Dam. For Condit, local and governmental opposition to dam removal contributed to delaying removal by a decade whereas full stakeholder and local support for removing Cove led to the dam being removed within a year of reaching a settlement.

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COVE DAM

Bear River, ID
Lower Bear River Basin

LAND ACKNOWLEDGEMENT:
Homelands of the Shoshone-Bannock

Project Overview

The Cove Dam was one of four hydropower dams built on the Bear River in southeast Idaho in the early 1900s. Cove Dam had maintenance issues and when it came up for relicensing, the licensee came to a settlement agreement to remove the dam while relicensing the remaining three projects.

Significance of This Removal

Removing Cove Dam provided environmental benefits while the licensee was able to relicense related projects and increase their net generation capacity.

Removal Decision and Process

DAM DETAILS	
Project Name and Number:	Grace/Cove Hydroelectric Project, P-2401, P-20
Licensee:	PacifiCorp
Height; Length:	26 ft; 141 ft
Reason for Removal:	Ecology
Reason for License Surrender:	N/A – License amended
Project Capacity:	7,500 KW
Removal Cost:	$3,200,000

The Cove Dam was one of four PacifiCorp hydropower dams on the Bear River in southeastern Idaho within 40 miles of each other. There were initially three FERC licenses for the projects, one for Grace Dam and Cove Dam together, and individual licenses for Soda Dam and Oneida Dam. PacifiCorp went to renew the licenses and group the projects under a single license starting in 1999. Conservation groups along with state and federal resource agencies became involved in relicensing as the projects initially lacked any environmental mitigation or base flow requirements. The lack of in-stream flow requirements allowed the projects to divert the entire flow from large segments of the river in order to produce maximum electricity.

A settlement was reached in 2002 that established the Environmental Coordination Committee (ECC), who would oversee implementation of the settlement agreement, including all environmental improvements, for the duration of a 30-year license (2003-2033). The settlement required minimum base flows in the river throughout the year as well as seasonal pulses to help scour the riverbed. The settlement also required PacifiCorp to conduct a feasibility study for fish passage at Cove Dam. Over the course of the relicensing process, the Cove Dam's mile-long wooden flume was breached twice and caused the powerplant to be shut down for safety and further assessment. Between the flume failures and the high cost of installing fish passage, PacifiCorp and the ECC decided that decommissioning the dam was the best alternative. This decision was brought to FERC in 2004 and a new settlement agreement was reached in 2005. The new settlement included plans to remove Cove by 2006. The revised settlement also allowed the Grace Dam to "take

back" 17 cubic feet per second (cfs) that was dedicated to instream flows in 2002 and use the water to increase generation, making up for the loss of Cove and generating funds to partially offset the cost of removal. Grace Dam is still required to have a minimum flow of at least 63 cfs in the bypassed reach of the river.

TIMELINE

- 1907: Congress authorized construction of the Bear River Hydro projects (Soda, Grace, Cove, and Oneida)
- 1917: Cove Dam built
- 1999: Licensee filed for relicensing
- 2002: Settlement reached with environmental improvements and the four dams coming under the same license
- 2003: New license issued for the projects
- 2004: Licensee recommended decommissioning
- 2005: Revised settlement agreement submitted including the removal of Cove Dam
- 2006: Decommissioning plans accepted; Cove Dam removed

The Bonneville cutthroat trout (BCT) is a local native species that was in decline and was the primary driver behind requiring fish passage at Cove. The ECC developed plans restore habitat, funded by PacifiCorp, and included actions such as restoring riparian areas, working with local farmers to install fences to restrict livestock from the river and, and contributing financially to the Grace Fish Hatchery to raise trout stock. PacifiCorp and the ECC have continued to work together since the agreement and in 2014 they successfully opposed a potential new hydropower project that was proposed to be built just below the last of the Bear River projects, Oneida Dam. This was a unique example of a hydropower licensee opposing construction of a new project that would have threatened their mitigation investment.

PacifiCorp fully funded the removal of Cove Dam and the associated structures aside from the powerhouse, which was left in place for historic purposes. The removal cost was $3.2 million, much less than the estimated $5 million required to repair the dam and project and get the powerhouse back online.

PARTIES TO THE SETTLEMENT

16 parties: U.S. Fish and Wildlife Service, United States Bureau of Land Management, United States National Park Service, United States Forest Service, Shoshone-Bannock Tribes, Idaho Department of Environmental Quality, Idaho Department of Fish and Game, Idaho Department of Parks and Recreation, Idaho Council of Trout Unlimited, Idaho Rivers United, Greater Yellowstone Coalition, American Whitewater, and other interveners.

Key Takeaways

- Personal relationships were vital to the success of this project. While removal was not what the licensee originally sought, the combination of developing relationships with stakeholders through settlement and establishing ECC, as well as the financial realities of requirements for updating the project brought the licensee to come to agree to dam removal.
- PacifiCorp was the licensee for the projects at Cove Dam and Condit Dam. For Condit, local and governmental opposition to dam removal contributed to delaying removal by a decade whereas full stakeholder and local support for removing Cove led to the dam being removed within a year of settlement being reached.

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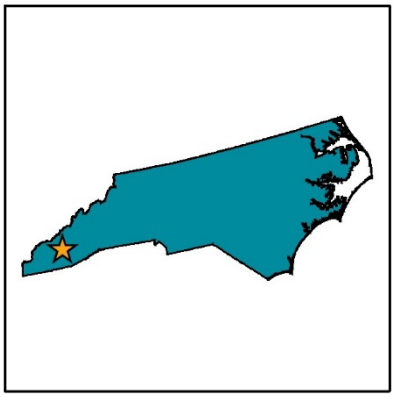
DILLSBORO DAM

Tuckasegee River, North Carolina
Upper Tennessee River Basin

LAND ACKNOWLEDGEMENT:
Homelands of the Anikituwagi (Cherokee)



Project Overview

The Dillsboro Dam was built in 1913 on the Tuckasegee River in western North Carolina. The license was set to expire in 2005 and the licensee, Duke Energy, started the relicensing process in 2000. Several additional projects licensed by Duke Energy were up for relicensing around the same time and Dillsboro Dam was removed as mitigation for relicensing.

Significance of This Removal

This dam removal was fully funded by the licensee to mitigate for impacts from nearby projects that were relicensed.

DAM DETAILS	
Project Name and Number:	Dillsboro Hydroelectric Project, P-2602
Licensee:	Duke Energy
Height; Length:	12 ft; 310 ft
Reason for Removal:	Ecology
Reason for License Surrender:	Ecology
Project Capacity:	225 KW
Removal Cost:	$1,000,000

Removal Decision and Process

Dillsboro Dam was built in the historic homelands of the Eastern Band of Cherokee Indians (EBCI). EBCI got involved in the project to help protect Tribal interests. Although the current extent of EBCI Tribal lands was not directly impacted by the projects involved in the settlements, they impacted the Tribe in other ways. On top of altering the flow and features of a homeland river, the Dillsboro Dam impacted redhorse fish populations, which are historically an important sustenance fish for the EBCI. The Sicklefin Redhorse, in particular, has been listed as a threatened species in North Carolina, and the dam removal has helped to restore instream connectivity and expansion of the population upstream of the dam location, though not enough to return them to numbers able to provide sustenance.

The Dillsboro Dam in its infancy provided power to a local pin company, then eventually to the town of Sylva, North Carolina. As larger hydropower operations in the area came online, the small capacity of Dillsboro was quickly dwarfed. When the project came up for relicensing in the early 2000s, Duke Energy initially intended to go through with relicensing. The company had several other larger capacity projects that were going through relicensing around the same time, three in the Tuckasegee Basin – the East Fork, West Fork, and Dillsboro, along with four other proximal projects – the Nantahala, Bryson, Mission, and Franklin projects. These projects lacked fish passage, utilized bypass channels, or greatly disrupted the natural flow of the rivers. In relicensing, fish passage and/or increased base flow would have likely been required at great expense to the utility. Two of the projects did not

have a release mechanism for providing minimum flows and fulfilling this requirement would not have been feasible from an economic or engineering perspective. Removing Dillsboro Dam became an opportunity to mitigate the impacts of the other dams by fully restoring a segment of the Tuckasegee River to protect Appalachian elktoe mussel habitat and open up recreational opportunities. Dam removal was proposed by Duke Energy as mitigation for the projects as a package. Their commitment to removal and fighting for it throughout the process was essential to success and unique among utilities.

TIMELINE

- 1913: Dillsboro Dam built
- 1980: FERC license issued
- 2003: Licensee filed application for license renewal and Settlement reached
- 2004: License surrender filed
- 2007: FERC issued a surrender order
- 2010: Dillsboro Dam removed

The settlement agreements reached in 2003 were the Tuckasegee Cooperative Stakeholder Team (TCST) Settlement Agreement and the Nantahala Cooperative Stakeholder Team (NCST) Settlement Agreement. Between the two agreements, Duke Energy agreed to remove Dillsboro Dam, improve flow regimes on the East Fork and West Fork Tuckasegee Rivers and the Nantahala River, enhance recreational areas and public access to the rivers, and cover all costs along with three years of monitoring the Dillsboro site after removal. The settlements established that Duke Energy would surrender the Dillsboro license with intent to remove the dam, which they did in 2004. FERC issued the surrender order in 2007, and the dam was removed in 2010.

There were several causes of delay in removing the Dillsboro dam, from ecological studies to removal opposition. The presence of endangered Appalachian elktoe mussel required time for habitat studies and relocation of over a thousand mussels upstream of the dam to protect them from sediment anticipated with removal. Other species in the area that are on the North Carolina species of concern list are the wavy-rayed lampmussel, the sicklefin redhorse, the wounded darter, and the olive darter.

Jackson County, where the dam was located, actively tried to stop the removal. One attempt was to deny the required permits for dewatering the reservoir and the other was to file a lawsuit against Duke Energy to seize the dam and surrounding riverbank using eminent domain. The county and others wanted the dam to remain in place primarily for aesthetic reasons. The water tumbling over the dam was considered a local "waterfall" and community members did not want to lose the sound. Fortunately, the dam was built on a natural ledge, which continued to provide the sound of falling water and associated aesthetic attributes once the dam was removed. If the natural ledge was not present, the

PARTIES TO THE TUCKASEGEE SETTLEMENT

19 parties: Duke Energy, American Whitewater, Bear Creek Lake and Cedar Cliff Lake Residents, Carolina Canoe Club, Dillsboro River Company, Eastern Band of Cherokee Indians, North Carolina Council of Trout Unlimited, NC Department of Environment and Natural Resources – Division of Water Resources, Division of Parks and Recreation, and Division of Water Quality, NC Wildlife Federation, NC Wildlife Resources Commission, Signal Ridge Marina, Swain County Economic Development Commission, Town of Dillsboro, Town of Sylva, Tuckasegee Gorge Association, U.S. Fish and Wildlife Service, U.S. Forest Service.

dam removal team was prepared to strategically place rocks in the river after removal to generate the sound of rushing water.

Through the settlement agreements, Duke Energy was able to maintain generation capacity with the other six projects getting relicensed and postpone fish passage requirements for another 20 years. Dillsboro had only generated enough power for about 69 homes per year and the removal had significant environmental benefits as well as recreational benefits.

Key Takeaways

- Remain respectful of Tribes and ensure they are supported in what *they* want and need. Work to educate yourself on the history of the first people of the area and allocate time for building relationships.
- This project took years of patience and perseverance to see the removal through. Despite having the licensee on board with removal and over twenty supportive stakeholders, it took an additional seven years of dedication to remove the dam. One party opposing the project can delay implementation for years.
- Evaluate projects with the same licensee within the same basin with similar relicensing timelines for opportunities to remove one (or more) to mitigate for the impacts of the remaining projects.
- Use economic analyses to support removal efforts. For this example, it was more economical for the licensee to remove Dillsboro Dam and restore the site than it would have been for them to do individual environmental improvements at multiple projects.
- Use environmental studies to support removal efforts. Settlement parties determined that dam removal and restoration would provide more environmental benefit than the benefits of bypass flows or fish passage at the other projects in the settlements.
- Incorporate recreational opportunities when and where possible. American Whitewater was a strong advocate for the improved flow releases at the remaining dams and helped to demonstrate the economic benefits of improved recreational opportunities at Dillsboro.
- Work with the licensee as much as possible. Collaboration with Duke Energy helped lead to a greater basin assessment and a plan to balance hydropower demands with environmental needs and recreational opportunities.
- An unexpected benefit was that a local company determined that the sediment behind the dam was valuable. Instead of hiring a dredging company to haul out the sediment and dispose of it at great cost to the project, this company volunteered to remove the sediment in a classic example of a market-based solution. Unfortunately, after the plan was accepted by FERC, the company determined they did not have the equipment to do the work and Duke had to assist in financing the sediment removal.

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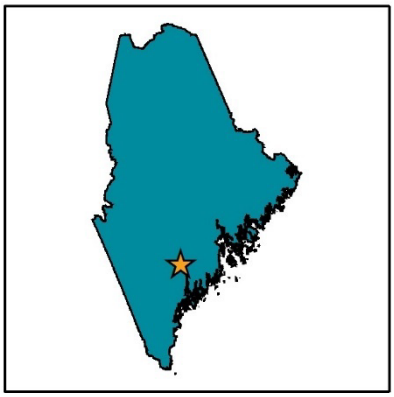
EDWARDS DAM

Kennebec River, Maine
Kennebec River Basin

LAND ACKNOWLEDGEMENT:
Homelands of the Indigenous People of the Kennebec



Project Overview

The removal of the 160-year-old Edwards Dam was a high-profile restoration project on Maine's Kennebec River. The dam blocked all upstream fish passage and environmental groups advocated for dam removal when the project came up for relicensing in the 1990s. FERC ordered the dam to be removed, and the licensee transferred the project to the State of Maine who then removed it.

Significance of This Removal

This was the first project where FERC denied a relicensing application and ordered a dam to be removed against the wishes of the owner, determining that the river's ecological, economic, and community benefits outweighed the hydropower production of the project.

Removal Decision and Process

DAM DETAILS	
Project Name and Number:	Edwards Dam Hydroelectric Project, P-2389
Licensee:	State of Maine
Height; Length:	24 ft; 917 ft
Reason for Removal:	Ecology
Reason for License Surrender:	Ecology
Project Capacity:	3,500 KW
Removal Cost:	$7,300,000

The Edwards Dam was built in 1837 on the Kennebec River to assist navigation and provide mechanical power to several local mills. The location of the dam, 44 miles upstream from the mouth of the Kennebec River, fully blocked all further upstream fish passage to a large watershed network. A fish ladder was initially added in 1839 but it washed out in a flood the year after the dam was completed and was never rebuilt. The Kennebec River was once home to enormous quantities of sea-run diadromous fish species including Atlantic salmon, American shad, shortnose and Atlantic sturgeon, striped bass, blueback herring, and alewives. Removal of the Edwards Dam reopened 17 miles of the river with the Atlantic Ocean and greatly improved habitat and water quality.

For decades, industries along the Kennebec River degraded the river's water quality, contributing to precipitous aquatic species population declines. Livestock processing, paper, textile production, and industrial and municipal sewage all contributed to the pollution of the river. The enactment of the Clean Water Act (1973) helped to start restoring the river, and dam removals have continued to improve water quality.

There had been opposition to the dam since it was first proposed in the 1800s. This opposition grew throughout the 1900s and resulted in the formation of the Kennebec Coalition (American Rivers, Atlantic Salmon Federation, Natural Resources Council of Maine, and the Kennebec Valley Chapter of Trout Unlimited) in 1989 to advocate for dam removal.

In the 1980s, Maine developed a comprehensive Kennebec River Resource Management Plan (Plan). It was completed in 1993 with the goal of balancing the use of hydropower and natural resources throughout the watershed. The Plan targeted removing the Edwards Dam for fish passage and improving fish passage at hydropower projects upstream. A group of hydropower licensees formed the Kennebec Hydro Developers Group and reached an agreement with the State of Maine and natural resource agencies on a plan to restore fisheries, and this was incorporated into the settlement agreement to remove Edwards Dam.

TIMELINE

- 1837: Edwards Dam built
- 1913: Hydroelectric power capacity installed
- 1964: FERC license issued
- 1984: Licensee signed a 15-year contract to sell electricity to Central Maine Power at approximately three times the market rate
- 1989: Kennebec Coalition formed to advocate for dam removal
- 1991: Licensee applied for license renewal
- 1992: City of Augusta, Maine became co-licensee of the project
- 1993: Original license expired, and Edwards project switched to an annual license; Kennebec River Resource Management Plan completed
- 1995: FERC adopted their decommissioning policy statement
- 1996: Kennebec Coalition presented 7,000 pages of evidence supporting dam removal
- 1997: FERC denied relicensing and ordered the dam to be removed at owners' expense
- 1998: Settlement reached: license transferred, and dam given to the State of Maine who surrendered the license
- 1999: Edwards Dam removed

When the Edwards Dam owner applied to renew their license in 1991, river restoration advocates took action. The Kennebec Coalition petitioned FERC to deny the relicensing and produced 7,000 pages of documentation on the dam's impacts and the economic importance of a restored fishery. The U.S. Fish and Wildlife Service would also require a nine-million-dollar fish passage installation as part of relicensing. The intervention helped FERC reach the decision in 1997 to deny relicensing and instead ordered the dam to be removed at the owner's expense for environmental benefit.

Because the Kennebec River had been devastatingly polluted prior to the enactment of the Clean Water Act, the community did not have a significant relationship with the river. To address this, the Kennebec Coalition conducted extensive outreach and education to help people understand the impacts of the dam and the benefits of removal. This work resulted in many organizations, agencies, and levels of government supporting dam removal, including Governor John McKernan and Governor Angus King, who openly called for removing the dam in 1991 and 1996, respectively. Collaboration between the stakeholders, as well as their involvement in the community, were critical aspects ensuring the success of removing Edwards Dam.

FERC had only recently issued a policy statement stating their authority to call for dam removal in the *Policy Statement on Project Decommissioning at Relicensing*, 60 Fed. Reg. 339 (Jan. 4, 1995). The Edwards project was the first test of this authority when FERC denied the relicensing application and ordered dam removal. The licensee opposed this decision and requested a rehearing and motion to stay, stating in their letter that FERC was acting

against the Federal Power Act and the U.S. Constitution. Before the situation escalated to challenging FERC's authority in court, stakeholders and the licensee came to a settlement agreement.

In 1998, the Lower Kennebec River Comprehensive Hydropower Settlement Accord was signed. The settlement included transferring the Edwards Dam license to the State of Maine and fish passage agreements for seven upstream hydropower projects (which later contributed to the removal of Fort Halifax and Madison Electric Works dams). The State surrendered the license and removed the Edwards Dam with the help of the Kennebec Coalition.

PARTIES TO THE SETTLEMENT

15 parties: Edwards Manufacturing Company; The City of Augusta, Maine; the Kennebec Coalition (American Rivers; Atlantic Salmon Federation; Kennebec Valley Chapter of Trout Unlimited; Natural Resources Council of Maine; Trout Unlimited); Kennebec Hydro Developers Group (Central Maine Power Company; Merimil Limited Partnership; UAH-Hydro Kennebec Limited Partnership; Ridgewood Maine Hydro Partners; Benton Falls Associates); the State of Maine; National Marine fisheries Service; and the U.S. Fish and Wildlife Service.

The economics of power production played an important role in the project's fate. Edwards Manufacturing, owner of the dam and primary licensee, had an agreement to sell power at three times the market rate through a contract via the Public Utility Regulatory Policies Act (PURPA). The contract expired around the time of the removal order, which would have forced Edwards Manufacturing to sell at the market rate. The project would have been operating at a significant loss if it had been relicensed and required to construct fish passage.

The primary funding for removal came from Bath Iron Works, a shipyard located at the mouth of the Kennebec River, as mitigation for expanding its shipyard into sturgeon habitat.

See the case studies for the Fort Halifax Dam and Madison Electric Works Dam for additional removals in the Kennebec River Basin.

Key Takeaways

- Get involved early in the relicensing process.
- Collaborate with other stakeholders. If necessary, form a coalition to align the goals of the group and distribute the workload.
- Agencies, communities, and civic organizations working together are critical to success.
- Use science and data to help strengthen the argument for river restoration. You may not necessarily need 7,000 pages of documentation but enter the information you have into the administrative record to demonstrate the environmental impacts of the project and the benefits of removal.
- FERC has authority to call for dam removal, but this has yet to be fully tested in a court setting (as of 2023) and has not been used since the Edwards project. If a settlement can be reached to bring about dam removal, this is the preferred method by FERC as well as most licensees.

- Basin-wide River Management Plans can be very helpful, especially if other hydropower operators are participating in the plan. The Kennebec River Resource Management Plan has so far contributed to the removal of three dams. Note that effort is still needed to hold the projects to the plan and that not all fish passage facilities are efficient or state-of-the-art, but plans are a good start and can have legal significance.
- Changing energy markets continue to impact hydropower operations and practices. Balancing production with mitigating environmental impacts has led many small projects to consider decommissioning. A 2020 survey performed by Kleinschmidt, an engineering firm involved in several dam removals, found that approximately a third of licensees were considering decommissioning due to economics.

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ELWHA RIVER PROJECTS

ELWHA
GLINES CANYON
Elwha River, Washington
Puget Sound Basin

LAND ACKNOWLEDGEMENT:
Homelands of the Lower Elwha Klallam Tribe

Project Overview

The Elwha Dam and Glines Canyon Dam were built on the Elwha River in the early 1900s for hydropower. The dams lacked fish passage and FERC's jurisdiction was brought into question when the owner applied to license one project and relicense the other. The Lower Elwha Klallam Tribe and conservation groups advocated for dam removal, which resulted in an act being passed in 1992 to achieve full restoration of the Elwha River and allowed the Secretary of the Interior to acquire both dams and remove them if necessary. The dams were removed from 2011-2015.

Significance of This Removal

This was the world's largest dam removal and river restoration project at the time and included federal law enactment, strong Tribal leadership, and conservation groups willing to push the envelope at a time when dam removal was considered a more radical notion. The project also represented the second largest ecosystem restoration project ever undertaken by the National Park Service (second only to the Everglades).

Removal Decision and Process

The Elwha River Valley has been home to the Lower Elwha Klallam Tribe (Tribe) since time immemorial. The river was and is culturally important to the Tribe and provided food for the People. The dams decimated spiritually significant places of the Tribe, including their creation site. The Tribe had fishing rights on the Elwha River, but the construction of the Elwha and Glines Canyon Dams devastated fish runs and prevented the Tribe from exercising those rights. The dams were originally constructed with no consultation with the Tribe or even acknowledgement of their use and occupancy of the river corridor. As treaty rights to the fishery resource were acknowledged in the 1970s, the Tribe took an active role intervening in attempts to relicense the projects. The Tribe financed studies on the feasibility of dam removal and called for the full restoration of the Elwha and native fisheries. They also

DAM DETAILS		
Project Name and Number:	Elwha Hydroelectric Project, P-2683	Glines Canyon Hydroelectric Project, P-588
Licensee:	Crown Zellerbach Corporation	
Height; Length:	108 ft; 450 ft	210 ft; 270 ft
Reason for Removal:	Ecology	Ecology
Reason for License Surrender:	Ecology	Ecology
Project Capacity:	12,600 KW	16,000 KW
Removal Cost:	$34,400,000	

took the issue to Congress and found a receptive champion in Senator Bill Bradley who chaired the Senate Water and Power Subcommittee. The Tribe worked with agencies and environmental groups to ensure a holistic approach to dam removal and restoration.

The Elwha Dam was built about five miles from the mouth of the Elwha River, and the Glines Canyon Dam was built upstream thirteen years later. The dams prevented anadromous salmon from ascending into Olympic National Park, diminishing the ecology of the park. Nearly 85% of the Elwha watershed lies protected within Olympic National Park, and the Glines Canyon Dam and associated Lake Mills were located entirely within the boundaries of the park. Neither dam had any type of fish passage despite requirements within Washington State law even at the time of their construction. Salmon were threatened throughout the Pacific Northwest by the 1980s, with Puget Sound Chinook Salmon listed under the Endangered Species Act by the late 1990s.

While the projects' combined authorized capacity was nearly 30,000 kilowatts, the Elwha Dam never reached its full capacity. It produced about 5,000 kilowatts at peak production. Combined, the projects produced 18,700 kilowatts, most of which came from the Glines Canyon Dam. The cost to maintain the Elwha Dam was starting to exceed the value of power produced. This poor performance contributed to the willingness of the dam owner to work with federal agencies.

In 1968, Crown Zellerbach Corporation (Crown), owner and operator of both dams, filed to license the Elwha Dam project. At the time, Crown did not dispute FERC jurisdiction over the Elwha Dam. By 1976, Crown filed for FERC to declare they did not have the jurisdiction and that Crown should be able to withdraw the license application. At the same time, the Tribe and Secretary of the Interior filed a motion jointly to request FERC to determine if the Elwha dam was a public safety hazard. The motion was denied as the jurisdiction still had not been determined. The Tribe demonstrated that FERC had jurisdiction over the Elwha project because the dam was on navigable waters and was not within the boundaries of Olympic National Park, while Glines Canyon dam was. This led to FERC's Initial Decision Finding Licensing Jurisdiction over Elwha Dam in 1978.

The Glines Canyon Dam was built in an area that was initially designated as the Olympic Forest Preserve in 1897. It became the Olympic National Monument in 1909, then Olympic National Forest, and finally was designated as Olympic National Park in 1938, ten years after the construction of the dam. While it was built for hydropower and first licensed in 1926, licensing of the Glines Canyon dam was controversial because of its location within the boundary of the park and the fact that FERC may not issue a license for a hydroelectric power project located within the boundaries of a National Park System unit under 16 U.S.C. § 797c. The powerhouse was on privately held land within park boundaries, but the reservoir was fully on park land. FERC's jurisdiction was openly challenged when Crown tried to relicense the project in 1973. The project operated on an annual license after the original license expired in 1976. In 1986 the Tribe and a coalition of environmental groups (Seattle Audubon Society, Friends of the Earth, Olympic Park Associates, and Sierra Club) were the first parties to intervene in a hydropower licensing proceeding to call for dam removal. This,

coupled with calls from the Department of the Interior (DOI) and the National Park Service (NPS) led to a long legal battle and jurisdictional disagreement. Jurisdiction remained unsettled and was being actively litigated in federal court until Congress passed the Elwha River Ecosystem and Fisheries Restoration Act in 1992 (Elwha Act).

The Elwha Act authorized the DOI to acquire both dams if studies found that dam removal was necessary to restore the Elwha River. It also authorized FERC to issue annual licenses for the projects until the restoration plan was established.

In 1995, the Environmental Impact Statement on the projects was published that evaluated dam removal to fulfill the mandated restoration of the ecosystem and native fisheries. The following year the DOI decided to remove the dams. In 2000, the DOI purchased the dams and began studies on how to remove them. Due to the complexity of the project, including the largest dam removals in history, along with a massive restoration process after the dams were removed, and political opposition in congress, it took another decade before the dams were breached. The Elwha Dam was removed in 2012 and the Glines Canyon Dam removal was completed in 2015.

TIMELINE

- 1910-1913: Elwha Dam built
- 1926-1927: Glines Canyon Dam built; project licensed
- 1968: Licensee applied to license the Elwha Dam project
- 1973: Licensee applied to relicense the Glines Canyon Dam project
- 1976: Original Glines Canyon license expired; licensee asked FERC to say they do not have jurisdiction over Elwha Dam
- 1978: FERC decided the Elwha Dam is within their jurisdiction
- 1986: February- Department of the Interior (DOI) said FERC lacks jurisdiction to license Glines Canyon; May -Lower Elwha Tribe and conservation groups submitted motions for intervention and call for dam removal
- 1991: FERC released draft EIS that finds dam removal to be feasible
- 1992: Elwha Act passed, calling for full restoration of the Elwha River and federal takeover of the dams if needed
- 1994: Final Elwha Report recommended removal of both dams
- 1995: EIS identified dam removal as the preferred alternative for restoring fish runs
- 1996: the DOI signed in favor of dam removal
- 2000: DOI purchases both dams; FERC jurisdiction ended
- 2011-2012: Elwha Dam removed
- 2014-2015: Glines Canyon Dam removed

NPS and the Olympic National Park played a major role in making the project happen. NPS provided most of the funding for the dam removals, restoration, and related infrastructure projects. This included water treatment plants, fish hatcheries, and a sewage treatment plant for the Tribe (the anticipated rise in the groundwater table associated with dam removal made the traditional septic systems ineffective). NPS also managed the project in partnership with the Bureau of Reclamation.

Salmon and steelhead have been returning to the Elwha River since the dams were removed. Seventy miles of spawning grounds are accessible again and both wild and

hatchery salmon can be found throughout the river. Part of the effort to restore the salmon population was to use hatcheries to boost the Elwha salmon stock. This protected the fish population during dam removal and sped up the population recovery after removal. A new Lower Elwha Klallam Tribe Hatchery was constructed, and the Washington Department of Fish and Wildlife used several hatcheries for the ESA listed Elwha Chinook.

Sediment distribution has reshaped the river channel and the delta. By releasing about thirty million tons of sediment from behind the dams, the unnaturally deep and straight river channel downstream has filled and allowed to return to a meandering and braided state, developing new pools and habitat. Sediment has filled in the delta, stabilizing the shore and creating braided channels that support the estuarine ecosystem.

This project is difficult to summarize in a short case study. The book Elwha: A River Reborn does an incredible job of telling the detailed story of the historic project.

Key Takeaways

- This project was only possible by the single vision shared by the Tribe, conservation groups, and local, state, and federal agencies and representatives. The Elwha Act provided the vision, and the dedication of countless individuals made it a reality.
- The Lower Elwha Klallam Tribe and conservation groups championing the push for dam removal was critical.
- Technical support and advocacy from conservation partners was essential to making the case to FERC for dam removal at a time before this was considered an option in hydropower licensing. Ultimately federal legislation took decision authority out of the hands of FERC, but the advocacy on the Elwha set the stage for dam removal as a serious alternative for other projects.
- Work with Tribal Nations impacted by the projects if they are willing and able. If removal can restore or protect treaty rights, support the interests of Tribes to participate in a manner that respects their sovereignty. Depending on the location, Tribes, and treaties, it could be that the Tribe has already been fighting to protect and restore rivers of their homelands.
- Have a thorough sediment release plan in projects where significant sediment is present. Both Elwha and Glines Canyon dams were removed slowly to prevent sediment from overwhelming downstream habitat. There was also much more organic load than anticipated and screens kept getting overwhelmed because they were designed for minerals and not organic substances.
- Be persistent. While formal intervention in the licensing of the projects and calls for removal began in the 1980s, it took nearly three decades for the projects to come out.
- Complete long-term monitoring of dam removal impacts and set aside funding for it. The Elwha restoration has a 20+ year monitoring plan.

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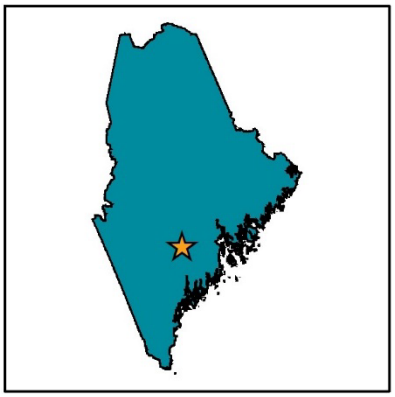
FORT HALIFAX DAM

Sebasticook River, Maine
Kennebec River Basin

LAND ACKNOWLEDGEMENT:
Homelands of the Indigenous People of the Kennebec



Project Overview

The Fort Halifax Dam was built at the mouth of the Sebasticook River within the Kennebec River Basin in 1907 for hydropower. Located about 18 miles upstream from the Edwards Dam, the Fort Halifax Dam did not have fish passage as the downstream Edwards Dam completely blocked all sea-run species from reaching the base of the Fort Halifax Dam. The removal of the Edwards Dam triggered a fish passage requirement at Fort Halifax and the licensee decided to remove the dam instead.

Significance of This Removal

A basin management plan and settlement agreement between multiple licensees and the State of Maine led to the removal of this project for permanent fish passage.

Removal Decision and Process

Dams and industrial development had damaged water quality and habitat in the Sebasticook River. Anadromous fish were in steep decline and in the 1980s Maine authorized the development of a comprehensive Kennebec River Resource Management Plan. The Plan was finalized in 1993 and included balancing hydropower and natural resources throughout the watershed to promote fish passage. The Plan targeted removing the Edwards Dam to allow for fish passage and coordinated with the upstream hydropower projects to establish deadlines for them to either install fish passage or remove dams.

DAM DETAILS	
Project Name and Number:	Fort Halifax Project, P-2552
Licensee:	Florida Power and Light
Height; Length:	29 ft; 553 ft
Reason for Removal:	Ecology
Reason for License Surrender:	Economics
Project Capacity:	1,500 KW
Removal Cost:	$800,000

Several hydropower licensees, including Central Maine Power, formed the Kennebec Hydro Developers Group (KHDG) and they worked with the state on a settlement agreement based on the Management Plan. This agreement was revised and finalized in 1998 as the Lower Kennebec River Comprehensive Hydropower Settlement Accord. It included the plan to remove Edwards Dam and gave the licensee of Fort Halifax until 2003 to install permanent upstream fish passage. Several other hydropower projects of KHDG members had similar deadlines and the licenses of the projects were amended to incorporate the conditions of the settlement.

This settlement, along with the poor economics of the project, led to the removal of the Fort Halifax Dam in 2008. The licensee said they would install a fish lift throughout negotiations but eventually decided that dam removal was more economical than installing a state-of-the-art fish lift, which was estimated to cost over $3.5 million while removal was less than $1 million. Central Maine Power (CMP) was the licensee at the time of the settlement. Florida

Power and Light (FPL) purchased the Fort Halifax Dam in 1999 and agreed to move forward with removal. FPL filed to surrender the license and remove the dam in 2002.

Local opposition to dam removal stalled the removal for five years. Landowners along the reservoir formed Save Our Sebasticook (SOS) and fought removal fiercely. The group hired an attorney and appealed the FERC decommissioning ruling. They brought this to the state level and even tried to prohibit any dam in the state from being removed. In total, SOS brought three legal cases. The first was an appeal of FERC's order of license surrender and dam breaching, which primarily delayed the removal process as they simultaneously tried to get the licensee to consider alternatives to removal. The second was bringing a lawsuit against the governor and Department of Marine Resources, which went all the way to the Maine Judicial Supreme Court. The third case was an appeal against the Maine Department of Environmental Protection's authority on dam removal. They lost in all three cases, but it was still a costly delay for all parties involved. The judges sided with the dam owner on removal.

TIMELINE

- 1907: Fort Halifax Dam built
- 1968: FERC License issued
- 1986-7: Kennebec Hydro-Developers Group (KHDG) came to a settlement agreement with Maine
- 1995: KHDG revised settlement
- 1997: Fort Halifax relicensed
- 1998: KHDG revised the settlement agreement to have triggers for fish passage or dam removal at specific projects within the basin, Fort Halifax to have fish passage by 2003
- 1999: Project is sold by Central Maine Power to Florida Power and Light (FPL)
- 1999: The downstream Edwards Dam is removed
- 2002: FPL filed for license surrender and to breach the dam
- 2003: Deadline from Kennebec plan for the licensee to either install fish passage or remove the dam
- 2004: FERC approved license surrender and breaching the dam for fish passage
- 2008: FPL proposed to remove entire spillway
- 2008: Dam removed

Because of the delays from SOS intervention, FPL proposed a fish pump instead of removal. This proposal was denied by FERC because they had already committed to removal. There was also a last-minute attempt from another company to purchase the dam with the promise of installing fish passage. The U.S. Fish and Wildlife Service reviewed the plans and determined that they were inadequate and not in line with the settlement agreement.

Stakeholders were persistent in holding FPL to the settlement agreement and worked with FERC and state and federal agencies along with elected representatives. In the beginning of the removal negotiations, Governor Angus King was not fully supportive of removal, as he had been with removing Edwards Dam. When Governor John Baldacci took office in 2003, he supported removing Fort Halifax Dam, which garnered additional support.

This was the third hydropower dam removed within the Kennebec River Basin. The Kennebec River Resource Management Plan and the Lower Kennebec River Comprehensive Hydropower Settlement Accord played a significant role in establishing guidelines for restoring sea-run fish throughout the basin and supporting a coordinated effort to accomplish this goal. Though the licensee of Fort Halifax Dam did not want to pursue

removal at first, stakeholders, FERC, and natural resource agencies helped hold the licensee accountable. FPL received about $500,000 from Bath Iron Works as mitigation for project impacts at the mouth of the Kennebec.

A few additional difficulties came up with removal, including a sewer pipe that had to be removed during construction and a water intake that needed to be addressed, which required additional time and engineering effort.

See the case studies for the Edwards Dam and Madison Electric Works Dam for additional removals in the Kennebec River Basin.

PARTIES TO THE SETTLEMENT

15 parties: Edwards Manufacturing Company; The City of Augusta, Maine; the Kennebec Coalition (American Rivers; Atlantic Salmon Federation; Kennebec Valley Chapter of Trout Unlimited; Natural Resources Council of Maine; Trout Unlimited); Kennebec Hydro Developers Group (Central Maine Power Company; Merimil Limited Partnership; UAH-Hydro Kennebec Limited Partnership; Ridgewood Maine Hydro Partners; Benton Falls Associates); the State of Maine; National Marine Fisheries Service; and the U.S. Fish and Wildlife Service.

Key Takeaways

- Be persistent. Opposition to dam removal was very organized, well-funded, and had strong political ties. This required the stakeholders to stay incredibly organized as well. From one of the stakeholders, "Don't give up. It's a lot of grunt work and outreach."
- The language in the settlement agreement itself was one of the most useful tools in securing dam removal. However, the settlement was not a fully done deal, stakeholders still needed to keep federal agencies in the loop and utilize law firms to hold the licensee to the agreement.
- Politics and individual politicians can play a significant role in the success or failure of a project. Advocates for dam removal may need to consider fostering support from elected officials.
- Close coordination between advocates for dam removal and the U.S. Fish and Wildlife Service, along with pro dam removal state representatives helped on the road to removal.

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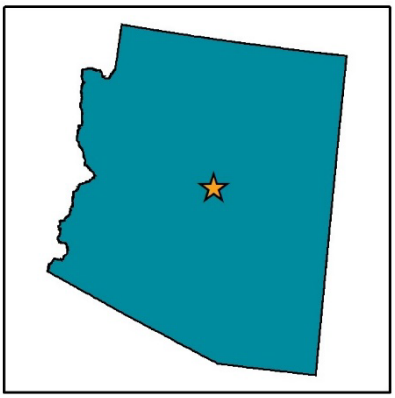
FOSSIL CREEK DAM

Fossil Creek, Arizona
Verde River Basin

LAND ACKNOWLEDGEMENT:
Fossil Creek is in the heart of the shí kéyaa, the special place, and traditional homelands of the Apache people who have a special connection to the earth.



Project Overview

The Fossil Creek Dam was built as part of the Childs-Irving Hydroelectric Project on Fossil Creek in central Arizona, near the Coconino National Forest. Project construction occurred from 1907-1916. While going through relicensing in the 1990s, dam removal advocates worked with the licensee to come to a settlement agreement to remove the project.

Significance of This Removal

The utility company voluntarily surrendered and decommissioned this project and covered all expenses of removal and restoration. Following removal, the river was designated Wild and Scenic to prevent the possibility of any future hydropower development.

Removal Decision and Process

DAM DETAILS	
Project Name and Number:	Childs-Irving Hydroelectric Project, P-2069
Licensee:	Arizona Public Service Company
Height; Length:	5 ft; 27 ft
Reason for Removal:	Ecology
Reason for License Surrender:	Ecology
Project Capacity:	6,000 KW
Removal Cost:	$15,000,000

Fossil Creek is an important and holy place for the Apache people and has been for thousands of years. For the Apache, the creek is a living being and water is life. Damming the creek was a culturally painful experience for the Tribe and restoring the area was an important reparation of cultural harm. Representatives of the Apache Tribe were closely involved in advocating for removing the project and restoring Fossil Creek. At the removal of the dam, Tribal elders came and blessed the now free-flowing waters, welcoming life back to the creek. One of the messages from the Tribe is to remember that we need to treat the land with respect and take care of it; if you take care of it, it will take care of you. This message rings true for this project and all other restoration efforts.

The Fossil Creek Dam was part of the Childs-Irving Hydroelectric Project in Arizona, consisting of two powerhouses, two diversion dams, several miles of conduit, and an off-stream reservoir. The Childs project was constructed first, starting in 1907 on Fossil Creek. A small diversion dam (Fossil Creek Dam, five feet high) was built to divert water into a conduit for hydropower. Water was diverted to an off-stream artificial reservoir to be held for use by the Childs project. Water from Childs was then discharged into the downstream Verde River. Later, with the development of the Irving project in 1916, a larger diversion dam (Fossil Creek Diversion Dam, also known as Fossil Springs Dam (twenty-five feet high), was built upstream

of the Fossil Creek Dam and just below the Fossil Springs source. The much larger dam diverted nearly all of the water from the creek for hydropower, leaving only a small fraction to flow downstream.

While the powerhouses had separate names, they shared a license as the Childs-Irving Hydroelectric Project. The original license for the project was granted to Arizona Power Company (APC) in 1951, effective 1945-1994. APC became Arizona Public Service Company (APS) who operated the project on an annual license after the 1994 expiration. APS filed for license renewal in 1992 and proposed minimum instream flows of only 2-5 cubic feet per second of water.

TIMELINE

- 1909: Childs project and Fossil Creek Dam built
- 1916: Irving project and Fossil Creek Diversion Dam built
- 1951: FERC license issued
- 1992: Licensee filed for license renewal
- 1998: Licensee decided not to relicense and pursued decommissioning
- 2000: Licensee submitted settlement agreement
- 2001: Licensee filed surrender application
- 2004: Power generation ceased
- 2008: Fossil Creek Dam removed; Fossil Creek Diversion Dam partially removed
- 2009: Fossil Creek designated as a Wild and Scenic River

Environmental groups and the Apache Tribe wanted APS to consider project removal instead of relicensing. It was a small capacity project with a large environmental impact on a sensitive ecosystem. After completing multiple site studies and public comments and working with the CEO of APS to demonstrate the impacts of the Childs-Irving project, APS agreed to surrender the license and remove the project. APS agreed that removal would have a greater public benefit than the power generated from the project and signed a settlement in 2000 to remove the project. Although the U.S. Forest Service did not sign the settlement, they participated in the negotiations and drafting of the agreement. The settlement dictated that the project would cease generation in 2004, the license would be surrendered, and APS would take on the cost of removing the dams and most of the hydropower infrastructure. The power plants were left in place for historical purposes, the small Fossil Creek Dam and off stream reservoir dams were removed, and the large Fossil Creek Diversion Dam had the top fourteen feet removed. Over 20 miles of flume was removed as well.

Managing the impact on riparian habitat and managing invasive species in the creek were among the most difficult obstacles to the project. Some proponents even considered keeping the dams in place and just returning all the water flow back to the creek. However, a sediment plan was established that capitalized on a storm event to help move sediment downstream after removal. The larger dam was only partially removed for invasive species management. Non-native fish were present below the dam, and fishery managers believed that these fish eliminated the lowland leopard frog, a species of special concern. The frogs were only found above the dam, where non-native fish could not reach them. As part of the invasive species management plan, a small fish barrier was built downstream of the dams near the confluence with the larger Verde River, and all the non-natives above the fish barrier were eliminated to allow native species to reestablish themselves. The Fossil Creek Dam was removed after this. The fish barrier is still in place today, as is the partial Fossil Creek Diversion Dam.

Fossil Creek provides a unique habitat and is unique geologically as a travertine stream. Calcium deposits create natural barriers and pools, and this process was able to begin again once full flow was returned to the stream. Protecting the unique geology of the creek was another driving force behind removal. Due to the nature of the geology of the area, the fish barrier and remnants of the diversion dam mimic the natural barriers found in the creek. These barriers have allowed the native species to thrive after the invasive species were removed and blocked from the area.

PARTIES TO THE SETTLEMENT:
7 Parties: Arizona Public Service Company, American Rivers, Center for Biological Diversity, the Yavapai-Apache Nation, Northern Arizona Audubon Society, Arizona Riparian Council, and The Nature Conservancy: Arizona Chapter.

The project included significant community engagement despite its remote location. The utility provided tours prior to removal to help inform the public of what removal would include. Community meetings were held to discuss the decommissioning plan, biological impacts, and the plan for addressing the history of the project. As the location was considered a historic site, the state historic preservation office had to be consulted for documentation and assessment of what would stay in place. The state decided that the powerhouses would remain intact while the rest of the project infrastructure would be removed.

One unique layer of the project was how APS addressed the project employees. The workers of the power plants had company housing where they lived with their families. APS was sensitive to their situation and gave the employees time to relocate once the decision was made that the project would be decommissioned.

The utility had to work closely with FERC on the decommissioning process. As there were still very few projects that had been decommissioned and removed in the early 2000s, FERC was still determining what was needed for the process and looked to dams in the Pacific Northwest for reference (Condit Dam and the Bull Run project). FERC was very responsive to communications with APS and there was a lot of back and forth between the two while navigating decommissioning.

Another important aspect of the project was that it fell under Western water rights laws. The Childs-Irving project had non-consumptive rights to the water, meaning that they were allowed to use the water so long as it was returned to the waterway afterwards. Downstream, the Salt River Project owned the consumptive rights to use it without needing to pass it on. Throughout this process, water rights needed to be managed to ensure that the Salt River Project continued to receive the water they had been designated. Fortunately for all, Childs-Irving was in a remote area and there were not any stakeholders between the hydropower project and the Salt River Project that were trying to claim the water.

In order to continue protecting this area, stakeholders pursued designating this section as Wild and Scenic. Senator John McCain championed the designation throughout the removal negotiation process. Fossil Creek is the first and perhaps only river that has been dammed, deeply degraded, then restored and designated as Wild and Scenic. The protection of the creek through this designation was another important layer of caring for this culturally significant place. Following return of flows, the popularity of Fossil Creek as an oasis in the desert increased, leading to demand that greatly exceeded capacity. The Wild and Scenic

designation allowed the U.S. Forest Service to develop a management plan that requires parking permits for use during the spring and summer seasons to limit human impact on the creek.

Key Takeaways

- Work with Tribal Nations impacted by the projects if they are willing and able. Support the interests of Tribes to participate in a manner that respects their sovereignty.
- Dam removal advocates were able to sway the utility to voluntarily remove this project because of the rare opportunity to restore the unique Fossil Creek habitat. Demonstrating the ecological benefits, being persistent with messaging, and appealing to the licensee by showing them the benefits they can have were important in communicating with the licensee.
- Be conscious of sensitive biological areas and how to manage dam removal in a way that does minimal damage.
- Evaluate if invasive species are an issue and how dam removal may impact their mobility. Avoid building fish dams if possible as it is usually biologically more beneficial to allow the river to fully return to a free-flowing state.
- Be conscious that the power company may have to take time to develop a plan for project employees and their transition to another plant or phasing out.
- Identify similar projects whose decommissioning plans and paperwork can serve as a model for what your project may need.
- For permanent protection of the area, and to prevent any future entity from developing the site for hydropower, evaluate if the river qualifies for the national Wild and Scenic designation or consider other protection measures such as conservation easements. The Wild and Scenic process can take many years, so start early and find a champion in congress to see it through.

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HARVELL DAM

Appomattox River, Virginia
James River Basin

LAND ACKNOWLEDGEMENT:
Homelands of the Powhatan Confederacy

Project Overview

The Harvell Dam was constructed in 1930 to produce hydropower. Power generation ceased in 2002, and the owner passed away in 2006 in the middle of license revocation proceedings. The new owner agreed to remove the dam after intervention by the state and American Rivers, and the dam was removed in 2014.

Significance of This Removal

This project had complex compliance and ownership issues; FERC revoked the license and stakeholders led dam removal advocacy.

Removal Decision and Process

The Harvell Dam was the lowermost dam on the Appomattox River and blocked nearly all fish from traveling up this major James River tributary. Even with a Denil fish ladder, fish passage was insufficient. Removal of the dam was necessary for migratory fish passage and opened 127 miles of habitat.

DAM DETAILS	
Project Name and Number:	Harvell Hydroelectric Project, P-8657
Licensee:	Virginia Hydrogeneration and Historical Society
Height; Length:	9 ft; 400 ft
Reason for Removal:	Ecology
Reason for License Surrender:	Economics
Project Capacity:	150 KW
Removal Cost:	$485,000

The licensees of the project had a long history of regulatory non-compliance on several issues, including insufficient fish passage. By 2002, the project ceased generation, and FERC reached out to the licensee because they did not have power sales contracts. FERC informed the licensee that if they did not intend to take on new contracts, they should apply to surrender the license and pursue "termination by implied surrender." The licensee would no longer be permitted to generate hydropower and jurisdiction of the dam would shift from FERC to the State of Virginia. FERC published a draft Environmental Assessment (EA) in 2003 that proposed revoking the license as an unconditional license surrender (without mitigation requirements such as fish passage). Stakeholders including U.S. Fish and Wildlife Service (FWS), National Marine Fisheries Service, Virginia Department of Wildlife Resources (VDWR, at the time it was Department of Game and Inland Fisheries), American Rivers, and the James River Association, intervened and pushed for EA alternatives that would provide fish passage and dam safety through full or partial removal of the dam.

The licensee had no interest in taking further responsibility for the dam. They submitted a settlement agreement to FERC in 2005 agreeing to accept the license revocation and stated they had already dismantled all the generation equipment and disconnected from the grid. The intervenors stepped in to prevent the dam from being abandoned in place. They

attempted to reach a new settlement with the licensee that would ensure fish passage and dam safety. However, the licensee passed away in the middle of negotiations, and the dam remained dormant for several years.

The dam was eventually sold to a new private owner, Harvell Dam Corporation (HDC). The FERC license stayed in the name of the company that the previous owner had set up, the Virginia Hydrogeneration and Historical Society, and did not transfer to the new dam owner with the sale of the dam. HDC's primary interest in purchasing the dam was to develop the site for riverside recreation and they were not interested in dam removal.

Stakeholders continued to push for removal with HDC. Because the fish passage was non-operational, VDWR informed the owner that they could either remove the dam or upgrade the project to meet Virginia fish passage requirements.

TIMELINE

- 1930: Harvell Dam built
- 1987: FERC license issued
- 1995: Fish passage plan denied due to inadequacies
- 1997: License transferred to the Virginia Hydrogeneration and Historical Society
- 1998: Denil fishway built on the dam
- 2002: Power generation ceased
- 2003: FERC published a draft EA
- 2005: Licensee attempted to file settlement with FERC
- 2006: Licensee passed away; negotiations halted
- 2010: Dam purchased by a new owner
- 2013: FERC issued Order Terminating License by Implied Surrender
- 2014: 240' of Harvell Dam removed

The City of Petersburg was an important stakeholder in the pursuit to remove the dam. The City Manager feared dam removal would result in unsightly mudflats, so they worked against the dam removal efforts. Around 2010, there were failed attempts by the city to purchase the dam, as well as failed legislative attempts to exempt the dam from state fish passage laws. Representatives from VDWR worked with the City Manager describing the benefits that dam removal would bring to the river and the community. The following Manager became much more supportive of removal and helped to convince the dam owner to remove the dam.

The license was formally revoked by FERC in 2013 as an implied surrender. VDWR and HDC signed a Memorandum of Agreement (MOA) in March of 2014 that outlined dam removal according to final design and permits. The dam was partially removed in the summer of 2014, leaving approximately 160' of the dam and an older weir fishway along river left for historic interpretation. It ultimately took over ten years of negotiations to reach this conclusion. Post–removal spring sampling by VDWR documented the successful passage of hickory shad, alewife, blueback herring, striped bass, and American eel past the former dam site.

Complexities during dam removal included discovering two previously unidentified timber/rock/crib dams, leading to additional historical mitigation monitoring, reporting, and protection. The MOA governing the obligations of all consulting parties in complying with Section 106 of the National Historic Preservation Act included provisions for such discoveries. In addition, severe erosion at a municipal stormwater outlet was daylighted by the lowering of the pool, necessitating shaping and armoring the bank at the outlet for long-term stabilization.

Funding for dam removal implementation was made possible by grants from FWS's National Fish Passage Program and NOAA's Open Rivers Initiative. Feasibility and additional engineering funding was provided by VDWR and the EPA Chesapeake Bay Program.

Working with VDWR was critical to the success of the project. VDWR held the federal grants and provided non-federal match for those grants. VDWR also conducted the feasibility study, completed the final design, managed the removal project, and conducted the biological surveys. They were at the center of completing the project from concept to dam removal.

Key Takeaways

- Persistence is crucial. Continue to work through FERC processes and leverage all available avenues for removal through the license surrender and revocation processes. The intervenors worked diligently to prevent the licensee from abandoning the project without appropriate environmental mitigation and advocated for removal for over a decade before they had consent from both the dam owner and FERC.
- Municipal politics can make or break a project. However, given enough time (or election cycles), support for or against a removal project can shift. Reaching out directly to individuals opposed to removal can help them understand the current impacts of the project and potential benefits of removal. Economic and safety benefits of removal are especially useful to highlight for municipalities.
- Establish processes for managing unanticipated outcomes. The MOA helped immensely during the Harvell Dam removal.
- Grant funding to cover the costs of removal and restoration is usually necessary, especially in cases where the dam owner does not have the resources from an uneconomical project.

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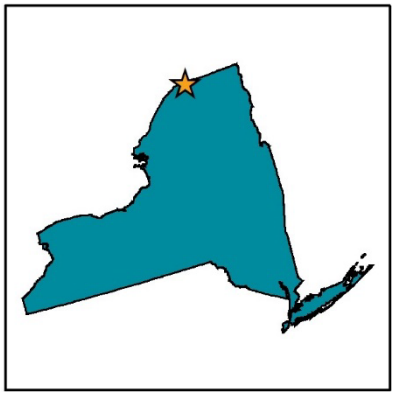
HOGANSBURG DAM

Saint Regis River, New York
St. Lawrence River Basin

LAND ACKNOWLEDGEMENT:
Homelands of the Mohawk



Project Overview

The Hogansburg Dam was built in 1929 on the Saint Regis River to provide power for the nearby hamlet of Hogansburg in upstate New York. The dam owner, Erie Boulevard Hydropower, was undergoing the relicensing process when the company decided to partner with the Saint Regis Mohawk Tribe as co-licensee, who led the decommissioning and removal of the dam.

Significance of This Removal

Hogansburg was the first hydropower dam removed by a Tribe, restoring ecosystem health to Tribal lands.

Removal Decision and Process

The Hogansburg Dam was built on Aboriginal Mohawk lands and was the first barrier on the St. Regis River, blocking fish from reaching hundreds of miles of spawning grounds. The Saint Regis Mohawk Tribe (SRMT or Tribe) had wanted to remove the Hogansburg Dam for decades. Taking down this dam was an important step for the Tribe to reconnect with their homeland and start cultural healing. Restoring this river through dam removal also helped to improve the health and welfare of the Tribal community. This was the first FERC-regulated hydropower dam removed by a Tribe in the U.S. and the first removal of an operating hydropower dam in New York.

DAM DETAILS	
Project Name and Number:	Hogansburg Hydroelectric Project, P-7518
Licensee:	Erie Boulevard Hydropower, L.P.; Saint Regis Mohawk Tribe
Height; Length:	12 ft; 281 ft
Reason for Removal:	Ecology/Economics
Reason for License Surrender:	Ecology
Project Capacity:	485 KW
Removal Cost:	$1,500,000

The Tribe worked proactively to get dam removal on the table. Prior to Erie Boulevard Hydropower (Erie) starting the relicensing process, the Tribe did a cost-benefit analysis to demonstrate that the project was uneconomical. This analysis helped lead to a dam removal conversation with the licensee. The dam could not produce power year-round due to low flows and was only operating at 40% capacity when there was enough water and was losing over $100,000 each year. Mandatory updates were calculated to range from $3.5-8 million, fish passage alone would have cost $1.5-2 million, while decommissioning was only $1.5 million.

Erie acknowledged that the operation was an economic loss and agreed to pursue license surrender. The Tribe worked with Erie and FERC to have the license transferred to them so that they could fully manage the surrender, decommissioning, and removal of the dam. Though Erie was on board, FERC denied this effort as the Tribe did not have prior experience with a hydroelectric project and they were concerned about the Tribe financing the project. FERC did approve of the Tribe becoming a co-licensee with Erie, with the Tribe leading decommissioning and dam removal efforts. The Tribe was able to fund the project from a large settlement in 2013 with GM, Alcoa, and Reynolds for pollution of the St. Lawrence River.

TIMELINE

- 1929: Hogansburg Dam built
- 1985: FERC license issued
- 2010: Licensee filed a notice of intent to relicense
- 2013: Licensee filed licensing proposal, later submitted a joint application to transfer the license to Saint Regis Mohawk Tribe
- 2014: Settlement reached with Saint Regis Mohawk Tribe, Erie Boulevard, and environmental agencies
- 2016: License surrendered and dam removed

The Tribe and Erie came to a settlement agreement with environmental agencies to ensure environmental protections during removal, including an in-depth sediment management plan. The sediment tested negative for contaminants and the primary concern became managing the sediment release to protect downstream habitat. The management plan included drawing down the reservoir months before deconstruction of the dam, which allowed the sediment to flush downstream and for the revegetation of the impoundment banks to help stabilize them.

A few unique challenges contributed to the difficulty of this project. The St. Regis River is prone to ice jamming and although the dam could help grow ice cover, in extreme events the dam could not manage the ice during breakup. Ice experts studied the risk and determined that the dam removal did change the risk of ice jams and actually reduced the risk of flooding upstream of the dam. Another concern was the depth of the channel. During construction of the hydropower project, a tailrace was excavated, resulting in an unnaturally deep channel that some feared would result in low to no flows during times of low water. This has proven not to be an issue, and the ice jam events are consistent with historical observations.

Along with coordinating efforts between the Tribe, Erie, FERC, and environmental agencies, community engagement was another critical endeavor for the success of this project. Even with widespread support, opposition to dam removal needed to be addressed. The opposition was primarily rooted in fears of what might happen after removal – increased flooding, the river levels dropping too low, and negative impacts on fish when the sediment was released from behind the dam. These are common fears and the Tribe addressed them by setting up public information meetings, going door-to-door to talk with community members, handing out pamphlets, explaining study results on what would happen with removal, and using an artistic rendering of what the area would look like without the dam so people could start to envision it themselves.

Removing the Hogansburg Dam reconnected over 550 miles of river and streams. The fish have started to return, and the river is coming back to health. In addition, upstream flooding

has decreased, and the sediment management plan was successful in preventing inundation of downstream habitat.

Key Takeaways

- Support the interests of Tribes to participate in a manner that respects their sovereignty. Depending on the location, Tribes, and treaties, it could be that the Tribe has already been fighting to protect and restore rivers of their homelands.
- An economic analysis of the project can strengthen, if not independently drive, the dam removal conversation and decision to remove the project.
- Work with natural resource agencies to address environmental concerns early on. The sediment management plan and implementation were key factors for the success of this project.
- If applicable, becoming a co-licensee can help the original licensee with license surrender and removal. This can be an option for non-utility groups that FERC may not accept as full licensees. A settlement can help outline the plan and obligations of the parties involved in the process.
- Community outreach and education is important throughout the process to address fears that members may have, develop support for removal, and help the community develop a relationship with the newly restored river.
- An artist rendition of a restored river can help people envision a free-flowing river.

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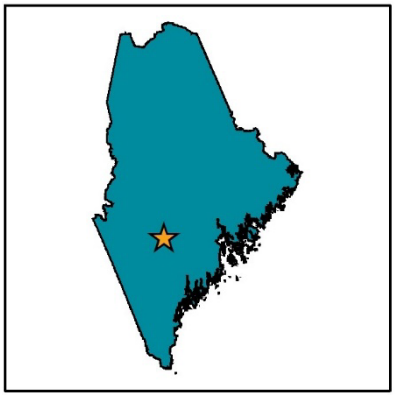
MADISON ELECTRIC DAM

Sandy River, Maine
Kennebec River Basin

LAND ACKNOWLEDGEMENT:
Homelands of the Indigenous People of the Kennebec



Project Overview

The Madison Electric Dam, also known as the Sandy River Project, was built on Maine's Sandy River in 1893 and provided power to the town of Madison. The dam was the first obstruction on the Sandy River in the Kennebec River Basin. The licensee had a fish passage requirement and they decided to remove the dam instead.

Significance of This Removal

This is an example of holding the licensee accountable to basin planning and fish passage agreements, which ultimately resulted in removal of the dam.

DAM DETAILS	
Project Name and Number:	Sandy River Hydroelectric Project, P-11433
Licensee:	Madison Electric Works
Height; Length:	15 ft; 313 ft
Reason for Removal:	Ecology
Reason for License Surrender:	Economics
Project Capacity:	547 KW
Removal Cost:	$500,000

Removal Decision and Process

The Madison Electric Dam provided power to the town of Madison but was not regulated by FERC for most of the years it was in operation. The dam was operated by the town's Department of Electric Works, known as Madison Electric Works (MEW). In 1993, MEW applied for a FERC license, proposing to name the project the Sandy River Hydroelectric Project. The application stated that the MEW would begin construction of fish passage before 2002. The State of Maine intervened and said that FERC needed to hold MEW to the fish passage requirements of the Kennebec River Resource Management Plan (Management Plan) that was established in 1993. The Maine Department of Environmental Protection issued a conditional Water Quality Certificate requiring finalized fish passage designs by 1999 and operational upstream and downstream fish passage facilities by May 1, 2002. The Kennebec Valley Trout Unlimited (KVTU) chapter also filed comments during the licensing that focused on the eventual need for fish passage. The FERC license for the project was issued in 1997.

The goal of the Management Plan was to balance the use of hydropower and natural resources throughout the Kennebec River Basin. Several hydropower licensees in the Kennebec Basin formed the Kennebec Hydro Developers Group (KHDG) in the 1980s and they worked with the state on a settlement agreement based on the Management Plan. This agreement was revised and finalized in 1998 as the Lower Kennebec River Comprehensive Hydropower Settlement Accord and included the plan to remove Edwards Dam from the Kennebec mainstem and established deadlines for KHDG members to either install fish passage at their projects or remove their dams. The licenses of these projects were amended to incorporate the conditions of the settlement. Fish passage at the Madison Electric Dam was one of the objectives of phase II of the Management Plan.

Fish passage plans were submitted to FERC on time and accepted under the condition that the planned Denil fishway be compliant with the recommendations of the U.S. Fish and Wildlife Service. In 2001, however, MEW filed for an extension on the timeline for installing fish passage after they learned that the downstream Weston project on the Kennebec mainstem, would not have fish passage until 2012. After the extension approval, MEW determined that installing the necessary fish passage was not economically feasible. While they were not opposed to dam removal as a method to meet the fish passage requirements, they did not want to take on the full cost. A state agency staffer who had read through the FERC docket record saw the comments from TU and suggested MEW follow up with them to see if they could help with fundraising.

TIMELINE

- 1893: Madison Electric Dam built
- 1986-7: Kennebec Hydro-Developers Group (KHDG) came to a settlement agreement with Maine fisheries agencies
- 1993: Application for FERC license submitted; Kennebec River Management Plan established
- 1995: KHDG revised settlement
- 1997: FERC license issued
- 1998: KHDG revised the settlement agreement to have triggers for fish passage at specific projects within the basin; Madison Electric Dam to have fish passage by 2002
- 2001: Licensee filed for an extension on the timeline for fish passage
- 2005: Licensee applied for license surrender and dam removal
- 2006: Deadline from Kennebec plan for the licensee to either install fish passage or remove the dam; license surrender approved, dam removed that year

The conversation between MEW and TU launched a collaborative effort between state and federal agencies, TU, and the Atlantic Salmon Federation (ASF) to remove the dam. MEW worked with the agencies to reduce the scope of work and support a joint application for surrender and removal to submit to FERC, the Maine Department of Environmental Protection, and USACE. Several agencies contributed significant staff resources for studies and mitigation efforts, including participating in a multi-day mussel relocation effort during drawdown with staff from the Maine Department of Inland Fisheries and Wildlife, NOAA Fisheries, EPA, TU, ASF, and the general public.

In 2006 FERC approved the license surrender and decommissioning plans. MEW cited that fish passage would have cost over $900,000 while removal was estimated to be less than $500,000. TU and ASF worked with others to raise funding for the removal, ultimately contributing about $250,000 plus in-kind services to the project and MEW was able to cover the rest of the cost. The funding sources included NOAA Fisheries, U.S. Fish and Wildlife Service, USDA – Natural Resources Conservation Service, private foundations, and the State of Maine. The rest of the funding came from MEW, including the necessary funds to cover an expensive archeological resource recovery and stabilization along the banks of the river. Dam removal took place through the end of the summer and fall of 2006, completely removing the dam and spillway while leaving the powerhouse in place. The powerhouse was placed on the National Historic Register as it was one of the first powerhouses in Maine built solely for hydropower.

See the case studies for the Fort Halifax Dam and the Edwards Dam for additional removals in the Kennebec River Basin.

Key Takeaways

- Always file comments to the docket's administrative record. Because the Kennebec Valley Trout Unlimited chapter filed comments on the need for fish passage, they were later contacted by state agencies to help identify funds to make dam removal feasible for MEW. Note that sharing dam removal comments through other venues such as letters to the editor in a local newspaper, while important for generating public interest and visibility, will not be reviewed by the regulatory agencies. Be deliberate about your target audience and submit comments to the docket so that FERC can read and evaluate them.
- Monitor projects of interest and if one comes up for relicensing, immediately sign up for the FERC docket for that project to monitor process and file comments in a timely manner.
- Work with state and federal agencies to review fish passage requirements and plans put forth by the licensee. Functional fish passage requirements can render marginal hydropower projects uneconomical and provide an opportunity for dam removal as the most cost-effective means of achieving fish passage.
- Basin-wide River Management Plans can be very helpful, especially if other hydropower operators are on board participating in a basin management plan. The Kennebec River Resource Management Plan and subsequent Lower Kennebec River Comprehensive Hydropower Settlement Accord has so far contributed to the removal of three dams. (Note that effort is still needed to hold the licensees to the plan and that not all the fish passage is efficient or state-of-the-art, but this is a good place to start and has legal significance.)
- With a shared vision, dam removal planning and permitting can be completed quickly and at a relatively low cost, and licensee costs can be minimized.
- Reach out to partners and agencies if you need help with a project, whether it is finances, technical assistance, scientific documentation, or something else.
- Remember that it takes a team working together to bring down a dam; share the credit and find ways to elevate voices of those who play important roles but may have less communications or outreach capacity.

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MILBURNIE DAM

Neuse River, North Carolina
Neuse River Basin

LAND ACKNOWLEDGEMENT:
Homelands of the Eno, Tutelo, Saponi, Occaneechi, and Shakori Native people

Project Overview

Milburnie Dam was built in 1984 on the Neuse River in North Carolina, on a site that had a history of dams since 1813. The project operated until 2006 and maintenance stopped. FERC terminated the license in 2013 through implied surrender, also known as abandonment. The dam was removed in 2017 for mitigation credits.

Significance of This Removal

This was the second hydropower dam removed for mitigation credits in North Carolina and it was a deadly low-head dam.

DAM DETAILS	
Project Name and Number:	Milburnie Hydroelectric Project, P-7910
Licensee:	Milburnie Hydro Inc.
Height; Length:	15 ft; 600 ft
Reason for Removal:	Mitigation
Reason for License Surrender:	Economics
Project Capacity:	640 KW
Removal Cost:	$1,400,000

Removal Decision and Process

The Milburnie Dam was identified by a group of state and federal agencies as an ideal removal project to maximize environmental and public safety benefits. The group, known as the North Carolina Dam Removal Task Force (DRTF), was comprised of the U.S. Army Corps of Engineers (USACE), U.S. Fish and Wildlife Service, North Carolina Division of Water Quality, North Carolina Wildlife Resources Commission, U.S. Environmental Protection Agency (EPA), National Marine Fisheries Service, North Carolina Division of Marine Fisheries, North Carolina Natural Heritage Program, North Carolina Division of Coastal Management, and the North Carolina Department of Transportation. The task force identified ten dams as priorities for removal, so long as their owners were willing. Removal of Milburnie would bank mitigation credits that could be purchased by the state, counties, cities, or other organizations impacting streams and wetlands through development who must follow the “no net loss” policy of the Clean Water Act. The dams identified by the DRTF, including Carbonton and Milburnie, provided the most mitigation credits among identified dam removals.

Milburnie Dam was issued a license exemption from FERC when it was built in 1984. In 2006, wiring was stolen from the powerhouse and never replaced. FERC terminated the license in 2013 because the project was not generating power and the licensee did not intend to repair it.

Milburnie was a dangerous low-head dam. Low-head dams are usually smaller dams where water continuously flows over the top of the dam. The water creates a recirculating current at the base of the dam that can prevent trapped swimmers from escaping. Dams of this design are often referred to as “drowning machines”. Milburnie Dam had taken an estimated fifteen lives, including two young children in 2012, five years before the structure was removed.

The dam was not an operational hydro plant when the DRTF identified it as a target. Restoration Systems (RS), a mitigation banking company, decided to pursue removing the dam to sell mitigation credits (about 40,000). RS started collecting data and pursuing necessary dam removal permits in 2009, working with DRTF and the dam owners.

The dam owner passed away in 2010 and the heirs saw the dam as a liability and were in favor of removing it. The license termination three years later also helped the removal process as RS would not have to navigate the license surrender and decommissioning process in addition to the mitigation banking work and project permitting.

TIMELINE

- 1813: Original dam built at the Milburnie site
- 1984: Milburnie Dam became a hydropower project, FERC license exemption issued
- 2002: North Carolina Dam Removal Task Force formed
- 2006: Power generation ceased
- 2009: Restoration Systems started data collection and permitting process for removal
- 2013: License exemption terminated
- 2017: Dam removed

The Wilmington USACE District and EPA had provided crediting guidance for North Carolina dam removal mitigation banking in 2004. The guidance has since been withdrawn and at this time North Carolina is considering dam removals as mitigation projects on a case-by-case basis—in part because of issues with reconciling the guidance with the national mitigation rule and in part because of push back from traditional stream mitigation companies who were not removing dams. RS initiated the Milburnie project during the credit guidance discussions and was grandfathered into the mitigation bank program under the 2008 version, so they were still able to sell the banked credits to the state when the dam was removed in 2017.

Restoration Systems set up several public meetings, reached out to all landowners along the reservoir, and communicated openly with the community about the project. One landowner on the reservoir adamantly opposed the removal and attempted to set up petitions against the project, but outreach from RS helped the individual come to terms with the project.

Following removal of the dam, RS funded seven years of monitoring at the site with five of those years in partnership with Duke University supporting a PhD student. Shad were caught upstream of the former dam to demonstrate their return to the area. This project restored six river miles and resulted in the Neuse River having nearly 250 river miles connected thanks to previous downstream dam removals.

As noted in the Carbonton Dam case study, the North Carolina dam removal mitigation crediting guidance led to at least three successful dam removals: Carbonton, Lowell, and Milburnie. The projects inundated the credit market to the point that the permitting agencies felt that dam removals were disproportionate compared to other mitigation projects. The crediting guidance, which was drafted by Restoration Systems and approved by the USACE, was rescinded after just these few dam removals. North Carolina has yet to come to another agreement on crediting dam removals for mitigation.

Key Takeaways

- If pursuing a mitigation project, ensure state and federal policies align and that all necessary permitting is covered along with collaboration with necessary state and federal agencies.
- Have a community outreach plan including outreach to landowners along the reservoir, if applicable. Address potential fears preemptively and help people understand what to expect from the removal project and how the site will change after removal. Use illustrations or digital renderings if possible.
- Some aspects of community outreach and communication can be done through social media.
- Longer term monitoring (5+ years) can be achieved through partnerships with local universities.
- Budget for longer studies with mitigation projects, as they require quantifiable outcomes and performance standards and that can take several years.

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MILL POND DAM

Sullivan Creek, Washington
Pend Oreille River Basin

LAND ACKNOWLEDGEMENT:
Homelands of the Kalispel

Project Overview

The Mill Pond Dam was built on Sullivan Creek in 1909 and replaced by a concrete structure just downstream in 1921 to generate electricity. Around the early 2000s, the project licensee wanted to be free from regulatory oversight and leave the dam in place. Intervenors connected the licensee with another licensee in the watershed who agreed to remove the Mill Pond Dam to meet their mitigation responsibilities.

Significance of This Removal

Dam removal was a win-win-win for the utility that owned the dam, a separate utility that needed to mitigate their impacts, and restoring natural flows to Sullivan Creek.

DAM DETAILS	
Project Name and Number:	Sullivan Creek Hydroelectric Project, P-2225
Licensee:	Pend Orielle County Public Utility District
Height; Length:	55 ft; 134 ft
Reason for Removal:	Mitigation
Reason for License Surrender:	Economics
Project Capacity:	N/A
Removal Cost:	$16,000,000

Removal Decision and Process

The Mill Pond Dam was in the remote mountains of northeast Washington state, and without fish passage it blocked Sullivan Creek for over a century. The dam initially held timber back waiting for the mill, then later it was used to generate electricity. Water was diverted through a wooden flume to the powerhouse downstream. The flume broke in the 1950s and the powerhouse was shut down as power was more easily sourced from elsewhere. The local Pend Oreille Public Utility District (PUD) purchased the project with the idea that they would upgrade it for production if necessary. FERC issued the project a non-generating license in 1958 with provisions to update the project in the future. Pend Oreille PUD started to take steps towards updating the project in 1996. This prompted American Whitewater to do a recreational flow study, as it was an important paddling area and they wanted to ensure that recreational impacts would be mitigated if the project were to start generating power again.

As the PUD evaluated upgrades to restart power generation, the Washington Department of Ecology issued an instream flow requirement as part of the 401 Water Quality Certificate. The PUD challenged this requirement, but the decision was upheld in court. The requirement rendered the already marginal project uneconomical, and the PUD decided to abandon their upgrade plans, filing a notice of intent to not license in 2003. In 2006 the PUD signaled their intent to abandon the project when the 50-year license expired, and FERC initially issued an order in 2007 requiring no further action by the PUD. This would have allowed the dam to fall into “no man’s land” jurisdiction and potentially be abandoned without any mitigation or safety requirements.

American Whitewater had been monitoring the project progress and intervened, along with state resource agencies, Kalispel Tribe of Indians, and the U.S. Forest Service. American Whitewater, Washington Department of Wildlife, and the U.S. Forest Service challenged FERC's decision to void the license and won the case in 2008. FERC then ordered the licensee to submit a formal surrender application and develop plans for the future of the dam.

TIMELINE

- 1909: Mill Pond Dam built
- 1921: Concrete dam built to replace the original log crib
- 1956: Powerhouse shut down
- 1958: FERC issued license as non-generating project
- 1996: Licensee intended to rehabilitate and operate the facility
- 2002: 401 Water Quality Certification requirements upheld in court
- 2006: Utility tried to escape jurisdiction of the project
- 2008: License expired; FERC ordered licensee to develop plans for the dam
- 2010: Settlement reached for Seattle City Light to take over removal of the dam
- 2013: FERC approved settlement
- 2017: Dam removed

For two years stakeholders worked with the Pend Oreille PUD to develop a plan for the project and come to a settlement agreement. In 2010 two settlements were reached to encapsulate the agreed upon terms – the Boundary Hydroelectric Project Relicensing Settlement Agreement and the Sullivan Creek Settlement Agreement. Funding the dam removal would have been an outsized financial challenge for the small PUD. Seattle City Light, a much larger utility, was relicensing the Boundary Project located downstream in the watershed. Seattle City Light needed to mitigate the impacts of the Boundary Project and stakeholders that spanned both projects connected them to the Mill Pond project. Seattle agreed to cover the cost of the Mill Pond Dam removal to meet their mitigation responsibilities. An additional element of the settlement was to modify the Sullivan Lake Dam operation on a tributary upstream of the Mill Pond Dam, also part of the Sullivan Creek Hydroelectric Project, to enhance cold water releases into Sullivan Creek, improving fish habitat, sediment transport, and recreation.

FERC accepted the settlements and issued their Final EIS in 2011, which was incorporated in the Boundary license NEPA analysis. FERC issued the Surrender Order in 2013. The removal plan was filed with FERC in 2017 and removal was underway that year.

PARTIES TO THE SULLIVAN SETTLEMENT:

14 Parties: Public Utility District No. 1 of Pend Oreille County, Washington; Seattle City Light; Bureau of Indian Affairs; U.S. Fish and Wildlife Service; U.S. Forest Service; Kalispel Tribe of Indians; Washington State Department of Fish and Wildlife; Washington State Department of Ecology; Lands Council; American Whitewater; Selkirk Conservation Alliance; Town of Cusick, Washington; Rick Larson and Al Six.

There was some local opposition to the removal as the Mill Pond had been used for recreation. There was a sense of loss from community members that had to be addressed delicately. In the end, the benefits to the community came in many forms, including restoration of Sullivan Creek, better habitat for fish and other aquatic species, enhanced whitewater recreation access, and keeping the cost of dam removal from the 10,000 or so rate payers of Pend Oreille PUD.

Key Takeaways

- Pay attention to the FERC docket. Identify what projects are of interest or concern to you and sign up for updates from FERC. American Whitewater had been tracking both the Sullivan project and the Boundary project. This not only notified them of the changes at Sullivan but allowed them to act quickly when it became apparent that the licensee intended to abandon the dam.
- Get creative in problem solving. Pend Oreille PUD was looking at their project individually, as was Seattle City Light while they were evaluating their options to meet mitigation requirements. By connecting the two, both licensees were able to meet their respective needs and Sullivan Creek benefitted from dam removal.

PARTIES TO THE BOUNDARY SETTLEMENT:
12 Parties: Seattle City Light; Bureau of Indian Affairs; National Park Service; U.S. Fish and Wildlife Service; U.S. Forest Service; Kalispel Tribe; Washington State Department of Fish and Wildlife; Washington State Department of Ecology; Public Utility District No. 1 of Pend Oreille County, Washington; Selkirk Conservation Alliance; American Whitewater; and The Lands Council.

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MILLTOWN DAM

Clark Fork River, Montana
Pend Oreille River Basin

LAND ACKNOWLEDGEMENT:
Homelands of the Salish and Kootenai Tribes

Project Overview

Milltown Dam was built on the Clark Fork River in 1908 and was licensed by FERC in 1968. In 1983 the area was designated as a national Superfund site due to the contaminated sediment behind the dam. The license was surrendered in 2006 and the Environmental Protection Agency (EPA) led the site remediation work, including removing the dam in 2008.

Significance of This Removal

This site was a designated Superfund site due to contaminated sediment and the water table that required the EPA to come in to oversee the removal of the project and remediation of the site.

Removal Decision and Process

DAM DETAILS	
Project Name and Number:	Milltown Project, P-2543
Licensee:	Clark Fork and Blackfoot LLC
Height; Length:	40 ft; 219 ft
Reason for Removal:	Ecology/Safety
Reason for License Surrender:	Ecology
Project Capacity:	3,400 KW
Removal Cost:	$120,000,000

The Milltown Dam was built in the mountains of Montana, downstream of historic mines. Mining waste of the 1800s was washed downstream in a flood in the early 1900s, contaminating the watershed and eventually the drinking water of the communities in the Clark Fork River Basin with arsenic, copper, zinc, and other heavy metals. Most of the contaminated sediment built up in the reservoir behind the Milltown Dam, allowing it to slowly leach down into the water table. The Missoula County Health Department detected the reservoir contamination and played a key role in monitoring and implementing remediation. In the 1980s the EPA designated the area as a Superfund site. Their initial proposal was to fence off the reservoir behind Milltown Dam, put up “no trespassing” signs, and cease hydropower operation. Two successive years of intense winters in 1996 and 1997 proved that the pollution could not be contained in the reservoir alone and a more aggressive approach was required. In addition to the contaminant issues, an engineering report found that the dam was collapsing and slowly moving downstream.

The power plant was still in operation throughout the discussion on what to do with the contaminated sediment. The original FERC license expired in 1993 and FERC granted the licensee four extensions while the EPA reviewed options to address the contaminants. The third and fourth extensions were opposed by several groups including the EPA, City of Missoula, Missoula Health, Missoula County, the Clark Fork Pend Oreille Coalition, Trout Unlimited, the Department of the Interior, American Whitewater, American Rivers, and

numerous individuals. The opposition wanted to see the license surrendered and the dam removed, though the licensee could not act without a decision from the EPA on how to address the site. The Confederated Salish and Kootenai Tribes also submitted a motion to intervene in the proceeding, stating that the license extensions may affect the Tribes' Treaty-reserved natural resources and that they want to see comprehensive and permanent protection for the Clark Fork River.

TIMELINE

- 1907: Milltown Dam built
- 1968: FERC license issued
- 1981: Residents reported contaminated drinking water
- 1983: Milltown site designated as a Superfund site
- 1989: License extension granted
- 1993: Original license expiration date
- 1994: License extension granted
- 1996-1997: Large amounts of contaminants released downstream
- 2002: License extension granted
- 2003: EPA endorsed dam removal to address contaminants
- 2004: License extension granted
- 2006: License surrendered; EPA remediation began
- 2007: Sediment removal began
- 2008: Dam removed
- 2012: Restoration efforts complete

The Clark Fork Coalition (CFC) and Friends of 2 Rivers (FOTR), two local nonprofits working to protect the river, led the campaign to remove the Milltown Dam and restore the river. When the hydropower licensee sought to renew their license extension in 2001, CFC and FOTR renewed their efforts to push for dam removal and river restoration. The groups communicated that the reservoir and the contaminants within it were a public health threat that needed to be addressed. A campaign was launched to educate the community on the issue, including posting billboards saying, "Not all time bombs tick," and similar phrases. An artists' rendition of what the site could look like after restoration assisted in helping the community envision the healed river and helped foster action to remove the dam. Additional critical support came from the Missoula County Health Department, who detected and monitored the contamination; leadership and responsiveness from the EPA; supportive Missoula County Commissioners; and motivated and committed local residents.

In addition to the water supply contamination, bull trout were listed as a threatened species in 1999. The trout's need for clean and connected waterways was severely impacted by both the presence of the dam and the contaminants. The CFC pushed back against FERC extending the Milltown license without consideration of bull trout. After the CFC submitted comments to the FERC docket and threatened to sue if they did not reevaluate the license, FERC looked more closely at the impacts of the dam on the bull trout populations.

Some local opposition to removing the dam existed, primarily from the Bonner Development Group (BDG). Friends of 2 Rivers (FO2R) was created in response to BDG with the mission to remove the dam and reservoir sediment. The Governor met with FO2R to discuss the project and later announced her support for removing the dam.

The EPA ultimately decided to move forward with dam removal in 2003 and began preparations. The hydropower license was surrendered in 2006 and the EPA began their remediation efforts. Much of the sediment in the reservoir needed to be removed and hauled away, and this took place from 2007 to 2009. Over two million tons of contaminated sediment were removed but found a use as vegetative cap material at the Opportunity Tailings Ponds, another mine remediation site 90 miles upstream. Once the worst sediment

was gone, the dam was breached, and dam removal was completed in 2008. Additional steps were taken to restore the floodplain and reconstruct the river channel through the now empty reservoir and were completed in 2012.

Funding for the restoration efforts was partially covered by Atlantic Richfield Company (ARCO), the owner of the mines. Even though ARCO shut down the mines shortly after acquiring them, they still needed to take responsibility for the impacts of mining waste on the watershed caused by leaching arsenic and other heavy metals.

This is an example in which persistence paid off for the benefit of the river and surrounding community. The Clark Fork Coalition, Friends of 2 Rivers, and partners continued to advocate for restoration and worked tirelessly to push back against the notion that the river was too contaminated to be rescued. Thanks to their efforts, the watershed is starting to return to health, fish are starting to rebound, and the community is able to reestablish a relationship with their river. The area of the former reservoir has been converted to the Milltown State Park, which boasts hundreds of acres and river access along with trails and interpretive signs that help educate visitors on the history of the Clark Fork River restoration.

Key Takeaways

- Be persistent and ready to take action when the opportunity arises.
- Be crystal clear about your goals and outcomes when communicating with partners, stakeholders, and the community.
- Push back against agency decisions if necessary. When FERC decided to relicense the project without consideration for the bull trout, CFC pushed back with comments in the docket. When the EPA decided to fence off the reservoir and not address the contaminated sediments, CFC launched a campaign to rally the community and push back against this decision. They ultimately gathered 13,000 comments in support of dam removal.
- Hiring a campaign coordinator can help for large projects that need to help educate and sway the community and general public. In this case, it was known that ARCO was also putting money into trying to fight dam removal and remediation so that they would not have to pay for it, so a strong counter move/campaign was necessary.
- An artist rendition of a restored river helped people envision what could be.
- Contaminated sediment poses unique challenges, and, in this case, it became an opportunity to use the sediment for another remediation project.

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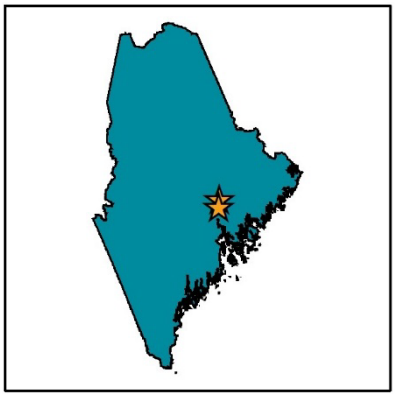
PENOBSCOT RIVER PROJECTS

GREAT WORKS DAM
VEAZIE DAM
Penobscot River, Maine
Penobscot River Basin

LAND ACKNOWLEDGEMENT:
Homelands of the Penobscot Nation



Project Overview

The Great Works Dam was built on the Penobscot River in 1887 and the downstream Veazie Dam was later built in 1913. The Penobscot Indian Nation and environmental groups started developing plans to restore fisheries and habitat on the Penobscot. They worked together with agencies and conservation groups on a settlement agreement with the owner of the dams in which a newly formed Penobscot River Restoration Trust would purchase the dams. After purchasing both dams, the Trust removed them.

Significance of This Removal

This was a major multi-dam basin settlement and restoration project that resulted in two dam removals and nature-like fish passage at a third while increasing the net power generation in the basin.

DAM DETAILS		
Project Name and Number:	Great Works Hydroelectric Project, P-2312	Veazie Hydro Project, P-2403
Licensee:	Penobscot River Restoration Trust	
Height; Length:	20 ft; 1,353 ft	30 ft; 850 ft
Reason for Removal:	Ecology	Ecology
Reason for License Surrender:	Ecology	Ecology
Project Capacity:	7,730 KW	16,400 KW
Removal Cost:	$6,000,000	$6,800,000

Removal Decision and Process

The Penobscot River was once a thriving home to fish and wildlife and supported the peoples of the Penobscot Indian Nation. Protecting the rights of the Penobscot Nation was a cornerstone of the restoration efforts. The Penobscot Nation has the right to catch sea-run fish in the river, yet the dams prevented this right from being exercised. In addition, the river-bound migratory fish that were present had excessive toxin build up in their flesh from spending their life in the contaminated river. The Penobscot Nation had protested the dams from the beginning, and in 1980 the Maine Indian Lands Claims Settlement Act reaffirmed the Tribe's sustenance fishing rights, including sea-run fish, and gave them more authority in exercising these rights and addressing obstacles (i.e., dams). Restoring the native anadromous fish runs along with access to the free-flowing river was an important part of the project supported by the Penobscot Nation. Removal of the dams and improved upstream fish passage at the Milford Dam allowed alewives and the eleven other migratory fish species to once again reach the Penobscot Reservation.

Over the course of a century, the dams built on the Penobscot River and industry along the riverbanks significantly degraded the fisheries and water quality. In the 1990s, a new dam

that was proposed, Basin Mills Dam, would have been the final, catastrophic blow to the ecosystem. After environmental groups and the Penobscot Indian Nation successfully defeated the project, they turned their attention to a larger restoration vision for the Penobscot River.

The Penobscot Partners established themselves as a coalition in 1999, consisting of the Penobscot Indian Nation and conservation partners. Later that year they formed the Penobscot River Restoration Project (PRRP), which was housed under the Natural Resources Council of Maine's office and an external office at the Penobscot Nation's Department of Natural Resources. The Penobscot Partners developed a plan to restore the Penobscot and targeted the Veazie and Great Works Dams for removal and creating a bypass channel around the Howland Dam to restore access to the Piscataquis River. This would reopen the full historical habitat for sturgeon, rainbow smelt, tomcod, and striped bass.

TIMELINE

- 1887: Great Works Dam built
- 1913: Veazie Dam built
- 1980: Maine Indian Lands Claims Settlement Act reaffirmed Tribe's sustenance fishing rights
- 1989-1996: Penobscot named one of America's Most Endangered Rivers
- 1999: Penobscot River Restoration Project began; Penobscot Partners formed
- 2003: Penobscot Partners released plans for restoration of the Penobscot River
- 2004: Penobscot Partners formalized as the Penobscot River Restoration Trust
- 2004: Lower Penobscot River Comprehensive Settlement Accord is signed, gives trust an option to buy the Veazie, Great Works, and Howland dams
- 2008: The Trust purchased the Veazie, Great Works, and Howland dams, files to surrender licenses
- 2009: Atlantic Salmon in the Penobscot Basin listed as endangered
- 2010: FERC accepted surrender of licenses and dam removal plan for Great Works and Veazie, and surrender for Howland
- 2012: Great Works Dam removed
- 2013: Veazie Dam removed
- 2016: Howland Dam bypass channel completed

Beginning in 1999, the Penobscot Partners worked with dam owner, Pennsylvania Power and Light (PPL) and stakeholders to develop the Lower Penobscot River Multiparty Settlement Agreement (2004) and established the Penobscot River Restoration Trust. The settlement gave the Trust a set deadline and price to purchase Veazie, Great Works, and Howland. The Trust then campaigned for the funds to purchase all three dams and complete the restoration projects. The funds were successfully acquired, the dams bought, and licenses surrendered for all three, with approval to remove Veazie and Great Works and build a state-of-the-art nature-like bypass channel for Howland. The Great Works Dam was removed in 2012, Veazie was removed in 2013, and the Howland bypass was completed in 2016. The project also included new fish passage at the Milford dam, upstream of Great Works, and net increase in the power generation from dams that were left in place (Ellsworth Project, Oronoco Dam, Stillwater Dam, Milford Dam, West Enfield Dam, and Medway Dam).

The full Penobscot River Restoration Project came out to $63 million. This included purchasing the dams, removing Great Works and Veazie, installing the bypass channel around Howland, and additional remediation work. Over $10 million came from private

donors by 2007, and the Maine congressional delegation of Sens. Snow and Collins and Congressmen Allen and Baldacci worked to get additional funds through Congress. Their efforts led to NOAA getting $10 million appropriated for the restoration project with the support of President Bush. Additional funds came from NOAA, the U.S. Fish and Wildlife Service, grants, and private donors.

PARTIES TO THE SETTLEMENT:
17 parties: PPL Maine, LLC; PPL Great Works, LLC; PPL Generation, LLC; Penobscot River Restoration Trust; Penobscot Indian Nation; U.S. Fish and Wildlife Service; Bureau of Indian Affairs; National Park Service; Maine State Planning Office; Maine Atlantic Salmon Commission; Maine Department of Inland Fisheries and Wildlife; Maine Department of Marine Resources; American Rivers; Atlantic Salmon Federation; Maine Audubon Society; Natural Resources Council of Maine; and Trout Unlimited.

Community engagement was critical to the success of the project. The project manager had the unique capacity to do door-to-door outreach and conduct interviews in the community to listen to people's values and how they saw the river and the restoration project. Over ten years of outreach and townhall-type meetings led to wider support for river restoration.

Just upstream of the former Great Works Dam, the Milford Dam owner completed a new fish lift in 2014 and that year two hundred thousand river herring made it to the dam. By 2023, over five million river herring made it to the Milford Dam fish lift. Monitoring efforts to track populations of other species are also underway.

This expansive project is difficult to summarize in a short case study. For more information, we recommend the book *From the Mountains to the Sea* by Peter Taylor, which provides a detailed account of the historic project.

Key Takeaways

- Work with Tribal Nations impacted by the projects if they are willing and able. Support the interest of the Nation to participate in a manner that respects their sovereignty. Depending on the location, Tribes, and treaties, it could be that the Tribe has already been fighting to protect and restore rivers of their homelands.
- Collaborate with partners to be able to achieve more. The Penobscot Partners and later the establishment of the Trust allowed for greater collaboration, communication, and broader accomplishments.
- Designate or hire a strong lead person who can commit to seeing the project through. In this case, it took over 15 years of commitment with turnover at different organizations and agencies, adding to the importance of a dedicated project leader to preserve the institutional knowledge and keep the overall project on track.
- Listen. A project as large as this had a lot of people who just wanted to be heard and the project team needed to listen to and understand the community relationship with the river to help move the community towards a free-flowing future.

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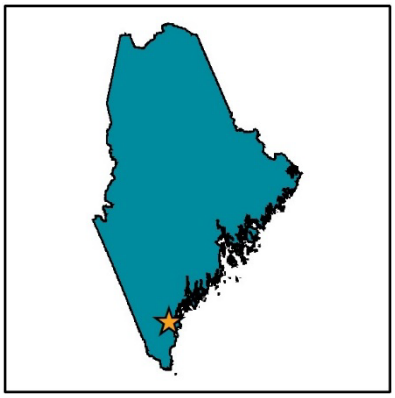
SACCARAPPA DAM

Presumpscot River, Maine
Presumpscot River Basin

LAND ACKNOWLEDGEMENT:
Homelands of the Wabanaki Confederacy



Project Overview

The Saccarappa Dam was built on the Presumpscot River in 1911 to generate hydropower. Changes to fish passage at downstream projects triggered fish passage requirements at the Saccarappa Dam in 2015. The licensee chose to remove the dam instead of installing fish passage.

Significance of This Removal

Fish passage requirements rendered the project uneconomical but even with removal, significant alteration to the bedrock under the dam required post-dam removal fish passage efforts.

Removal Decision and Process

The Saccarappa Project was one of five projects owned and operated by Sappi North America, Inc. (Sappi) on the Presumpscot River. The five projects began the relicensing process in 1996. Friends of the Presumpscot River intervened to request removal of the three lowermost dams and fish passage at the final two. FERC did not make removal a condition of the projects when they were relicensed in 2003, but they were each required to build fish passage once fish were able to reach the project's lowermost dam, the Saccarappa.

DAM DETAILS	
Project Name and Number:	Saccarappa Project, P-2897
Licensee:	Sappi North America, Inc.
Height; Length:	12 ft; 239 ft
Reason for Removal:	Ecology
Reason for License Surrender:	Economics
Project Capacity:	1,350 KW
Removal Cost:	$4,500,000

There were two dams downstream of the Saccarappa Dam. The furthest downstream was Smelt Hill Dam, which was severely damaged in 1996 and removed in 2002. The next downstream project was Cumberland Dam. Fish passage was completed at that project in 2013.

Sea-run fish were subsequently able to reach Saccarappa Dam for the first time in over a century. This triggered the requirement for fish passage at the dam, but a cost analysis found that dam removal would be cheaper.

Dam removal was not straightforward. Due to structural changes made to the bedrock falls when the dam was built, engineered fish passage was constructed to assist upstream migration of weaker swimming fish. Negotiations between the licensee, stakeholders, and agencies were prolonged due to disagreements over the work the licensee would do, the complexity of the removal project and ensuring that fish were able to move upstream of the site in a safe and timely way. As a result, the project required complex studies and engineering designs, and the parties were slow to agree on how to achieve this. The licensee

ultimately implemented an approach to have multiple pathways for the fish to get past the heavily modified falls. After the dam was removed, nature-like fishways were built over the eastern and western sections of the falls and a Denil fishway was built in the filled in tailrace area.

TIMELINE

- 1911: Saccarappa Dam built
- 1981: FERC license issued
- 1998: Relicensing application submitted
- 2003: New license issued, contingent on downstream fish passage
- 2013: Remaining downstream dam installed fish passage
- 2013: Licensee applied for license surrender, later withdrew
- 2015: Licensee applied for license surrender again
- 2016: Settlement reached for dam removal
- 2019: License surrendered, and dam removed

The licensee filed a license surrender application in 2013. This application was retracted while settlement negotiations were underway and resubmitted in 2015, then retracted until it was filed a final time in 2018. In 2016, stakeholders and the licensee reached a settlement agreement. The licensee then filed for an extended deadline to address the dam and fish passage; this was granted until 2019. In 2019 the license surrender was accepted, and dam removal commenced. The dam, powerhouse, and other project works were removed. The licensee completely covered the cost of removal and restoration.

Once a designated number of either American shad or blueback herring pass at Saccarappa, fish passage or removal will be triggered at the next two dams upstream, the Mallison Falls (P-2932) and Little Falls (P-2941) projects, respectively. The settlement agreement lifted fish passage requirements of the final two most upstream dams, Gambo (P-2931) and Dundee (P-2942).

PARTIES TO THE SETTLEMENT:

6 parties: S.D. Warren Company; U.S. Department of the Interior – U.S. Fish and Wildlife Service; Maine Department of Marine Resources; Conservation Law Foundation; Friends of the Presumpscot River; City of Westbrook, Maine.

Key Takeaways

- Monitor projects that are downstream of your project in question. Changes in their operation can impact requirements of the upstream facilities.
- Modified natural features may need to be assessed to ensure that fish can pass through the area once the dam is removed. This may require extensive research, engineering, time, and funds.
- Repeated extensions on the license surrender filing gave time for negotiations to determine the best solution for fish passage. The stakeholders agreed that more time was needed to come to a consensus.
- Dedication to the cause was the key to success. Multiple interventions and comments were filed by stakeholders over two decades as well as countless hours coming to the table with the licensee and natural resource agencies.
- Legal help can be a great asset, especially in preemptively preparing for questions and assisting with settlement negotiations.
- Be flexible in how goals are met, maintain focus on river restoration, and allow for different paths to get there.

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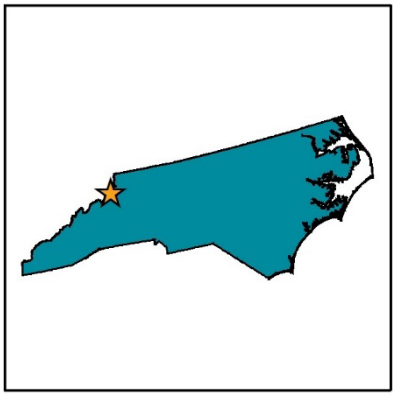
WARD MILL DAM

Watauga River, North Carolina
Watauga River Basin

LAND ACKNOWLEDGEMENT:
Homelands of the Anikituwagi (Cherokee)



Project Overview

Ward Mill Dam was a small private hydropower dam built by the Ward family to power their mill and a few local homes. The project was licensed through FERC in the 1980s and successfully relicensed by the Ward family in 2017. After realizing that the dam was no longer economical and that there was not anyone to take it over on the family property, the Ward family surrendered the license and removed the dam.

Significance of This Removal

This was a small family-owned hydropower project that was voluntarily surrendered through FERC, and then the dam was removed outside of FERC jurisdiction.

Removal Decision and Process

The Ward family has lived in the Watauga River Valley for over two centuries and utilized the river to operate several mills over the years. There was once a gristmill on the property that was replaced by a wood dam for a sawmill in 1906, but this was washed away in a flood in 1940 and had to be rebuilt. In the 1960s the wooden dam was replaced by a concrete dam and the Ward family licensed the project for electricity through FERC in 1986.

When the owners began relicensing the project, river restoration groups intervened in the process and started a dialogue on dam removal. The project continued through relicensing and was granted another 30-year license in 2017. A month after the order came from FERC issuing the new license, the license was declined by the family. It became apparent that maintaining the dam was becoming too much for the family and the heirs did not want to take over operation of the project. Because the dam was on the family's property, they had no interest in having another party take over the license.

DAM DETAILS	
Project Name and Number:	Ward Mill Hydroelectric Project, P-9842
Licensee:	Ray F. Ward
Height; Length:	20 ft; 110 ft
Reason for Removal:	Ecology
Reason for License Surrender:	Ecology
Project Capacity:	168 KW
Removal Cost:	$500,000

The Ward family surrendered their FERC license in 2017. The surrender conditions included removing the generators, turbines, and connectivity to the grid. Removing the dam structure was not included in the surrender as they wanted the removal to be separate from FERC jurisdiction.

Once the license surrender was accepted, the project was able to proceed like a standard dam removal with state and federal regulators. American Rivers, MountainTrue, and Blue Ridge Resource RC&D worked together to raise funds and manage the dam removal. They

secured funds from several sources and contributing parties were moved by the family's story to restore the river after using it for decades to support their livelihood.

The removal opened 100 river miles and restored habitat for the eastern hellbender. The hellbender is a very large aquatic salamander of special concern and removal was scheduled to avoid its fall breeding season. Fall is often a targeted time for dam removals due to the seasonal low flows.

TIMELINE

- 1890: Original gristmill dam built on the Ward Mill Dam site
- 1901: Gristmill washed away
- 1906: Wooden dam for sawmill constructed
- 1964: Ward Mill Dam rebuilt for hydroelectric power
- 1986: FERC licensed issued
- 2016: License expired; annual license issued from FERC
- 2017: License surrendered
- 2021: Ward Mill Dam removed
- 2022: Phase 2 of restoration completed with rebar removal and replanting

In May of 2021 U.S. Fish and Wildlife Service's Aquatic Restoration Team removed most of the dam over four days. In March of 2022, the final removal of remaining rebar occurred as well as planting throughout the drained reservoir. The powerhouse and sawmill remained in place for historic purposes and per the wishes of the Ward family.

Key Takeaways

- This project is a key example of a dam reaching the end of its useful life and a dam owner ready to pursue removal. Countless dams across the country could follow this narrative if positive relationships are established with owners, funding for removal can be acquired, and experienced organizations have the capacity to manage the removal.
- Surrendering the license and separating FERC from the process before removal was practical in this case because the owner was firmly committed to dam removal. Currently, FERC license surrender with dam removal in the scope greatly lengthens the process, but without FERC jurisdiction, the project runs the risk of dam owners changing their minds and leaving the project in place. These options need to be weighed carefully for individual projects.
- The strong partnership and collaboration between the three conservation groups contributed significantly to the success of the removal. Each had a unique strength they were able to bring to the project.
- Allocating a lot of time, even for a project as straightforward as this, is incredibly important. It still took four years between the licensee deciding to surrender and the dam removal taking place. The license surrender process can be long depending on several variables and a few years should be budgeted for most projects.
- The state historic preservation office determined that removal created an adverse effect to historic properties, which extended the project timeline. To resolve the adverse effect, the project management team created detailed reports and a story map to tell the story of the dam and the surrounding context.

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BACK PHOTO
ELWHA RIVER, WASHINGTON
THOMAS O'KEEFE

AMERICAN RIVERS

HYDROPOWER REFORM COALITION