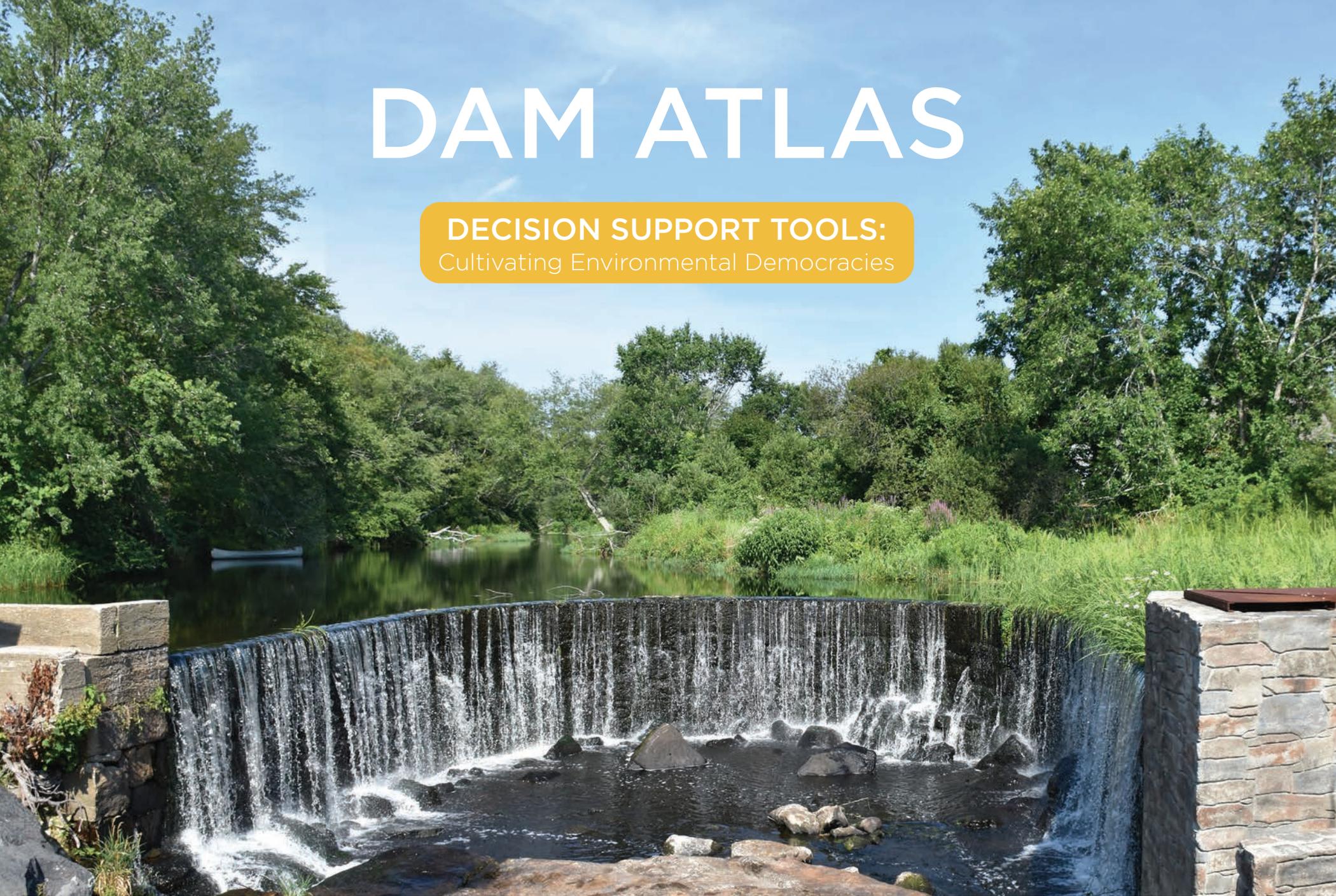
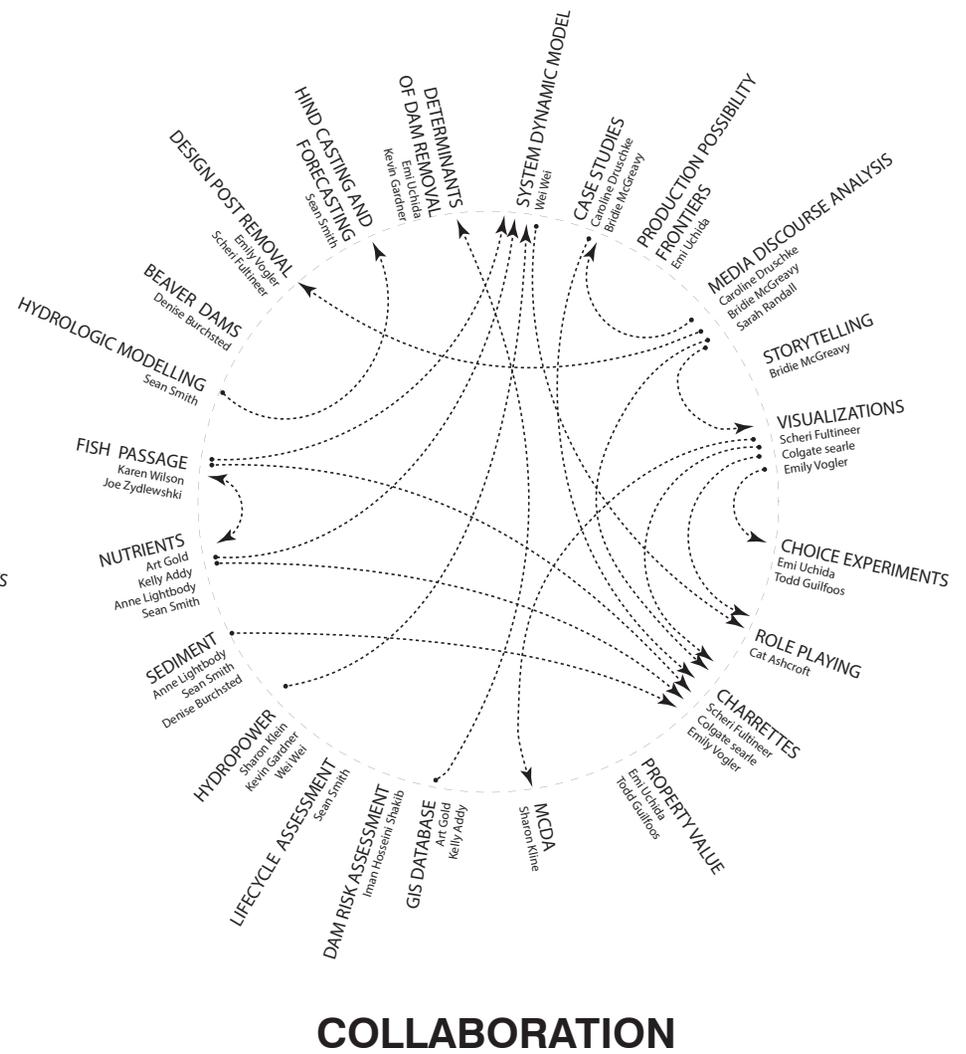
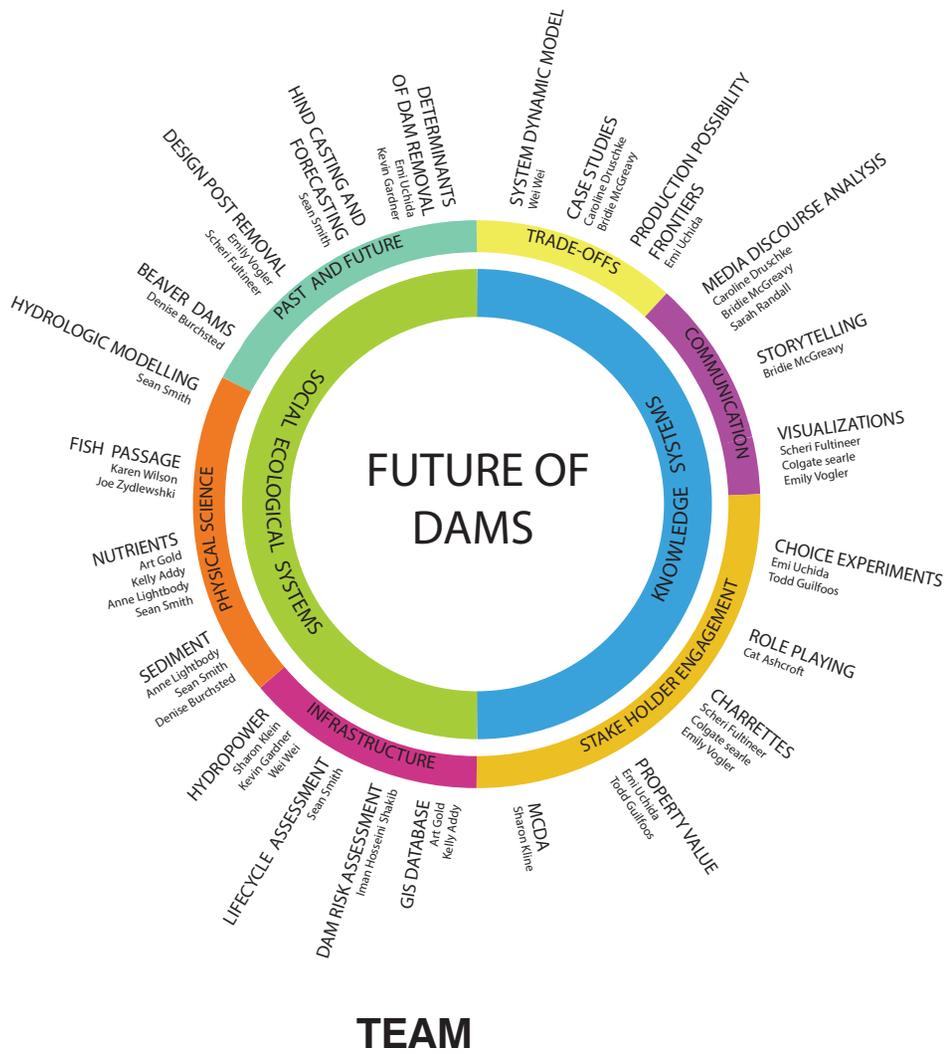


DAM ATLAS

DECISION SUPPORT TOOLS:
Cultivating Environmental Democracies



COMMONPLACE
Landscape and Planning



WICKED ENVIRONMENTAL PROBLEMS REQUIRE INTERDISCIPLINARY CREATIVE APPROACHES





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“You kill the dam, you are killing a part of me”: Dam removal and the environmental politics of river restoration

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ABSTRACT

River restoration through dam removal provides an opportunity to investigate the changing nature of environmental conflicts and politics in long-humanized landscapes. In New England, where over 14,000 dams fragment the region's rivers, dam removals are often highly contested. This is due, in part, to how the intertwined roles of history, identity, and aesthetics coalesce to create attachment to place and inspire the defense of dammed landscapes. Dam removal provides a useful lens to consider the following: How do the historical and geographical contingencies of this region shape and alter conflicts over dam removal in specific ways? In instances where conflicts emerge, what do the conflicts reveal about the politics of ecological restoration in highly altered landscapes? We use a political ecology approach to reveal how complex cultural dynamics, competing interpretations of science and the environment, micropolitics, and the role of multiple actors generate and shape conflicts over dam removal. We show that the historical geography of New England influence conflicts over removal in important ways, particularly with regard to the roles of aesthetics and identity in landscapes that are characterized largely by consumptive as opposed to productive uses. Our findings also suggest that restoration in long-humanized landscapes will embroil new constellations of human and nonhuman actors, requiring attention to the political and cultural, as well as the ecological, dimensions of restoration. This paper contributes to research on the political and social dimensions of dam removal, as well as to research at the nexus of ecological restoration and environmental politics.

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1. Introduction

In 2008, following an eight-year study by the United States Army Corps of Engineers (USACE), the Town of Greenfield, Massachusetts (MA) agreed to remove both the Wiley and Russell and Mill Street dams as part of a broader river restoration project on the Green River. After town officials determined that removing the Mill Street Dam would be too costly due to upstream infrastructure issues, the focus of the project shifted to the Wiley and Russell Dam. The dam, which the MA State Office of Dam Safety had previously labeled as “high hazard,” blocks passage for migratory fish such as American eel, blueback herring, sea lamprey, and Atlantic salmon. It is, according to nearly all independent estimates,

an economic liability that no longer serves its original purpose of providing power to 19th century industrial facilities. All told, 17 agencies and organizations, ranging from the National Ocean and Atmospheric Administration (NOAA) to Trout Unlimited, partnered in the proposed removal, spending >\$500,000 over five years. Yet, in August of 2014, after a campaign by community members concerned about the loss of the dam and the landscape that it created, which “have been an essential part of the ecosystem for 200 years,”² the Mayor of Greenfield unilaterally decided to halt the removal.

Similar stories are emerging across New England. In Warren, Vermont (VT) local townsmen are fighting to preserve the village's dilapidated crib dam (and surreptitiously repair it, if necessary) as a crucial element of the area's industrial heritage, while the VT Agency of Natural Resources (ANR), the dam's owner, has said that the structure is irredeemable and must go. In Durham, New Hampshire (NH), townspeople angrily protested in 2009 when state officials attempted to discuss removal of aging dams on the Oyster River (Fig. 1). The proposal was subsequently dropped. In central

“The Swift River has been part of me since I was a little kid. You kill the dam, you are killing part of me”

Quote from resident of Swift River*

* Corresponding author.

E-mail addresses: Coleen.A.Fox@Dartmouth.edu (C.A. Fox), Francis.J.Magilligan@Dartmouth.edu (F.J. Magilligan), Christopher.S.Sneddon@Dartmouth.edu (C.S. Sneddon).¹ State agencies throughout New England define a dam's hazard according to the potential loss of human life and economic damages incurred should the dam fail (“high hazard”). In other words, the designation it is not a reflection of the dam's material condition.² <http://www.industrialhistory.org/save-the-historic-wiley-and-russell-dam>.



More than **50** dams identified for potential removal by state agencies in New England have been stalled or delayed due to opposition on a variety of grounds.

According to Fox et al. (2016) Conflicts often center on 2 main factors:

1. Perceived loss or threat to individual and collective sense of place around dams and impoundments
2. Sense that the dam removal process ignored community-based stewardship of local resources



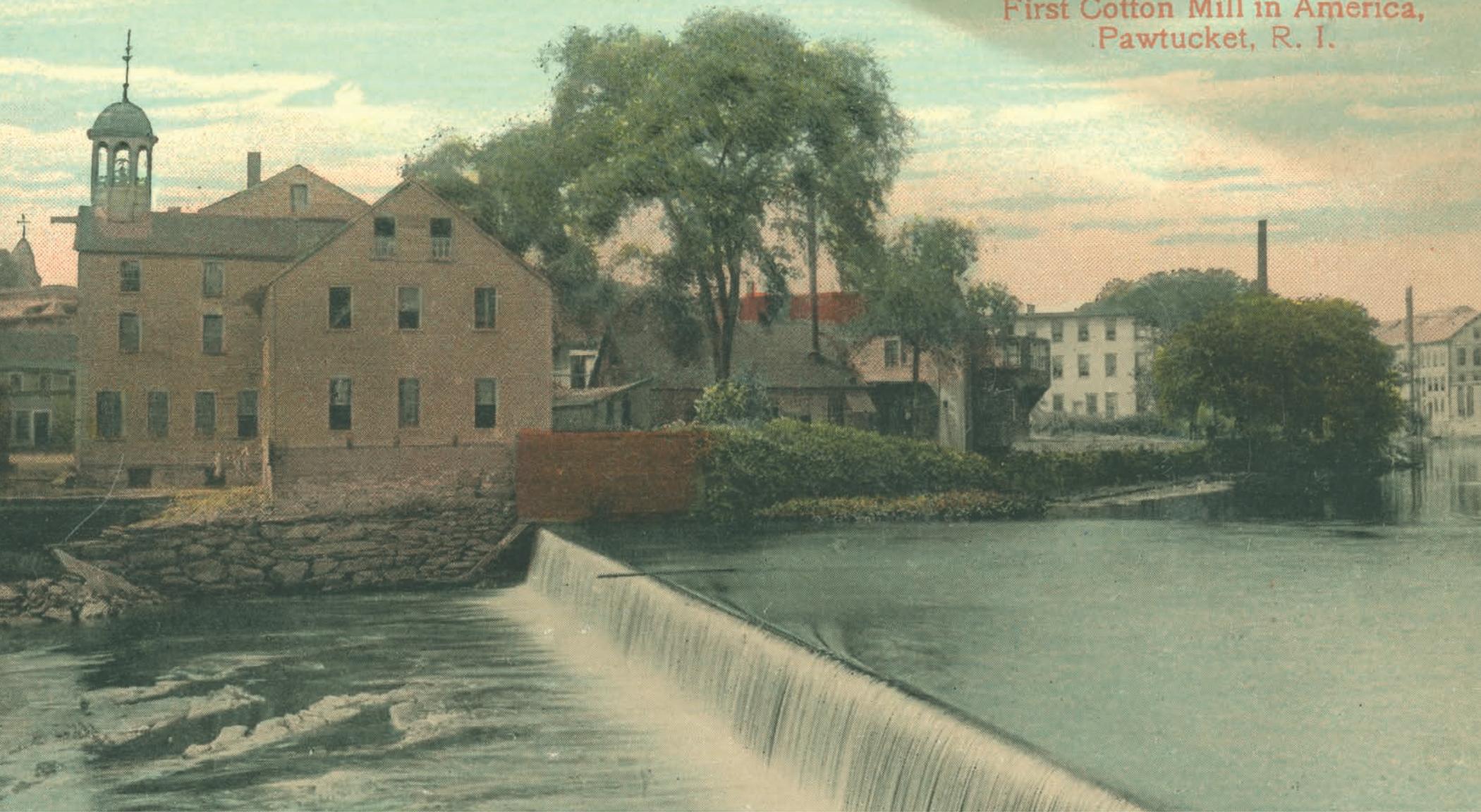
Johnson and Graber (2002) identified three issues that lead to more divisive decision making around dams:

- When the idea of removal is new to the community
- When a quick decision needs to be made
- When outsiders (e.g., state agencies or conservation organizations) are leading the decision process.



These controversies raise important questions about how the public should be involved in decision-making about the management of rivers, water, and other common pool resources. We need new models of what environmental democracies can look like.

Old Slater Mill and River Dam,
First Cotton Mill in America,
Pawtucket, R. I.



We need new creative social practices that bring people together at the local level to compassionately discuss divergent viewpoints; to critically re-evaluate history, science, and personal values; and to fully consider the social and environmental repercussions of individual and community beliefs, identities, and actions.



In the coming decades there will be the need to make decision about thousands of aging dams.....

1. How can we improve the decision making process to reduce the number of dam removal projects that stall or fail due to community opposition?



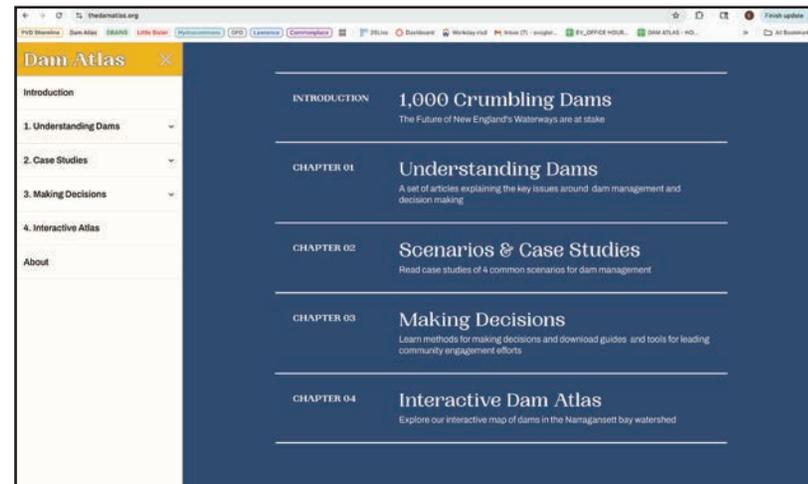
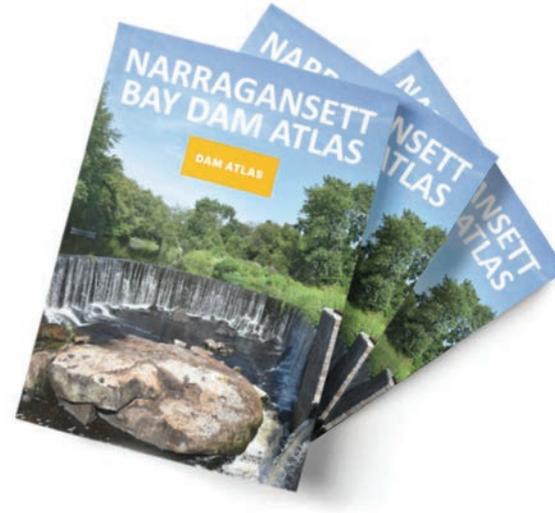
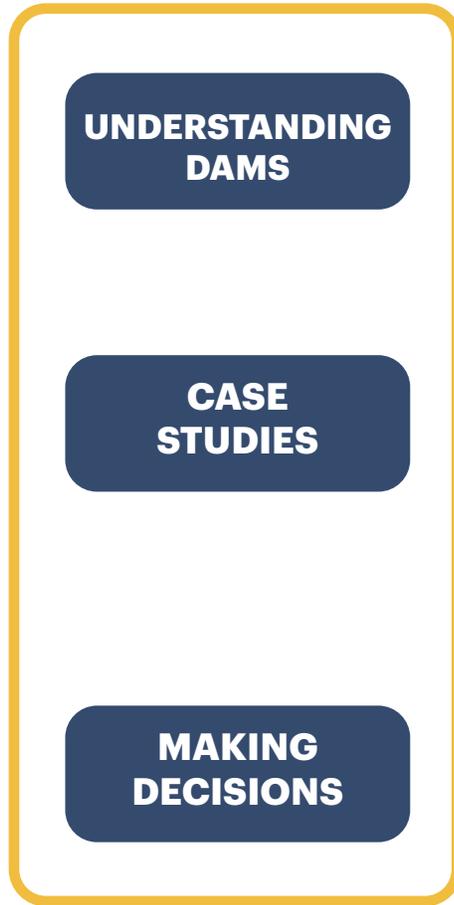
2. How can we use art and design to find creative solutions that can maintain and strengthen sense of place even if landscapes are changing?



In Collaboration with Bidon Community Print Studio + Buena Gráfica Social Studio



COMPONENTS OF THE PROJECT

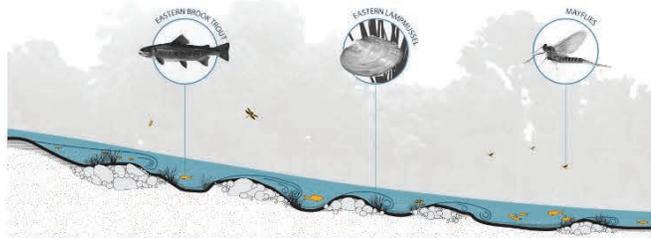


FISH PASSAGE + ECOSYSTEM IMPACTS

River systems are dramatically altered by the construction of a dam, which often has a lasting impact on interspecies relationships and overall habitat connectivity. More than just flowing water, rivers transport fish, sediment, and aquatic organisms between the headwaters (the smallest parts of river and stream networks) to the mouth (where the rivers discharge into coastal waters), sustaining healthy ecosystems along the way. Dams disrupt the system by acting as barriers that disconnect upstream and downstream river lengths, effectively weakening multiple ecosystems¹.

RIVER FLOW AND ECOSYSTEM DYNAMICS

Before European settlement, beaver dams and ponds were common in the smaller streams of the Narragansett Bay Watershed. However, these beaver dams did not generate the extent of changes associated with current dams in the watershed; beaver dams are relatively small, highly porous (leaky) and often seasonal or temporary. In contrast to beaver dams, dams constructed for industry and power along the rivers in the Narragansett Bay and coastal watersheds were permanent and impervious, creating a large-scale shift in the flow and ecology of rivers. Dams effectively transform portions of a river ecosystem into a lake ecosystem (or impoundment). While different aquatic and terrestrial species thrive in these distinct habitats, both rivers and

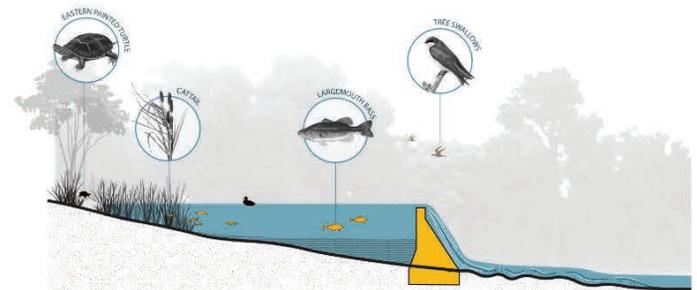


Diagrammatic Section of free flowing river

impoundments can provide critical wetland habitat. These wetlands may serve as travel corridors; nesting, feeding, resting, nursery and brood-rearing sites; drinking water sources and escape cover; and provide seasonal breeding, migration and overwintering habitat for wildlife².

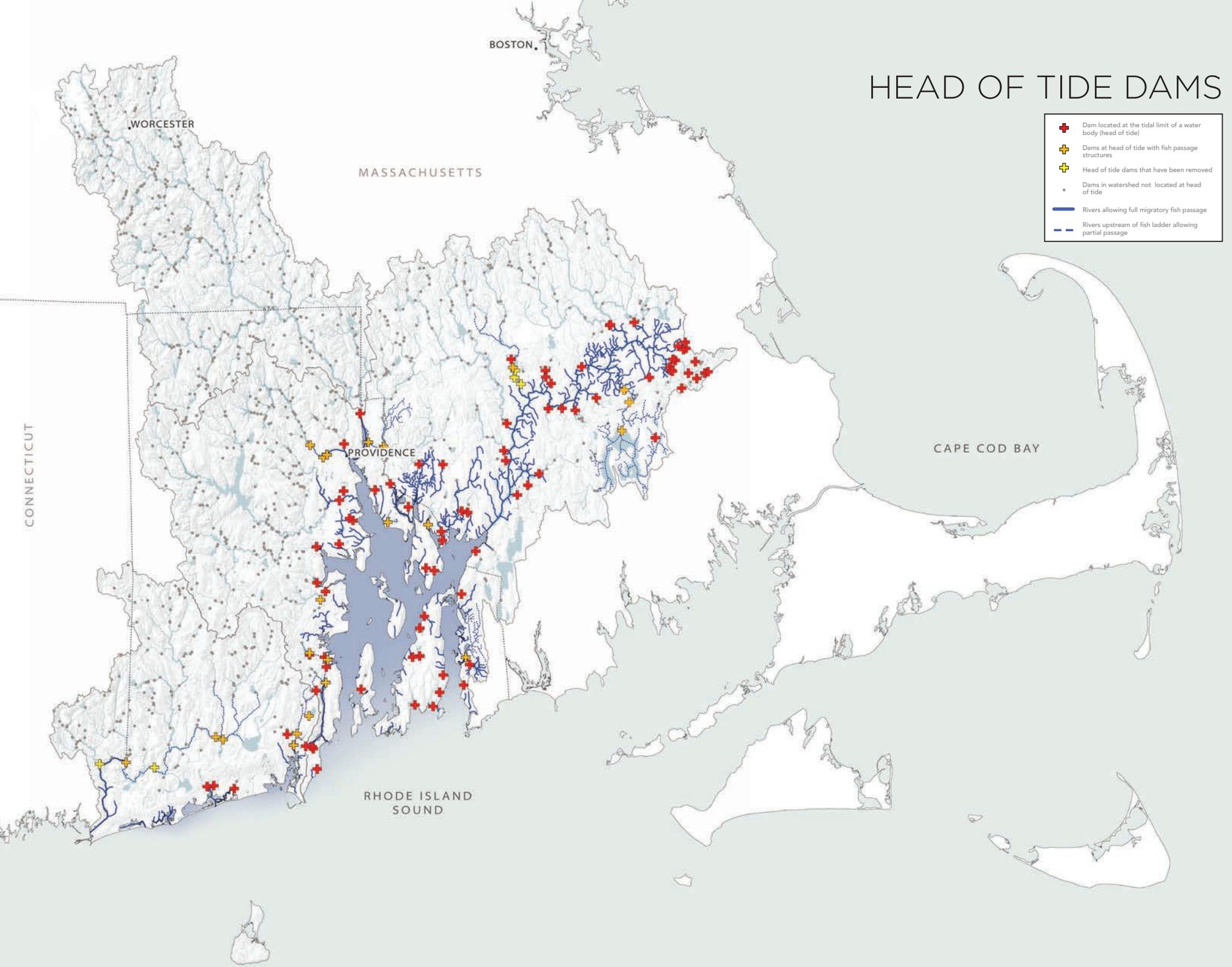
Free-flowing reaches of rivers and streams transport wood, rocks, and other natural debris downstream where they accumulate to create characteristic riffles (shallow rocky areas), pools, and meanders. These habitat features act as shelter for prey species and help to support coldwater fish species such as Brook Trout, Fallfish, Blacknose Dace, and Longnose Dace. There is also a unique macroinvertebrate fauna of mayflies, stoneflies, caddisflies, midges, craneflies, blackflies, dragonflies and damselflies, crayfish, and mollusks. In Rhode Island, due to habitat loss, dams, water pollution, and climate change, Eastern brook trout are listed as a Species of Greatest Conservation Need.

When dams are constructed, the river habitat above the dam is transformed into a lake habitat that supports warm-water species such as large and smallmouth bass, bluegill, and chain pickerel. Within these impoundments, wetlands often emerge along the shoreline or in shallow areas, providing

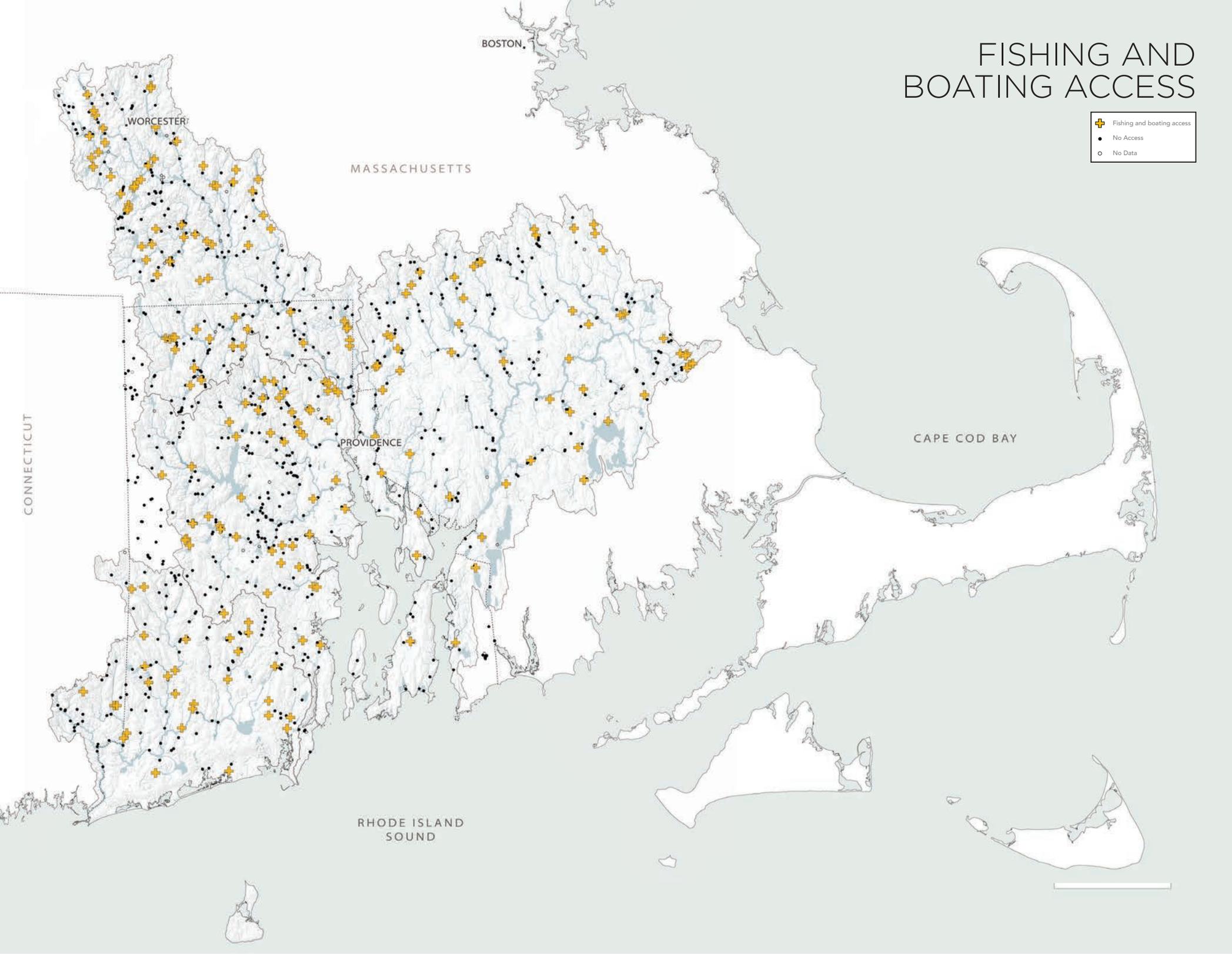


Diagrammatic Section of free flowing river

HEAD OF TIDE DAMS



FISHING AND BOATING ACCESS





Introduction

1. Understanding Dams

- 1. Types, Uses, Ownership
- 2. Hazard Risk, Climate Change, Failure
- 3. History
- 4. Sense of Place + Recreation
- 5. Fish Passage + Ecosystem Impacts
- 6. Water Quality + Sediment
- 7. Cost + Funding
- 8. Social + Ecological Metrics

2. Case Studies

3. Making Decisions

4. Interactive Atlas

About



CHAPTER 01

Understanding Dams

Chapter 01 introduces key ecological, social, infrastructural, and economic factors that are important to consider for the management of dams at the individual and watershed scale.

- 1. Types, Uses, Ownership
- 2. Hazard Risk, Climate Change, Failure
- 3. History
- 4. Sense of Place + Recreation
- 5. Fish Passage + Ecosystem Impacts
- 6. Water Quality + Sediment
- 7. Cost + Funding
- 8. Social + Ecological Metrics



Introduction

1. Understanding Dams ^

1. Types, Uses, Ownership

2. Hazard Risk, Climate Change, Failure

3. History

4. Sense of Place + Recreation

5. Fish Passage + Ecosystem Impacts

6. Water Quality + Sediment

7. Cost + Funding

8. Social + Ecological Metrics

2. Case Studies v

3. Making Decisions v

4. Interactive Atlas

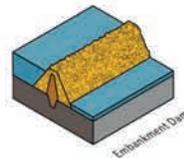
About

1.1

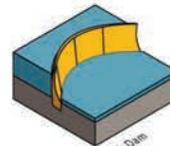
Types, Uses, Ownership

Dam Types

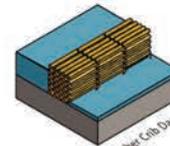
Depending on the size, age, and purpose of a dam, a range of construction materials and methods may have been used in the original construction. Some common materials used to construct dams include earth, timber, stone, concrete, and masonry. Embankment dams are made of compacted earth ("earthfill") or rock ("rockfill"). Concrete and masonry dams are categorized as gravity or arch dams. Gravity dams hold back water using only the weight of the construction material. Arch dams are built of thin concrete walls, and the force of the impoundment water is borne by the abutments on the side of the dam. Some historic dams within Narragansett Bay and the coastal watersheds of Rhode Island were originally timber crib dams that were constructed of heavy timbers cross stacked like log houses and filled with boulders. Most of the timber crib dams were later rebuilt with concrete and stone, or a new dam was built immediately downstream of the older legacy dam. Many older dams are composed of a combination of materials added as repairs were made to the structure over the years.



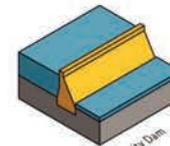
Embankment Dam



Arch Dam

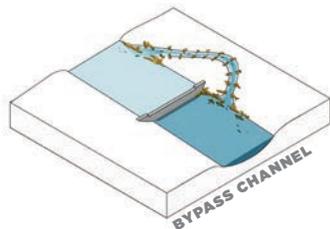
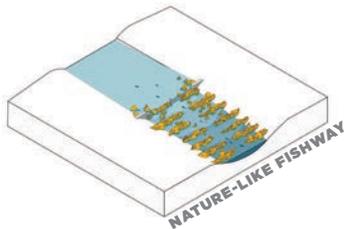
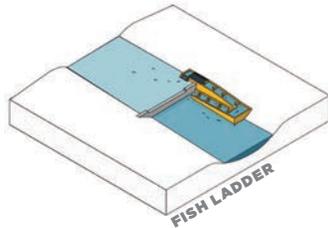
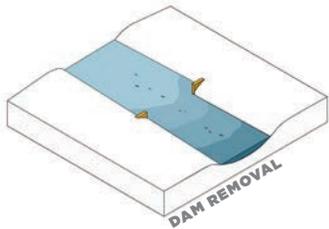
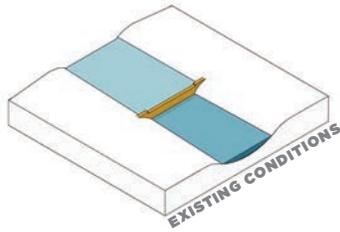


Timber Crib Dam

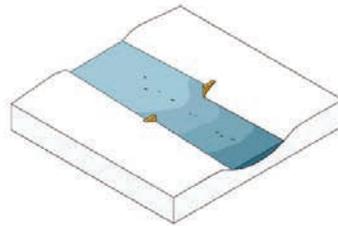


Gravity Dam

CASE STUDIES

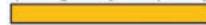


DAM REMOVAL



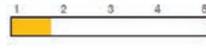
FISH PASSAGE UP AND DOWN STREAM

Low Fish Passage 1 2 3 4 5 High Fish Passage



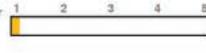
UPSTREAM WATER LEVELS

Potential Lowering of Water Levels 1 2 3 4 5 Maintain Existing Upstream Water Levels



RECREATION ON THE IMPOUNDMENT

Reduced Flat Water Recreational Opportunities 1 2 3 4 5 Maintains Existing Flat Water Recreational Opportunities



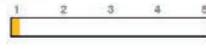
RECREATION ON THE RIVER

Maintains Existing Difficulties to River Recreation 1 2 3 4 5 Improves River Recreation by removing hazards and portages



VISIBILITY OF DAM

Dam Structure No Longer Visible 1 2 3 4 5 Dam Structure Remains Visible



WATER QUALITY

Maintain Existing Water Quality 1 2 3 4 5 Improve Water Quality



RISK OF DAM FAILURE

No Risk of Failure 1 2 3 4 5 Maintain Existing Risk of Failure



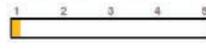
UP-FRONT COST

Less Expensive 1 2 3 4 5 More Expensive

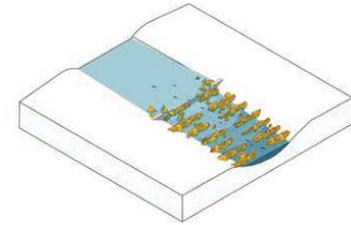


LONG-TERM COST AND MAINTENANCE

Lower Long Term Cost And Maintenance 1 2 3 4 5 Higher Long Term Cost And Maintenance



NATURE-LIKE FISHWAY



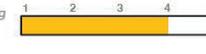
FISH PASSAGE UP AND DOWN STREAM

Low Fish Passage 1 2 3 4 5 High Fish Passage



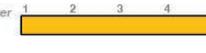
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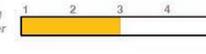
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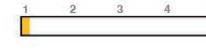
RECREATION ON THE RIVER

Maintains Existing Difficulties to River Recreation 1 2 3 4 5 Improves River Recreation by removing hazards and portages



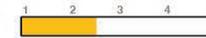
VISIBILITY OF DAM

Dam Structure No Longer Visible 1 2 3 4 5 Dam Structure Remains Visible



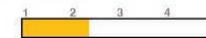
WATER QUALITY

Maintain Existing Water Quality 1 2 3 4 5 Improve Water Quality



RISK OF DAM FAILURE

No Risk of Failure 1 2 3 4 5 Maintain Existing Risk of Failure



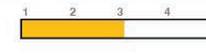
UP-FRONT COST

Less Expensive 1 2 3 4 5 More Expensive



LONG-TERM COST AND MAINTENANCE

Lower Long Term Cost And Maintenance 1 2 3 4 5 Higher Long Term Cost And Maintenance



CASE STUDIES - REMOVAL

HEAD TIDE DAM

PROJECT SUMMARY

Although outside of the Narragansett Bay watershed, the High Tide Dam in Alna provides a case study of a partial removal of a dam. The project consisted of the removal of 26 feet of the west side of the dam, the construction of an overlook in its place, construction of a retaining wall at the foundation of the dam, and the addition of a path to the river. The modification of the Alna dam is the second project in a series of three projects aiming to improve fish passage in the Sheepscot River, improve public safety and access, and honor the history of the individual sites. The first of the three projects, completed in 2018, was the removal of the Coopers Mills Dam in Whitefield upstream of the Head Tide Dam. The third project, at Branch Pond Mill in China, Maine, will stabilize the dam and install a fishway. Together the project aims to improve fish passage on the Sheepscot River which is home to the southernmost genetically unique wild populations of Atlantic salmon remaining as well as 11 other species of migratory species.



LOCATION
Alna, Maine

RIVER
Sheepscot River

YEAR
2019

GOAL
Improve fish passage, enhance public safety and access, and honor the history of individual sites.

TYPE
Partial Removal

COST
\$515,000.

PROJECT PARTNERS
Town of Alna, Atlantic Salmon Federation (ASF), The Nature Conservancy, Midcoast Conservancy, National Oceanic and Atmospheric Administration (NOAA), U.S. Fish and Wildlife Service, Maine Department of Marine Resources, Environmental Protection, and the National Fish and Wildlife Foundation.

FUNDING SOURCES
NOAA Community Habitat Restoration Program, US Fish and Wildlife Service, Enbridge Corporation, The Nature Conservancy, Elmina B. Sewall Foundation, Davis Conservancy Foundation, Patagonia, Farnsworth Foundation, Trout and Salmon Foundation and others.

CHALLENGES:

The Head Tide Dam was constructed over 250 years ago to power a series of mills in Alna. The Jewett family donated the dam to the town in 1964. One of the main challenges in the project was deciding whether work could proceed due to a covenant in the deed stating the dam could never be destroyed.

SOLUTIONS:

To address the concerns about the legal deed covenant, the decision was made to partially remove the western portion of the dam. The partial dam removal and construction of the overlook platform – which maintained one contiguous line from shore to shore – was deemed acceptable by selectmen and legal counsel complying with the legal deed covenant. In addition, the partial removal maintained a portion of the dam structure as a landmark for the community.

Access was an important aspect of the design of the site. Over the portion of the river where the dam was removed, an elevated viewing platform was constructed. The viewing platform provided a lookout onto the river. Using a grate rather than a solid concrete walkway, the project team hoped that it wouldn't be as sensitive to erosion as concrete. The final design was strengthened and provided opportunities at the site. The removal of the dam, a

swimming hole that has been a popular destination for generations was preserved. In addition, the pedestrian path down to the river provided access to the river and a safe place to put in and take out kayaks and canoes.

SUCCESSES:

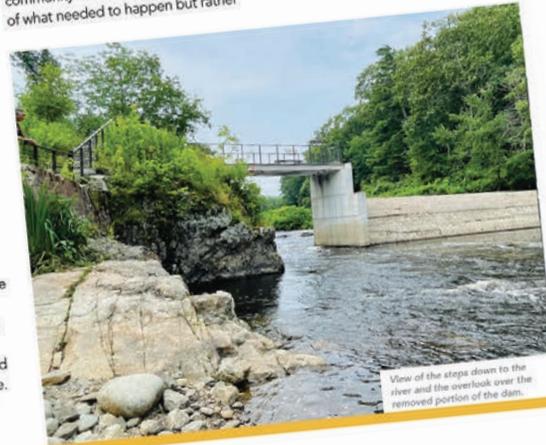
The partial removal of the Head Tide Dam is a good example of the ability to think and work creatively to address legal limitations on a project. It also was successful in providing habitat connectivity as well as preserving the historic dam structure that was important to the community.

LESSONS LEARNED:

The partial removal of the Head Tide Dam resulted from a strong team that worked on the project. The restoration team did not go into the community with a preconceived idea of what needed to happen but rather

worked with the community to decide how to improve fish passage and river connectivity.

Just because there are legal challenges or deed restrictions on a dam, doesn't mean that modifications can not be made to a dam. This project highlights the opportunity to think creatively to work through legal challenges and deed restrictions.



View of the steps down to the river and the overlook over the removed portion of the dam.

ADDITIONAL RESOURCES

[restoration.org/projects/magic-on-the-river](https://www.restoration.org/projects/magic-on-the-river)
[enbridge.com/news/work-starts-at-head-tide-dam-in-](https://www.enbridge.com/news/work-starts-at-head-tide-dam-in-alna)
[enbridge.com/news/head-tide-dam-project-a-gift-](https://www.enbridge.com/news/head-tide-dam-project-a-gift-to-the-community)
[enbridge.com/news/head-tide-dam-project-a-gift-](https://www.enbridge.com/news/head-tide-dam-project-a-gift-to-the-community)



Introduction

1. Understanding Dams



2. Case Studies



- 1. Dam Removal
- 2. Conventional Fishway
- 3. Nature-Like Fishway
- 4. Keep and Repair Dam
- 5. Comparing Scenarios

3. Making Decisions



4. Interactive Atlas

About



CHAPTER 02

Scenarios and Case Studies

Chapter 02 describes four future scenarios that have been used within the region to address aging dams, including real-life example case studies of each scenario.

- 1. Dam Removal
- 2. Conventional Fishway
- 3. Nature-Like Fishway
- 4. Keep and Repair Dam
- 5. Comparing Scenarios

CASE STUDY

Horseshoe Falls Fish Ladder



Challenges

Removal of the dam was challenged as the Horseshoe Falls Dam was a local landmark widely appreciated for its scenic beauty. It is the only horseshoe-shaped falls in Rhode Island. Many perceive Horseshoe Falls Dam as an historically significant part of the state's industrial heritage.

Location

Charlestown/Richmond, RI

River

Pawcatuck River

Year

2010

Type

Denil Fishway

Cost

\$628,469

Project Partners

Wood Pawcatuck Watershed Association; Kenyon Industries, Inc; Town of Charlestown; Trout Unlimited; United States Fish and Wildlife Service; RI Coastal Resources Management Council; RI Department of Environmental Management; National Oceanic and Atmospheric Administration; Save the Bay; Richmond Conservation Commission; Town of Charlestown; USDA Natural Resources Conservation Service; American Rivers; Fuss

INTERACTIVE MAP

Dam Atlas

Filter Search Categorize Export Starting Points

All 1034 Dams Shown

Wyassup Lake Dam
Wyassup Brook, North Stonington, CT

Green Falls Reservoir Dam
Green Fall River, Voluntown, CT

Nemasket Park Dam
Middleborough, MA

Unnamed Dam
Carver, MA

Tupperware Dam
Blackstone River, Blackstone, MA

Coes Reservoir Dam
Tatnuck Brook, Worcester, MA

Unnamed Dam
Tatnuck Brook, Worcester, MA

Patch Reservoir Dam
Tatnuck Brook, Worcester, MA

Cook'S Pond Dam
Tatnuck Brook, Worcester, MA

Salisbury Pond Dam

Location Attributes

Town

Watershed

- Beaver River
- Big River
- Branch River
- Chepachet River
- Chipuxet River-Pawcatuck River
- Clear River
- Cotley River-Taunton River
- Emerson Brook-Blackstone

Physical Attributes

Construction Materials

Height of Dam

Weymouth

Brockton

Taunton

Providence

Cranston

Warwick

Fall River

New Bedford

Plymouth

Pilgrimage Highway

LEGEND

Dam Atlas



Filter

Search

Categorize

Export

Starting Points



Olney Pond Dam



Dam Atlas ID: 3710

Lincoln, RI

Year Built: 1883

[41.89484228289356,](#)

[-71.42684519290924](#)

River System

Threadmill Brook

Owner

--

Purpose

Recreation

Hazard Level

High

Height

29.5 ft

Construction Material

Masonry, Gravity, Earth

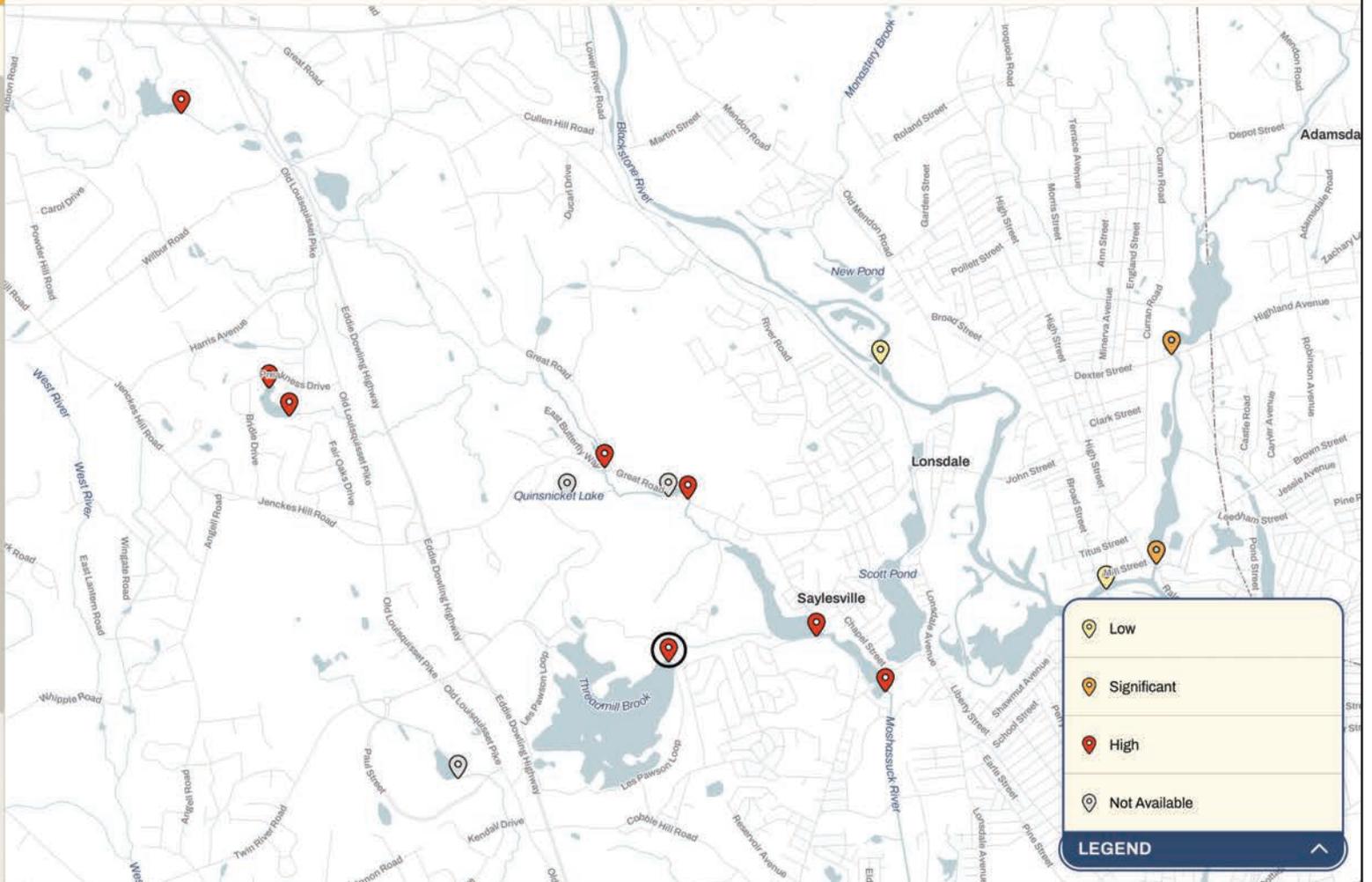
Upstream Functional Network

1.374898283

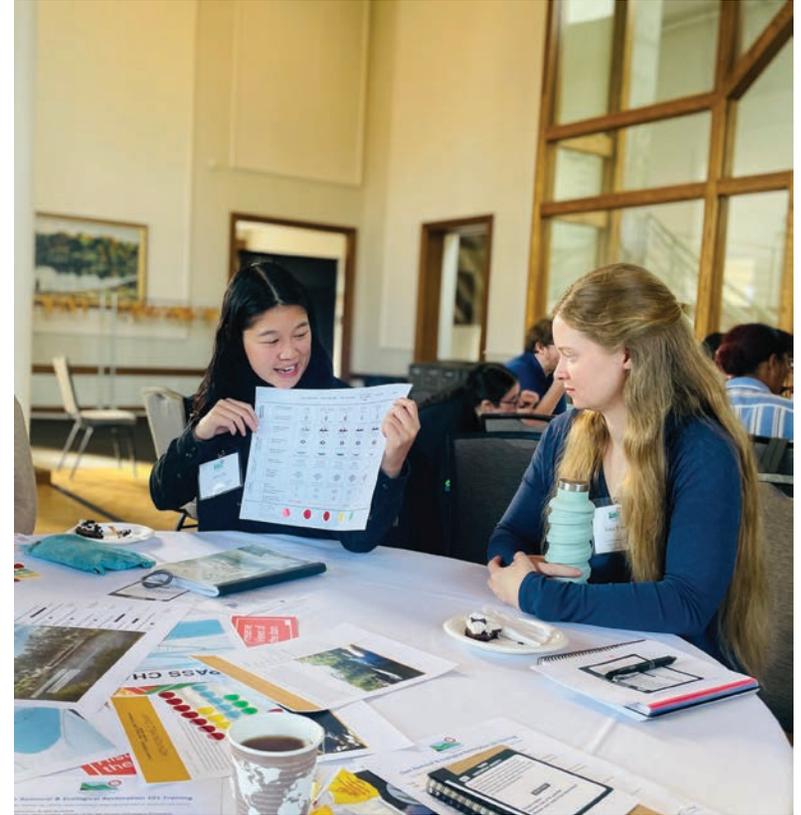
Downstream Dam Count

3

Fish Passage Modification Pond Area



MAKING DECISIONS



OVERVIEW OF APPROACH

RESPECTING LOCAL PEOPLE'S VALUES AND PERSPECTIVES

Listening, acknowledging, honoring, and being willing to factor in community and individual values into the decision making process are key to community engaged processes.

NEUTRAL FACILITATORS + STRUCTURED DIALOGUE

In order to create a space for dialogue, sharing, and learning, it is important that the facilitators be neutral. The aim is to not to go into a community with a set agenda, but to bring stakeholders and the community into the creative process of exploring alternatives.

HELPING PARTICIPANTS SHIFT FROM POSITION TO INTERESTS

Positions are something that participants have decided upon whereas interests are what caused them to make that decision.

EXPLORATION OF A RANGE OF ALTERNATIVES TO MOVE PAST BINARY POSITIONS

Unlike large dams, where there are often very few options beyond removing or keeping a dam, with small dams, there are often a range of alternatives that can achieve multiple objectives.

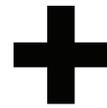
FOSTERING LEARNING BY MAKING INFORMATION ACCESSIBLE AND VISUAL

Visual tools can help foster insights not accessible through other, often more quantitative approaches to communicating information.

TRANSPARENT EVALUATION OF ALTERNATIVES BASED ON OBJECTIVES

The Structured Decision Making process allows for the transparent evaluation of alternatives based on how well each alternative meets the project objectives.

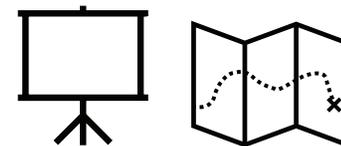
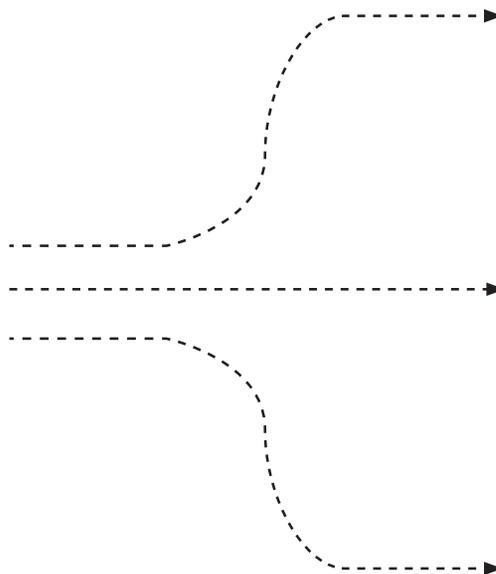
DESIGN CHARRETTE



STRUCTURED DECISION MAKING

STEPS IN PROCESS	BENEFITS	LIMITS
STRUCTURED DECISION MAKING	<ul style="list-style-type: none">• Clearly defined process for coming to a decision• Ability to evaluate alternatives based on performance measures	<ul style="list-style-type: none">• Limited guidance on how to engage the public in decision making
CHARRETTES	<ul style="list-style-type: none">• Geared toward groups of the general public• Use of visualizations to communicate about complex alternatives• Guidance on facilitation	<ul style="list-style-type: none">• Often more open ended design process without clear guidance on how to make a final decision.

DESIGN CHARRETTE



Visualizations



Public Process

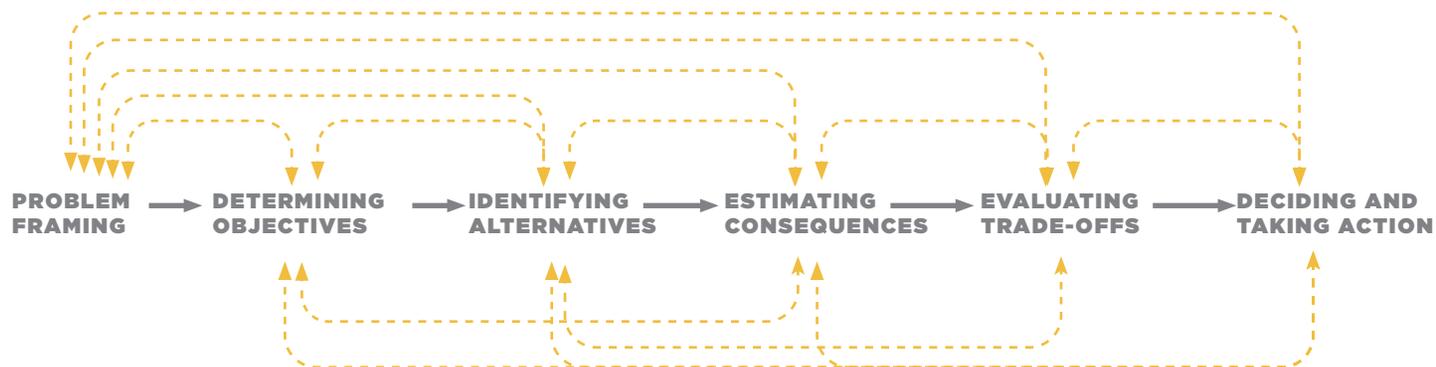


Sense of Place



STRUCTURED DECISION MAKING

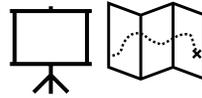
STEPS IN PROCESS	UNDERLYING QUESTION	EXAMPLE in the context of dam decisions
1. Problem Framing	What is the context for (scope and bounds of) the decision?	<ul style="list-style-type: none"> • Single Dam • Whole River approach
2. Determining Objectives	What objectives and performance measures will be used to identify and evaluate the alternatives?	<ul style="list-style-type: none"> • Improve Fish Passage • Increase Recreational Opportunities • Reduce Flooding
3. Identifying Alternatives	What are the alternative actions or strategies under consideration?	<ul style="list-style-type: none"> • Do Nothing • Remove Dam • Nature-Like Fishway • Technical Fishway • By-pass Channel
4. Estimating Consequences	What are the expected consequences of these actions or strategies?	<ul style="list-style-type: none"> • 50% improved fish passage • 80 summer days when the river would be passable by canoe
5. Evaluating Trade-offs	What are the key trade-offs among consequences?	<ul style="list-style-type: none"> • Trade-off between fish passage and Hydropower
6. Deciding And Taking Actions.	How can the decision be implemented in a way that promotes learning over time and provides opportunities to revise management actions based on what is learned?	<ul style="list-style-type: none"> • Citizen science • Ongoing stewardship



WORKSHOP PLAN

1. Introduction

- Description of the scenario
- Hand out character cards



2. Group Introductions

- Introductions
- Select and discuss objective cards
- What are your interests and concerns about the future of the dam?



3. Present Case Studies and Matrix

- Present projects that are examples of how other communities have addressed their aging dam infrastructure.
- Present alternatives being considered for this project
- Explain matrix



4. Group Discussion of Alternatives

- Discuss case studies and alternatives
- Brainstorm other alternatives
- Review Matrix



5. Rank Alternatives

- GREEN = Preferred option
- YELLOW = Acceptable option
- RED = Oppose



6. Conclusion

- Report Out
- Closing remarks



Fish Migration Ecological

Ecological Tradeoffs

WETLAND
Fish are unable to reach spawning habitat upstream.

WETLAND DAM
Fish are able to reach spawning habitat.

FISH MIGRATION
Up and down stream connectivity. Dams prevent fish from reproducing by blocking their passage upstream to fresh water spawning habitats. This leads to a decline in fishery health and population numbers.

Upstream Habitat Ecological

Ecological Tradeoffs

UPSTREAM HABITAT
Wetlands in the upstream pond. Dams have affected the character of river ecosystems by altering water levels, producing near ponds and wetland areas upstream. These flooded areas can become important habitat for wetland and aquatic species.

Recreation on the Pond Cultural

Cultural Tradeoffs

RECREATION ON THE POND
Cultural uses of upstream ponds. Ponds and impoundments created by dams can be a recreational amenity for community members, providing opportunities for boating and fishing on open water.

History of the dam Cultural

Cultural Tradeoffs

HISTORY OF THE DAM
Connections to the past. Dams tell a story about the history of a community. This history is part of the local identity and communicates about the evolving relationship between people and the river.

Impact to the Surrounding Landscape Aesthetic

Aesthetic Tradeoffs

IMPACT TO THE SURROUNDING LANDSCAPE
Altering familiar landscapes. Altering a dam or their dam impact surrounding landscape due to redesign and construction.

View of the Dam Aesthetic

Aesthetic Tradeoffs

VIEW OF THE DAM
The structure as a landmark. Dams can contribute to the sense of place along the river and in the community. Altering a dam can affect its visibility, aesthetics, and function as a local landmark.

Upfront Cost Economic

Economic Tradeoffs

UPFRONT COST
Initial investment in dam alternative. Certain alternatives are more expensive options in the short term due to more involved design and construction factors.

Long-Term Cost Economic

Economic Tradeoffs

LONG-TERM COST
Continual maintenance costs. Any alternative other than dam removal will require long term maintenance.

YEAR 1 YEAR 20 YEAR 50

MAKING DECISION - DETERMINING OBJECTIVES

OBJECTIVE CARDS

OVERVIEW

WHO:
General Public

TIME:
3-5 hours

PURPOSE:
Clarify project objectives and help people focus on interests not positions.

MATERIALS:
Trade-off cards

The deck of "Trade-Off Cards", are 6"x4" physical cards that on one side have written out the objective and on the other side have a diagram and text that further explained the issue.

Many people come into a public meeting about a dam with a clear position (ex. keep or remove the dam). One of the goals of the trade-off cards is to help shift the conversation away from a focus on positions to a conversation about the underlying interests (ex. improve fish passage, preserve the history of the town, etc.). This shift is key because while positions lock participants into advocating for a single alternative, many of the underlying interests that they care about could be achieved through multiple alternatives.

Using the trade-off cards early on in the public process can allow people to start by building a common ground. For example, many participants may agree that having a healthy river is important. This agreement then can allow for participants to collectively discuss and consider options that could help to achieve their shared goals later on in the process.

This process allows for the public to agree on what matters and will need to be assessed in order to effectively compare alternatives. By doing it in a public setting it also ensures that all considerations (both ecological and social) are being factored into the final decision. One of the goals of this process is to engage the public in determining the project objectives.



THE OBJECTIVE:

1. Allow participants to introduce themselves in a structured way that encouraged dialogue.
2. Help participants clarify the issues that they felt most strongly about.
3. By choosing 5 cards it helps participants move beyond a focus on single issue.
4. Encourage participants to shift from thinking about their position (keep or remove the dam) to thinking about their interests (improve fish passage, preserve sense of place, etc.).
5. Communicate to the participants that both scientific facts and social values are being considered in the discussion about the future of the dam.

PRE-WORKSHOP PREPARATION:

First you need to determine what the objectives are for the project. This would come from discussions with

SETTING UP THE EXERCISE:

Following an introduction presentation that outlines the decision context and the goal of the workshop, place trade-off cards face down in a row in the center of the table.

the steering committee. It can also be informed by research into the history of the dam and any previous community involvement. While you should try to represent all the issues, there will also be blank cards that the community members can fill in which will help determine if any objectives are missing.

Once you have a sense of the key objectives for the project, print out the trade off cards from the card deck that are most relevant. In addition, print enough extra blank cards so that community members can add additional project objectives.

It is suggested that enough cards are printed so that everyone can take 5 cards. However, if printing costs are a concern, you can ask community members to look at the cards and make a list of their top 5 choices on a sheet of paper. When it is an individual's turn, you can ask the participant to pick up their top 5 cards during their turn and return them to the middle of the table when their turn is over.

Go around the whole table until everyone has had a time to introduce themselves and go over their cards.





Introduction

1. Understanding Dams

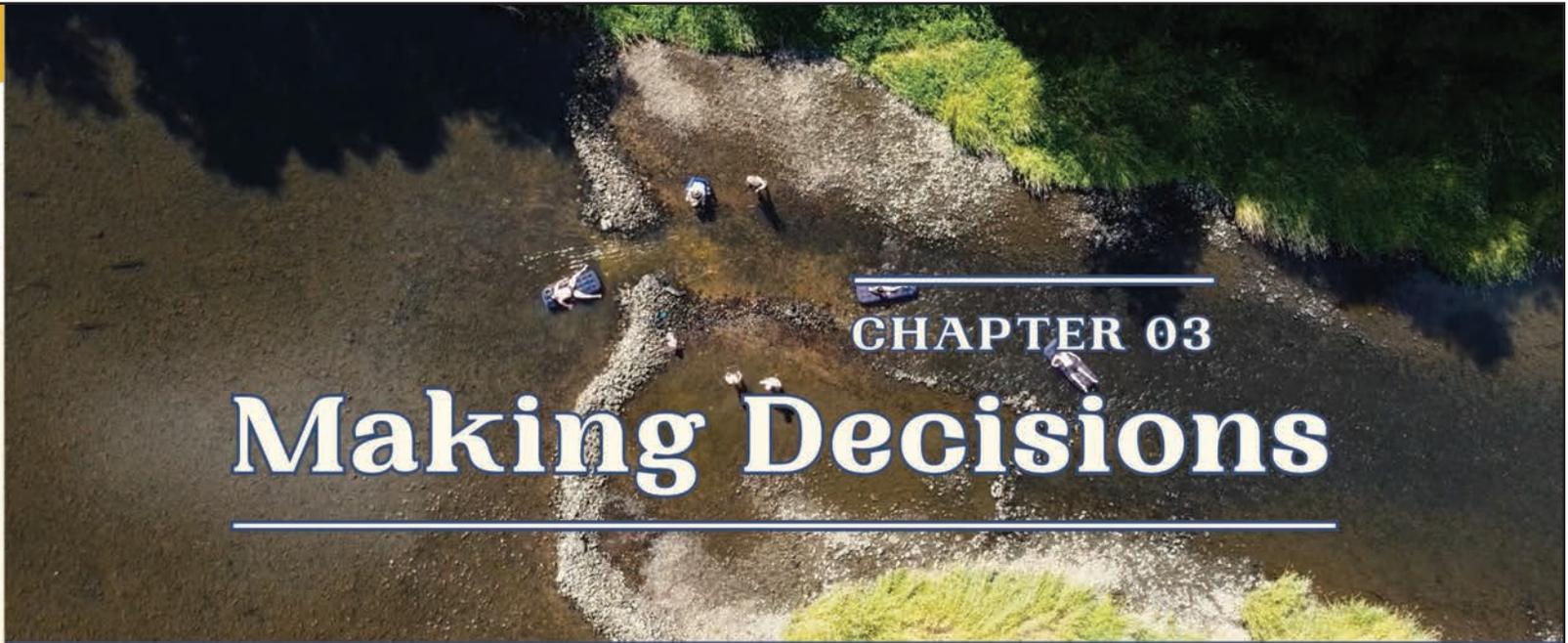
2. Case Studies

3. Making Decisions

- 1. Overview
- 2. Problem Framing
- 3. Determining Objectives
- 4. Identifying Alternatives
- 5. Estimating Consequences
- 6. Evaluating Trade-Offs
- 7. Deciding and Taking Action
- 8. Resources & Downloads

4. Interactive Atlas

About



CHAPTER 03

Making Decisions

Chapter 03 shares methods and tools to support the decision making process around dams with the goal of improving the ability of communities to work together to find creative solutions to addressing the competing demands of rivers and dams.

- 1. Overview
- 2. Problem Framing
- 3. Determining Objectives
- 4. Identifying Alternatives
- 5. Estimating Consequences
- 6. Evaluating Trade-Offs
- 7. Deciding and Taking Action
- 8. Resources & Downloads



Introduction

1. Understanding Dams

2. Case Studies

3. Making Decisions

1. Overview

2. **Problem Framing**

3. Determining Objectives

4. Identifying Alternatives

5. Estimating Consequences

6. Evaluating Trade-Offs

7. Deciding and Taking Action

8. Resources & Downloads

4. Interactive Atlas

About

Below are some questions that may be helpful to clarify early on:

- What is the decision to be made?
- Does it make sense to look at a single dam, a segment of the river, or a whole river approach?
- What is the potential relationship of this decision to other decisions?
- Who will make the final decision? Is it a single individual or a group?
- When and how will the decision makers be engaged in the process?
- How will public input be factored into the final decision?
- What is the timeline within which the decision needs to be made?
- What deliverable will be needed from the decision process?

The PDF below includes 4 activities that help guide the Problem Framing process.



DOWNLOAD

Problem Framing Exercises

Download PDF ↓

Increase Fish Passage

Ecological Tradeoffs

WITH DAM



Dam blocks fish passage

Fish are unable to reach spawning habitat upstream

WITHOUT DAM



Fish are able to swim upstream and reproduce

FISH PASSAGE

Up and down stream connectivity

Dams prevent fish from reproducing by blocking their passage upstream to fresh water spawning habitats. This leads to a decline in fishery health and population numbers.

Protect Upstream Habitat

Ecological Tradeoffs



UPSTREAM HABITAT

Wetlands in the upstream pond

Dams have affected the character of river ecosystems by altering water levels, producing new ponds and wetland areas upstream. These flooded areas can become important habitat for wetland and aquatic species.

Format Shape

Shape Options | Text Options





> Fill

> Line



PROBLEM FRAMING

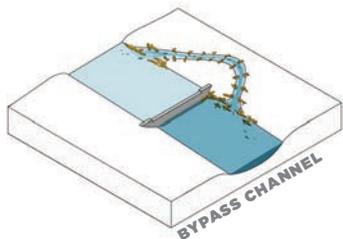
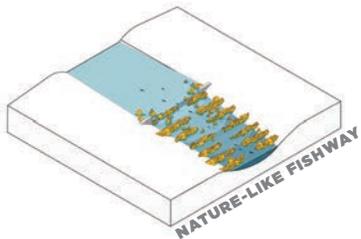
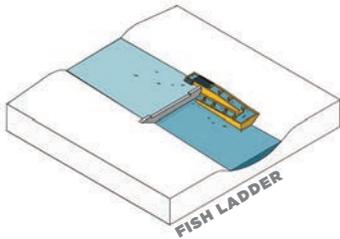
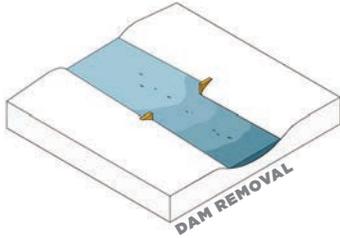
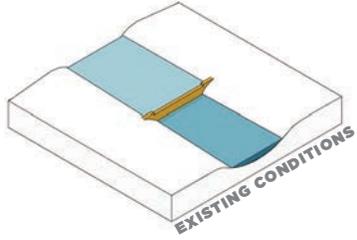
DETERMINING OBJECTIVES

IDENTIFYING ALTERNATIVES

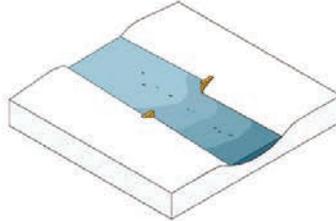
ESTIMATING CONSEQUENCES

EVALUATING TRADE-OFFS

DECIDING AND TAKING ACTION



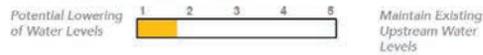
DAM REMOVAL



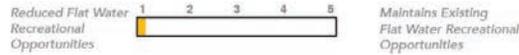
FISH PASSAGE UP AND DOWN STREAM



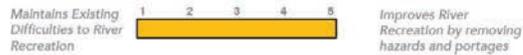
UPSTREAM WATER LEVELS



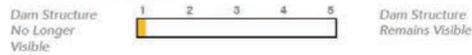
RECREATION ON THE IMPOUNDMENT



RECREATION ON THE RIVER



VISIBILITY OF DAM



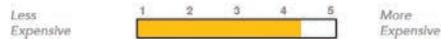
WATER QUALITY



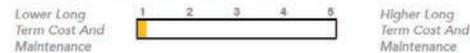
RISK OF DAM FAILURE



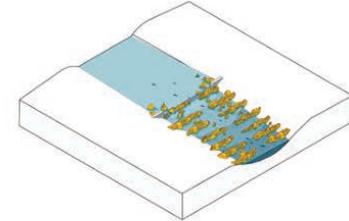
UP-FRONT COST



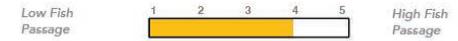
LONG-TERM COST AND MAINTENANCE



NATURE-LIKE FISHWAY



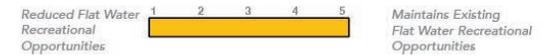
FISH PASSAGE UP AND DOWN STREAM



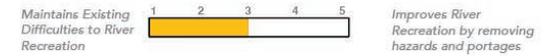
UPSTREAM WATER LEVELS



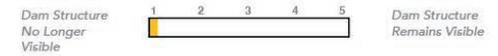
RECREATION ON THE IMPOUNDMENT



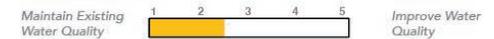
RECREATION ON THE RIVER



VISIBILITY OF DAM



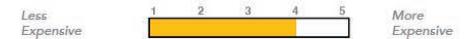
WATER QUALITY



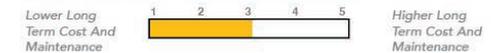
RISK OF DAM FAILURE



UP-FRONT COST



LONG-TERM COST AND MAINTENANCE

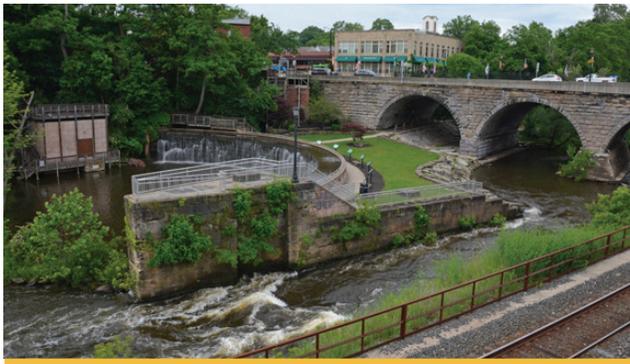


CASE STUDIES - REMOVAL

KENT DAM AND WATERFALL

PROJECT SUMMARY

Although outside of the Narragansett Bay watershed, the Kent Dam case study is a useful example of a project that provided habitat connectivity, improved water quality, and historic preservation of a dam structure. The Cuyahoga River in Kent, Ohio has been a vital resource for people of the river valley since approximately 9,000 BC—acting as a travel corridor, water supply, and hunting and fishing grounds. The arch-shaped Kent Dam was constructed in 1836 to power various mills in the rapidly-industrializing Kent area. Because it is the oldest masonry dam in Ohio and the second oldest arch-shaped dam attached to a canal lock in the US, it has become an iconic feature of the city. However, after falling into disuse in the early 20th century, it caused dam pool stagnation, obstructed fish passage, and led to other water quality issues. The nation's attention was drawn to the Cuyahoga River in 1970, when industrial and sewage waste caused the river to catch fire. This event, along with others across the country, spurred the adoption of the Clean Water Act, which was passed in 1972 in an effort to “restore the chemical, physical and biological integrity of the nation's waters.”



LOCATION

Kent, Ohio

RIVER

Cuyahoga River

YEAR

2005

GOAL

Improved water quality, Historic preservation, Migratory fish passage, Aquatic habitat

TYPE

Partial removal with historic preservation

COST

\$5,013,150

PROJECT PARTNERS

The Ohio EPA; Kent Dam Advisory Committee; The City of Kent.

FUNDING SOURCES

The City of Kent
Ohio EPA WRRSP Grants
Clean Ohio Fund Grant
Ohio Department of Natural Resources Grant
Ohio EPA Section 319 Grant

CHALLENGES:

The stretch of the Cuyahoga River that ran through the defunct Kent Dam was cited for noncompliance with the Clean Water Act by the Ohio EPA for exceeding pollutant concentrations. The EPA informed the City of Kent that they must pursue a modification—removal of the dam or face more stringent permitting limits at the City's Water Reclamation Facility. Because this permitting would be costly to Kent taxpayers and have little benefit to the quality of the river, the City of Kent began the processes of review and public engagement necessary to remove the dam with historic preservation.

SOLUTIONS:

Due to the potential conflict between historical preservationists and environmental advocates, the city created a 19-member Kent Dam Advisory Committee (KDAC). Their goal was to examine feasibility and decision-making pathways by studying factors like applicable laws and regulations, water quality issues, historical significance, and fish migration routes. After several meetings, the KDAC proposed a solution: the removal of a concrete wall that had been placed across the old lock area. This removal would allow water to flow around the arch dam, which would improve water quality and allow fish passage while maintaining the historic arch structure. Tannery Park was constructed surrounding the historic arch dam and a pump circulates water so water continues to flow over the front of the dam.

SUCCESSES:

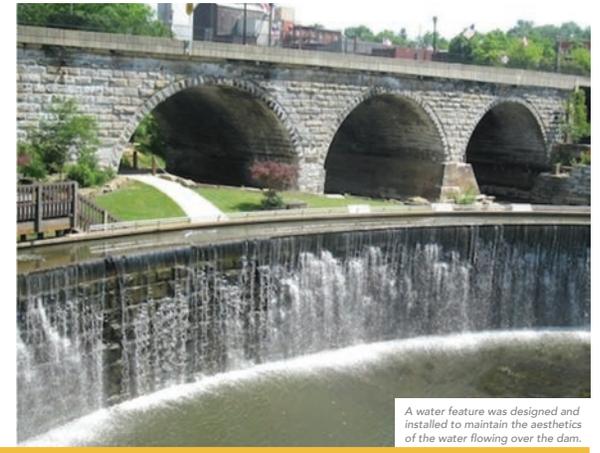
By removing part of the dam to create a by-pass channel around the arch dam structure, the health of the river was restored without jeopardizing the historical aspect of the dam or interfering with the city's identity. Since the partial removal of the dam, once-stagnant pools that emitted a foul odor are now flowing and allows for migratory fish passage. Dissolved oxygen levels at Kent Dam have improved. Also, the adjacent Tannery Park was expanded to allow increased public access to the historic landmark.

LESSONS LEARNED:

By creating an advisory committee dedicated to research and resolution, the project team was able to reach a solution that met the needs of the environment as well as the citizens of Kent. Because so much national attention was focused on the project,

early involvement spurred the Clean Water Act, strategies of engagement, analysis, and implementation; it even helped to inform similar projects across the country.

The Kent Dam is also a good example of a project that was able to achieve the dual goals of habitat connectivity and historic preservation. By creating a public park at the dam site, the history of the site and sense of place was able to be preserved and possibly enhanced. In addition, by adding a water feature to the arch dam artifact, the aesthetic and acoustic experience of being near a waterfall was preserved.



A water feature was designed and installed to maintain the aesthetics of the water flowing over the dam.

REFERENCES and ADDITIONAL RESOURCES

City of Kent: <https://www.kentohio.org/409/Dam-Restoration-Project>

CASE STUDIES - REMOVAL

HEAD TIDE DAM

PROJECT SUMMARY

Although outside of the Narragansett Bay watershed, the High Tide Dam in Alna provides a case study of a partial removal of a dam. The project consisted of the removal of 26 feet of the west side of the dam, the construction of an overlook in its place, construction of a retaining wall at the foundation of an old mill, and the addition of a path to the river. The modification of the Alna dam is the second project in a series of three projects aiming to improve fish passage in the Sheepscot River, improve public safety and access, and honor the history at the individual sites. The first of the three projects, completed in 2018, was the removal of the Coopers Mills Dam in Whitefield upstream of the Head Tide Dam. The third project, at Branch Pond Mill Dam in the town of China, Maine, will stabilize the dam and install a fishway. Together the project aims to improve fish passage on the Sheepscot River which is home to the southernmost genetically unique wild populations of Atlantic salmon remaining as well as 11 other species of migratory species.



LOCATION

Alna, Maine

RIVER

Sheepscot River

YEAR

2019

GOAL

Improve fish passage, enhance public safety and access, and honor the history of individual sites.

TYPE

Partial Removal

COST

\$515,000.

PROJECT PARTNERS

Town of Alna, Atlantic Salmon Federation (ASF), The Nature Conservancy, Midcoast Conservancy, National Oceanic and Atmospheric Administration (NOAA), U.S. Fish and Wildlife Service, Maine Department of Marine Resources, Maine Department of Environmental Protection, and the National Fish and Wildlife Foundation.

FUNDING SOURCES

NOAA Community Habitat Restoration Program, US Fish and Wildlife Service, Enbridge Corporation, The Nature Conservancy, Elmina B. Sewall Foundation, Davis Conservation Foundation, Patagonia, Farnsworth Foundation, Trout and Salmon Foundation and others.

CHALLENGES:

The Head Tide Dam was constructed over 250 years ago to power a series of mills in Alna. The Jewett family donated the dam to the town in 1964. One of the main challenges in the project was deciding whether work could proceed due to a covenant in the deed stating the dam could never be destroyed.

SOLUTIONS:

To address the concerns about the legal deed covenant, the decision was made to partially remove the western portion of the dam. The partial dam removal and construction of the overlook platform – which maintained “one contiguous line from shore to shore” – was deemed acceptable by Alna selectmen and legal counsel as complying with the legal deed covenant. In addition, the partial removal maintained a portion of the historic structure as a landmark for the community.

Public access was an important aspect of the redesign of the site. Over the western portion of the river where the dam was removed, an elevated ADA accessible viewing platform was constructed. The viewing platform provided a space for informational signage and a lookout onto the river. By using a grate rather than concrete for the elevated walkway, the project team hoped that it wouldn't deter shad which can be sensitive to passing under concrete. The final design maintained and strengthened recreational opportunities at the site. By maintaining part of the dam, a

swimming hole that has been a popular destination for generations was preserved. In addition, the pedestrian path down to the river provided access to the river and a safe place to put in and take out kayaks and canoes.

SUCCESSES:

The partial removal of the Head Tide Dam is a good example of the ability to think and work creatively to address legal limitations on a project. It also was successful in providing habitat connectivity as well as preserving the historic dam structure that was important to the community.

LESSONS LEARNED:

The partial removal of the Head Tide Dam resulted from a strong team that worked on the project. The restoration team did not go into the community with a preconceived idea of what needed to happen but rather

worked with the community to decide how to improve fish passage and river connectivity.

Just because there are legal challenges or deed restrictions on a dam, doesn't mean that modifications can not be made to a dam. This project highlights the opportunity to think creatively to work through legal challenges and deed restrictions.



View of the steps down to the river and the overlook over the removed portion of the dam.

REFERENCES and ADDITIONAL RESOURCES

<https://atlanticsalmonrestoration.org/projects/magic-on-the-river>

<https://cnme.com/currentnews/work-starts-at-head-tide-dam-in-alna/>

<https://cnme.com/currentnews/head-tide-dam-project-a-gift-thats-going-to-outlive-us-all/>

CASE STUDIES - FISH LADDER

DAMARISCOTTA MILLS

PROJECT SUMMARY

Although outside of the Narragansett Bay watershed, the Damariscotta Mills provides a unique case study of a fish ladder. In Algonquian, the name Damariscotta means "place of an abundance of alewives." However, in 1729, a double sawmill was constructed at the falls between fresh water Damariscotta lake and the tidal headwaters of the Damariscotta river. The dams blocked the annual alewife migration. In 1741, the legislature called for fish passage at Damariscotta mills, but it wasn't until 1807 that the towns built the new "stream" to bypass the dam. In 2007, after two centuries of use, a restoration project was initiated by a strong community group working with the Towns of Nobleboro and Newcastle and the Nobleboro Historical Society to restore the deteriorating fish ladders.



LOCATION

Nobleboro, Maine

RIVER

Damariscotta River

YEAR

Originally constructed in 1807 and then restored and rebuilt and restored between 2007-2017

GOAL

Fish passage

TYPE

Pool and Weir Fishway

COST

Restoration cost over \$1,000,000

PROJECT PARTNERS

Towns of Nobleboro and Newcastle, the Nobleboro Historical Society, US Fish and Wildlife Service, Maine Department of Marine Resources, and the involvement of many community members.

CHALLENGES:

The original fish ladder was a series of small pools connected by short passages that raised over 42 feet from the bay to the impoundment. The fish ladder worked well for about 180 years but its stonework and the underlying concrete deteriorated as ice dislodged stones and blocked the path for the fish. By the 1990s, the fish ladder was in very poor condition, and fish count plummeted to less than 200,000.

SOLUTIONS:

With strong community organizing, and fundraising, the reconstruction of the fish ladder began in 2007. The redesign and reconstruction of the fish ladder is similar to that of the original, consisting of a series of 69 ascending pools connected by weirs, or short waterfall passageways that each rise 8-10 inches. The reconstruction took over 10 years and could only take place from November - April to avoid spawning season. In April every year, the construction team had to stop so the ladder could be used for the spring migration. The renovated ladder winds 1,500 feet up the hill and was reconstructed using the original stones and designed to weave around mature trees that shade the pools.

The lower pools are publicly accessible and include a boardwalk and signage. The upper portions snake through residential backyards before reaching the lake.

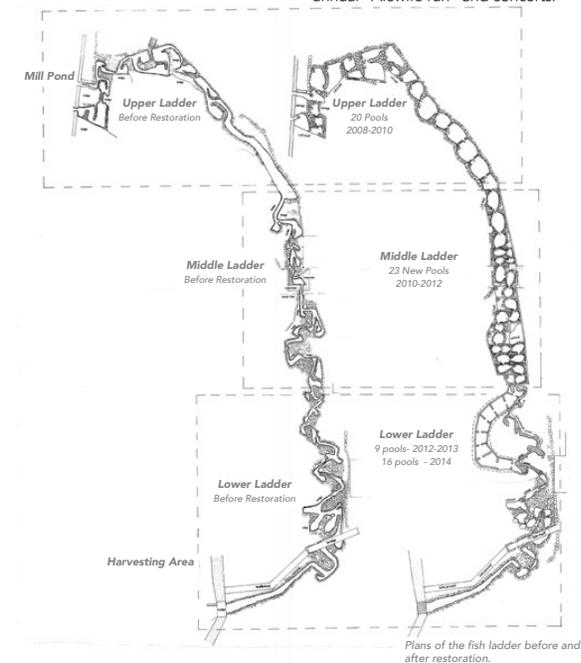
At the lower end of the pools, a set of "dippers" and troughs, allow for the towns to harvest alewife. The harvested

alewives are used primarily as lobster bait however a few bushels are smoked and sold for human consumption. All funds received for harvested alewives are spent to maintain and restore the fish ladder and harvesting area.

SUCCESSES:

Following the restoration, more than one million alewives pass up the fish ladder to spawn each spring making the Damariscotta river one of Maine's oldest and most productive alewife fisheries.

Community support has been key to the restoration of the fish ladders. An annual Herring festival took place from 2007 until the pandemic and helped raise funds and support for the restoration. Currently the community group is raising funds to replace the boardwalk and foot bridges. Volunteers are present at the Fish Ladder on May weekends to welcome visitors, and sell tee shirts caps and other Fish Ladder. In addition, fundraising takes place at community events such as a silent auctions, an annual "Alewife run" and concerts.



REFERENCES and ADDITIONAL RESOURCES

<https://damariscottamills.org/>

<https://www.atlasobscura.com/articles/fish-ladder-maine-lobster-industry>

CASE STUDIES - NATURE-LIKE FISHWAYS
RIVER WIDE

KENYON MILL DAM

PROJECT SUMMARY

Located on the Upper Pawcatuck River in Rhode Island, Kenyon Mill was built around 1772. The privately-owned mill houses and Kenyon Industries, a fabric producer housed in the historic mill building, once used the impoundment created by the dam to retain water for possible fire suppression. By 2010, the dam had fallen into disrepair and had a partial breach at the end of its spillway. This work was part of a comprehensive project that opened fish passage through seven dams along the Pawcatuck River.



LOCATION

Richmond, Rhode Island

RIVER

Pawcatuck River

YEAR

2013

GOAL

Migratory fish passage

TYPE

River Wide Nature Like Fishway

COST

\$1,124,322

PROJECT PARTNERS

Wood Pawcatuck Watershed Association; Kenyon Industries, Inc.; Town of Richmond; Trout Unlimited; United States Fish and Wildlife Service; RI Coastal Resources Management Council; RI Department of Environmental Management; National Oceanic and Atmospheric Administration; Save the Bay; Richmond Conservation Commission; USDA Natural Resources Conservation Service; American Rivers; and Narragansett Bay Estuary Program.

CHALLENGES:

The neighboring community did not support full dam removal due to concerns about the impacts of lowered water levels on residential wells upstream. In addition, Kenyon Mills owned the dam and was willing to have it removed, but needed the impoundment for fire suppression.

SOLUTIONS:

Construction crews implemented a partial dam removal and installed a rock ramp, or nature-like fishway spanning the full width of the river channel. The dam height was lowered and a rock ramp was constructed to create the riffles and flow necessary

to sustain fish passage with a gradual incline in elevation.

SUCCESSES:

Creating a nature-like fishway provided fish passage while allowing for the impoundment to remain upstream, providing water for fire suppression and ensuring that the upstream wells would not lose drinking water. In addition, during low flow, the rock ramps provide diverse habitat along the river's edge.



The Kenyon Mills Nature Like Fishway created pockets of wetland habitat between the weirs.

REFERENCES and ADDITIONAL RESOURCES

Wood Pawcatuck Watershed Association's presentation: [http://www.wpwa.org/documents/KenyonPublicPresentation%20\(3\).pdf](http://www.wpwa.org/documents/KenyonPublicPresentation%20(3).pdf)

Turek, J., A. Haro, and B. Towler (2016). Federal Interagency Nature-like Fishway Passage Design Guidelines for Atlantic Coast Diadromous Fishes. Interagency Technical Memorandum.

CASE STUDIES - NATURE-LIKE FISHWAYS
BYPASS CHANNEL

HOWLAND DAM BYPASS CHANNEL

PROJECT SUMMARY

Although outside of the Narragansett Bay watershed, the Howland Dam case study is a good example of a nature-like bypass channel. The Penobscot River Restoration Project was a decades-long effort to restore migratory fish passage while maintaining hydropower within Maine's largest watershed. In order to reconnect the Lower Piscataquis River to the Upper Penobscot River, various dams needed to be altered or removed to accommodate passage. In 2012, the Great Works dam was removed at the head of tide, followed by the 2013 removal of the Veazie Dam, and 2014 installation of a fish lift at Millford Dam. The Howland Dam would become the final obstacle in the effort to reconnect the two rivers.



LOCATION

Howland, Maine

RIVER

Piscataquis River

YEAR

2016

GOAL

Migratory fish passage,
Maintain hydropower

TYPE

Bypass- Nature Like Fishway

COST

~\$4.8 million

PROJECT PARTNERS

Penobscot River Restoration Trust, Penobscot Indian Nation, Atlantic Salmon Federation, The Nature Conservancy, American Rivers, Natural Resources Council of Maine, Maine Audubon, Maine Department of Marine Resources, Maine Department of Inland Fisheries and Wildlife, Maine Department of Environmental Protection, U.S. Fish and Wildlife Service, National Marine Fisheries Service, Kleinschmidt, Inter-Fluve.

FUNDING SOURCES

50/50 by government grants and private donations

CHALLENGES:

Because the Howland, Great Works, and Veazie Dams once generated hydroelectric power, production would need to be shifted elsewhere. The river also experienced dramatic variations in flow, necessitating careful monitoring of volume and velocity to prevent flooding.

resemble a natural stream, reflecting ideal conditions for migratory species. In order to re-grade the sloped site into a channel, bedrock was blasted and strategically placed throughout the stream bed to create roughness and water perturbation critical to the health of migrating fish.

SOLUTIONS:

The project team ensured that hydroelectric energy production could continue by strategically decommissioning the existing facilities and implementing system upgrades at six other sites. These upgrades resulted in as much hydropower production as before the dam removals. A nature-like bypass channel was designed to

SUCCESSES:

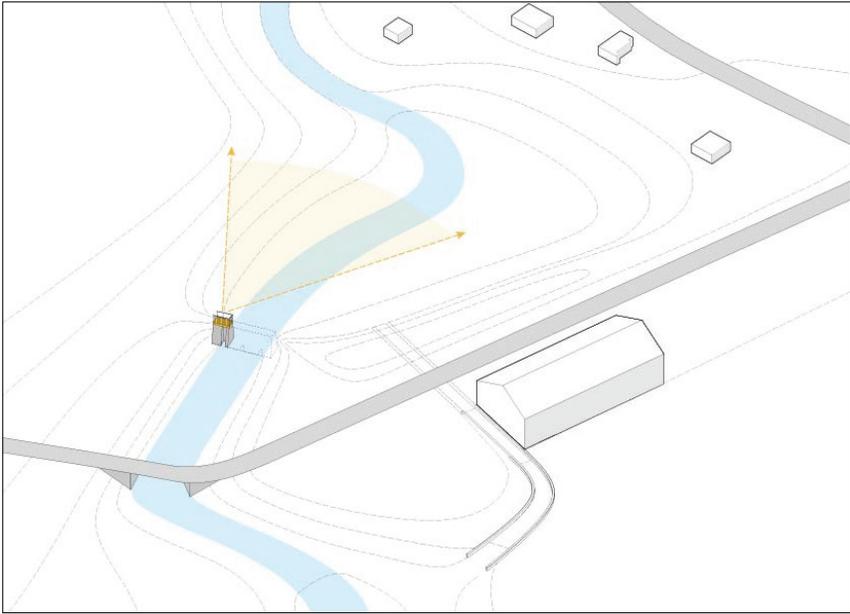
This project was the first large-scale natural fish passage channel of its kind, allowing for a restored Salmon run up the Penobscot River. Its complex construction accommodates a wide range of flow volumes and velocities. Overall, the Penobscot River Restoration Project restored nearly 2,000 miles of historic river habitat.



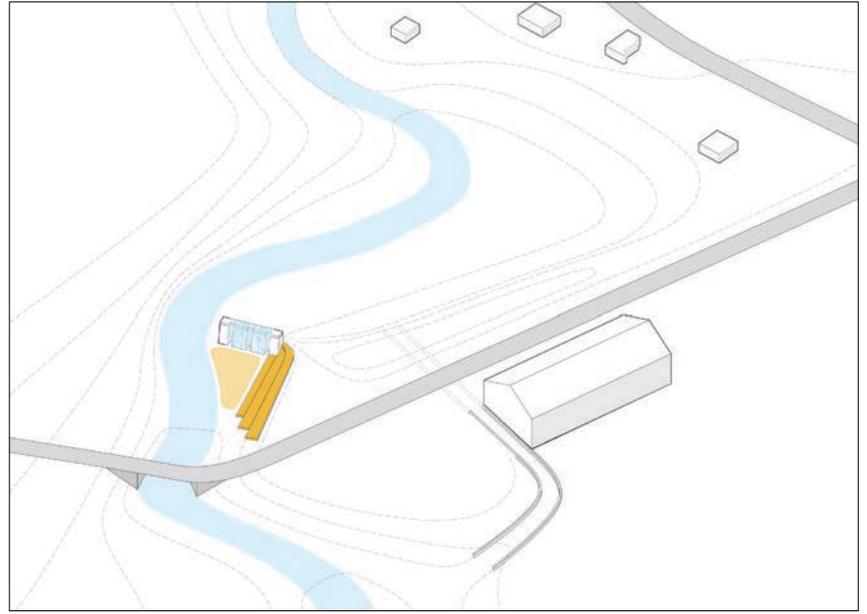
The Nature-Like bypass channel allowed fish passage and continued recreation on the impoundment.

REFERENCES and ADDITIONAL RESOURCES

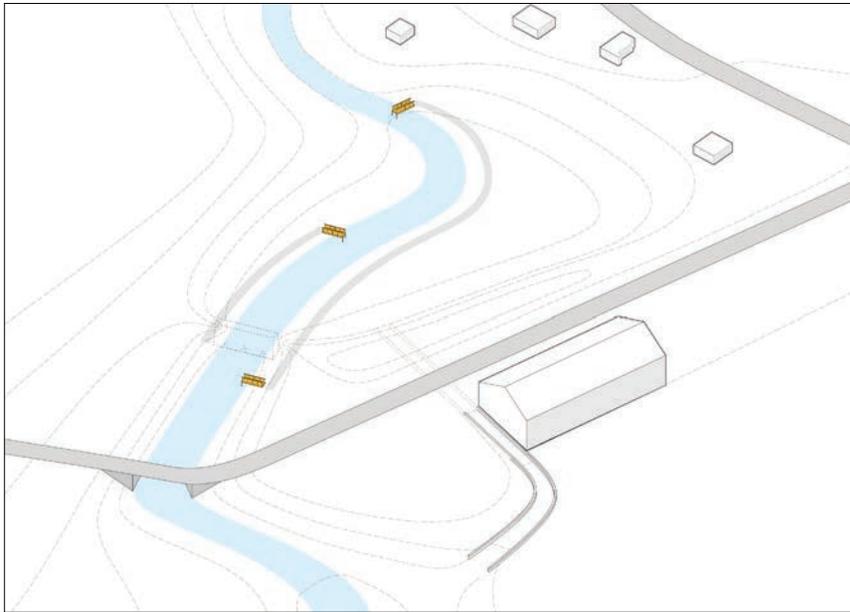
PENOBSCOT RIVER RESTORATION TRUST: <https://www.nrcm.org/wp-content/uploads/2016/06/Howlandbypassfacts.pdf>



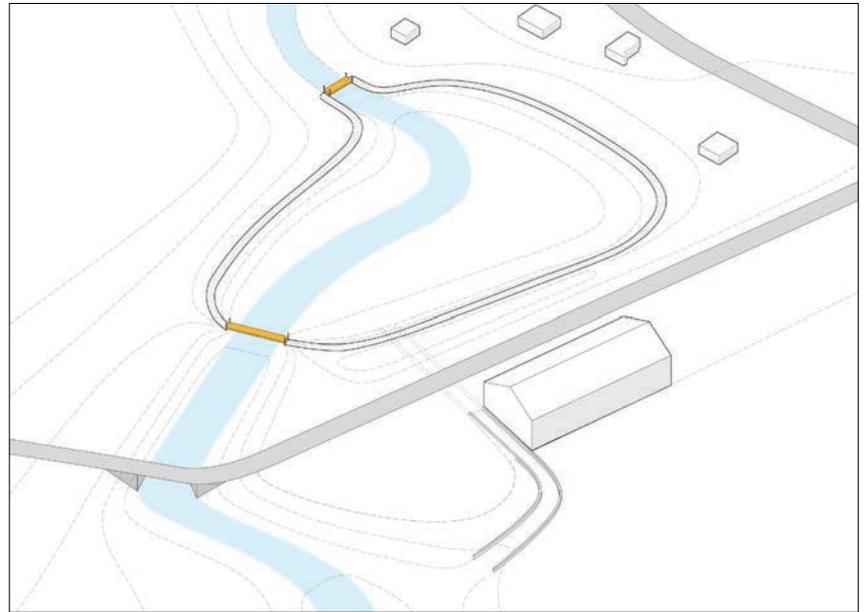
OVERLOOK: An overlook can be constructed on top of the historic dam structure to provide views of the river.



PUBLIC GATHERING SPACE: River can be diverted around the historic dam. A public gathering space can be constructed adjacent to the historic structure and a water feature installed to maintain the aesthetics of the waterfall.



FISHING ACCESS: Fishing docks or rocks can be installed along river to improve fishing access and improve recreation.



PATHS: Path can mark the location of the historic impoundment or provide trails to access the floodplain.



1st ROUND		Keep and Repair Dam	Denil Fish Ladder	Nature Like Fishway	ByPass Channel	Remove Dam
ECOLOGICAL TRADE-OFFS	Fish Passage up and downstream	0% Passage	30%-50% Passage	60%-70% Passage	30%-50% Passage	100% Passage
	Conservation of upstream wetlands	 Upstream Wetlands Conserved	 Upstream Wetlands Conserved	 Upstream Wetlands Conserved	 Upstream Wetlands Conserved	 Potential Loss of Wetlands
CULTURAL AND AESTHETIC TRADE-OFFS	Recreational Opportunities on the impoundment	 Recreation Maintained	 Recreation Maintained	 Recreation Maintained	 Recreation Maintained	 No recreation on impoundment
	Visibility of Historic Dam	 Dam visible	 Dam visible	 Dam no longer visible	 Dam visible	 Dam no longer visible
	Impact to existing park	Remove vegetation from berm	Remove vegetation from berm + Denil fish ladder	Remove vegetation from berm + downstream channel elevated	Remove vegetation from berm + new bypass channel construction	Keep vegetation on berm + dam removed + water elevation lowered
ECONOMIC TRADE-OFFS	Up-Front costs	\$	\$\$	\$\$	\$\$\$\$	\$\$
	Long-Term costs and maintenance	\$	\$\$	\$\$	\$\$\$\$	0
	Likelihood of external funds to offset upfront cost	NOT LIKELY	LESS LIKELY	LESS LIKELY	LESS LIKELY	MORE LIKELY
<p>GREEN = Preferred YELLOW = Acceptable RED = Oppose</p> <p>You must use at least one green and one yellow sticker</p>						

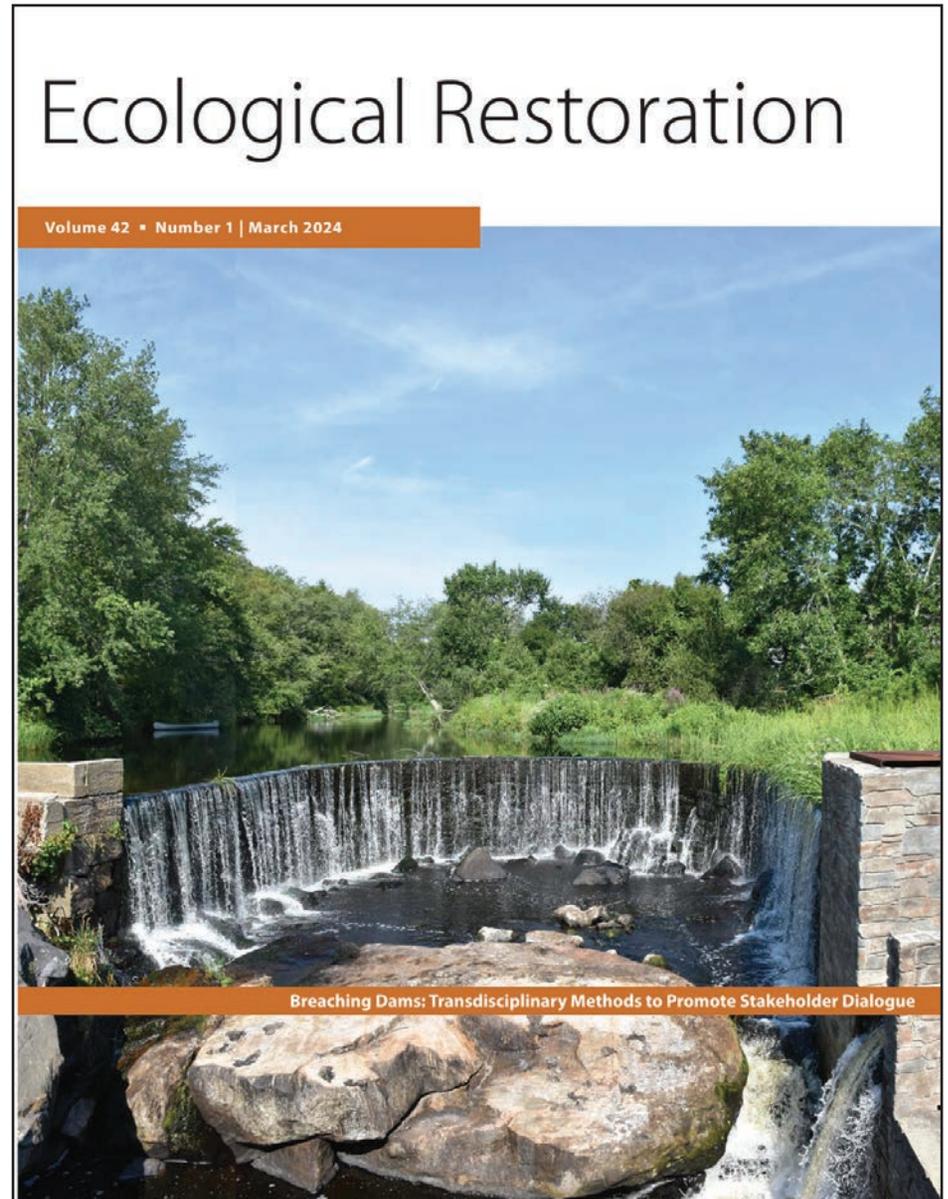
RIVER ALTERNATIVES SUMMARY TABLE			No Action Alternative	Sediment Trap	Remove Wareham St Dam	Full River Restoration Remove Wareham St Dam Naturalized channel Widen 3 bridges
ECOLOGICAL OBJECTIVES	Fish Passage up and downstream		NO CHANGE	MINOR IMPROVEMENT	IMPROVED	GREATLY IMPROVED
	Improve Water quality + Habitat		<ul style="list-style-type: none"> — Dissolved Oxygen — Water Temperature — Sediment Transport 	<ul style="list-style-type: none"> — Dissolved Oxygen — Water Temperature ↓ Sediment Transport 	<ul style="list-style-type: none"> ↑ Dissolved Oxygen ↓ Water Temperature ↓ Sediment Transport 	<ul style="list-style-type: none"> ↑ Dissolved Oxygen ↓ Water Temperature ↓ Sediment Transport
	Improve low-flow aquatic connectivity	Points along river where challenging for Herring to pass	7 potential low points	7 potential low points	5 potential low points	4 potential low points
INFRASTRUCTURAL AND OPERATIONAL OBJECTIVES	Minimize flood damage to infrastructure and property downstream of APC.	Flooded Area (100 Year storm)	723 Acres	723 Acres NO Reduction	680 Acres 6% Reduction	653 Acres 10% Reduction
		Impacted buildings	27 Buildings	27 Buildings	23 Buildings	19 Buildings
	Reduce ongoing maintenance by working with river morphology		Works against river morphology	Works against river morphology. Requires ongoing maintenance	Works with river morphology	Works with river morphology
	Permitting		N/A	VERY CHALLENGING	CHALLENGING	CHALLENGING
RECREATIONAL OBJECTIVES	Maximize quality and quantity of recreation on the river	Boating Opportunities	FLAT WATER RIVER RECREATION Maintains Existing "flat water" recreation on river + ease of round trips	FLAT WATER RIVER RECREATION Maintains Existing "flat water" recreation on river + ease of round trips	FREE FLOWING RIVER RECREATION No portage at Wareham st and fewer low flow areas 	FREE FLOWING RIVER RECREATION No portage at Wareham st and fewer low flow areas 
		Expanding fishery habitat diversity				
ECONOMIC OBJECTIVES		Cost	N/A	\$	\$\$	\$\$\$
		Availability of Funding	N/A	UNLIKELY	LIKELY	LIKELY
GREEN = Preferred YELLOW = Acceptable RED = Oppose You must use at least one green and one yellow sticker						







Guiding decisions on the future of dams: A GIS database characterizing ecological and social considerations of Dam decisions- 2023



Beyond Binaries: Transdisciplinary Methods for Engaging Communities in Decision Making about Aging Dam Infrastructure in New England- 2024



Dam Atlas 2.0

A guide for community
decision making around
aging dams



www.thedamatlas.org

NEXT STEPS



1. Zooming into the river scale to inventory, analyze and prioritize dam projects- thinking holistically about where and how these decisions intersect with public access, ecological restoration and climate resilience.



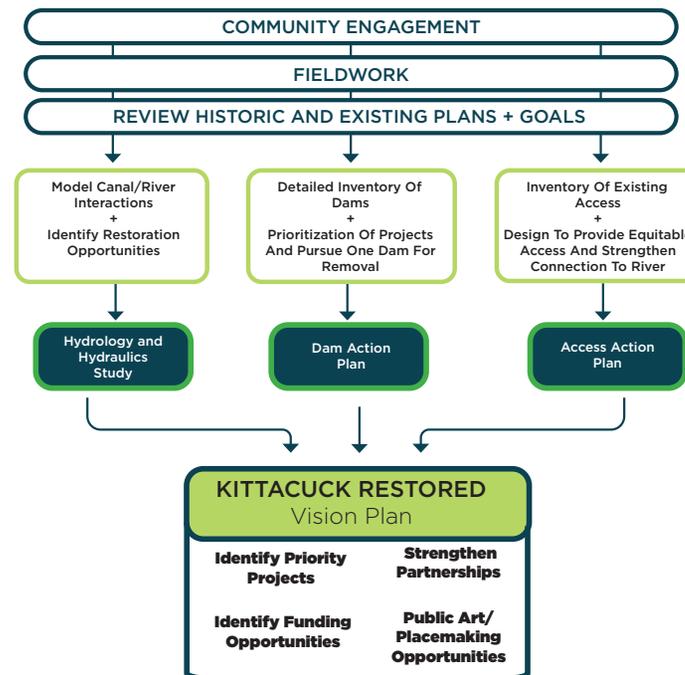
MISH KITTACUCK SEPE

RESTORED

The Blackstone Watershed Collaborative and partners are looking for your help to create a **forward-looking action plan for river restoration.**

Through 2027, we'll study the hydrology of the river's mainstream to **improve flow** in drought and flood conditions, create a detailed inventory of **dams** and explore opportunities for removal, and identify and design new and improved free **public access points**. We're looking for your input at every step.

Together, we'll compile top priorities in an action-oriented plan called **Mish (kittacuck) sepe Restored** reflecting the river's names from its longstanding stewards and our partners: the Narragansett Indian Tribe (Mishkittakooksepe) and Hassanamisco Nipmuc Band (Kittacuck).

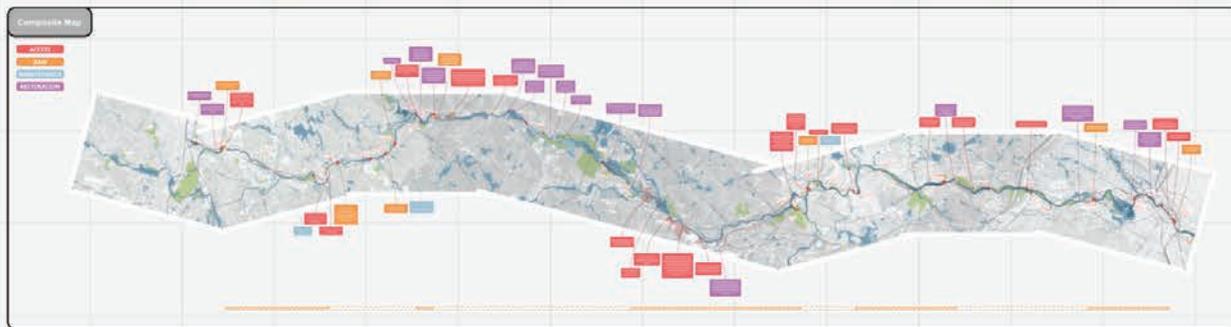
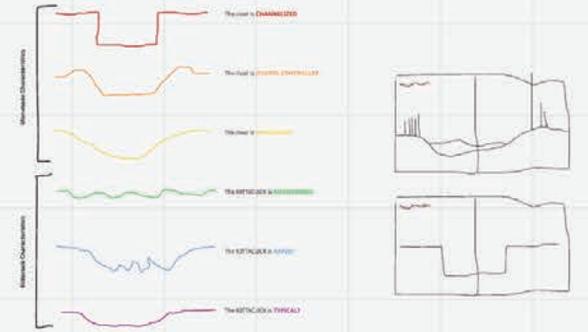
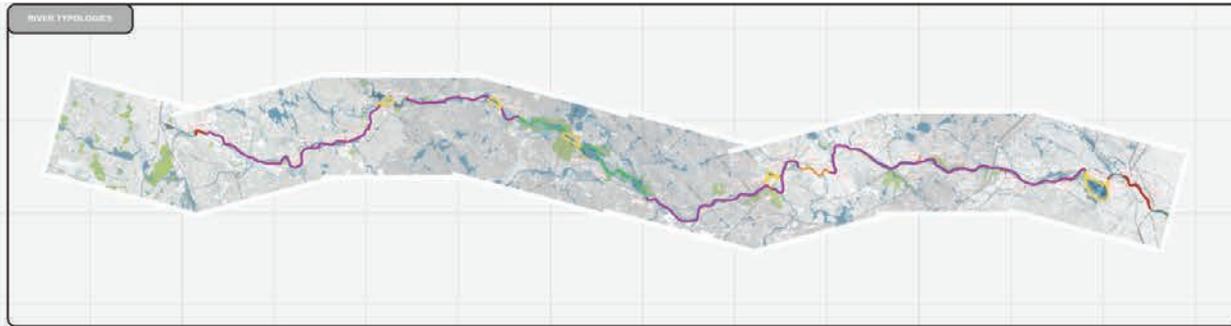


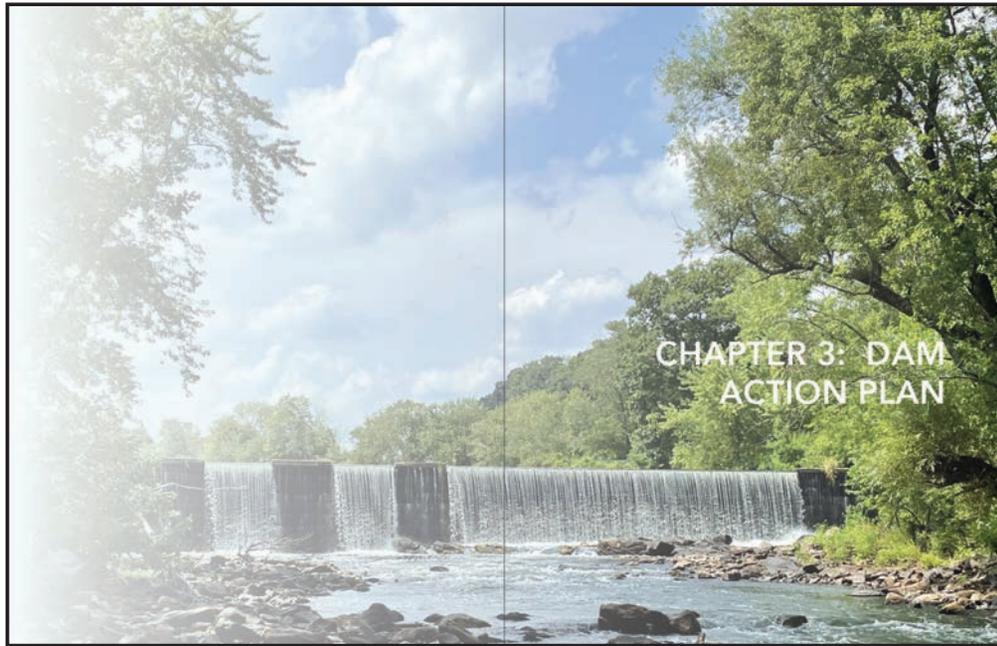
Learn more at:
blackstonecollaborative.org/river-restored



This project was made possible by funding from:







BLACKSTONE RIVER DAM ACTION PLAN

The Blackstone River is a place of historic, economic, cultural, and ecological value. Starting in Worcester, it spans two states and provides critical habitat and recreational opportunities to 24 towns and cities along 48 miles of New England.

This study examines the region's relationship to the maintenance of the Blackstone River and proposes a collective vision of working with the river as a valuable resource. It reviews the current condition and use, along with the history and recommendations for the twenty-one dams along the Blackstone River. This document argues that legacy dams are central to ecological recovery, public safety, and future stewardship of the Blackstone River.

The Blackstone River is the ancestral homeland of the Narragansett and Nipmuc nations, whose fishing practices were grounded in long-standing systems of stewardship and care for the river. Beginning in the 1600s, European settlement initiated a period of industrial development that fundamentally altered the river and its surrounding landscapes.

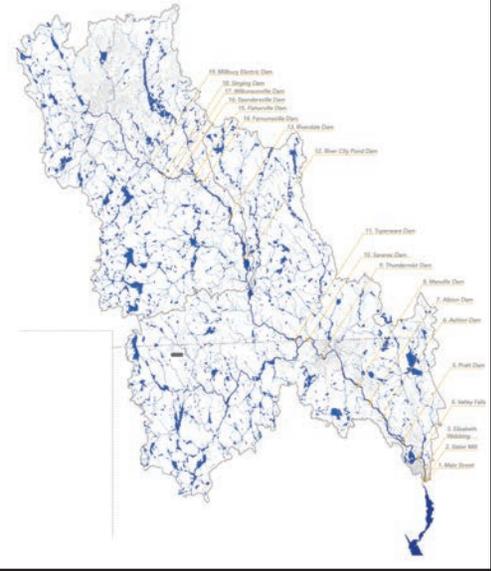
In the wake of this development, the river's natural hydrology and ecology were neglected, as it became more contaminated and fragmented. By blocking access to historic spawning habitats, these dams remain a primary barrier to aquatic ecosystem recovery and recreational use.

Many of these dams pose a risk and are undervalued. Six of these dams are rated as a Significant or High Hazard. Thirteen of the dams are rated in poor condition. Fourteen of these dams are not currently serving a purpose. This assessment aims to reexamine the value of these dams with Significant Hazard, in poor condition, serving no purpose.

Over the past 50 years, a series of regulatory and community-led efforts have addressed the impacts of dams on the Blackstone River. The Clean Water Act in 1972 brought a turning point for the river, as pollution dropped, fish and wildlife increased, and communities had more access to the water. This same year, Operation Zap was a grassroots effort that organized volunteers across twenty towns to clean up the Blackstone River on September 10, 1972.

In 1997, the U.S. Army Corps of Engineers released The Blackstone River Watershed Reconnaissance Investigation. This document defined federal standards for river restoration and established a precedent for dam-related flood risk, ecosystem analysis, and industrial contamination.

In 2002, RIDEM and the Narragansett Bay Estuary Program produced the Blackstone River Fisheries Restoration Plan, evaluating RIDEM to commission feasibility studies for fish passage alternatives and activating passage requirements for the dams.



MASSACHUSETTS DAMS	HEIGHT	HAZARD	CONDITION	OWNERSHIP	FUNCTION	FISH PASSAGE	UPSTREAM MILES	PORTAGE DIFFICULTY	SEDIMENT CONCERNS	SEDIMENT CONCERNS
1 Quinsigamond Village Dam 1 Worcester, MA NID	12'	HIGH	BREACHED	MUNICIPAL	NONE	NONE	X			
2 Quinsigamond Village Dam 2 Worcester, MA	12.2'	UNKNOWN	NOT RATED	UNKNOWN	NONE	NONE	X			
3 Millbury Electric Millbury, MA	10'	LOW	BREACHED	PRIVATE	NONE	BREACHED, PASSAGE INFEASIBLE	X			
4 SINGING DAM Sutton, MA	10'	SIGNIFICANT	SATISFACTORY	PRIVATE	NONE	NONE	1.2 Miles			
5 WILKINSONVILLE DAM Sutton, MA	2'	UNKNOWN	BREACHED	PRIVATE	NONE	BREACHED, PARTIAL PASSAGE	0.6 Miles			
6 SAUNDERSVILLE DAM Grafton, MA	17'	SIGNIFICANT	POOR/ BREACHED	PRIVATE	NONE	NONE	2.5 Miles			
7 FISHERVILLE POND DAM Grafton, MA	13'	HIGH	POOR	PRIVATE	NONE	NONE	20.5 Miles			
8 FARNSWORTH DAM Grafton, MA	13'	LOW	BREACHED	PRIVATE	NONE	BREACHED, PARTIAL PASSAGE	2.6 Miles			
9 ROUTE 46 DAM Uxbridge, MA	X	UNKNOWN	BREACHED	UNKNOWN	NONE	BREACHED, PARTIAL PASSAGE	X			
10 RIVERDALE DAM Northbridge, MA	10'	LOW	SATISFACTORY	PRIVATE	HYDROELECTRIC	NONE	6.1 Miles			
11 RICE CITY POND DAM Uxbridge, MA	14'	HIGH	FAIR	STATE GOV	NONE	NONE	0.4 Miles			
12 ROLLINS DAM Blackstone, MA	9'	LOW	SATISFACTORY	PRIVATE	HYDROELECTRIC	NONE	57.9 Miles			
13 SARANAC DAM Blackstone, MA	13'	LOW	FAIR	MUNICIPAL	NONE	NONE	X			

6. SAUNDERSVILLE DAM

NID: MA00578
State ID:
FERC No.:
LRI Certificate No.:
Location: Grafton, MA
Year Built: 1820
Owner: Last Known Owner - Dissolved - Cacao Inc. (Private)
Purpose: Legacy
Height: 17 ft
Length: 350 ft
Construction Material: Masonry, Earth
Associated Structures: No
Safety buoys present:
Dam ahead signage status:
Fish Passage Modification: None
Breached: Yes
Storage: 100 Acres-Ft
Surface Area: 5.7 Acres
Hazard Potential Classification: Significant
Condition Assessment: Poor (3/19/24)
EAP Prepared: Yes (5/1/24)
Upstream Functional Network: 2.5 Miles
Downstream Dam Count: 15



Current Condition and Use
The Saundersville Dam in Grafton, Massachusetts is a partially breached granite block and earth dam. Its current height is 17 feet, with a length of 350 feet. What remains is a remnant structure that no longer impounds water or supports a millpond or wetland.

Because the dam is breached, it does not serve any active water storage, hydropower, water supply, or flood control function. The reach presents a navigation hazard for paddlers, often requiring portage around it. Without an impoundment area, the river flows in more natural riverine condition, but legacy sediment and remaining structures still alter hydraulics and limit habitat quality. The dam is rated in Poor condition, with Significant Hazard Potential.

Construction details are partially documented but not fully characterized. The mill village remains are part of the Town of Grafton's historic and cultural landscape, though there are no specific protections in place.

History

The Saundersville Dam used to be one of three major mill villages. Esik Saunders built a three-story granite mill in 1815 and founded the Saunders Cotton Company with his brothers.

The dam provided industrial waterpower infrastructure to support the Saunders Cotton Mills and functioned as part of the broader Blackstone River and Canal water-control system. A millpond west of the mill likely provided storage for water that powered mill wheels. A trail race diverted water and returned it to the river below the dam.

The mill village consisted of 50 houses, and a fully developed industrial community. The mill operated until 1920, when it closed to the declining demand for cotton goods.

The 2005 Blackstone Canal Preservation Study includes the Saundersville Dam in a list of partially extant water-control structures and recommends stabilization, debris removal, and vegetation management. The study also highlights opportunities for public access through the Blackstone River Bikeway. The Blackstone



Watershed Collaborative has identified the dam as a potential candidate for removal in order to improve ecological resilience and public safety.

Opportunities and Constraints
Cultural: The granite dam, mill ruins, and village remnants offer limited interpretive and heritage education opportunities due to their incomplete condition and lack of historic protection.

Habitat: The breached dam presents an opportunity for river restoration. Full removal could improve habitat continuity and reconnect wildlife corridors, though sediment assessment would be required.

Aquatic Connectivity: The existing breach allows intermittent passage, but full connectivity could be achieved with minimal additional intervention. Raceways remain visible northwest of the locks along the riverbank.

Portage/Access: The site lacks formal access points. Structural instability, exposed stonework, and debris

limit safe recreation. The dam's proximity to the Blackstone River Bikeway presents an opportunity to integrate into the riverfront area.

Safety: The breached, aging dam is a safety risk to visitors and paddlers. Removal or stabilization would reduce hazards and improve visibility of the river corridor.

Scenic/Aesthetic: The granite block dam and historic mill setting offer strong scenic potential, though overgrowth and deterioration reduce visibility.

Infrastructure: Granite blocks, foundations, and the historic tailrace remain on site, but unknown subsurface conditions complicate reuse.

Hydrology: This dam is not currently used for hydropower.



THREE MILL VILLAGES

GRAFTON, MA

CURRENT CONDITION:

In Grafton, there is an existing public park—Mill Villages Park—located on the former Fisherville Mill site. The Fisherville Redevelopment Authority owns this property as well as additional land on the north side of Route 122A, which has been identified for future redevelopment.

Further downstream, the Town of Grafton owns the wastewater treatment facility along the river and has recently acquired several additional parcels along the Blackstone River mainstem, including 324 Providence Road (with direct river frontage), 380R Providence Road, and 334R Providence Road. Across the river, a parcel is owned by the Grafton Land Trust.

Between the Fisherville site and the town-owned properties lies the Farnumsville parcel, owned by Deborah Lippman. This parcel includes the former mill structure and the Farnumsville mill pond, which drained following a dam breach. The property lies entirely within the floodplain.

OPPORTUNITY:

The Town of Grafton has expressed interest in strengthening physical and cultural connections between the three historic mill villages—Saundersville, Farnumsville, and Fisherville—and has cited the 2004 Blackstone River Visioning Document as a guiding framework. The town has indicated a willingness to collaborate on projects in this area and views improved river access and continuity as beneficial for recreation and community use.

Acquisition of the Farnumsville property would fill a critical gap between existing conserved and publicly owned lands. It could also enable the removal of the breached Farnumsville Dam, restoring river continuity and opening a significant new reach of the Blackstone to paddling and ecological recovery.

This opportunity directly reinforces the Town of Grafton's South Grafton Villages Master Plan, which identifies the Blackstone River as a key organizing

feature for recreation, open space, and village connectivity. The plan emphasizes strengthening physical and visual access to the river, linking the historic mill villages of Fisherville, Farnumsville, and Saundersville, and using trails and river-based recreation to support community identity and revitalization. Proposed access improvements and potential dam removal at this site align with—and help advance—the Master Plan's long-standing goals by creating continuous river access, filling gaps between publicly owned and conserved lands, and reconnecting residents and visitors to the river as a shared community asset

CONSIDERATIONS:

The current property owner has not responded to outreach efforts from the Blackstone Collaborative. One potential strategy could involve an acquisition approach that allows for subdivision of the property—separating the mill structure from the dam site and floodplain—which may increase the owner's willingness to engage while still achieving restoration and access goals. Since this seems critical to the town's master plan, maybe they can help secure the site.

PORTAGE:

If the remnants of the Farnumsville Dam were removed, paddlers could put in at Fisherville and travel approximately 4.5 miles downstream to the Riverdale Dam. Riverdale already has an improved portage, making this reach the longest continuous stretch of the Blackstone River currently accessible for paddling.

NEXT STEPS:



REFERENCES and ADDITIONAL RESOURCES



2. Using decision support tools to explore creative thinking around specific dams

GREAT STONE DAM GRAN PRESA DE PIEDRA

Energy Production and Distribution

The Great Stone Dam also referred to as the Stone Dam was constructed between 1918 and 1920 at a site known as Northville Falls. The dam historically generated energy to supply water to the city of Lawrence. Under the terms of the 1970 Energy Act as implemented by the CREC and the Lawrence Hydroelectric Development Authority provided the dam for hydroelectric generation in 1970 as part of a hydroelectric system of alternative energy projects. The project was granted a 50 year FERC license (Federal Energy Regulatory Commission) which is set to expire on September 30, 2020.

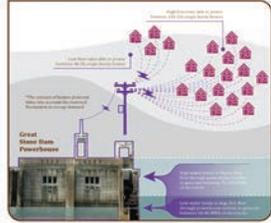
The energy produced by the hydroelectric powerhouse fluctuates greatly throughout the year following the flow of the river. The peak flow rate is in the spring when average flows are relatively high. The dam can provide power by 150 MW single family homes or enough fuel for the population of Lawrence. While the dam can not flow and the dam cannot be generating, the dam means the dam can only generate between the single family homes and the population of Lawrence. Currently the power generated by the Great Stone Dam is transmitted out of the city and through single energy to Lawrence residents or used for the city energy and some additional or related.

Producción y distribución de energía

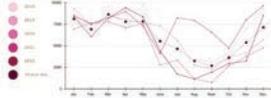
La gran Presa de Piedra también conocida como la Gran Presa, se construyó entre 1918 y 1920 en un sitio conocido como Northville Falls. El dam históricamente generó energía para abastecer a la ciudad de Lawrence. Bajo los términos de la Ley de Energía de 1970, implementada por la CREC y la Autoridad de Desarrollo Hidroeléctrico de Lawrence, se permitió la generación de energía hidroeléctrica en 1970, como parte de un sistema de proyectos de energía alternativa. El proyecto fue otorgado una licencia de 50 años por la FERC (Comisión Federal Reguladora de Energía) que expira el 30 de septiembre de 2020.

La energía producida por la central hidroeléctrica fluctúa mucho a lo largo del año, dependiendo del nivel del río. El flujo de agua es más alto en primavera cuando el caudal promedio es relativamente alto. La presa puede generar energía suficiente para abastecer a la población de Lawrence. Aunque la presa no puede fluir y la presa no puede generar, la presa significa que la presa solo puede generar entre las viviendas familiares y la población de Lawrence. Actualmente, la energía generada por la Gran Presa de Piedra es transmitida fuera de la ciudad y a través de una sola energía a los residentes de Lawrence o utilizada para la energía de la ciudad y algunos adicionales o relacionados.

Homes Powered by Dam



Dam Energy Production (MWh)



Great Stone Dam Aerial View



Developed by the Lawrence Commission for the Lawrence Land and Energy Commission. Lawrence, Kansas

Developed by the Lawrence Commission for the Lawrence Land and Energy Commission. Lawrence, Kansas

FISH PASSAGE PASO DE PECES

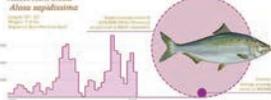
Dams + Fish Passage

Dams like Stone on the Missouri River and the hydroelectric dams on the Colorado River are designed to generate power by blocking upstream and downstream fish passage necessary for reproduction and growth. Changes to river flow and sediment transport may also affect upstream important fish habitats and downstream reproductive success for multiple fish species. Dams impede fish passage and affect riparian habitat. While dams have great potential for passage restoration, but they cannot always be removed. Dam removal is a costly and risky process that is often not done. Although dam removal is a risky process, it is often the best way to restore fish passage and riparian habitat. Dam removal is a risky process, but it is often the best way to restore fish passage and riparian habitat. Dam removal is a risky process, but it is often the best way to restore fish passage and riparian habitat.

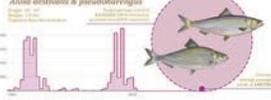
Passes + Paso de peces

Passes like the fish passage on the Missouri River and the hydroelectric dams on the Colorado River are designed to generate power by blocking upstream and downstream fish passage necessary for reproduction and growth. Changes to river flow and sediment transport may also affect upstream important fish habitats and downstream reproductive success for multiple fish species. Dams impede fish passage and affect riparian habitat. While dams have great potential for passage restoration, but they cannot always be removed. Dam removal is a costly and risky process that is often not done. Although dam removal is a risky process, it is often the best way to restore fish passage and riparian habitat. Dam removal is a risky process, but it is often the best way to restore fish passage and riparian habitat.

American Shad



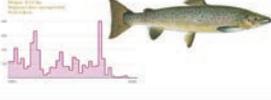
Blackback Herring & Alewife



American Eel



Atlantic Salmon



Fish Passage at Great Stone Dam



Developed by the Lawrence Commission for the Lawrence Land and Energy Commission. Lawrence, Kansas

Developed by the Lawrence Commission for the Lawrence Land and Energy Commission. Lawrence, Kansas

FLOODING ISSUES PROBLEMAS DE INUNDACIONES

Impacts of Flooding

Flooding can have significant impacts on the community, including property damage, displacement, and loss of life. The Great Stone Dam and its associated infrastructure are critical to the city's water supply and energy production. Flooding can also affect the dam's structural integrity and the surrounding environment. Flooding can also affect the dam's structural integrity and the surrounding environment. Flooding can also affect the dam's structural integrity and the surrounding environment.

Impacts of the Inundaciones

Las inundaciones pueden tener impactos significativos en la comunidad, incluyendo daños a la propiedad, desplazamiento y pérdida de vidas. La Gran Presa de Piedra y su infraestructura asociada son críticas para el suministro de agua y la producción de energía de la ciudad. Las inundaciones también pueden afectar la integridad estructural de la presa y el medio ambiente circundante. Las inundaciones también pueden afectar la integridad estructural de la presa y el medio ambiente circundante.

Flood of 1936, Great Stone Dam



Future Storms



Tormentas Futuras



Future Streamflow Projections



Future Streamflow Projections



Developed by the Lawrence Commission for the Lawrence Land and Energy Commission. Lawrence, Kansas

Developed by the Lawrence Commission for the Lawrence Land and Energy Commission. Lawrence, Kansas

	OBJECTIVES	PERFORMANCE MEASURE (based on estimates developed through literature review and expert elicitation)		ALTERNATIVE PACKAGE 1	ALTERNATIVE PACKAGE 2	ALTERNATIVE PACKAGE 3	ALTERNATIVE PACKAGE 4	ALTERNATIVE PACKAGE 5
E C O L O G I C A L	Maximize fish passage for migratory species to have sustainable runs and viable populations of fish (Timing and % passage rate)	Passage efficiency and # passed for target species	D/C	HERRING- xx% (#) SHAD- xx% STURGEN- XX% EEL- xx% Sea Lamprey- xx% Mussel Host species- xx%				
	Improve instream and floodplain habitat and habitat connectivity for all river-dependent species (e.g., freshwater mussels, resident fish species)	Constructed scale- Degree of habitat connectivity (longitudinal and lateral)? Quality of Habitat- Lentic vs Lotic?	D/C/R					
	Improve water quality (DO, sediment regimes, nutrients, temp)	Measure estimated impacts (higher/Lower) on water quality measures.	D/R	Temperature Dissolved Oxygen Nutrients				
P U B L I C H E A L T H	Reduce negative impacts of flood events and anticipate future flood conditions, risks and costs to improve climate resilience of local communities to flood events, especially for community members with disproportionate burdens (EJ Communities)	Number of houses and businesses in floodzone and percentage of those that are EJ. - frequency and area	D/R					
	Maintain or improve resilient, safe drinking water sources for communities relying on the Merrimack for public water supplies	Number of households with tap water that meets drinking water standards	D/R					
	Reduce water pollution associated with stormwater sewers and sanitary sewers	Number of outfall events/number of "no contact" days.	R/C					
S O C I A L + C I V I C	Preserve the historical value, improve community benefits and aesthetics of canals.	Constructed scale	C	Historical Value Community Benefits Aesthetics				
	Preserve the historical value and aesthetics of the dam	Visibility of the dam from public space. Aesthetics measure	D					
	Improve the aesthetics of the river	Aesthetics measure	R					
	Maintain or improve recreational opportunities (boating/fishing/walking) and access to the river and riverfront green spaces above and below the dam and along the canals.	Number of river access points, miles of river/canal with a walking path/trail, acres of riverfront parks, Portages around the dam.	D/C/R					
	Increase economic development opportunities while minimizing displacement risk		C/R					
	Minimize property loss as a result of erosion	Linear feet of eroding shoreline. Properties impacted by erosion.	R					
	Increase public educational opportunities of river, dam, canals.	Number of people that are potentially reached with educational events and signage	D/C/R					
C O S T + E N E R G Y	Improve local, resilient and affordable electricity for Lawrence residents.	Cost of electricity to Lawrence residents; long-term availability and stability of electricity for residents. Amount of electricity that is from local sources.	D/C					
	Maintain power production and project financial viability in order to continue to provide renewable non-fossil fuel energy	Megawatts of power produced when it is most needed/dollars?	D					
	Minimize total cost of licence conditions and total project alternative cost	\$ per entity	D					
	Promote innovative and holistic thinking that integrates social, ecological, economic, and infrastructural benefits	Number of benefits across categories	D/R/C					

Case Studies

(Dots indicate interest in pursuing)

MILL CITY PARK

Location: Franklin, New Hampshire

Date: 2022

Description: Mill City Park, a 100-acre park in Franklin, New Hampshire, is a prime example of adaptive reuse and urban revitalization. The park is situated on the banks of the Merrimack River, which flows through the heart of the city. The park features a large, multi-level plaza with a mix of paved and green spaces, a playground, and a walking path. The park is a popular destination for families and friends, and it provides a great view of the river and the city skyline.

Sources:

- https://www.millcitypark.com/
- https://www.franklinnh.gov/

CHARLES RIVER SWIM PARK

Location: Boston, Massachusetts

Date: 2022

Description: The Charles River Swim Park is a new public swimming area located in Boston, Massachusetts. The park is situated on the banks of the Charles River, which flows through the heart of the city. The park features a large, multi-level plaza with a mix of paved and green spaces, a playground, and a walking path. The park is a popular destination for families and friends, and it provides a great view of the river and the city skyline.

Sources:

- https://www.charlesriver.com/
- https://www.boston.gov/

BRECKSVILLE DIVERSION DAM REMOVAL

Location: Brecksville, Ohio

Date: 2022

Description: The Brecksville Diversion Dam Removal project is a multi-phase project that aims to remove the Brecksville Diversion Dam and replace it with a new structure. The project is being funded by the state of Ohio and the city of Brecksville. The project is expected to be completed by 2025.

Sources:

- https://www.brecksville.com/
- https://www.ohio.gov/

DAMARISCOTTA MILLS

Location: Damariscotta, Maine

Date: 2022

Description: The Damariscotta Mills project is a multi-phase project that aims to restore the Damariscotta Mills and surrounding area. The project is being funded by the state of Maine and the city of Damariscotta. The project is expected to be completed by 2025.

Sources:

- https://www.damariscotta.com/
- https://www.maine.gov/

WILD MILE CHICAGO

Location: Chicago, Illinois

Date: 2022

Description: The Wild Mile Chicago project is a multi-phase project that aims to restore the Wild Mile area in Chicago. The project is being funded by the city of Chicago and the state of Illinois. The project is expected to be completed by 2025.

Sources:

- https://www.wildmile.com/
- https://www.chicago.gov/

CHEONGGYE STREAM

Location: Seoul, South Korea

Date: 2022

Description: The Cheonggye Stream project is a multi-phase project that aims to restore the Cheonggye Stream in Seoul. The project is being funded by the city of Seoul and the state of South Korea. The project is expected to be completed by 2025.

Sources:

- https://www.cheonggye.com/
- https://www.seoul.gov/

WILLOW SPILING

Location: Willow Spiling, Ohio

Date: 2022

Description: The Willow Spiling project is a multi-phase project that aims to restore the Willow Spiling area in Ohio. The project is being funded by the city of Willow Spiling and the state of Ohio. The project is expected to be completed by 2025.

Sources:

- https://www.willowspiling.com/
- https://www.ohio.gov/

HOWLAND DAM BYPASS CHANNEL

Location: Howland, Maine

Date: 2022

Description: The Howland Dam Bypass Channel project is a multi-phase project that aims to restore the Howland Dam Bypass Channel in Howland, Maine. The project is being funded by the state of Maine and the city of Howland. The project is expected to be completed by 2025.

Sources:

- https://www.howland.com/
- https://www.maine.gov/

RICHMOND CANAL WALK

Location: Richmond, Virginia

Date: 2022

Description: The Richmond Canal Walk project is a multi-phase project that aims to restore the Richmond Canal Walk in Richmond, Virginia. The project is being funded by the city of Richmond and the state of Virginia. The project is expected to be completed by 2025.

Sources:

- https://www.richmond.com/
- https://www.virginia.gov/

BUFFALO BAYOU PARK

Location: Houston, Texas

Date: 2022

Description: The Buffalo Bayou Park project is a multi-phase project that aims to restore the Buffalo Bayou Park in Houston, Texas. The project is being funded by the city of Houston and the state of Texas. The project is expected to be completed by 2025.

Sources:

- https://www.buffalobayou.com/
- https://www.houston.gov/

KENT DAM

Location: Kent, Ohio

Date: 2022

Description: The Kent Dam project is a multi-phase project that aims to restore the Kent Dam in Kent, Ohio. The project is being funded by the city of Kent and the state of Ohio. The project is expected to be completed by 2025.

Sources:

- https://www.kent.com/
- https://www.ohio.gov/

KENYON MILLS

Location: Kenyon, Ohio

Date: 2022

Description: The Kenyon Mills project is a multi-phase project that aims to restore the Kenyon Mills in Kenyon, Ohio. The project is being funded by the city of Kenyon and the state of Ohio. The project is expected to be completed by 2025.

Sources:

- https://www.kenyon.com/
- https://www.ohio.gov/







3. Cultivating a community of practice...
Hands on interactive workshops to share decision support tools



30.6.-2.7.2026, Oulu, Finland

Symposium on restoration

Habitat restoration for diadromous fishes – best practices and impacts on stock assessment.

Registration

Abstract submission

CASE STUDIES - REMOVAL

HEAD TIDE DAM

PROJECT SUMMARY

Although outside of the Narragansett Bay watershed, the High Tide Dam in Alna provides a case study of a partial removal of a dam. The project consisted of the removal of 26 feet of the west side of the dam, the construction of an overlook in its place, construction of a retaining wall at the foundation of the dam, and the addition of a path to the river. The modification of the Alna dam is the second project in a series of three projects aiming to improve fish passage in the Sheepscot River, improve public safety and access, and honor the history of the individual sites. The first of the three projects, completed in 2018, was the removal of the Coopers Mills Dam in Whitefield upstream of the Head Tide Dam. The third project, at Branch Pond Mill in China, Maine, will stabilize the dam and install a fishway. Together the project aims to improve fish passage on the Sheepscot River which is home to the southernmost genetically unique wild populations of Atlantic salmon remaining as well as 11 other species of migratory species.



LOCATION
Alna, Maine

RIVER
Sheepscot River

YEAR
2019

GOAL
Improve fish passage, enhance public safety and access, and honor the history of individual sites.

TYPE
Partial Removal

COST
\$515,000.

PROJECT PARTNERS
Town of Alna, Atlantic Salmon Federation (ASF), The Nature Conservancy, Midcoast Conservancy, National Oceanic and Atmospheric Administration (NOAA), U.S. Fish and Wildlife Service, Maine Department of Marine Resources, Maine Department of Environmental Protection, and the National Fish and Wildlife Foundation.

FUNDING SOURCES
NOAA Community Habitat Restoration Program, US Fish and Wildlife Service, Enbridge Corporation, The Nature Conservancy, Elmina B. Sewall Foundation, Davis Conservancy Foundation, Patagonia, Trout Foundation, Trout and Salmon Foundation and others.

CHALLENGES:

The Head Tide Dam was constructed over 250 years ago to power a series of mills in Alna. The Jewett family donated the dam to the town in 1964. One of the main challenges in the project was deciding whether work could proceed due to a covenant in the deed stating the dam could never be destroyed.

SOLUTIONS:

To address the concerns about the legal deed covenant, the decision was made to partially remove the western portion of the dam. The partial dam removal and construction of the overlook platform – which maintained one contiguous line from shore to shore – was deemed acceptable by selectmen and legal counsel complying with the legal deed covenant. In addition, the partial removal maintained a portion of the dam structure as a landmark for the community.

Access was an important aspect of the design of the site. Over the portion of the river where the dam was removed, an elevated viewing platform was constructed. The viewing platform provided a lookout onto the river. Using a grate rather than concrete for the elevated walkway, the project team hoped that it wouldn't be as sensitive to erosion as concrete. The final design provided and strengthened opportunities at the site. The removal of the dam, a

swimming hole that has been a popular destination for generations was preserved. In addition, the pedestrian path down to the river provided access to the river and a safe place to put in and take out kayaks and canoes.

SUCCESSES:

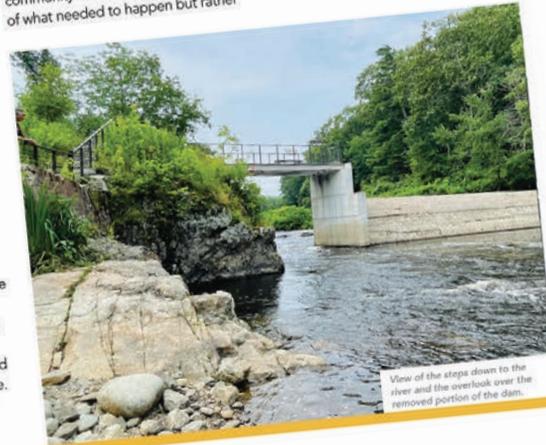
The partial removal of the Head Tide Dam is a good example of the ability to think and work creatively to address legal limitations on a project. It also was successful in providing habitat connectivity as well as preserving the historic dam structure that was important to the community.

LESSONS LEARNED:

The partial removal of the Head Tide Dam resulted from a strong team that worked on the project. The restoration team did not go into the community with a preconceived idea of what needed to happen but rather

worked with the community to decide how to improve fish passage and river connectivity.

Just because there are legal challenges or deed restrictions on a dam, doesn't mean that modifications can not be made to a dam. This project highlights the opportunity to think creatively to work through legal challenges and deed restrictions.



View of the steps down to the river and the overlook over the removed portion of the dam.

ADDITIONAL RESOURCES

- [restoration.org/projects/magic-on-the-river](https://www.restoration.org/projects/magic-on-the-river)
- [news/work-starts-at-head-tide-dam-in-](https://www.maine.gov/news/work-starts-at-head-tide-dam-in-alna)
- [news/head-tide-dam-project-a-gift-](https://www.maine.gov/news/head-tide-dam-project-a-gift-to-the-river)
- [ll/](https://www.maine.gov/news/head-tide-dam-project-a-gift-to-the-river)



4. Exploring what it means to develop a relational practice

A photograph of a river flowing through a dense forest. The water is brownish and turbulent, with white foam from rapids. The banks are covered in lush green trees and bushes. The text 'THANK YOU' is overlaid in white, with an arrow pointing up and to the right.

THANK
YOU ↗

evogler@risd.edu

COMMONPLACE
Landscape and Planning