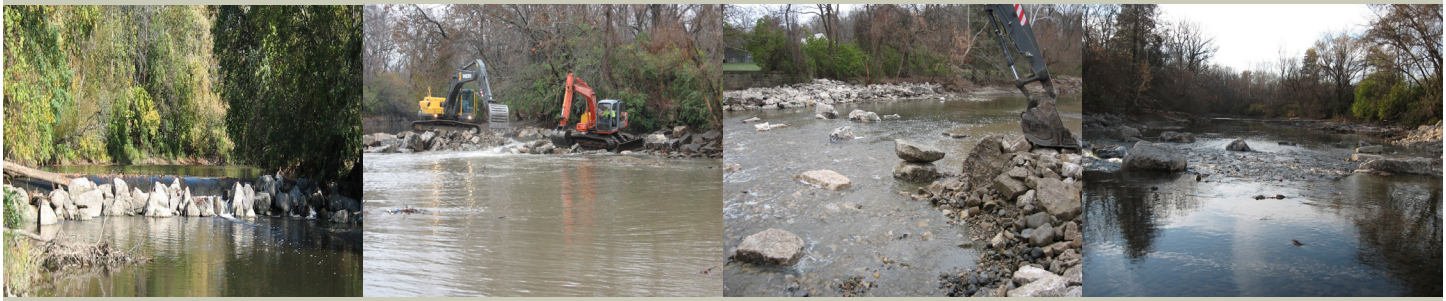

An Evaluation of Dam Removal Policy and Practices In The Nature Conservancy's Eastern Region

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Abstract

There are over 80,000 dams in the United States, many of which pose a threat to ecological systems by disrupting fish passage, causing habitat fragmentation, and altering water quality and flow. As these negative effects of dams become better-documented and more widely understood, dam removals have been increasingly used to address these ecological issues. The Nature Conservancy (TNC), along with other non-profits and government agencies with a stake in the protection of wildlife, has worked on a number of stream connectivity projects that involve dam removals. This report is an attempt to understand how different states approach the complex issue of dam removal. The key elements of successful dam removal programs were distilled from interviews with The Nature Conservancy, state agencies, and non-profit organizations in TNC's Eastern Region, as well as the best practices of two "exemplary" case study states, Pennsylvania and Wisconsin. Five recurring elements or "evaluation criteria" were identified for the major role they play in facilitating dam removal: regulatory authority, collaboration, funding, public education and outreach, and outlook. Each state was analyzed using the evaluation criteria to assess its dam removal policies and programs. From these assessments, state-specific recommendations were made to address "next steps."

Executive Summary

There are over 80,000 dams[1] in the United States, many of which are aging, pose safety hazards, or are completely obsolete (National Inventory of Dams, 2007). Additionally, and perhaps most pertinent to The Nature Conservancy's (TNC) mission of preserving biological diversity and communities, dams create a barrier to migratory fish passage. Dams fragment natural habitats in a manner that not only has a significant impact on the region hosting the dam, but downstream communities as well. Two general approaches have been taken to mitigate problems caused by these obstructions: creating structures that allow fish passage over the dams and removal of the dam. Of these approaches, the method favored by TNC is dam removal because it is permanent and thus not prone to future and potentially costly failures of the fish passage equipment. Dam removal also alleviates the dangers posed towards human communities.

As an organization that works closely with states to preserve natural resources, TNC desired to understand how it could better facilitate dam removals within its Eastern Region: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, Virginia, and West Virginia. Each state's commitment and approach to fish passage varied widely, ruling out the possibility of blanket solutions. To better understand its potential role in each state, TNC hoped to first gain a clearer understanding of what makes a successful dam removal program, as exemplified by two case study states, Pennsylvania and Wisconsin. In total, 15 states were included in the study.

1 The National Inventory of Dams counts dams over 1.8 meters tall. Many more dams exist. By one estimate (National Resource Council, 1992) there may be as many as 2.5 million total dams.

Executive Summary

Through interviews with staff from The Nature Conservancy, state agencies, and non-profit organizations, five recurring elements were identified as "evaluation criteria" for dam removal programs: regulatory authority, collaboration, funding, public education and outreach, and outlook. After individually analyzing states using the evaluation criteria, recommendations or "next steps" were made that are accessible to both TNC and state agencies.

1: Introduction

1.1 Project Goals

The primary goal of the study was to distill key elements of successful dam removal programs from two "exemplary" case study states, Pennsylvania and Wisconsin, and to analyze the success of individual states within TNCs Eastern Region according to these key elements. In total, five key elements, or evaluation criteria, were identified by a state's ability to remove dams in an expedient, organized, and non-controversial manner. Each state was then analyzed using the five evaluation criteria to assess its current dam removal policies and programs. From these assessments, state-specific recommendations were made which addressed "next steps" for each state's dam removal policies and programs.

1.2 Introduction to Dams

A dam is defined as "a barrier to obstruct the flow of water, esp. one of earth, masonry, etc., built across a stream or river" (Merriam Webster, 2009). The term thus encompasses a broad range of water obstructions from the massive Three Gorges Dam in China or the giant Hoover Dam in the southwestern United States to the much smaller structures prepared and constructed by our nation's largest rodent, the beaver.

For the purposes of this report, dams are divided into seve ral classes. Because this report focuses on state policies and practices it deals strictly with dams that fall, or that could fall, under each state's jurisdiction to remove. Energy producing hydroelectric dams are federally regulated and licensed under the Federal Energy Regulatory Commission (FERC). A removal of a dam licensed under FERC involves a level of federal involvement that this study determined to be outside the boundaries of how a state operates on its own terms.

All non-federal dams fall within the scope of this project, but not all of these dams are regulated. Each state also has many unregulated dams. The determinations for what is regulated vary from state to state (see section 1.4). The estimated numbers of regulated dams vs. total dams in this country suggest that the vast majority of dams are still unregulated (National Resource Council, 1992). While unregulated dams pass below the radar of dam safety, many are nonetheless still barriers to fish passage and states may have an

interest in removing them for that purpose. Other barriers, such as culverts and bridges, were considered in the initial research and early interviewing stages of this report. Ultimately, the ways that individual states manage these barriers vary greatly both from each other and from policies that led towards dam removal in general. State regulated dams that have a current utility such as water supply reservoirs or flood control dams, while not explicitly excluded from this study, are implicitly not considered candidates for removal.

1.3 Ecological Benefits of Dam Removal

In recent years, the negative effects that dams have upon ecological systems have become better documented and more widely understood (Bednarek, 2001, American Rivers, 2001). As this knowledge base has grown, dam removals have been increasingly utilized to accomplish ecological goals (Pohl, 2002). Non-profits and government agencies with a stake in the protection of wildlife and commercial and recreational fish stocks have (or could) become invested in dam removal. TNC has been one of the organizations leading the charge towards removals, having collaborated on several removals and initiated a number of stream connectivity projects, of which this report is a part.

Dams have numerous impacts upon fish habitats that can severely limit the extent of fish habitats in many cases and can change the wildlife composition in a river or stream. Perhaps the most significant effect that dams have upon is fragmentation of habitat, the converse of connectivity. For many species of fish, dams create an impassible barrier in rivers and their tributaries. (Dynesius and Neilson, 1994, Naiman et al., 1995). This can be particularly devastating for diadromous fish, fish that migrate between saltwater and freshwater as part of their life cycle. Migratory fish that live in upstream habitats and spawn in saline conditions (catadromous) or live in saline conditions and migrate upstream to spawn (anadromous) experience drastic habitat losses as a result of this fragmentation. This loss of spawning territory increases competition amongst available spawning grounds and has been considered a major factor in the decline of many diadromous fish species. Restoration of connectivity

1: Introduction

between habitats can reverse these effects (Lenhart, 2003, McCleave, 2001).

Fragmentation is also a challenge for fish that are year-round stream dwellers. The two main problems are the creation of physical barriers and the alteration of river conditions. Dams inherently change water flow patterns. The impoundments behind dams have flow patterns that behave more like a lake than a stream or river. Because of the increased surface area and relative stagnation of flow behind the dam, temperature stratifications can begin to occur with cooler water remaining at the bottom and warming waters at the surface (Yeager, 1994). Depending on the release point of the dam to the stream, the water cycled back in to the stream flow can either be warmer or cooler than natural temperature conditions. These temperature gradients can have a number of negative impacts upon stream life including affecting spawning rates and reducing macro-invertebrate populations downstream (Bednarek, 2001). Dams that regulate flow for flood control and hydropower purposes also change flow rates more regularly than natural stream fluctuations.

Both flow and temperature affect the habitats of aquatic organisms. Cooler, fast flowing water has more of a capacity to hold dissolved oxygen than warmer, stagnant water. Removing a dam can restore higher dissolved oxygen rates that can in turn support a greater aquatic diversity. Water monitoring tests taken before and after several dam removals in Ohio showed increased oxygen levels post-removal (Zawiski, 2006).

Changes in flow also change sediment transport patterns. Lower flow rates in dam impoundments allow sediment to settle. This sediment often contains fine grain particles and nutrients that are critical for downstream habitats (Skalak et al., 2008). In the impoundment, the overabundance of fine sediment that settles can also limit habitat space between the crevices of submerged rocks (Bednarek, 2001).

Although a stream will likely return to its original (improved) state over time, when removing a dam, the short term ecological impacts have to be taken into account. If sediments are contaminated, that must be addressed first. In the accidental 1973 breach of the Fort Edwards Dam, PCBs

1: Introduction

were released that ultimately contaminated much of the commercial fish stock in the Hudson River (Bednarek. 2001). Even when sediments are not contaminated, the release of sediments into downstream habitats can temporarily reduce macro-invertebrate populations until sediment releases stabilize (Thomson et al., 2003). Impoundments accumulate large amounts of sediments over time and the rate of release can vary greatly.

Additionally, wildlife composition is also a consideration. Habitat for wetland animals and fish that prefer standing water is often lost in a removal. In some cases endangered species can be disturbed. These ecological balances must be weighed when considering removal. In addition, while the ecological principles leading up to a removal may be sound, people have their preferences for certain types of habitats and the species therein (R Gable, personal communication, March 18, 2009). These preferences can be hard to break

1.4 Introduction to Dam Safety

The other major impetus for dam removal comes from state and federal dam safety initiatives. The way that states define and classify dams determines which dams are regulated and inspected. In turn, this determines which dams a state has authority to apply regulatory pressure towards removal[1]. Deficiencies discovered in the inspection process are a major trigger that initiates the process towards removal (Pejchar and Warner, 2001).

Dam safety programs of varying kinds have existed in this country in some form for nearly as long as dams have been constructed. In recent years, deterioration of older dams has underlined the need for more streamlined standards for dam safety to reduce risks of breached dams flooding downstream properties and/or communities (Pejchar and Warner, 2001).

States' develop their framework for permitting classifications based upon a set of guidelines laid out in Chapter 222.6 Title 33 Code of Federal Regulations, the federal regulations for The National Program for Inspection of Non-Federal Dams. While states are given (and use) broad deference as to how they

1 Removal vs. repair is almost universally the landowner's choice.

1: Introduction

choose to define and regulate dams, the structures are universal for every state that has adopted dam safety legislation.

States are required to classify their dams as low, significant, or high hazard depending on both the potential for loss of life and loss of economic resources in the event of a breach (33 CFR 222.6 (h)). Some states have modified the language (e.g. class 1,2,3,4 instead of low, significant or high) and/or added a class (such as moderate or insignificant hazard). These classes, as illustrated in Table 1 of these regulations, create a benchmark for prioritization for how rigorously to pursue inspection and enforcement.

Hazard Potential Classification[2]

Classification	Loss of life	Economic Loss
Low	None expected	No Permanent
Significant	Few	No urban developments or appreciable loss
High	More than few	Excessive

(33 CFR 222.6 (h) A (3))

2 The column describing the type of development downstream for each classification has been omitted as it adds little to this discussion.

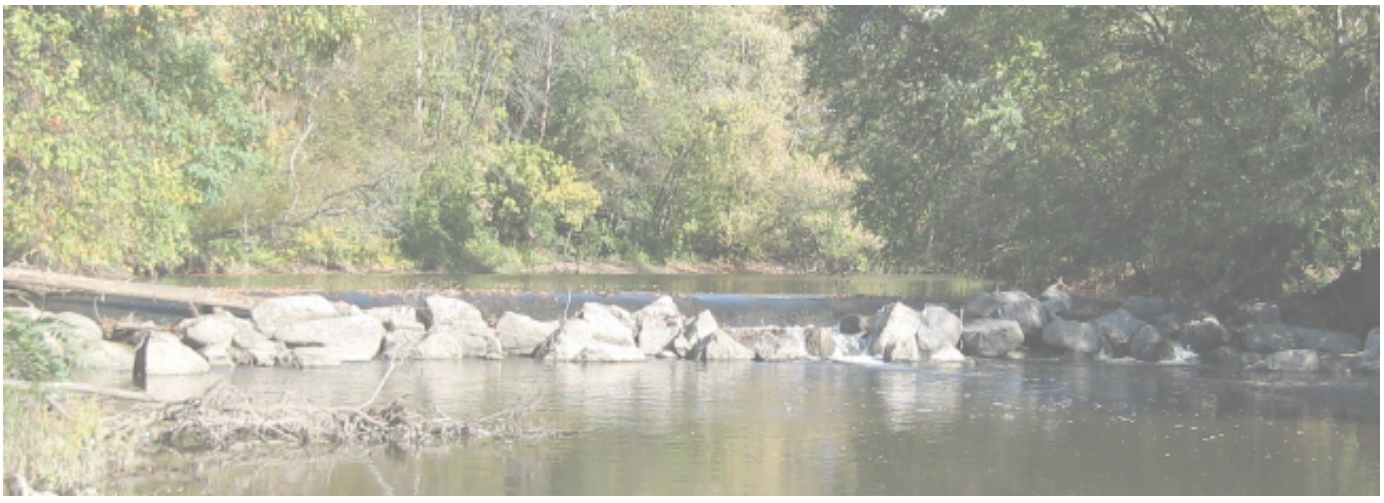
Dam height and the amount of water behind the impoundment, measured in acre-feet, are also factors in dam safety inspections (33 CFR 222.6 (h) (1)). States definitions of dam and impoundment size and their associated hazard and regulation classifications differ widely. States also have the jurisdiction to upgrade dams to a higher hazard classification on a case-by-case basis. For example, if the breach of a small dam would flood a large number of downstream properties then the hazard classification of that dam could get raised from low to significant or high because of the specific risk posed.

The low bar for regulation, in particular, for each state will be noted in the state discussions. Pennsylvania, for example, essentially regulates any structure over three feet in height. On the other end of the spectrum, Delaware refrains from regulating any low hazard dams at all, leaving the vast majority of privately owned dams in the state completely unregulated.

States are also required to develop an inspection interval for their regulated dams (33 CFR 222.6 (j)). High hazard dams are given priority in the inspection process

1: Introduction

though no set intervals are stated. Many states require inspection by owner and/or a certified engineer for all or some classes of regulated dams at a more regular interval than the dam safety officials themselves are able to administer. In the event that a dam is found to be unsafe, the state is required to order "corrective action" though no particular means are specified (33 CFR 222.6 (j)). States typically offer either repair or removal options.



2: Evaluation Criteria

2.1 Development of the Evaluation Criteria

Interviews were conducted with contacts from 14 state agencies in TNC's Eastern Region, plus agency staff in Wisconsin. Two of these states had been preliminarily chosen by the client and steering committee as "exemplary" case studies in terms of their dam removal programs, policies, or activities: Wisconsin and Pennsylvania.

The goal of interviewing the "exemplary" states first was to understand main factors that facilitated dam removal in those states. Similarities or differences in the preliminary interviews could then be used to inform and focus the remaining interviews with the other 13 states. During interviews with "exemplary" state agencies, staff frequently cited several key themes as main factors that facilitated or inhibited dam removal in their state. These themes included: their regulatory authority including permitting, owner liability, and enforcement; collaboration; funding; public education; and outlook. It was also clear that the underlying mission of the state agency or non-profit, or the personal determination of one or a few staff members was an influential factor in dam removal. Although many of the evaluation criteria were identified and selected through the "exemplary" state interviews, additional criteria were identified and added during future interviews with the other 13 states when unique programs, policies, or approaches were discovered.

2.2 Limitations of the Evaluation Criteria

As discussed in 2.1 above, efforts were made to include the findings from all 15 states, not just the "exemplary" states, when developing the evaluation criteria. Because each state approached dam removal through its own laws, regulations, agencies, and attitudes, one state's success may not be transferable to another state. The evaluation criteria were also limited by the number of individuals interviewed in each state, which ranged from one to five interviews, depending on state. One final limitation was the fact that individual dam owners could not be interviewed to understand their perspective of the removal process.

Another limitation of this study is that while its findings are applicable to the states and

2: Evaluation Criteria

region we studied, it may not apply across the United States. Due to various historical forces, dam construction in the eastern and western United States differed substantially. The east is characterized by many out of use, smaller mill dams owned by individuals or municipalities. In most cases these are small landowners without the means to personally fund a removal. Western dams tend to be larger water supply and hydroelectric dams with prosperous owners (D. Ruzicka, personal communication, March 5, 2009). This report's evaluation criteria for how states can best work towards performing more dam removals may not apply as best practices in states where the composition of dams is so vastly different from the eastern United States.

2.3 Evaluation Criteria

2.31 Regulatory Authority

A state's authority to order a dam removal is typically or primarily vested within its dam safety department or division. At the time of writing, all states researched had adopted dam safety legislation. These statutes define the classes of dams that are to be regulated by the state (see chapter 1.5) and provide the state with the authority to permit, inspect and require owner inspections, and order the owner to take action to repair or remove their dam in the event that it fails to meet safety standards.

Other legislation can influence removals as well. Fish passage laws that require new structures to provide passage for migratory fish can urge environmental agencies to prioritize and pursue removals. The stringency of a state's environmental laws, including wetlands protection laws, and federal laws, such as the Endangered Species Act, pollution standards from the Clean Water Act, and The National Environmental Policy Act (NEPA) and state derivatives can also successfully or prohibitively influence removals.

Both interviews and the analysis of the existing literature on dam removal indicate that a state's regulatory authority has a large and complicated influence on dam removal. The authority given to state agencies, the decision to enforce that authority, and the method of enforcement all affect how dam removal is approached within a state.

2: Evaluation Criteria

Whether a state agency has the regulatory authority to inspect, inventory, permit, or remove a dam may have little to do with whether those activities are actually conducted by the state. In many cases, the more important question is whether the state agency actually enforces or uses its authority. If a state enforces or uses its authority, this may facilitate, inhibit, or have no effect on dam removal. If a state does not enforce or use its authority, this too may facilitate, inhibit or have no effect on dam removal.

In some states, the lack of regulations applying to certain types of dams can facilitate dam removal by removing steps from the permitting process, yet the lack of agency interest in dam removal may also preclude the opportunity for state assistance with dam owner education, project planning and design, funding assistance or collaboration.

Regulatory components that are indicators of a successful state include, "agency assistance in planning and funding [dam removals]," a "predictable regulatory process" including information on dam removal aimed at the public, and "inter- or intra-agency forums" to address issues such as conflicting permits that may arise during a dam removal project (Lindloff and Wildman, 2006, p. 2).

Best Practices: Regulatory Authority

Pennsylvania

Pennsylvania's Division of Dam Safety has the authority to issue a waiver of construction permitting, including fees. If a landowner or municipality is looking to remove a dam, this waiver allows them to avoid lengthy permitting processes that the state has deemed not relevant to the project. While a waiver is not a guarantee, the Division of Dam Safety often uses their authority to issue the waiver and give preference to dam removals over repair. The process is streamlined even further in Pennsylvania. Dam owners send all permitting applications to Dam Safety, and the Division takes care of sending out other permits.

In addition, Pennsylvania has a large Dam Safety staff. The office has the manpower to write letters requesting compliance. This allows the state to be thorough and up to date with inspections and gives them the opportunity to continually spot dams that are candidates for removal.

Last, Pennsylvania has fish passage laws administered by the Fish and Boat Commission that allow the state to order dam owners to provide structures for fish passage. These laws working in tandem with the dam safety laws have provided a common ground for safety and ecological goals.

Best Practices: Regulatory Authority

Wisconsin

In Wisconsin, a dam owner has the right to remove their dam through an "abandonment" permitting process. While the landowner is responsible for the removal, the abandonment gets the state involved, offering technical advice and expertise. In addition, the state will actively remove a dam if no owner can be identified. Wisconsin also makes sure that landowners are aware of and understand their liabilities in relation to their dam. When purchasing land with a dam on it, a new owner must demonstrate their ability to maintain the dam for the next ten years. This requirement forces landowners to be acutely aware of their responsibilities related to their dam, and often encourages to removal.

2: Evaluation Criteria

2.32 Collaboration

The removal of a dam may affect or involve many parties including the federal government, United States Army Corps of Engineers (USACE), one or more state agencies, non-profit organizations, the dam owner, abutting landowners, concerned residents, and Historic Preservation commissions. Because of this, many complex relationships form during a dam removal project.

Within a state there may be several agencies that have some authority related to dam removal. Aside from dam safety, environmental agencies and programs that regulate fish and wildlife often have an interest in dam removals that applies to their mission. Collaboration or communication between these different regulatory agencies plays an important role in how the states are able to approach dam removal (Lindloff and Wildman, 2006). Interagency relations may often be strained or non-existent. There is often the opportunity to collaborate in a way that facilitates or encourages funding, streamlines the permitting process, or improves the general relationship between the state, non-profits, and dam owners. Creating a forum such as a dam removal task force that would meet on a regular basis would provide an opportunity for dam owners to voice concerns about dam removal issues (Lindloff and Wildman, 2006).

Some additional examples of collaborative relationship that were provided during interviews included those:

- Between state agencies (such as the NH River Restoration Task Force);
- Between states (such as the Chesapeake Bay Program, Connecticut River Watershed);
- Between state agencies and non-profits (such as the Wisconsin River Alliance and the Wisconsin Department of Natural Resources);
- Between the project designers (whether it be the state or an individual dam owner) and private consulting firms that specialize in dam removal projects (such as the Riverways Program in Massachusetts);
- Between state agencies or non-profits and the community or Historic Preservation;
- Between state agencies and individual dam owners.

Best Practices: Collaboration

Pennsylvania

Best practice states have a strong collaboration between an environmental agency and dam safety. Pennsylvania's Division of Dam Safety and Pennsylvania Fish and Boat Commission collaborate closely on many dam removal projects. There is open and frequent communication between them. Having an environmental agency and a dam safety agency that both prioritize dam removal as part of their mission facilitates removal projects by allowing the respective agencies to develop consistent roles.

Wisconsin

There is a strong and consistent collaboration between the River Alliance of Wisconsin and the Wisconsin Department of Natural Resources (DNR) Dam Safety Bureau. This collaboration is streamlined, with the DNR focusing on the technical and permitting aspects of the dam removal while the River Alliance mobilizes the community and assists with funding acquisition.

2: Evaluation Criteria

2.33 Funding

In most states the majority of dam removal projects are funded through a piecemeal approach of grant acquisitions and/or landowner co-payment, with grants often targeting different stages of a removal project (first design and feasibility, then actual project implementation). While this does require more work on the part of the grant applicant, grants may be facilitated by collaborative relationships between states, non-profits and dam owners. Often, one funding source can be used to pursue matching funds on another grant application. Successful project design and feasibility studies can improve a project's chances of being funded for implementation in a later grant application.

A dam may also receive funding from sources not directly related to removal, such as river restoration grants and Department of Transportation or hydropower mitigation funds. Support for dam removal projects may also come in the form of in-kind services such as project design/engineering consulting, or assistance with river restoration work after a dam removal.

Funding sources that were shared during interview varied by state and project, but included:

- Revolving loan funds initiated by the state, often leveraged as "matching" state funds on grant applications;
- State fundraising programs (license plate funds);
- Federal grants through agencies such as the National Oceanic and Atmospheric Association (NOAA), U.S. Fish & Wildlife and the USDA's National Resource Conservation Services (NRCS), and Clean Water Act (CWA) 319 funds;
- Non-profit organizations;
- Environmental mitigation from other state and private projects;
- Corporate sponsors;
- Local organizations that support river restoration, such as sport fishing clubs.

Agencies should provide technical, regulatory, and financial assistance such grants or low-interest loans to dam owners interested in removal (Lindloff and Wildman, 2006). Many factors such as agency mission and time constraints, play a role in determining whether agencies support removal funding.

Best Practices: Funding

Pennsylvania

Pennsylvania has identified a consistent source of funding for its removal projects. The Growing Greener Fund, a fund administered by the Department of Environmental Protection to address Pennsylvania's critical environmental concerns. This fund has frequently issued grants to dam removal projects. Pennsylvania also finds other creative sources of state funding to support dam removals. Offset funds from the impacts of projects undertaken by the Pennsylvania Department of Transportation and Turnpike Commission have been used to fund dam removals. In addition, in order to supplement projects, the Division of Dam Safety actively writes grants for dam owners. Once a consistent funding source is identified these projects gain credibility with other funding sources.

Wisconsin

The River Alliance of Wisconsin actively assists dam owners as they acquire funding, and is especially knowledgeable about the state's two dam removal grant programs. Because the River Alliance understands DNR's dam removal priorities it can connect individual dam owners with their best opportunity for funding. In addition, the River Alliance's website includes a comprehensive list of funding sources for removal projects.

2.34 Public Education/Outreach

Many dam removal projects are the result of educating a dam owner about his or her options. Oftentimes dam owners are forced to make a decision to either repair or remove a dam based on little concrete information. Sometimes dam owners are able to access information through state or non-profit websites or staff. In the 15 states included in this study, interview results suggest that dam owner education is often done on a case-by-case basis when an opportunity for removal presents itself.

Because a dam removal may affect more than the dam owner's land, other parties, such as abutters or concerned community members, may have a voice in the discussion. Even if abutters are unable to stop a dam removal project, there is a community grieving process associated with the dam and its aesthetic and cultural characteristics (M. Galloway, personal communication, February 26, 2009). Because of this, beyond a familiarity with the local, state and federal regulatory procedures and permitting requirements, there should be collaboration with "the state historic preservation office" (The Aspen Institute, 2002). In addition to abutters, the local community is often involved either through voluntary collaboration or discussion, or as required through the permitting process.

While public education is often used synonymously with public notice, the Aspen Institute noted that "increased scientific research and education curricula on dam removal would help facilitate public education on dams and dam removal. Public understanding is a critical component in dam removal projects that involve public expenditures" (The Aspen Institute, p. 66).

The Heinz Center's study on dam removal decision making found that "decision-making processes for dam removal are most effective when they are well organized, open, and inclusive of all the people in the affected communities (The Heinz Center for Science, Economics and the Environment, p. 24)." Public participation is key in order to identify the goals, the major issues of concern, gather all necessary data, and to make a final decision (The Heinz Center for Science, Economics and the Environment, 2002).

2: Evaluation Criteria

Another aspect of education is internal government education. Some interviewees responded that state agency staff may be basing decision on dam removal on incomplete information, which in turn limited the alternatives they presented to dam owners.

Best Practices: Public Education & Outreach

Pennsylvania

Pennsylvania's Division of Dam Safety actively identifies key stakeholders and potential adversaries to dam removal and reaches out to them. When Pennsylvania's dam removal position in the Dam Safety Division was first established, Dam Safety met with the Museum Commission to iron out conflicts that might arise and develop creative solutions to avoid them in the future. Since this meeting, the Museum Commission has been an active and positive participant in the dam removal process throughout the state.

Pennsylvania brought community groups to get involved with post removal remediation efforts in the removal process. The strong connection between the agencies and non-profits has helped coordinate this. American Rivers and TNC have been involved in this sort of outreach in Pennsylvania.

Pennsylvania was one of the first states to make dam removal a priority. It benefited from a high profile removal of a leaking high hazard dam around the turn of the millennium. The removal was covered by local, state, national and international news agencies, exposing the public to the benefits of dam removal. This event highlighted the importance of dam safety by perhaps saving an entire town from destruction (V. Humenay, personal communication, February 26, 2009). Since that time, the Division of Dam Safety has had a constant stream of applicants interested in removal. Currently, there are more that 130 applications for dam removal.

Best Practices: Public Education & Outreach

Wisconsin

The Wisconsin DNR's website is very clear and accessible. The DNR is also very supportive if a dam owner has questions about the technical or permitting aspect of dam removal. The DNR frequently sends dam owners to the River Alliance for additional information about dam removals. Besides developing a dam removal toolkit, the River Alliance has collaborated with the University of Wisconsin-Madison to conduct research on the effects of dam removal on property values and stream sedimentation, adding to the data that supports removal in the state. The DNR, River Alliance and dam owner are then able to work as a team.

2: Evaluation Criteria

2.35 Outlook

Regulatory authority, collaboration, funding and public outreach and education do not tell the full story of a successful state. The mission of state agencies and the attitude of the staff towards dam removal have a significant influence on how and whether a state agency interprets and enforces its regulatory and permitting authority. The importance of state agency staff's perception of dam removals, were expressed during interviews. Although nearly all 15 states had less than one full time equivalency (FTE) of work related to dam removal, the state agencies that were successful at dam removals often had dam removal or river restoration in their missions or as the staff's own professional goals.

With dam removal there is the opportunity to work at a watershed scale to address long-term ecological goals, but when state agency staff are not specifically directed (through their mission or professional opinion) to consider dam removal as an option when reviewing a dam, state permitting applications often treat dam removals as another form of construction rather than as a remediation tool. The Aspen Institute was aware of this fact, and recommended that "the permitting process…ensure that short-term impacts of dam removal do not preclude projects for which restoration benefits outweigh those impacts" (The Aspen Institute, 2002).

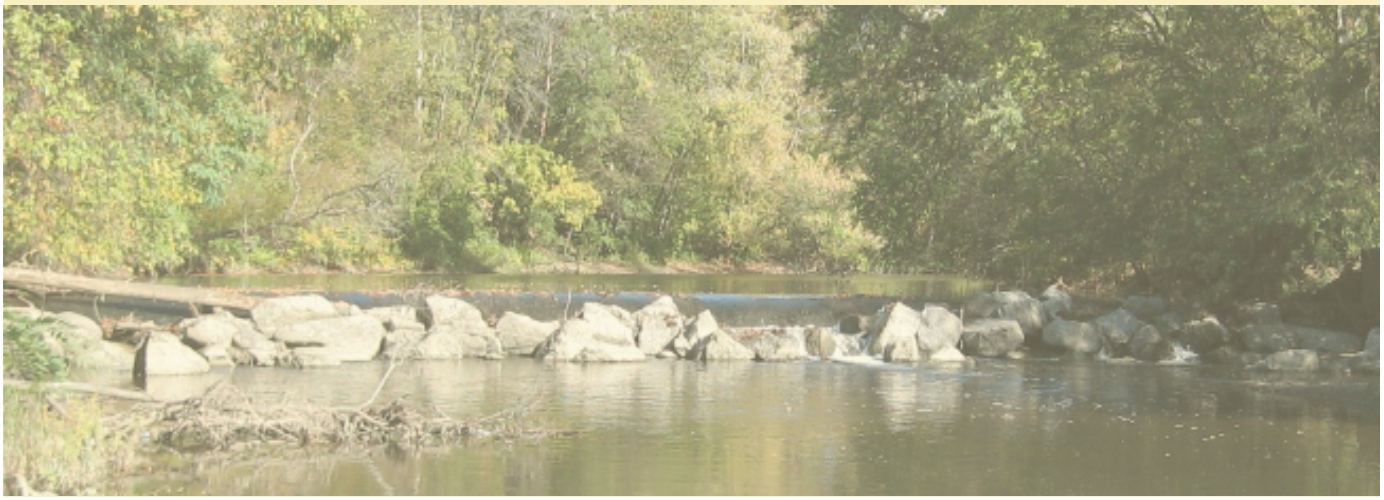
Best Practices: Outlook

Pennsylvania

Pennsylvania is in a unique position. The state benefits from having consistent staff in both the Division of Dam Safety and PA Fish and Boat who are in favor of and actively pursue dam removal. Dam removal is part of the status quo in Pennsylvania at this point. This attitude has spread to non-profits and the general public as well. Landowners are seen as an asset to removal as opposed to an obstacle. It is a team effort, which solidifies Pennsylvania's position as an exemplary state.

Wisconsin

In general, the Wisconsin DNR tries to be technical and unbiased. However, overall, they do support dam removal when it is the appropriate action. DNR Dam Safety is currently working on policy that may allow them to advocate for removals and to take a position that is in favor of removal.



3: State Summaries

3.1 Connecticut

Summary of Findings

Five dams in Connecticut have been reported as removed or are in the process of removal since 1999 (American Rivers, 2007). The Connecticut DEP recently updated their inventory of state dams and now maintains an ad hoc list of dams that are potential candidates for removal to improve water quality and/or provide fish passage. The DEP has three staff within the division of Planning and Standards working on "watersheds" within the state; dam removal is a priority among these staff members. However, permitting is not streamlined through one application or agency and there is no state funding available for dams that are not owned by the state.

Statistics

State Regulated Dams	1187
High Hazard	226
Significant Hazard	462
Low Hazard	499

(Association of State Dam Safety Officials (ASDO), 2006)

According to American Rivers (2007), Connecticut has removed five dams since 1999.

Regulatory Authority

There is no centralized program that responsible for dam removal in Connecticut. Dam removal pops up as an issue in different state agencies. Steve Gephard in the Inland Fisheries Division works on the restoration of diadromous fish in Connecticut rivers. This involves an in depth knowledge of the impact of dams. Inland Fisheries has an advisory role only and has no regulatory authority to order removals. Other DEP divisions that come upon opportunities for dam removals are the Inland Water Resources Division and the Division of Planning and Standards.

The Inland Water Resource Division (IWRD) is the regulatory agency responsible for dams. This division issues the permits for removal and diversion. The IWRD is also in charge of regulating dam safety and repairs of state owned dams. This unit is responsible for periodic inspections and is able to take people to court in order to insure that they maintain their dams in a safe condition. If unsafe,

neglected dams are discovered by IWRD, the division continues to take appropriate regulatory and enforcement action to secure dam repair or removal. When the state is forced to take action at an unsafe, abandoned dam, DEP's policy is to remove the hazard by breaching the dam, unless there is a compelling environmental benefit from preserving the impoundment (D. Ruzicka, personal communication, March 5, 2009).

Dam Removal in Connecticut is addressed in Section 22a-402 of the Connecticut General Statutes. Inspections of dams are made on a periodic basis as well at the discretion of the Commissioner of Environmental Protection. If a dam is deemed to be in an unsafe condition, the Commissioner can order the owner of the dam to place it in safe condition or remove it (22a-402 CGS).

A permit is necessary to construct, alter, rebuild, substantially repair, add to, replace or remove a dam or barrier. In Connecticut, a permit is also required in order to alter a wetland in any way. Permitting for dam removal is not streamlined through one application. However, an applicant under Connecticut's dam safety statute is not required to apply for three permits that may normally be required for work in a waterway. These permits are the Stream Channel Encroachment Line Permit, the Diversion Permit, and the Inland Wetlands Permit. The review for the dam safety permit does include reviews commensurate with the reviews that would have taken place for the permits not required. As a result, with the exception of federal permit requirements, the state dam safety permitting process is minimally burdensome and is not very streamlined. (D. Ruzicka, personal communication, March 5, 2009). The DEP's website has general information on how to apply for a permit and a list of general permits. Specifics about dam removal permits are found under "Dam Construction" and grouped together with construction, alteration, and repair (Department of Environmental Protection (DEP), 2009).

According to the rules and regulations, dam owners are responsible for making sure their dams are inspected (22a-409-1-(f)). Right now, landowners who prefer to make their dams safe by removing the dam, or wish to remove their dams to reduce liabilities, maintenance responsibilities or for other

environmental reasons, would be fully responsible for paying for any associated sediment removal. In many cases, this could tip the balance between whether a landowner decides to repair a dam or remove it (D. Ruzicka, personal communication, March 5, 2009).

Funding

If there is a state owned dam that needs work, the funding comes from the bonding commission. However, if there is a privately owned dam to be removed, there is no funding assistance currently available through the state. There are third party funds available through NOAA and others for removal of private dams, however, such grants are usually not provided for dams with an administrative order associated requiring repair or removal (S. Gephard, personal communication, February 23, 2009).

Collaboration

Dam removal is a collaborative effort in Connecticut, as it is in every state. The Division of Inland Fisheries has worked with The Nature Conservancy, American Rivers, the Connecticut River Watershed Council and other watershed associations. There is no state funding assistance for dam removal, so they need these partners to facilitate projects (S. Gephard, personal communication, February 23, 2009). The Nature Conservancy has been willing to purchase dams to take them down (D. Ruzicka, personal communication, March 5, 2009).

Public Education/Outreach

Overall in Connecticut there is a misperception of the environmental impacts of dam removal. Many people think that a turbine should be attached to an existing dam to generate power, but don't realize that many of the dams cannot maintain that. The general public also has misperceptions about dam removals resulting in muddy waters, flooding, etc. Public education about these general ideas would go a long way towards dam removal and fish passage (S. Gephard, personal communication, February 23, 2009). In general, outreach programs are not very formalized and therefore have not been as effective at raising public awareness as they could be (D. Ruzicka, personal communication, March 5, 2009).

Outlook

The Inland Water Resources Division's main concern with dam removal is public safety and reduction of regulatory burden. Though they do value fish passage, it is not their priority. There have been some cases where the DEP dam safety section has issued a permit to a dam owner to partially breach their dam, thus allowing for additional spillway capacity, a reduced hazard classification and ultimately not allowing for pond bottom sediments to be released. A recent inventory of dams in Connecticut showed that over 70 of the 264 dams that are owned by the state itself have been determined to be candidates for removal. The DEP dam safety program is prioritizing dam removals and hopes to ultimately remove several state owned dams. These dams have priority for removal (D. Ruzicka, personal communication, March 5, 2009).

The DEP also benefits from have three staff within the division of Planning and Standards working on "watersheds" within the state. These three individuals are out in the communities and have been in on the grass roots level in several dam removal projects throughout the state. Their focus is on overall stream restoration including water quality improvements (S. Gephard, personal communication, February 23, 2009).

Connecticut Best Practices

Connecticut has a comprehensive and recently updated list of dams in Connecticut and their associated hazard classification. From this list, the state has prioritized dams for removal.

Connecticut has three staff within the DEP who have been involved on the grass roots level in several dam removal projects throughout the state. Their focus is on overall stream restoration including water quality improvements

3.2 Delaware

Summary of Findings

Dam removals have occurred infrequently in Delaware, with no dams being reported as removed or in the process of removal since 1999 (American Rivers, 2007). At the time of this report the Department of Natural Resource and Environmental Control's (DNREC) Division of Fish and Wildlife was engaged in its first dam removal project, which had stalled due to strained relations with one of the dam's owners. Proposed dam safety regulations excluded small dams that have no or low risk to loss-of-life, reducing the number of permits required for a dam removal, but also removing most of the mechanisms by which dam safety could have facilitated dam removal (such as owner liability, inspection or enforcement of repairs).

Statistics

State Regulated Dams	37
High Hazard	9
Significant Hazard	21
Low Hazard	1

(Association of State Dam Safety Officials (ASDO), 2006)

While these numbers reflect the number of state-regulated dams, as described in more detail below, other smaller or lower hazard impoundments may exist and be targeted for removal. For instance there were 98 state regulated dams. While these dams still exist, they no longer show up on national inventories of state-regulated dams because of changes to dam safety regulations.

Regulatory Authority

With the passage of dam safety regulations on April 27, 2009, Delaware's Dam Safety Division has the authority to review dam construction, breach, abandonment and removal (Delaware Code Chapter 42, Dam Safety, 2009). While The Division will have the ability to permit dam abandonment and removal, it intends to regulate only those dams that pose high or significant hazards to public safety. The majority of these high and significant hazard dams are publicly owned by municipalities, utilities and state and federal government. Their use is often such that dam removal would rarely be an option pursued by these public owners (F. Piorko, personal communication, March 19, 2009).

3: State Summaries

Any owner has a right to remove a dam from their property, as long as they receive the necessary permits and submit the correct applications, which could include dam safety permits, wetlands permits or Environmental Impact Statements. Which permits and applications an owner might need to submit would depend on the nature of the project, the dam's location, and its previous use. Since Delaware's Dam Safety chose not regulate small or low hazard dams through the new Dam Safety regulations, only those dams that are high or significant hazard to human safety would require a dam safety permit for removal (F. Piorko, personal communication, March 19, 2009).

Any dam removal project may require a sub-aqueous wetland permits if it involved "dredging, draining [or] filling" (Delaware Code 7502 Wetlands Regulations). Other environmental issues such as endangered species and sedimentation may need to be addressed in an Environmental Assessment/ Environmental Impact Statement, such as zinc stored behind a dam from mining or smelting upstream (F. Piorko, personal communication, March 19, 2009). In its work with the Brandywine Conservancy, the Division of Fish & Wildlife found the "in-house" sub-aqueous permit to be simple and straightforward, while a permit from the US Army Corp of Engineers took months to acquire (C. Shirey, personal communication, March 18, 2009).

Just as permitting will only be required for high and significant hazard dams, inspection and Emergency Action Plans (EAPs) will only be required for those hazard rankings as well. As explained by dam safety staff, there is a low likelihood that a high or significant hazard dam would be removed because the owners of these dams - municipalities, the state and the federal government – will continue to require the use of the dams (F. Piorko, personal communication, March 19, 2009). While the inspections, EAPs, and permitting process might make ownership of a small dam onerous and push an owner to consider removal, small dams are not regulated, and the state will regulate roughly 62 high or significant hazard dams.

While DNREC has the authority to regulate culverts and embankments, it chose not to include them in the draft Dam Safety regulations that is currently undergoing review

(F. Piorko, personal communication, March 19, 2009). The reason for this exclusion may have been similar to the reason for excluding small dams from regulation – limited staff time and funding for projects that are unlikely to cause any significant safety issues. While DNREC still retains the authority to regulate culverts in the future, there is no foreseeable event that would motivate DNREC to regulate culverts through Dam Safety (F. Piorko, personal communication, March 19, 2009).

Through its new Dam Safety regulations, DNREC will require that a dam owner prove his ability to secure funding for any dam projects, as well as for "continued maintenance of the project throughout the life of the structure." If this were to be enforced, it could have a similar effect as the liability requirements in Wisconsin, where owners must prove that they have considered how they plan to maintain their dam over time (Delaware Code Chapter 42:12, Dam Safety, 2009). This requirement might encourage owners to permanently remove the liability of a dam from their property by removing it. Yet, as mentioned above, because small dams are excluded from dam safety regulations, these owner liability requirements also would not apply.

Currently, Dam Safety staff do not have any time specifically allocated to dam removal projects. The only time that Dam Safety staff would encounter a dam removal project would be on the permitting or regulatory side of the removal. Since smaller, low hazard dams are much more likely to be targeted for removal, and because these same smaller dams are not regulated by Dam Safety, removal permitting will likely be a rare occurrence in the Division of Dam Safety or other permitting offices. Although the Division of Fish and Wildlife had one staff member working on a dam removal project, since that project has stalled there are no other Fish and Wildlife staff commitments to dam removals (C. Shirey, personal communication, March 18, 2009).

Collaboration

The Dam Safety Division takes part in a monthly joint permitting meeting between state and federal agencies. At these meetings any individual working on a project that may require permits can be put on the agenda to receive informal verbal input from each of

the member agencies regarding what might be required. While this semi-formal group helps streamline the permitting between the state and federal government, it does not include all the parties involved with dam removals such as the counties and the cultural/historical societies (F. Piorko, personal communication, March 19, 2009).

The DNREC's Division of Fish and Wildlife recently became involved in a river restoration project headed up by The Brandywine Conservancy, a regional non-profit. Although The Division had historically improved fish passage through fish ladder installations, dam removal is often a better alternative because it restores more of the river to its natural state. Although state funding was not available to assist The Brandywine Conservancy with the removal, The Conservancy decided to create a partnership between the City of Wilmington, the State of Delaware, and other dam owners and interested groups which would improve the project's chance of being funded (C. Shirey, personal communication, March 18, 2009).

Funding

The legislation to create Dam Safety regulations was passed in 2004, but no funding was allocated until 2006. If the draft regulations are approved in 2009, the Department will have no budget for projects such as needs analysis, evaluations, rehabilitations or permitting. Because neither Dam Safety nor Fish and Wildlife staff have ever been involved in a completed dam removal project, other funding opportunities for dam removals were not discussed. There are no state funding sources (grants or loans) available to remove a dam, and the lack of removal projects in Delaware limited the project's ability to understand how agencies or organizations might approach outside funding, such as federal or corporate sources, in the future.

Public Education/Outreach

There is no proactive educational program through the DNREC's Dam Safety Division or Fish and Wildlife to communicate with dam owners, community members, or historic preservation about dam removal, the dam permitting process, or dam owner liability. The one Division of Fish and

Wildlife staff member who had taken on the responsibility of one dam removal had no educational component to his work associated with the project. In addition, the one removal project specifically stalled due to a lack of cooperation from one of the dam's owners (C. Shirey, personal communication, March 18, 2009).

There is no information at the state level to facilitate dam removal or educate dam owners about their dams. A small dam owner could own their dam and never have it inspected, permitted, repaired, or removed, and would never know the difference. Having a strong emphasis on dam removal within a state agency or non-profit plays a key role in facilitating dam removal. Without any educational campaign or regulatory force to encourage owners to consider removal, there will continue to be no removals in the state.

Outlook

Because there are so few dams scheduled to be removed in Delaware, there is little reason for the State to acquire staff that specialize in dam removal beyond current capacity. Although dam safety is a major impetus for dam removal in other states, Delaware's regulations may be far less likely to encourage dam removal if the owner is not required to inspect, maintain, or permit dam activities, even if the removal is less costly than repair.

Fish and Wildlife employees understand what role dam removals can play in opening up waterways for fish passage (especially compared to fish ladders), but staff had thus far only been willing to become involved in projects on state property.

3.3 Maine

Summary of Findings

Since 1986, there have been 17 dam removals in Maine. These have been largely initiated, sponsored, and supported by local communities, state wildlife management agencies and river restoration groups such as NOAA Community Based Restoration Program, the Atlantic Salmon Federation, and Trout Unlimited. Maine has no dedicated state position for managing dam removal projects. Furthermore, the significant presence of hydropower dams, and their potential as a cleaner source of energy influence both the regulatory language and regional disposition towards dams.

Statistics

State Regulated Dams	831
High Hazard	25
Significant Hazard	80
Low Hazard	726

(Association of State Dam Safety Officials (ASDO), 2006)

19 dams have been removed in Maine between 1986 and 2009 (Maine Department of Environmental Protection (DEP), 2009)

Regulatory Authority

Currently, dam safety is overseen by the Maine Emergency Management Agency (MEMA) with the intent of addressing the possible risk to human life. The Maine Department of Environmental Protection has regulatory authority over non-hydro powered dams in Maine; handling the permitting of dam construction and repair, water levels and releases and dam ownership releases. As of 1993 dams in Maine no longer need to be registered with the DEP, and as of 1996 dam owners may petition the DEP for release from ownership. There is currently no law in Maine that requires dams be kept in good condition, though MEMA can require that a dam be operated or maintained in a way that is not a threat to public safety. Construction or repair of a dam may be subject to regulation under one of several state laws:

- Natural Resources Protection Act (for non-hydropower dams);
- Maine Waterway Development and Conservation Act (for hydropower dams);
- Land Use Regulation Commission (LURC) (for dams in unorganized territories);

- The Erosion and Sedimentation Control Law;
- Maine's Endangered Species Act.

Prior to 1993, abandonment was connected to specifically to non-registration, a dam was deemed abandoned when an owner failed to properly register a dam. Upon abandonment, ownership automatically transferred to the state. Now that dams no longer need to be registered, they can no longer be legally abandoned. Additionally, all of the dams previously abandoned to the state have been awarded by the Maine DEP to new owners.

The permit process for dam removal is administered by the Maine DEP in organized towns and cities and by LURC in unorganized territories. Dam removal projects involve procuring a permit under the Maine Waterway Development and Conservation Act. The approval criteria for this dam removal permit include:

- Making adequate provisions for financial and technical needs, public safety, traffic movement, and also plans for mitigating any adverse environmental impacts that could be potentiated by dam removal;
- Assuring that water quality standards will be met;
- Consideration of the benefits and harm to wetlands, soil stability, fish and wildlife resources, cultural resources, public rights of access and use of surface waters, flooding, and power generation;
- Removal of non-hydropower dams also requires a Natural Resources Protection Act permit from DEP in organized towns and cities (in unorganized territories, a development permit from LURC).

Under limited circumstances, dam removal can be approved under Permit-By-Rule Standards as a habitat creation or enhancement or water quality improvement project. At a local level dam removal is also subject to approval under and applicable local shore land zoning ordinances and development or demolition standards. In many cases, no local approvals of any kind will be needed.

Collaboration

Currently the state data on dams is 15 years old (D. Murch, personal communication,

April 6, 2009). From the state's dam safety perspective, dam regulation largely addresses hydro powered dams. Hydro powered dams have a strong presence in Maine. There is no comprehensive registry of dams in Maine, beyond the National Dam Safety Inventory. In the past, non-profits and local community organizations have played a strong role in river restoration projects.

In order for dams to be removed for habitat protection, Inland Fisheries and Waterways (IF&W) will designate a species as meriting a listing; make a recommendation to the legislature, which will then make a final decision. Once a species is listed, IF&W develops protection guidelines, including protecting the species' "essential habitat." All activities which require a state or local permit within the habitat of an endangered or threatened species are subject to review by IF&W. Though such a process can help get dams removed that clearly threaten native fish species, it can also serve to protect dams if they seem to contribute to an essential habitat.

Maine is developing a new Interagency Stream Connectivity Group consisting of state and federal agencies as well as NGOs. Maine's six state organizations including the Department of Environmental Protection, the Department of Marine Resources, the Department of Inland Fisheries &Wildlife, The Department of Transportation, State Planning Office, and the Maine Forest Service. Federal agencies involved in this effort include The National Oceanic and Atmospheric Administration (NOAA), The US Fish and Wildlife Services (USFWS), and the US Department of Agriculture's National Resource Conservation Service (USDA-NRCS). The four non-governmental organizations involved are Project SHARE, American Rivers, Atlantic Salmon Federation, & TNC.

This group will work collaboratively to increase stream connectivity throughout the state through dam removals, culvert removal or replacement and fish passage at dams. This group held its first meeting in April 2009 and anticipates a great increase in the amount of restoration projects done in the state and increasing Maine's share of federal funding for restoration over the coming years. (J. Royte, personal communication, March 5, 2009).

3: State Summaries

Last, a partnership of six NGO's and the Penobscot Indian Nation called The Penobscot River Restoration Trust are currently working on a large dam-removal project on the Penobscot River, Maine's largest. The $56 million project involves purchasing three dams, removing the two most sea-ward dams, increasing fish passage on the next upstream dam, and developing a naturalistic fish by-pass around the next dam upstream. This is expected to increase fish passage for 12 species of diadromous fish including over 1,000 miles of habitat for Atlantic Salmon. The Trust is working closely with state and Federal agencies who both help steer, permit, and fund various components of the project.

Funding

Funding for dam removals is primarily obtained by non-profit river restoration and wildlife agencies, using traditional sources such as NOAA, American Rivers, and the USFWS. The state may collaborate with non-profits and generally, when a dam needs to be removed for safety or ecological issues, funding is not an issue (D. Murch, personal communication, April 6, 2009), Dams and Hydropower supervisor of the Maine Department of Environmental Protection.

Public Education/Outreach

Non-profits and community organizations play the strongest role in public outreach and education. Maine Rivers is an information-sharing network formed in 1998 (Maine Rivers, 2005), collaborating with member groups such as Friends of Presumpscot River and the Natural Resource Council of Maine. Maine Rivers both gathers from and redistributes information to environmental action groups and local stakeholders, with the intent of unifying those interested in river restoration. Maine Rivers also publishes watershed profiles within the state of Maine, fully accessible to the public via their website.

Outlook

Maine's success thus far in dam removal in part reflects the commitment of non-profit and river restoration groups. Additionally, the overall lack of direct regulation of small dams can contribute to ease of removal once funding is procured.

3.4 Maryland

Summary of Findings

The Maryland Department of the Environment's (MDE) Dam Safety Program maintains a high percentage of safe dams across the state. Partially due to this high level of dam safety, there is a correspondingly low level of interest in dam removal among dam safety staff and no incentives at the state level for dam owners to consider removal as an alternative to repair. However, the Department of Natural Resources (DNR) Fisheries Services, part of the EPA funded Chesapeake Bay Program, has been involved in several dam and culvert removals across the state.

Statistics

State Regulated Dams	465
High Hazard	68
Significant Hazard	105
Low Hazard	290

(B. Harrington, personal communication, March 17, 2009)

Less than 12 new dams (that meet state requirements for regulation) have been constructed since 2000, and most have either been stormwater management dams to prevent runoff from new development, or hydropower dams (B. Harrington, personal communication, March 17, 2009).

Regulatory Authority

The MDE Dam Safety Program has the authority, through the Code of Maryland Regulations (COMAR 26.17, 1988), to permit the construction, repair, or modification of dams; to conduct inspections of dams; and to order the repair of a dam. In general, the language and enforcement of dam safety regulations can either facilitate or deter dam removal. In Maryland the DNR Fisheries Services does not have regulatory authority associated with dam removal, but instead has ecological insight into the prioritization of dam removals in the state. It is because of DNR's efforts and prioritization strategy that a handful of dam removals have occurred in the state.

Dam Safety staff the authority to conduct inspections on all high, significant, and low-hazard. The Department also has the authority to inspect dams "on complaint or the Department's own initiative" (Maryland

Environment Article § 5-509(a), 2007). Dam Safety staff, not owners or hired consultants, conduct dam inspections and develop inspection reports. If Dam Safety finds the dam to be unsafe it will issue an order to the dam owner, along with a timeframe for compliance with that order. The Division also has the authority to spend its own money to address major dam safety issues, and later take the dam owner to court (Maryland Environment Article § 5-509(b), 2007). The Division has enforced this authority, although in the instances when the Division has spent its own money to address issues of dam safety it has repaired, not removed, the dams (B. Harrington, personal communication, March 17, 2009).

The main priority of the Dam Safety Division is to repair dams, not remove them. The state has an incredibly good record of dam safety, with only 3-4% unsafe dams (B. Harrington, personal communication, March 17, 2009). While a dam removal would also "take care of" dam safety issues, the state is equally satisfied with a safe dam that has an EAP. Rather than push for dam removals, The Division would like to see legislation developed to require all high or significant hazard dams to have Emergency Action Plans which provide the owner and those downstream with instructions in the case of a dam failure. Currently there is no formal EAP requirement, although roughly 70% of dams do have EAPs in place. (B. Harrington, personal communication, March 17, 2009).

There are two phases requiring two separate permits for any project related to a dam regulated by the state. This two phase system makes the process of removing a dam relatively complex. The Plan Development Phase involves the submission of a feasibility report to the Department, which must include not just project objectives, site analysis, and estimated costs, but alternative proposals considered, any environmental impacts, benefits from the project, and "written assurance that funds will be available to complete the project." The second permitting phase is the actual Construction Phase, which requires final construction designs, and "the applicant [must] post a construction bond, or similar security, to assure that the project has adequate funding" (Association of State Dam Safety Officials (ASDO), 2000). This

two-part permitting process may discourage individuals from removing a dam, especially if it is structurally meeting safety requirements.

Some permitting exemptions do exist for the estimated 290 dams small and low-hazard structures. Still, even the smaller dams that are exempt from dam safety permitting must submit permits to satisfy the Local Soil Conservation District, the Wetlands and Waterways Program, and Clean Water Action, Section 404. A "joint federal/state application for the alteration of any floodplain, waterway, tidal or nontidal wetland in Maryland" is submitted to both the state and U.S. Army Corp of Engineers.

The Dam Safety Division has five staff members, but none of their time is spent on dam removal. Instead, most of their time is dedicated to reviewing and issuing permits, and to repairing old dams, which is where any consideration of dam removal might take place.

The DNR's Fish Passage Program is successfully getting dam removal projects funded and has developed a unique prioritization document that has been shared with other states, The Fisheries Services has one employee working on dam removals. Nearly 100% of his time is spent working on removal of barriers, whether dams, culverts, or other obstructions to fish passage. In the past there were seasonal biologists working with him as well, but those positions have been cut.

Collaboration

Besides the previously collaboration between the Fish Passage Program and the state's DOT, Maryland is part of the Chesapeake Bay Program (CBP), a regional initiative headed up by the EPA. Since being signed in 1987, the Chesapeake Bay Agreement has brought the Maryland DNR Fisheries Services together with Pennsylvania, Virginia, and Washington D.C. Together, CBP members promote fish passage, originally through ladders, but in the last 4-5 years the Fisheries Services in Maryland began to focus on dam removals as a more successful and sustainable alternative. Through the CBP Fisheries Services has been able to share its prioritization document with other states, and to see what is happening in other states. Unfortunately, funding cut for

the 2009 fiscal year leaves the future of the program uncertain (J. Thompson, personal communication, March 12, 2009).

Funding

The Dam Safety Division does not help dam owners identify funds for removal or repair. While there are low-interest loans provided by the Division for repair, there are no state grant programs devoted to dam removal. Most dam removals in the state have been organized by the Fish Passage Program, and were funded in a piecemeal way by a variety of sources including: American Rivers and NOAA Community-Based Restoration Program River Grants, U.S. Fish & Wildlife, and mitigation money from Maryland's Department of Transportation. This working relationship between the DOT and DNR has allowed both departments to approach the other when funding or projects are being discussed that could use the expertise or assistance of the other. In the end, even the DOT collaboration is restricted by the availability of DOT funding and the projects that are related to DOT projects, which may not align with priority barrier removal projects, described below.

Public Education/Outreach

The Department of the Environment's Dam Safety Division website contains information related to dam safety, including owner liability and guides to dam construction and EAPs, but there is no information available regarding dam removals in the site. The Department of Natural Resources' Fish Passage Program website provides several dam removal case studies, but little other information. While the fish passage program prefers dam removal over the installation of fish ladders, fish passage staff must get the dam owner's permission to move forward with a removal project.

One Fish Passage staff works with dam owners, prioritizes removal projects, and does the legwork of applying for grants and other funding sources. Unfortunately, without the landowner's permission, the project cannot move forward, no matter how high on the Fish Passage Program's prioritization list, and no matter how well funded it might be. Since the Dam Safety Division is involved only with the permitting of dams, there is no technical or outreach support to get landowners or community-members on

board. All the work to convince landowners to remove their dam is put on the fish passage program or non-profits.

Outlook

Through the interviews for this project it became apparent that there is not a clear consensus or agreement on the benefits of dam removal within state agencies. The Dam Safety Division seemed to clearly understand why fish passage proponents desired to remove dams and why fish passage proponents prioritize certain lowhead dams for removal. The Division was much less eager to face issues such as sediment accumulation, ecological issues and public outcry that come with the removal of larger dams, and did not see it as their job to educate dam owners about their options regarding removal.

There was also disagreement over the comparative costs of repair versus removal. If the Dam Safety Division operates under the assumption that dam removal is more expensive than repair, or that dam removal causes more environmental degradation than benefits, then it is understandable why The Division does not advocate for removal. It is clear that different agencies in Maryland operate under very different fact sets regarding the usefulness and appropriateness of dam removal. Without the beginning of a dialogue, it may be impossible for the two agencies to fully understand and work with one another.

Maryland Project Prioritization

The Fish Passage Program has developed a prioritization formula, which not only take into account ecological costs and benefits, but cultural, historical and recreational benefits provided by blockages as well. Using his formula he can try to determine which blockages may be the most ecologically beneficial to remove while also having the least negative impact on human or political issues. This prioritization system has been shared with agencies in several other states that are now developing their own prioritization scheme (J.Thompson, personal communication, March 12, 2009).

3.5 Massachusetts

Summary of Findings

Massachusetts has made a strong commitment to dam removals both within the Division of Fish and Game Riverways Program and local watershed associations and other non-profits. The Riverways Program is one of the few governmental divisions that is focused on river restoration and ecological integrity of watersheds. The staff and website are easily accessible and have a wealth of information about permitting and funding. Their comprehensive GIS model allows for safety, ecology and community interests to be involved in prioritizing dam removals.

Statistics

State Regulated Dams	1627
High Hazard	303
Significant Hazard	761
Low Hazard	563

(Association of State Dam Safety Officials (ASDO), 2006)

Massachusetts also has 1,206 unregulated dams (under 6ft in height or under 15 acre feet of storage), bringing the total number of dams to 2,904. According to American Rivers (2007), Massachusetts has removed six dams since 1999.

Regulatory Authority

The Division of Fish and Game in Massachusetts has four divisions: Division of Fisheries and Wildlife, Division of Marine Fisheries, Office of Fishing and Boating Access, and the Riverways Program. The mission of the Riverways Program is to promote the restoration and protection of the ecological integrity of the Commonwealth's watersheds: rivers, streams and adjacent lands. It is one of the few programs of its type nationwide. A primary role of the restoration program within Riverways is dam removal. Riverways also focuses on low flow restoration, stream naturalization, stream stewardship (Adopt-A-Stream) program, technical assistance and continuity improvements. While dam removal is only one aspect of the Riverways Program, it is a large part of what the office does (T. Purinton, personal communication, March 13, 2009).

Dam Safety is regulated by Section 10.00 of Title 302 of the Code of Massachusetts

3: State Summaries

Regulations (302 CMR 10.00) through the Department of Conservation and Recreation. The Office of Dam Safety at DCR maintains records of dams throughout the state, ensures compliance with acceptable practices, and mandates dam inspection. The Commissioner can schedule an inspection at any time. If an owner fails to file a dam inspection report within the time prescribed, the Commissioner may enter the property and conduct inspections themselves (302 CMR 10.07). Dam safety regulations do not truly encourage dam removal, even if it is the best option (T. Purinton, personal communication, March 13, 2009)

Anyone who proposes to construct, repair, materially alter, breach or remove a dam must file a permit application with the DCR Commissioner. A permit application requires a preliminary report that includes maps, design plans, and development plans. This permit allows for removal of a dam due to new construction, abandonment or unsafe conditions. The state does not ask dam owners to consider ecological factors when filing for a permit to remove a dam.

The Riverways fact sheet clearly states all the necessary components of managing and permitting a dam removal project in Massachusetts and provides links to the appropriate forms. A municipality requires permits under the Wetlands Protection Act, which is administered by the local conservation commission. Other local permits may be required through local zoning bylaws. There are various state permits required depending on the size of the dam and the degree of environmental impacts. Each dam removal is unique; therefore, the required permits differ for each project (Riverways Program, 2009).

In accordance with dam safety regulations, dam owners are responsible for registering, inspecting, reporting inspection results to the Office of Dam Safety and maintaining their dams in good operating condition (Department of Conservation and Recreation (DCR), 2009). Non-compliance fees and violation fines range from $500 to $1000. The dam owner is responsible and liable for damage to property of others or injury to persons resulting from the operation, failure of or misoperation of a dam (302 CMR 10.13).

Collaboration

Riverways advocates a partnership approach to river restoration that involves working side-by-side with local citizens, town officials, watershed-based groups, and other partners. Riverways also works with state agencies, federal agencies, municipalities and nonprofit organizations to ensure that policies, actions and regulations protect river and riverine systems (Riverways Program, 2009). This collaborative focus has allowed Massachusetts to troubleshoot problems that other states continually have to address. Riverways has collaborated well with the Massachusetts Historical Commission since they began dam removals in Massachusetts (T. Purinton, personal communication, March 13, 2009).

To help ensure projects are designed well, Riverways has created a Master Service Agreement with qualified consultants that have a clear understanding of dam removal engineering and technical assessments. These contractors are hired to design and oversee dam removal projects under the direction of an independent project manager if the project becomes a designated Priority Project, a project that utilizes innovative approaches, is part of a larger restoration and revitalization plan, addresses causes over symptoms, and results in on-the-ground implementation. Qualified engineers also conduct rapid assessments of potential projects to determine if they are feasible and practicable (T. Purinton, personal communication, March 13, 2009). Riverways focus on organizing the regulatory, non-profit, and consulting aspects that are necessary around restoration projects has led to successful dam removals in Massachusetts.

An Aquatic Habitat Restoration Task Force[1] convened in the fall of 2007 to discuss a course for aquatic habitat restoration in Massachusetts. The task force was made up of government and non-government entities. The task forces published a blueprint for aquatic habitat restoration that has helped guide and promote dam removal and other sustainable ecological restoration techniques.

1 The Aquatic Habitat Restoration Task Force members included representatives from The Office of Coastal Zone Management, the Division of Marine Fisheries, Department of Fish and Game, the Executive Office of Energy and Environmental Affairs, The Nature Conservancy, American Rivers, USACE, Riverways Program, Department of Environmental Protection, MA Corporate Wetlands Restoration Partnership, Ipswich River Watershed Association, and Mass Audubon.

Currently, Riverways along with TNC, is part of the New England Stream Barrier Task Force (T. Purinton, personal communication, March 13, 2009).

Funding

Dam Removal is a multi-phase process. In Massachusetts, a large part of the feasibility and design funding comes from the state's environmental bond, which in 2008 received funding through an omnibus appropriations bill from the U.S. Congress. The bond designated $10 million toward river restoration over a five-year period. These funds are separate from the annual operational budget that primarily supports Riverways staff. Once dam removal projects are started other funders, such as the US Fish and Wildlife Service, NRCS, or NOAA, contribute additional design and construction funds. When Massachusetts begins dam removal projects, selecting the most viable projects and sorting out potential problems, it becomes more likely that other funders will then commit to a project. This gives Massachusetts an advantage when applying for funding from these sources, since funding is usually awarded to projects with multiple partners (T. Purinton, personal communication, March 13, 2009).

Riverways helps dam owners apply for grant funding and helps to match federal funding. Federal appropriations or "earmarks" are also used towards dam removal in Massachusetts (T. Purinton, personal communication, March 13, 2009).

State sources differ for each project. The Mass Environmental Trust (MET) funds environmental projects that benefit aquatic ecosystems. MET derives their funds from the sale of license plates. River restoration advocates can also tap into local funding sources through Town Meeting appropriations or the Community Preservation Act (T. Purinton, personal communication, March 13, 2009).

Private funds are used as well. For example, General Electric (GE) heavily impacted the Housatonic River through the course of many years of industrial use. Through the Natural Resource Damage Program, GE set aside restoration money for that river. Riverways is currently working two proposals and one approved project for restoration that

include dam removal on the Housatonic River (T. Purinton, personal communication, March 13, 2009).[2]

Public Education/Outreach

The Riverways website is easily accessible, navigable and available to everyone. The website contains a list of completed dam removal projects, a priority projects list for ongoing dam removal projects, a GIS site of environmental risk for all river and stream barriers throughout the state, past site reconnaissance information, and dam removal resources including fact sheets on permitting small dam removal, funding sources, and conservation issues (Riverways Program, 2009).

The DCR Office of Dam Safety is also easily accessible and navigable. Regulations and dam owner responsibility are clearly stated. Links to the appropriate statutes are provided in addition to links to appropriate forms for registration, inspection, permitting and emergency action plans.

Riverways has developed a comprehensive GIS model of all the dams in the state.[3] This model can be used to look at the potential effects of removing a dam. The model predicts the ecological benefits and community value that will come from a removal or any potential disadvantages. The intent of this model is to use it in conjunction with the Office of Dam Safety's hazard rating system to enable the inclusion of environmental impact when considering dam removal. Dams that are considered low hazard could possibly have detrimental ecological effects. Community value is assessed by looking at the size of the impoundment, the density of housing near the dam, the dam's proximity to the center of town, public access, whether it is near a bathing beach or not, and other similar factors. Rapid assessment is used to pick projects that have technical feasibility and community support. Projects that have cumbersome regulatory and community based issues go through a cost-benefit analysis and are generally avoided until more funding is available (T. Purinton, personal communication, March 13, 2009).

2 Past funding resources can be found at the Riverways Program website's fact sheet: Funding Sources for Small Dam removal. http://www.mass.gov/dfwele/river/programs/riverrestore/riverrestore.htm

3 This was a recommendation of the Aspen Institute's *Dam Removal: A New Option for a New Century* (2002).

3: State Summaries

Riverways does public outreach through public education, presentations, and pamphlets. There is also someone on staff who can explain the science of dam removal to the community. Riverways makes every effort to make sure that dam owners and the community are supportive of the removal; owners themselves have contributed money and energy to the project in the past. Although the management of dam removal projects is a function of local capacity, Riverways will retain project management capacity if no local partner is available (T. Purinton, personal communication, March 13, 2009). The Massachusetts Dam Removal Guide by the Executive Office of Environmental Affairs also offers detailed guidance on dam removal for dam owners in Massachusetts.

The Neponset River Watershed Association (NepRWA) has made a large effort to educate the public about the benefits of dam removal. NepRWA has been working on removing two dams at the mouth of the Neponset for over a decade. NepRWA initially presented river restoration alternatives to different stakeholders multiple times and encouraged members to be part of the removal process. NepRWA secured a grant to fund a facilitator to convene a community advisory committee (CAC) to determine the fate of these two dams. The CAC was a group of 25 people who each represented an interest group or society in the area. They met for a year with a facilitator and finally decided on full removal of one dam and partial removal of the second dam (I. Cooke, personal communication, April, 2, 2009).

Outlook

Riverways Program has ten full-time employees. The general view towards dam removal in the Riverways Program is that dam removal remains a priority, and has been a priority since the establishment of the Riverways Program in 1987. This branch of the Department of Fish and Game was created "to encourage and support local river protection initiatives as a vital compliment to state action" (Riverways Program, 2009). This has allowed them to streamline the process and address and reduce common issues based on experience.

The GIS model makes Massachusetts prioritization system one of the most

proficient and strongly supported by information and science in TNC's Eastern Region. The GIS model helps to evaluate potential dam removal projects in an efficient way. "A first-in-the-nation, this process helps focus scarce public dollars on necessary and environmentally appropriate dam repair and dam removal projects. It will also provide the baseline information necessary for dam owners, municipalities, and grassroots conservation organizations to address dams in their watershed communities" (Riverways Program, 2009).

The Riverways Program is focused on the river and its restoration, with dam removal as one of its main priorities and tools. The GIS model is a unique aspect to this state the every state would benefit from having. This, along with proactive non-profits and watershed groups in the state, has pushed Massachusetts towards being a model of dam removal policies, programs and practices.

3.6 New Hampshire

Summary of Findings

New Hampshire's dam removal efforts have recently been streamlined through The New Hampshire River Restoration Task Force; a group of state, federal, and NGO officials that specifically address dam removals. The task force was established in 2001 and is designed to assist dam owners that have decided on removal. It does not promote dam removal but is provides comprehensive assistance to landowners seeking to dams removed. Dam removal is always optional.

Statistics

State Regulated Dams	840
High Hazard	90
Significant Hazard	193
Low Hazard	557

(Association of State Dam Safety Officials (ASDO), 2006

Regulatory Authority

Dam safety inspection is the primary force driving dam removal in New Hampshire. The Dams, Mills and Flowage Act gives regulatory authority to the New Hampshire Department of Environmental Services (DES) Dam Bureau, addressing dam construction, safety, repair, removal registration and safety inspections. Inspection frequency is determined by hazard class. High hazard dams are inspected annually, significant between 1 and 5 years, and Low hazard dams between 7-10 years. The New Hampshire dam bureau has a comprehensive inventory on the location of dams, insuring that most dams are catalogued and subsequently inspected (D. Loiselle, Personal Communication, March 16, 2009). There are a total of 8 FTEs dedicated to dam safety (ASDSO, 2009) including five full time engineers.

Upon a dam being declared unsafe or hazardous, a deficiency letter is issued to dam owners and the dam inspector will recommend that they remove or repair the dam. Deb Loiselle, coordinator of the New Hampshire Dam Removal and River Restoration Program, states that dam safety engineers will often refer dam owners directly to the New Hampshire River Restoration Program before formal notification is sent (D. Loiselle, Personal Communication, March 16, 2009).

3: State Summaries

Collaboration

The New Hampshire River Restoration Task Force is a collaboration that focuses on dam removals. There is only one dedicated staff member for dam removal. The Task Force meets every other month. Regular topics include discussing potential funding, trust resources, and technical assistance for dam owners negotiating the dam removal process.

The Task Force coordinator has responsibilities that primarily involve dealing with funding (procuring and managing funds for dam removal, coordinating meetings, approving project invoices, and helping dam owners with applications for permits and grants). Even when the dam owner manages the funds, the Task Force provides assistance with all necessary paperwork.

State representation for the task force includes; New Hampshire Fish and Game, NH division of historic resources, and internal programs within the NH DES. Federal Representation consists of fish and wildlife, NOAA, and the Army Corps of Engineers. NGOs that commonly participate in task force meetings are: Trout Unlimited, American Rivers, National Wildlife Foundation, local river advisories, and various reservation commissions. Beyond a core group of participants, task force membership is always project specific (D. Loiselle, personal communication, March 16, 2009). Each dam removal project has unique needs and while many team members have worked with each other on other projects, actual team composition varies by region and project requirements.

Though dam safety is the primary factor that drives dam removal in New Hampshire, fish passage fish and wildlife do have numbers that trigger requirements from FERC licensing (D. Loiselle, personal communication, March 16, 2009). These are less frequently a starting point for dam removal projects. Dam safety engineers are not staff dedicated to New Hampshire's river restoration program. Though they do not spend a significant amount of time on dam removal, they play an important role in referring landowners.

Funding

There is dedicated funding for one full time river restoration task force coordinator

position, and soft money for individual projects. The majority of funding for individual projects comes from non-state sources. If there is a diadromous fish connection, fish and game will assess the site and potentially offer financial assistance for dam removal. NOAA, in partnership with private organizations, and the EPA's 319 fund are both common sources of federal funding. Beyond the annual salary for the task force coordinator, state funding is limited primarily to New Hampshire's Fish and Game Habitat Fund (D. Loiselle, personal communication, March 16, 2009).

Funders will often grant money through the DES, using this agency as a mechanism for receipt and dispersal of funds. This plays a significant role in getting dam removal projects funded past the development phase and into the production phase. State management of non-profit and federal grants play a huge role is successfully procuring funds for dam removal projects.

Currently getting funds from the state is a prohibitively lengthy procedure due to the fact that the governor's executive council creates an extra step of bureaucracy.

> "Organizations that do provide funding like to see that a state agency is managing the money."
>
> -Deb Loiselle, program coordinator, New Hampshire River Restoration Taskforce

Public Education/Outreach

Most dams in New Hampshire are deemed historic, and working with community historic preservation organizations has proven to be an essential component for project success. The New Hampshire River Restoration Task Force shares a memorandum of agreement with the New Hampshire Division of Historic Resources. Projects undergo a "Review & Compliance" in compliance with the American Recovery and Reinvestment Act of 2009, Section 106. The New Hampshire Division of Historic Resources serves on the river restoration task force. They have a long, successful working relationship and

work together by modifying removal (leaving a frame of the dam with no impoundment taking place) and focusing on the natural history of the region (New Hampshire Division of Historical Resources, 2009).

3: State Summaries

The New Hampshire River Restoration Program does public outreach, and the Dam Bureau has an education coordinator. The task force coordinator works closely with the education coordinator. Their offices abut and they both are involved in proactively working with local educational institutions, universities and schools. Often they choose to educate in a debate format. Students will participate in a debate and decide whether or not the dam should be removed or remain. Both organizations also work with in conjunction with Trout Unlimited on doing local community presentations.

Outlook

New Hampshire's unique approach to dam removal, characterized by the River Restoration Task Force, shows a commitment to removals that few states have shown. While not direct advocates of removal, the Task Force's mission to address removals gives both the government and residents a forum to push forward on this issue.

3.7 New Jersey

Summary of Findings

The state of New Jersey has a large number of small dams, most of which have never been formally inspected by the Bureau of Dam Safety. Even with the limited influence of Dam Safety, the majority of dam removals are driven by Dam Safety Orders issued by the Bureau. Although ecologically-minded non-profits and landowners collaborate to design and fund projects, state permitting and technical assistance is not streamlined to assist the removal process. Communication barriers and assumptions about the value of dam removal inhibit, rather than facilitate, conversations between these key actors.

Statistics

State Regulated Dams	1725
High Hazard	215
Significant Hazard	341
Low Hazard	1168

(The Interagency Waterway Infrastructure Improvement Task Force, 2004)

In New Jersey's Dam Safety Standards (New Jersey Administrative Code (NJAC) 7:20, 2008), a barrier is considered a dam if it raises water level more than five feet (3).
At least 17 dams were removed in NJ between 1999 and 2007 (D. Shaffer, personal communication, March 19, 2009).

Regulatory Authority

In 1912, the New Jersey legislature passed laws relating to the construction, repair and inspection of dams. 1981 amendments to the law became known as the Safe Dam Act, and gave the Department of Environmental Protection (DEP) the authority to create the Dam Safety Standards to regulate the construction, repair, alteration, or improvement of a dam in the state (1-8). These standards were last amended on June 16, 2008. These are enforced by the Bureau of Dam Safety within the DEP.

There was a concerted effort to compile a state-wide dam inventory by the US Army Corp of Engineers in the 1970's after some prominent national dam failures. Most of the state's inventory work was done at that time, with very few new dams being constructed and few previously unidentified dams being discovered (D. Shaffer, personal communication, March 19, 2009).

3: State Summaries

The Bureau of Dam Safety requires three types of inspections: regular, formal and informal. Regular inspections must be completed for all dams by a professional engineer retained by the dam owner. These regular inspections are conducted every one to four years depending on the dam's hazard classification and size. Formal inspections are also completed by an engineer retained by the owner, and include a regular inspection plus a review of design/performance considerations. Formal inspections are required only for Class I & II (High and Significant hazard) dams on a 3-10 year interval. Regular and Formal inspection reports are submitted to and reviewed by the state DEP. Informal inspections are conducted by the dam owner. Informal inspection reports do not have to be submitted (D. Shaffer, personal communication, March 19, 2009).

Through the state's inspection regulations, all dams are inspected at least every four years, with higher hazard dams being inspected more frequently and more formally (Dam Safety Standards 23). This may serve as a burden and as a reminder of the liabilities involved with dam ownership.
The Bureau of Dam Safety reviews and approves inspection reports and the accompanying compliance schedule, which include recommendations for repair or removal. Generally the Bureau of Dam Safety issues 20-30 repair permits and two to three removals a year, although after the flooding in 2000 there was a stronger emphasis on enforcing inspection requirements (D. Shaffer, personal communication, March 19, 2009). The Musconetcong Watershed Associated reported that owners frequently come to them with a letter of compliance from the DEP looking to remove their dam rather than repair it (B. Styler Barry, personal communication, March 19, 2009).

The Dam Safety Act also gave the DEP authority to enter upon private property and undertake removal if the owner does not comply with a state order to repair, remove or make safe a Class I or II (High and Significant hazard) dam which is in imminent danger of failure. The Bureau's authority is only for removal, not for repair of a privately owned dam. While this facilitates removal in extreme cases of non-compliance, the state's authority to remove dams does not extend to Class III or IV (Low hazard or small) dams.

3: State Summaries

The Bureau of Dam Safety requires that any permit application to remove or breach a dam include design plans, effects of the breach, how sediment or removed materials will be disposed, notification of all abutters of the permit application, and "a description of the potential effects of the dam removal or breach upon the environment…and upon life and property downstream of the dam" (NJAC 7:20, 2008, p.7). Even if a Class IV (small) dam were not required to go through this dam removal permitting it would be required to receive other permits through DEP such as a wetlands permit, environmental impacts, and endangered species (Dam Safety Standards 16).

Although staff within the DEP felt that permit applications should not deter people from removal projects, the permitting process is very extensive. The DEP, Fish and Wildlife, and Historic Preservation personnel may have an opportunity to review and comment on the removal plans (D. Shaffer, personal communication, March 19, 2009). One organization that had gone through the DEP permitting process noted that different permitting agencies valued dam removals differently. For instance, the wetlands permit application appeared to treat a dam removal project no differently than major construction along the riverbank (B. Styler Barry, personal communication, March 19, 2009).

New Jersey's Bureau of Dam Safety legally requires Class I and II (High and Significant hazard) dams to have an Emergency Action Plan (EAP), and it is the owner's responsibility to review the EAP annually. Along with inspections and permitting, this additional burden on dam owners may encourage them to consider removal as a viable alternative to the costs of dam maintenance and repair.

The Bureau of Dam Safety currently works with nine engineers and one biologist, but that number is half what it had been several years ago. The Bureau's work is focused on dam safety, and so no staff time is specifically committed to dam removal except those projects which come through the permit review process. It is the dam owner or non-profit's responsibility to hire consultants, to the find funding for projects, and to navigate the permitting and removal process (D. Shaffer, personal communication, March 19, 2009).

3: State Summaries

Because dam owners are responsible for everything from hiring engineers to conduct their dam safety inspection, owners who receive a letter of compliance from the Bureau of Dam Safety to repair or remove their dam often approach non-profits, such as the Musconetcong Watershed Association, for assistance. Owners want to not only repair the current liability but remove all future liability as well (B. Styler Barry, personal communication, March 19, 2009).

The DEP also requires notification when dam ownership is transferred, but similar to inspections, it is difficult to enforce the requirement (Dam Safety Standards 7). This requirement is important because it may encourage a new owner to become aware of a liability they are inheriting on their property, or it may encourage the present owner to remove that liability to encourage future property sales. For instance, the state of New Jersey does not purposefully acquire property that has a dam on it. Any owner wishing to sell to the state to preserve land may wish to remove the dam first (B. Styler Barry, personal communication, March 19, 2009).

Collaboration

The Musconetcong Watershed Association has been assisting with several dam removals since 2001. Similar informal relationships between the dam owner and watershed associations can be found in nearly every state. Such partnerships facilitate dam removal, particularly through its ability to guide dam owners and creatively piece together sources of funding. Even a strong relationship between a dam owner and a non-profit will be constrained within the permitting requirements, and thus even a well-supported or funded removal project may occur slowly. If dam removal projects are seen as ecologically destructive action that require mitigation, rather than as acts of mitigation, conversations between different parties may be stalled or abandoned.

Funding

Funding assistance for dam removal is not provided to private landowners through the DEP, although New Jersey provides low interest loans for a variety of dam projects including the demolition of dams. The "Dam, Lake, Stream, Flood Control, Water Resources, and Wastewater Treatment Project

Bond Act of 2003" was passed by the state legislature in response to severe flooding and dam failures in 2000, but only one dam owner has used these loans to remove a dam.

For landowners and non-profits that have collaborated on dam removal projects, money has generally come through the federal government, and program such as NOAA-American Rivers Restoration Grant and USDA's NRCS. The Musconetcong Watershed Association was also able to acquire funding from the Corporate Wetlands Restoration Partnership, as well as private funding from a local sportsman club and a foundation. One very resourceful source of funding was the sale of development rights along an impounded river. Through this method one dam owner was able to raise nearly all the necessary project funding. While an efficient method of fundraising, the sale of development rights allows the possibility of future development along the river, which could jeopardize the ultimate goal of river restoration.

Public Education/Outreach

Since 2002 there has been an educational program to help dam emergency managers be more aware of the importance of Dam Safety and of Emergency Action Plans. There are no such educational programs regarding dam removal, and a lack of awareness about the ecologic benefits of dam removal exists. When other parties such as abutters and historic preservation societies become involved their objections can hold up the process, and may deter some potential projects from even getting to a "project" stage, although once off the ground no dam removal projects have been stopped due to abutter objections (Beth Styler Barry, personal communication, March 19, 2009; Darin Shaffer, personal communication, March 19 2009). The state's Safe Dam Act (2001) also provides long-term abutters the opportunity to petition the DEP Commissioner against the removal of a dam (p.7). Having a strong relationship with historic preservation societies and project neighbors is a key to a smooth and successful dam removal.

3: State Summaries

After severe flooding in 2004, a Task Force was convened to make recommendations and address the insufficient enforcement capabilities of the DEP. The report recommended that dam owners be required to prove their ability to maintain the dam and to purchase liability insurance, neither of which is required in New Jersey (The Interagency Waterway Infrastructure Improvement Task Force, 2004, p.35).

Outlook

In the Bureau of Dam Safety there is the explicit assumption that dam safety's mission is to ensure the safety of dams. The state's regulations are very strict on owner responsibility, including inspecting their own dams, creating an Emergency Action Plan, and working without state guidance on dam removal projects.

3.8 New York

Summary of Findings

New York's Department of Environmental Conservation (DEC) has an organizational framework that could allow for a streamlined dam removal permitting process. The Department also has staff members who consider dam removal to be one of several barrier mitigation options. Within the Department there is an underlying focus on connectivity and ecological integrity as the reason for dam removal, but dam safety appears to be the key component that may encourage a barrier removal, since removal is a more cost-effective, viable option for dam owners that face regulations related to dam repair, operation and maintenance. The state has produced documents and tools to facilitate dam removal, and is currently drafting new dam safety regulations and a guidebook that should increase the interest in removals.

Statistics

State Regulated Dams	5060
High Hazard	386
Significant Hazard	762
Low Hazard	3912

(Association of State Dam Safety Officials (ASDO), 2006)

The actual number of dams in New York varies depending on one's source. The New York Rivers United website states that there are over 6,000 dams in the state, the Clearinghouse for Dam Removal Information reports over 5,000 and the DEC's own dam safety inventory includes roughly 5,500. Although the numbers may vary, the majority are small earthen dams that are privately owned. Since 2000, only 20 dams have been constructed (National Inventory of Dam, 2006). According to the American Rivers, only three dams have been removed since 1999, and agency staff reported that less than five dams have been removed in the past five years (L. King, personal communication, April 9, 2009).

Regulatory Authority

New York's DEC regulates dam safety through Chapter X, Division of Water, Part 673: Dam Safety Regulations as well as Part 608: Use and Protection of Waters. Although New York defines a dam is as "any artificial barrier…constructed for the purpose of impounding water," Dam Safety regulates all dams that are greater than 10 feet in height. State employees have found that the phrase "barrier mitigation" is more value-neutral than "dam removal" (D. Sheppard, personal communication, April 9, 2009).

"Dam safety rules have been proposed and re-proposed, but right now permitting a dam removal is very onerous – lengthy and costly, with lots of engineering requirements that need to be streamlined" (D. Sheppard, personal communication, April 9, 2009). Even with a complex permitting process, the breaching and complete removal of a dam should be more straightforward than a project that would maintain dam structure for fish passage (Personal communication, Alon Dominitz). New draft dam safety regulations would increase the burden of responsibility on dam owners, which should increase dam owners' interest in dam removals (D. Sheppard, personal communication, April 9, 2009).

Although they have not historically been regulated, the new draft Dam Safety regulations may also indirectly regulate culverts and other types of stream crossings as quasi-dam structures. The issue is especially pressing since the New York Department of Transportation (DOT) may be receiving stimulus funding to repair culverts, which would extend their life but could have additional adverse ecological impacts (D. Sheppard, personal communication, April 9, 2009).

There is an understanding among DEC staff that if a dam owner wishes to keep his dam, it must not only meet safe requirements but also "maintain a continuous flow of water below the structure [and] restore or maintain the connectivity of the natural resources in the water" (D. Sheppard, personal communication, April 9, 2009). A dam owner would be required to fulfill dam safety permitting requirements and to comply with state regulations regarding freshwater

or tidal wetlands, fish and wildlife, Historic Preservation Act requirements and State Environmental Quality Review (A Strategy for Removing or Mitigating Dams in New York, 2008, p.12).

Staff in the DEC have work related to dam removal, whether it be water quality, fish and wildlife, permit administration or dam safety, but even the staff who are committed to facilitating dam removal spend very little of their time, five to ten percent, on dam removal (L. King, personal communication, April 9, 2009).

Collaboration

Intra-agency collaboration within DEC occurs between Dam Safety, Nonpoint Source and Water Quality staff in the Division of Water, and staff in the Divisions of Fish & Wildlife and Permits through efforts of the Nonpoint Source Hydrologic and Habitat Modifications (HHM) Workgroup and informal communications.

The HHM Workgroup was formed in 1995 through the New York State Nonpoint Source Management Program. Under DEC Division of Water leadership, the Workgroup consists of experts in stream bank erosion control practices and flood control facilities and represents over 15 federal, state, and local agencies, non-profits (Trout Unlimited, American Rivers, Rivers United, and The Nature Conservancy) and other stakeholders who have an interest in ecological issues in the state. Although this collaboration allows for communication between divisions within the DEC as well as communication between other stakeholders, the physical proximity and work priorities of DEC divisions and stakeholders have not yet led to any comprehensive balancing out of the complexities of the permitting process (L. King, personal communication, April 9, 2009).

In addition, Fish and Wildlife staff at the DEC are involved in discussions with DEC Division of Operations to pilot work on its own dams as they age and are possibly decommissioned (D. Sheppard, personal communication, April 9, 2009).

Currently the DEC's more informal relationships with non-profits such as American Rivers, The Nature Conservancy and New York Rivers United is used to

direct dam owners to them for assistance. Removal projects often arise after a third party such as American Rivers or The Nature Conservancy brings the project to light. "State agency involvement in these…was principally regulatory" (D. Sheppard, personal communication, April 9, 2009).

Funding

Although DEC staff said that there was currently no state-based funding available for dam removal projects, the 2006 Bond Act made funds available for dam safety projects. DEC staff agreed that funding through the Environmental Protection budget would help encourage removal as a viable option for dam owners, but most dam removals have been funded in a piecemeal fashion by grants, barrier mitigation funds, or even by lobbying a State Senator (D. Sheppard, personal communication, April 9, 2009). The state relies on collaboration with non-profits to aid dam owners as they attempt a removal project.

Public Education/Outreach

Public education related to dam removal is done by non-profits such as American Rivers and New York Rivers United, although the HHM Workgroup has taken the initiative to address public education needs. In 2000 money was available to support the work of HHM Workgroup stakeholders, to develop tools, guidance and training related to barrier mitigation. One element of the plan was to develop a screening tool for identifying candidate barriers (dams) for removal. In May 2008, the USFWS also completed the report "A Strategy for Removing or Mitigating Dams in New York State and Lessons Learned in the Upper Susquehanna Watershed" with its companion CD. This report offers tools, funding and other guidance for stream professionals wanting to screen dam sites for potential removal or mitigation. The report also recommends that an office to be created within DEC to provide assistance and offer educational or informal guidance to dam owners (L. King, personal communication, April 9, 2009).

In 2006, the HHM Workgroup staff established the Barrier Mitigation Forum, which met three times. While the Forum recognized that more analysis was needed to streamline dam removal permitting, the first need was to develop a dam owner

applicant's guide for dam removal. A small subset of the Forum was challenged with preparing a 'working' applicant's guide that would be updated as experience was gained in permitting dam removal projects in New York. The draft guide "Barrier Mitigation Guidance for Project Applicants and Dam Owners" focuses on dam removal in particular (L. King, personal communication, April 9, 2009).

Outlook

The DEC prefers the phrase barrier mitigation to dam removal, because dams are just one of many types of barriers, just as removal is just one of several options that can meet the dual goal of maintaining dam safety while providing the best ecological habitat. Still, improving the ease and efficiency of dam removal permitting is a priority among DEC staff. Projects and work such as the guidebook for dam removal permitting is limited to the amount of professional staff time available. The stakeholders of HHM Workgroup still meet semi-annually to discuss needs and network and exchange information to continue progress. While progress has been slow (limited funding has been released over last few years), there is a commitment by stakeholders to work toward streamlining and facilitating dam removals (L. King, personal communication, April 9, 2009).

3.9 Ohio

Summary of Findings

Ohio's dam removal efforts are generally characterized by a strong scientific approach. While the legal framework is not particularly conducive towards removals, people within the organizations have found mechanisms to make removals work. Landowner interest in removing dams, or lack thereof, seems to be the biggest limitation toward Ohio starting to take more dams out.

Statistics

State Regulated Dams	1698
High Hazard	442
Significant Hazard	564
Low Hazard	692

(Association of State Dam Safety Officials (ASDO), 2006)

According to American Rivers (2007) 6 dams were removed in Ohio between 1999-2007.

Regulatory Authority

In Ohio, dam safety is regulated by the Ohio Department of Natural Resources (DNR) Division of Water §1501:21. Ohio uses numbers 1, 2, and 3 to represent high, significant, and low hazard dams respectively. All dams less than 25 feet tall and/or that impound less than 50 acre-feet of water are considered "Class 4" dams and are not subject to the permitting requirements and fees of dam construction. The removal and repair process are not subject to construction permitting fees. Removal is not favored legally to repair nor does the DNR knock on doors demanding that people remove their dam (R. Gable, personal communication, March 18, 2009).

For dams that are class 1, 2 and 3, the DNR runs inspections and requires upkeep of the dams. Inspections are run every five years. The DNR has the authority to order the removal of unsafe dams at owner's expense if a non-compliant owner fails to properly repair a dam. In the case of the St. Johns River dam, non-compliance with these safety requirements is what spurred the removal.

Restoration efforts based on science based Federal environmental law have been a catalyst for several removal projects in Ohio. Ohio EPA has used Total Maximum Daily Load (TMDL) requirements from the Clean

Water Act as justification for removing dams. Low dissolved oxygen levels have been the targeted for remediation by dam removal. Removing dams increases flow and prohibits the growth of microorganisms that consume large amounts of oxygen. Several removals have used this approach to raise funding. There are no specific provisions that require or suggest this mechanism towards TMDL attainment. Dam removal is merely a solution raised to meet attainment requirements. (A. Sasson, personal communication, March 7, 2009).

Collaboration

There are no staff members who are specifically assigned to dam removal, but the OEPA and the DNR Dam Safety Division, The DNR's Scenic Rivers Program, and the Division of Wildlife all have people involved that incorporate removals into their river restoration efforts. OEPA generally takes the lead on the scientific end whereas DNR, particularly the Scenic Rivers Program, acts as project manager though these roles are not set in stone. These agencies collaborate to seek relevant funding (R. Gable, personal communication, March 18, 2009).

Non-profits are not a large source for funding assistance in Ohio, though a few of the universities collaborate on projects at the local level, particularly on research. TNC, for example, has let the agencies take the lead in Ohio because their funding and support is concurrent with demand for removals.

Funding

If the state has to pursue a landowner over an unsafe, high hazard dam then it is up to the landowner to fund the project. There is no set procedure for funding dam removals. DNR is aware of several funding mechanisms out there and will help landowners go after available funds on a project-by-project basis (R. Gable, personal communication, March 18, 2009).

Ohio has accessed a number of different sources of state funding for projects. None of these sources are specifically allocated for dam removal, but can often be siphoned towards removal projects. The Scenic Rivers program has a license plate fund that has funded at least one project (R. Gable, personal communication, March 18, 2009).

Clean Water Act section 319 grants have, in a typical year, allocated $1million towards dam removal projects. While this source is not authorized, the amount OEPA has been able to grant towards removals has been fairly stable (R. Gibson, personal communication, March 20, 2009).

Project mitigation has been another funding source. ODOT projects as well as projects specifically impacting "scenic rivers" have both been funding sources. In Ohio, any project within 1,000 feet of a "scenic river" must be approved by DNR and sometimes mitigation is required.

Lastly, there are smaller pots of money that the Division of Wildlife goes after. Sale of fishing tackle and other tax monies have been utilized in the past. The agencies are also aware of Federal funding sources such as NOAA. (R. Gable, personal communication, March 18, 2009)

Public Education/Outreach

Ohio has not taken a concerted effort to court landowners towards removing their dams. Outreach from Dam Safety has been more focused on paddler safety in areas where there are dams. In general, there is a fair amount of concern within the agencies about citizen receptivity towards dam removal as well as local historic groups. Projects that are initiated by landowners or ones that would pose a significant risk if no action is taken seem to be the method of warming the public towards removal efforts. When a friendly removal happens, the agencies make sure to publicize hearings and generate local press (R. Gable, personal communication, March 18, 2009).

Ohio's heavily science based approach to dam removal is one of Ohio's strengths but may also limit its capacity to advocate for removals with full authority. There is significant debate, for example, that dam removals along Lake Erie would allow invasive species such as zebra mussels and sea lamprey to migrate upstream along with native species.

Outlook

The attitude in Ohio is generally that removals are a positive but with a number of cautions (as well as go-aheads) regarding situation specific criteria as in the sea lamprey example

above. Ohio's approach has bred consistency in removals and funding but the state has yet to harness enthusiasm for removals both within the governing branches and from the public at large.

3.10 Pennsylvania

Summary of Findings

Pennsylvania has done the most work on dam removals of any of the eastern region states. Their dual commitment through fish passage and dam safety mission and goals has provided a strong base to continue to take out a large number of dams. Pennsylvania had strong showings in each of the evaluation criteria and their galvanizing of landowner involvement has been an anomaly in TNC's Eastern Region states.

Statistics

State Regulated Dams	3177
High Hazard	789
Significant Hazard	268
Low Hazard	2120

(Association of State Dam Safety Officials (ASDO), 2006)

According to American Rivers (2007), 79 dams were removed in Pennsylvania between 1999-2007.

Regulatory Authority

The major regulatory force behind Pennsylvania's dam removal efforts comes from its massive Dam Safety Division. Dam safety is regulated under chapter 25, section105 in the PA State Code and is enforced by the Department of Environmental Protection (DEP). Over 3,200 public and private dams are regulated under DEP jurisdiction. Essentially, any structure over 3 feet is regulated, which is distinctive amongst the states.

Much of the strength of Pennsylvania's removal efforts is a result of the unique way in which removal is encouraged through the dam safety statutory framework. First, the inspection process is comparatively time consuming and expensive for dam owners. Dam owners have to submit quarterly reports on their dams and are responsible for all repairs. With a large number of staff in the Dam Safety Division, Pennsylvania is well equipped to diligently keep up with landowners and inform them of their legal responsibility to keep their dams safe.

The PA dam safety regulations were designed to favor removal over repair. The removal process is streamlined through the DEP Dam Safety Division. In addition, Pa. Code § 105.12 (a) gives the DEP broad deference

to determine the majority of the removal projects exempt from permits and fees associated with construction and repair. There is thus a presumption within the law that the removal will be beneficial.

Pennsylvania also has fish passage laws (Title 30, Chapter 35 Section 01), giving the state authority to order dam owners to provide and maintain fishways. These laws do not specify removal as an option, but citations from these laws can lead to removal.

Collaboration

The DEP Dam Safety Division and The PA Fish and Boat Commission are the two main agencies involved with removals in Pennsylvania. Legal requirements overseen by both departments can trigger removals and they view collaboration as important for meeting these dual goals. The roles between these two agencies seem well defined with Dam Safety managing landowner relations and regulatory issues and Fish and Boat and other DEP Divisions providing administrative and technical support as well as arranging funding sources. Permits are streamlined through Dam Safety (V. Humenay, personal communication, February 26, 2009). A Dam Safety position dedicated solely to dam removal was the only one of its kind among TNC's Eastern Region states.

The Dam Safety Division does not actively go out looking for projects but advises and designs projects that come to them. Fish and Boat can specifically seek out projects if they choose, but the final decision is still the landowner's. Previously, there had been another analogous position at PA Fish and Wildlife that has remained vacant since the person in that position moved on. The budget crunch has slowed new hires substantially, but Fish and Wildlife is a close partner as well. In better financial times, this is a position that could come back (V. Humenay, personal communication, February 26, 2009).

American Rivers and The Nature Conservancy are major non-profits that have been involved both with funding and project management and outreach.

Many states cite a tension between historic preservation groups and dam removal efforts. In Pennsylvania, the Dam Safety Program worked to cultivate a relationship with the Historical Museum Commission. A meeting between the two parties where each outlined their goals and concerns smoothed over any skepticism that previously pervaded between the two parties. In situations where the dams do have historic value but are not registered as such, part of the project can include leaving the dam abutments and putting up educational signs to commemorate the site (V. Humenay, personal communication, February 26, 2009).

Funding

Funding varies from project to project but Pennsylvania has drawn on a wide variety of sources to bring in funds. Since PA was the first state to embark on a major dam removal effort they were able to attract a lot of the funding sources early on (V. Humenay, personal communication, February 26, 2009). State funds and large grants from NGOs, particularly American Rivers, are siphoned through the Growing Greener fund, a state fund for environmental projects. If a project can be identified that would protect a target species, funding can be available from other non-profits such as Fish America, the National Wildlife Federation, and the Chesapeake Bay Foundation. Pennsylvania also issues grants with state money. Lastly, sometimes funding for projects is made available from mitigation for impacts from PA Department of Transportation projects.

Private landowners are a major focus of the funding effort, which is another anomaly of the Pennsylvania program. Though other states do this, Pennsylvania has been particularly prolific at getting smaller dams funded for removal.

Public Education/Outreach

The Dam Safety Program has actively sought out angler groups to help promote the benefits of dam removal. The state conducts ecological monitoring studies post removal to evaluate the removal's impact upon the environment, with 100% showing that the removal benefited the environment (V. Humenay, personal communication, February 26, 2009). Clear examples where dams were removed and (stream favoring) fish stocks

have improved have created a positive climate about dam removal amongst a sizable fishing community.

Education also happens at the removal site. For many removals American Rivers and TNC have brought in scout groups and other citizen groups to clean up and do plantings after a removal. This provides an educational opportunity as well.

Lastly, the program had a stroke of luck, in a sense, in performing a high profile removal of an 85 ft dam in Adams County that had sprung a leak and threatened a substantial community downstream. This removal prevented an event that could have essentially wiped out an entire town downstream and thus brought a good deal of good publicity to Pennsylvania's dam removal efforts and earned the Dam Safety program a blue medal (V. Humenay, personal communication, February 26, 2009).

Outlook

With staffing and legislation devoted to removals, Pennsylvania has made dam removal a priority. It shows, both in terms of the amount of removals the state has been able to do and landowner response. Having people committed solely to dam removal makes working with private landowners, pursuing a broad range of funding, developing laws amiable towards removal, coordinating engineering and research for projects, and developing relationships between agencies and with the public possible for dam removal efforts. It is hard to imagine similar efforts taking place in a state where the people working on removal have their attention divided between any number of other priorities.

These efforts accumulated over time have created a generally accepting to proactive view of removals. At the current moment, the state has 130 "wait list" projects waiting for funding to become available.

Pennsylvania is also unique in that its removals tend to be less costly than in other states, both as a result of the waiver process its less extensive and focused approach to researching before and after removal. The DEP makes an individual sediment management plan for each removal. However, sediment studies and other hydraulic studies have generally not

been as integral to Pennsylvania's removal process as for other states, the stated reason being that with more removals having been done in Pennsylvania they have been able to note trends about what does and does not create adverse impacts. The DEP generally avoids releasing large amounts of sediment during spawning runs, for example.

3.11 Rhode Island

Summary of Findings

Non-profits or watershed associations largely drive Dam removal in Rhode Island. The regulatory authority related to dam removal is currently based in dam safety; dams are not removed based on fish passage or other ecological reasons. Non-profit and state government advocates are working to establish policies that address social, cultural, environmental issues specific to dam removal projects.

Statistics

State Regulated Dams	671
High Hazard	17
Significant Hazard	41
Low Hazard	613

(Association of State Dam Safety Officials (ASDO), 2006)

Rhode Island has recently removed one dam. There are currently two partial removal and three total removal projects in progress (Save the Bay, 2008).

Regulatory Authority

The Department of Environmental Management (DEM) Dam Safety Program regulates dam removal and dam safety in Rhode Island. The rules and regulations they implement are under the provisions of Chapter 46-19, "Inspection of Dams and Reservoirs" of Rhode Island General Laws of 1956, as amended. Rhode Island has three classifications of dam hazard potential. A low hazard dam has a low possibility of loss of life and economic loss. A significant hazard dam is a low possibility of loss of life and high economic loss. A high hazard dam is classified as probable loss of life (State of Rhode Island and Providence Plantations Department of Environmental Management, Office of Compliance and Inspection, Rule 6).

According to these rules and regulations, owners of high hazard and significant hazard dams are responsible for keeping their dams in safe condition. Inspections are expected every two years for a high hazard dam and every five years for a significant hazard dam. In reality, there is only one dam inspector for all of the dams in the state, and very few dams are actually inspected when they are supposed to be. Many dams are without legal ownership, which places the burden

of inspection and the damage from a dam's failure on local communities and the state (Save the Bay, 2008).

In the regulations related to permitting dam removal is treated the same as construction and substantial alteration. Repairs to a dam must be in accordance with wetlands regulations, which largely favor the status quo as opposed to dam removal (R. Calabro, personal communication, March 26, 2009). Dam removal regulations in Rhode Island are not separated from other processes, making permitting a removal slow and complicated.

A dam owner must apply to the Dam Safety Program for a permit to remove a dam. The Director requires the applicant to provide written notice of the planned repair to abutters of the dam and to the municipality in which the dam is located. Any property owner with frontage on the reservoir or river is considered an abutter. This broad definition of an abutter and the requirement to have multiple abutters' approval of any application slows and complicates the process (C. Fox, personal communication, March 26, 2009).

Collaboration

The rules and regulations for dam safety mention that in order to maintain a safe dam infrastructure, a collaborative effort is required by state and municipal officials, private dam owners and elected officials (Rule 3). This is very accurate: for every dam project there are many different stakeholders and the stakeholders vary between projects. Non-profits are a very important factor in facilitating conversations between these parties towards dam removal in Rhode Island. Save The Bay, American Rivers, The Nature Conservancy, the Narragansett Bay Estuary Program, local watershed groups and land trusts informally collaborate on river restoration efforts throughout the state.

The Wood Pawcatuck Watershed Association (WPWA) is making headway toward dam removal in Rhode Island. Currently the WPWA has two dam removals planned for the near future. This project involves collaborating with state agencies, local businesses, dam owners, and abutters. The WPWA was the driving force in facilitating this organization (C. Fox, personal communication, March 26, 2009).

Funding

According to section 45-62-3 of the Rhode Island Statutes, the council of any city or town is empowered to establish one or more dam management districts within the city or town. The dam management district has the power to enter private property for periodic inspection, maintenance and/or repair of dams. They also have the power to provide supervision and apply for dam removal. Under this statute, dam management districts also have the power to apply for, contract for, receive, and expend grant and loans for the maintenance, repair, removal and/or reconstruction of dams. This was added in 2005. There are currently two established dam management districts in Rhode Island. However, it was not clear how the state is approaching this tool in order to facilitate dam removals.

There are a few funding opportunities through the DEM. The DEM just passed a water quality and open space protection grant. This grant includes money that can be used for fish passage or dam removal (P. Edwards, personal communication, March 10, 2009). Some of this funding is going towards a partial dam removal on the Pawtuxet River (Department of Environmental Management (DEP), 2009). Most funding requires match funding from non-profits or other government sources (C. Fox, personal communication, March 26, 2009).

Funding for restoration in Rhode Island has also come from NOAA, NRCS, RI Coastal Resources Management Council (CRMC), US Fish and Wildlife, and the US Army Corps of Engineers. Funding pays for staff time and for parts of some projects. Any contribution is usually added together into a much larger pot of funding for a project (R. Calabro, personal communication, March 26, 2009).

NRCS's Wildlife Habitat Incentives Program (WHIP) provides a funding opportunity for individuals who want to develop and improve wildlife habitat primarily on private land. This funding source could go towards dam removal from a fish passage and restoration perspective. In general, NRCS helps develop a resource management plan for landowners, which would include funding sources (A. Lipsky, personal communication, March 13, 2009).

3: State Summaries

The WPWA is currently working on a dam removal project that has funding from a variety of sources. American Rivers funded most of the feasibility study for the project, altogether there were eight contributors. Multiple funding sources increased the staff time required to manage the project and its funding allocation. The WPWA offers staff time to oversee the project as an in kind donation. The American Recovery and Reinvestment Act of 2009 (also known as the stimulus package) is a new source of funding that the WPWA is currently applying for to put towards this project. In kind donation and match funding are not necessary, since there would be only one source to report and manage. This simplifies project management and saves staff time.

Public Education/Outreach

Save The Bay's mission is to foster a connection between the people and the bay. Community organizers share information about restoration projects with watershed groups and citizen groups to encourage funding. The DEM Department of Fish and Wildlife attend public events and presents at public meetings when a fish passage or dam removal issue is present in a town. The WPWA has collaborated with local businesses on their current dam removal projects. They have successfully used this as an opportunity to point out the benefits of removing the dam to the local community and business owners.

Outlook

Dam removal in Rhode Island is part of different state agencies and nonprofits, but is not the main focus of any one program or position. The DEM Division of Fish and Wildlife focuses on the connectivity of the river for all fish species. Occasionally this may involve dam removal, but dam removal is not always deemed the best option depending on the target species in that river (P. Edwards, personal communication, March 10, 2009).

Rhode Island Best Practices:

Rhode Island's non-profits and watershed associations are the strongest component to dam removal in the state. Their collaborative efforts and advocacy are working to make dam removal a priority.

3: State Summaries

Save The Bay's first priority is restoration and the WPWA is focused on protecting the watershed, including the cultural and historical aspects of the river. Save The Bay and the WPWA would like to have full dam removal as a priority, but it is only one of many options they consider when approaching a project.

Full dam removal is the first choice toward restoring the river to its original condition, but they do not automatically go for removal. Thus far, the outlook of the non-profit staff members has been the impetus for dam removal in Rhode Island.

3.12 Vermont

Summary of Findings

Vermont currently has a dedicated dam removal program, the Department of Dam Safety and Hydrology in Vermont's Department of Environmental Conservation (DEC) handles dam removals. Fish passage proves to be a significant mechanism for procuring funding for dam removals in Vermont as well.

Statistics

State Regulated Dams	568
High Hazard	57
Significant Hazard	137
Low Hazard	364

(Association of State Dam Safety Officials (ASDO), 2006)

According to American Rivers 6 dams have been removed between 1999 and 2007 (American Rivers, 2007).

Regulatory Authority

Dams in the state of Vermont are regulated by the state under Title Ten: Conservation and Development, Chapter 43, Sections 1080 – 1106. Though only 568 dams are regulated, it is estimated that there may actually be closer to 1500 dams in the state (B. Fitzgerald, personal communication, April 2, 2009). Many very old dams were quite small and may not be on record, also some newer dams fall below the regulatory threshold (500,000 cubic sq ft of impounded water) and did not require a permit for construction.

There are circumstances where a dam may be forcibly removed if declared unsafe. However, for the most part dam removals are cooperative projects with dam owners. Action taken due to dams being unsafe may or may not mean removing them completely. There are also cases where a dam has been removed through an enforcement action due to sediment release from a dam.

High hazard dams do undergo regular annual inspection, significant hazard dams are inspected every 3-5 years and low hazard dams are not on an inspection schedule due to resource restraints. Land owners can refuse to let dam safety inspectors on their property, then requiring the state to get a court order, though to date this has not been necessary.

3: State Summaries

It is possible that nearly 300 unpermitted and small dams are not subject to inception and thus not targeted for dam removal. Knowledge of these dams comes about in a variety of ways, in recent years the most frequent way they've heard about new dams is in the development of basin plans, watershed plans, developed by their agency in cooperation with local watershed groups and other interested citizens in the watershed. The people involved in these projects really know their local watersheds and know where the dams are, so dams turn up during these processes (B. Fitzgerald, personal communication, April 2, 2009)

Bridges and culverts fall under the jurisdiction of the Vermont Department of Transportation. However, since the program is geared towards river and habitat restoration often the DEC ends up in contact with the Department of Fish and Wildlife when culverts become a direct threat to protected wildlife and need to be removed or replaced. Under such circumstances, staff that normally handles dam removal can become directly involved with culvert removal.

Collaboration

The number of staff working on dam removals in Vermont amounts to less than one full time employee (B. Fitzgerald, personal communication, April 2, 2009). Without dedicated staff, dam removal projects rely on expertise from other parts of the agency.

The primary responsibilities of the staff that deal with dam removal are identifying projects and funding sources for dam removal, working with land owners on initial work, and the permitting process, contracting the work for removal itself, and then follow-up monitoring. Though limited in staff, Vermont DEC representatives see all dam removal projects through from start to finish.

Funding

Most dam owners are generally open to dam removal. Financial assistance is available and the DEC makes a point of educating land owners of the hazards and liabilities associated with having a dam on the property that is in disrepair. Currently funding is generally raised project by project, frequently using monies from the US Fish

and Wildlife grants. Generally these funds go directly to the costs of physical removal whenever possible (B. Fitzgerald, personal communication, April 2, 2009). More staff could ensure that the public is aware of dam removal as an option and further assist them in procuring funds to make it more attractive.

Public Education/Outreach

There are strong advocates for hydroelectric power in the state, and a public perception that it is possible to attach a turbine and create clean energy. In this respect lack of public education on the topic of dams has become an issue. A couple of dam removals had have been stalled because the community thinks they can develop these dams for hydroelectric power, and they petition to stop removal plans. Public outcry about preserving dams for historic reasons has also caused projects to come to a halt. This is not the case for legal reasons, but because of public outcry and political pressure at a town level (B. Fitzgerald, personal communication, April 2, 2009).

Outlook

Currently staff time is part of the regular DEC budget. More funding, enough for dedicated staff would help make dam removal a priority.

Dam safety to date has been relatively proactive in citing removal as an option and removals have stemmed from this pursuit. Wetland and other environmental permitting have proven to inhibit dam removal more than facilitate it, heavily favoring the status quo and making change difficult. Dam Safety found some ways to work around some of these things, but they still a problem (B. Fitzgerald, personal communication, April 2, 2009).

3.13 Virginia

Summary of Findings

Virginia's fish passage initiatives were some of the strongest in the Eastern Region states and have led to a number of successful removal projects. This progress is in contrast to the dam safety office, which seems to have a cursory interest in removals. This is consistent with the regulatory framework, which has fish passage laws alongside dam safety laws that are somewhat disinterested in removal.

Statistics

State Regulated Dams	1604
High Hazard	146
Significant Hazard	304
Low Hazard	1154

(Association of State Dam Safety Officials (ASDO), 2006)

According to Virginia's Fish Passage website, Virginia has removed or partially breached 7 dams since 1999.

Regulatory Authority

Dam safety is regulated in Virginia under Title 10.1 Chapter 6 of the state code. Structures are regulated if they are 25 feet or greater in height and impound 15 or more acre-feet of water or if they are 6 feet or greater in height and impound 50 or more acre-feet of water, excluding exemptions. Removal is not a stated aim of the dam safety program nor is there any legal mechanism that specifically favors removal or repair. Virginia requires routine inspections by owner at intervals based upon hazard class. The state maintains the authority to inspect dams at its choosing, as well.

Virginia has a statute in place to promote fish passage in place to enforce fish passage over any obstruction that is less than twenty feet in height except in exempted regions (Title 29.1 Chapter 5 Section 32). This jurisdiction extends beyond dams to any barrier to fish migration, including bridges and culverts. Obstructions to fish passage are deemed a nuisance and owners can be fined for failure to comply.

Collaboration

Permitting for removals is done through dam safety with the Department of Conservation and Recreation (DCR). However, DCR

does not seem to invest itself in removals beyond that. The Department of Game and Inland Fisheries has taken the lead as project manager of removals. The fish passage coordinator position within that department plays a significant part in these projects. From the applicant's perspective, all the permitting is through DCR and they send appropriate permitting out to other relevant agencies. The US Army Corps of Engineers has done the work for the removals thus far and typically has the people available to satisfy the historic preservation requirements (A. Weaver, personal communication, March 19, 2009). Non-profits, such as the Oak Hill Fund, have assisted in funding and coordination efforts and US Fish and Wildlife has also helped secure funding for a few projects.

For any removal the Department of Historic Preservation is involved. If the dam is of historic significance, a phase 1 analysis must be done which involves bringing in a consulting firm to assess the site for archaeological value. After phase 1, a historic mitigation plan needs to be developed. It's a streamlined process and the relationships are strong between the agencies. However, this process involves a lot of time and expense (J. Halbert, personal communication, March 19, 2009).

Funding

Virginia has a revolving loan fund in place that has supplemented dam removal projects with both grants and loans in the past. These funds are non-reverting. To date, this fund has been used primarily as leverage to seek additional Federal aid for the removal of municipally owned dams. It could be used similarly to either match payments by private landowners or pursue federal funds, but to date it has not been utilized in that way. If landowners started to seek out state aid in dam removal (or vice versa) the mechanism of state support would be there (A. Weaver, personal communication, March 19, 2009).

A few non-profits have aided as well. The Oak Hill Fund has been a key non-profit funding source and has collaborated in a few of Virginia's removal projects (J. Halbert, personal communication, March 19, 2009). The Chesapeake Bay Program had been a federal source of funding but recently a cut funding has put pressure on the state

to fund positions and projects formerly supported by that fund (A. Weaver, personal communication, March 19, 2009).

Public Education/Outreach

There has not been a concerted outreach plan towards dam removal in particular. If a dam has been removed that is of historic significance then signs and information about the dam and project are a requirement (J. Halbert, personal communication, March 19, 2009).

The state website also has a summary of fish passage efforts along with past removals and major fish passage projects

Outlook

With an active fish passage coordinator position and laws requiring fish passage, Virginia has been able to take on a number of projects triggered by environmental concerns. To date, dam safety concerns have not been a significant trigger towards removal.

3.14 West Virginia

Summary of Findings

West Virginia has the foundation for developing a few of the best practices for the evaluation criteria. The Dam Safety Division seems open to working on removal projects should they start to surface. Both interagency partnerships and a regulatory system more favorable towards removals would be necessary first steps to galvanize removal efforts.

Statistics

State Regulated Dams	341
High Hazard	245
Significant Hazard	78
Low Hazard	18

(Association of State Dam Safety Officials (ASDO), 2006)

According to American Rivers (2007), Virginia has not removed any dams since 1999.

Regulatory Authority

Dam Safety is regulated through WV 47 CSR 34 under the umbrella of the WVDEP. West Virginia regulates dams using the Federal guidelines for size and impoundment classifications. Dams less than 40 feet high or containing less than 400 acre feet of water can apply for "negligible hazard" status and, if approved, are considered unregulated. The state has jurisdiction to regulate any other dam if its threat to life and property is high. Any other impediment, including bridges and culverts, is not regulated unless water passage becomes backed up. This is a low bar for regulation. Removal of dams is not a stated priority within Dam Safety and removal of a regulated dam requires a separate application process as well as the construction permitting.

State inspections are not run at any set interval. However, the state maintains authority to do so at any time. Dam owners are required to have their dams inspected by engineers at various intervals, annually for high hazard dams and less frequently for other classes. Owners are also required to inspect their dams monthly, though these inspections do not appear to require more than a visual assessment.

Fish passage is not a stated goal of the statute nor does it seem to be a priority of the Department. However in the upcoming revision of 47 CSR34 there is some mention of fish passage. It will be considered as

part of a greater rehabilitation effort, but will not be a factor on a project-by-project basis (B. Long, personal communication, March 18, 2009).

Collaboration

All permitting for dams is handled by the Department of Environmental Protection Dam Safety Program. Removal would be no different. The Army Corps may get involved if wetlands issues arise but otherwise they would not. If the streambed is state owned under the Public Land Corporation then a permit from the Department of Natural Resources would be necessary as well. Environmental non-profits and historic preservation groups would likely have a say but none have yet become involved in this issue (B. Long, personal communication, March 18, 2009).

Funding

At this time, the owner is not state supported with a removal project, though the DEP advises the owner that over the long run, removal is the cheaper option to repair (B. Long, personal communication, March 18, 2009).

West Virginia has a revolving loan fund on the books as part of 47 CSR 34. However, the process for receiving those funds is not clarified and the fund to date has been inaccessible. This glitch is currently being revised to provide a procedure for receipt of this money (B. Long, personal communication, March 18, 2009).

Public Education/Outreach

The state website has information about the dam safety program but little geared towards removal or stream restoration.

Outlook

The Dam Safety Program was receptive to dam removal as the cheaper term option, but did not make removals a significant part of the mission (B. Long, personal communication, March 18, 2009). Without a collaborating agency, the major push toward a removal would have to come from landowners. Dam removal is not a stated aim of the Dam Safety Section but it is one of the tools that can be used and will be discussed if a dam needs service.

3.15 Wisconsin

Summary of Findings

The major impetus for dam removal in Wisconsin is dam safety, with cost often the deciding factor. While the Department of Natural Resources Bureau of Dam Safety's strengths include its strong regulator authority, straightforward permitting, and collaborative relationship with non-profits, it also struggles to maintain its innovative state grants for dam removal. Dam removals are still "moments of opportunity" that are frequently facilitated by non-profit organizations that collaborate with the state. To facilitate dam removals the River Alliance of Wisconsin has created a GIS data viewer and conducted research on the science and economics of dam removal. Both state officials and non-profits recognize dam removal as a river remediation tool.

Statistics

State Regulated Dams	3749
High Hazard	211
Significant Hazard	188
Low Hazard	3350

(Association of State Dam Safety Officials (ASDO), 2006)

Regulatory Authority

The Wisconsin Department of Natural Resources (DNR) has a large amount of authority regarding dams, including the right to permit dam construction, repairs, reconstruction, ownership transfers, water levels, and abandonment. Beyond this permitting authority, the state also is able to ensure the safety of, inspect, construct, alter, repair and remove dams. All of the DNR's authority comes from Chapter 30 (Navigable Waters, Harbors and Navigation) and Chapter 31 (Regulation of Dams and Bridges Affecting Navigable Waters) of the state statutes. The Department's ability to permit the abandonment and removal of dams, along with a dedicated state funding source for removal projects, greatly facilitates dam removals.

Overall, the state has a very straightforward permitting system. The River Alliance of Wisconsin, a local non-profit, felt that the permitting was very streamlined in some respects, including the Army Corps of Engineers permit. The permitting process is also unique because it treats dam removal differently from other river construction or

restoration. The River Alliance credits the DNR staff with this efficiency, because they took the risk to make the permitting part of the process facilitate river restoration. Still, there are also those in disagreement that thinks the permitting process is longer than it needs to be (H. Sarakinos, personal communication, April 7, 2009).

Wisconsin has designed permitting to allow for many otherwise structurally unsound or neglected dams to be strategically abandoned and removed by their owner. The state also has the right to remove an abandoned dam (of unknown owner) (Chapter 31.187(1)). The Department's right to remove or repair abandoned dams[4] is an extremely powerful tool. If the state discovers an abandoned dam, then at the state's discretion it may remove or repair that dam. Since preliminary/feasibility studies often show that removal costs up to a third of repair, it is financially logical for the state to remove the dam.

For all dam removals in the state, whether by an individual, organization, or state agency, the owner must address wetland impacts through an environmental assessment or impact statement (Chapter NR 150). The DNR's assessment must address the requirements set forth in Water Quality Standards for Wetlands, NR 103, which defines "mitigation projects," "practicable alternatives," and which requires the DNR to analyze "alternatives to minimize impacts to wetlands as a result of the abandonment."

As with all states with dam safety division, dams in Wisconsin are classified as high, significant, and low hazard structures. DNR staff are charged with inspecting large dams every 10 years, and is exempt from inspecting federally regulated dams. Although smaller dams are not inspected regularly, they can be inspected by DNR staff upon complaint or at the discretion of DNR staff. Since there are roughly 1,200 dams that qualify for the national inventory, the additional 2,500 smaller dams would overwhelm the limited Dam Safety staff. While this means that most dams in the state are not subject to regular inspection, they are still regulated through

4 There is an important distinction between a dam with an unknown owner, rather than a dam which has been permitted for abandonment and is therefore "abandoned" and removed through the legal process.

other DNR permitting channels, including wetlands and environmental impacts (M. Galloway, personal communication, February 26, 2009).

If the Department finds that a dam is unsafe during an inspection, meaning that it is "dangerous to life or property," the state can order the owner of the dam to meet certain requirements to bring the dam up to meet safety requirements, within a specified time frame (Chapter 31.19 (5)). Although the department's requirements do not specifically order removal or repair, the Department sees its role as facilitator, bring in experts and local non-profits to ensure that dam owners are able to fully understand and weigh the costs and benefits of both repair and removal. The Department generally lets the facts, such as typically lower costs of removal, and success stories of past dam removals, speak for themselves. The Department allows the dam owner to make the final decision about his dam. If a dam owner fails to take any action, the Department may take more aggressive legal action by serving an administrative order, outlining exact actions that the dam owner must take, within a certain timeframe (M. Galloway, personal communication, February 26, 2009).

The Department's Waterways & Wetlands, not Dam Safety Bureau, is directly involved with the permitting of culverts and bridges. While there are specific DNR reviews associated with the state's Department of Transportation highway projects, Dam Safety is not responsible for reviewing them. At this time there is no formal collaborative arrangement between the Dam Safety and the Department of Transportation, although it seems that other Bureaus in the DNR do have an influence on future DOT highway planning activities, such as Chapter NR 320, which specifically identifies ecological impacts such as on fish migration that must be consider when permitting a culvert or bridge.

The owner of a dam in Wisconsin is liable for injury caused by the dam, and for any damage or injury caused by its failure (Chapter 31.26). A major strength of the Bureau of Dam Safety is the requirement that an owner show proof of his ability to operate and maintain a

dam on his property "for a reasonable period of time not less than 10 years" (Chapter 31.14 (2a)). This regulation forces prospective dam owners to become aware of any dam on the property at the time of sale, and to fully consider their responsibility and options regarding the dam.

At the time of dam removal, the owner is responsible for hiring an engineering consultant for the project, although there are instances when the DNR will become more directly involved with a removal project if it has been overcome the resolution of the owner and remove a dam that has been consistently failing over several years (M. Galloway, personal communication, February 26, 2009).

At the time of this report the DNR's Dam Safety Bureau included two staff people working in collaboration with many engineers and biologists in the field. Overall, roughly 6 FTE's are involved with dam safety, but little time is spent on dam removals.

The River Alliance is involved with roughly half of the state's dam removal projects that occur each year. The River Alliance has one full-time staff member committed to river restoration work, but dam removal projects are not the only responsibilities associated with that position (H. Sarakinos, personal communication, April 7, 2009).

Collaboration

The Department has a strong collaborative relationship with the River Alliance of Wisconsin. Through this relationship, dam safety staff have remained neutrally grounded in technical advice to dam owners without advocating for or against removal. This may soon change, with the Division currently working on policy that may allow it to advocate for removals (M. Galloway, personal communication, February 26, 2009). The River Alliance is much more focused on river restoration and ecological issues than dam safety, although its staff understand that money and safety, especially after major flooding events, are often the deciding factors for dam owners considering removal (H. Sarakinos, personal communication, April 7, 2009).

3: State Summaries

The River Alliance has found that strong relationships with qualified restoration consultants who understand river restoration projects can really speed the permitting process, lower a project's overall cost, and result in a better restoration. Another important relationship has been one between The River Alliance and University of Wisconsin-Madison, which has resulted in two studies, one on sedimentation and small dam removal, and the other on dam removal's effect on property values (H. Sarakinos, personal communication, April 7, 2009). The relationship between the state and the River Alliance has allowed the non-profit to channel research and science to the state, allowing state staff to have a better understanding of the effects of dam removal, and more data to share with dam owners interested in removal (H. Sarakinos, personal communication, April 7, 2009).

The DNR has not developed a working relationship with historic preservation commissions, thus each dam removal is a separate battle with its own confrontations and "grieving process" (M. Galloway, personal communication, February 26, 2009).

Funding

Another unique aspect of the Wisconsin Bureau of Dam Safety is its committed funding for dam removal, including a "Small and Abandoned Dam Removal Grant," which provided a 50-50 matching grant of up to $25,000, and the "Dam Maintenance, Repair, Modification, Abandonment and Removal Grant," which targets municipalities. Unfortunately, none of the grant programs have been funded since the 1999 legislative budget, and so very few dam removal grants have been distributed in the last decade. Even with the potential for legislative funding of the grant program in the 2010 budget, most of the money may be directed to municipalities where dams were damaged in flooding several years ago (M. Galloway, personal communication, February 26, 2009).

Even with limited funding availability, the fact that the funding is distributed in conjunction with dam safety, directly from and with the help of state officials, is a unique way to incentivize removal over repair. While the cost of removal is oftentimes lower than that of repair, a matching grant from the state, along with the knowledge that a liability has been

completely removed from one's property, can combine to strongly encourage removal.

The River Alliance of Wisconsin's 13 years of dam removals has allowed it to understand the state's funding mechanisms and priorities. For example, even though a large amount of the state's money is available through competitive grants, a dam removal project that is higher priority for the DNR may be more likely to receive funding. Understanding the DNR's priorities facilitates the funding process (H. Sarakinos, personal communication, April 7, 2009).

Besides the grants described above, which are dependent on funding through the state legislature, The Department's engineers and biologists directly assist dam removal projects by helping to acquire funding through foundations, nonprofits, NOAA and the U.S. Fish & Wildlife (M. Galloway, personal communication, February 26, 2009). The River Alliance also found that the U.S. Fish & Wildlife and U.S.D.A.'s NRCS were reliable sources of funding. Besides grants, mitigation money and in-kind services also help projects along (H. Sarakinos, personal communication, April 7, 2009). The Wisconsin chapter of The Nature Conservancy, recently involved with one dam removal on its property, was able to receive funding through several sources, but found that it was difficult to piece together the $160,000 for removal, and eventually had a large amount of internal TNC funding. Specifically difficult to fund was the initial project design and engineering stage; it was far simpler to find funding for the project's implementation (Personal communication, Hannah Spaul). Still, the piecemeal approach may actually help to acquire other funding sources that like to match committed money (H. Sarakinos, personal communication, April 7, 2009).

Public Education/Outreach

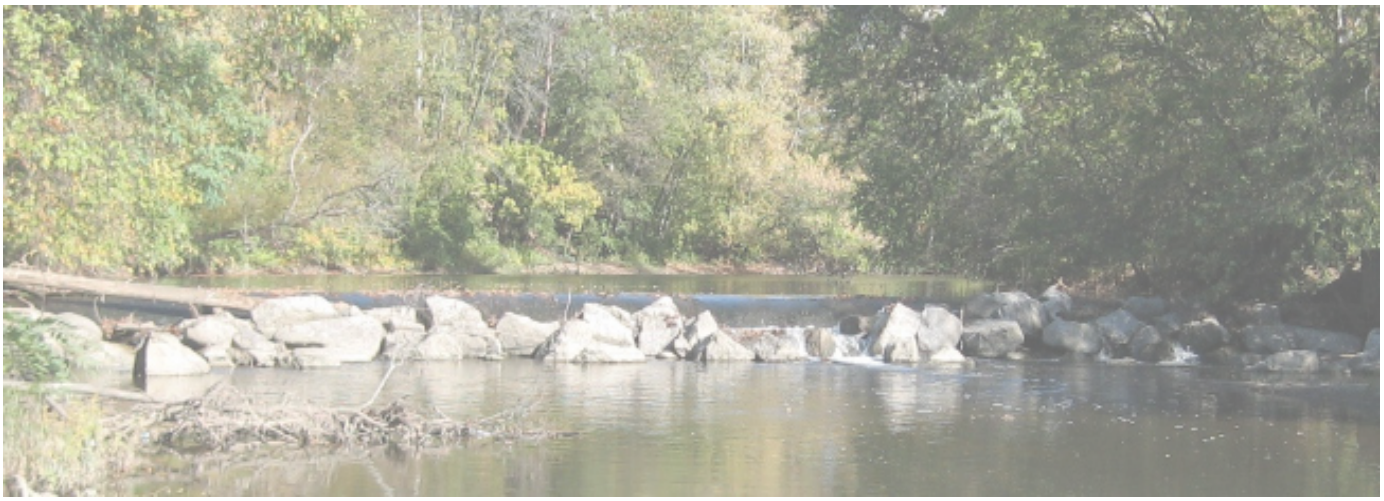
The DNR Dam Safety website contains a large amount of valuable information for dam owners. Topics range from general permitting guidelines, dam safety, FAQ's, resources for owners, grant opportunities, and a case study listing of successful dam removals in the state, with cost of removal, but the site has become out-of-date. Other than the website, the Dam Safety staff do not proactively approach the public or dam owners about dam removal.

Instead, the Dam Safety staff will work opportunistically with a dam owner who is interested in removal, to provide them with all of the facts as they make a decision. Because the DNR has a very strong relationship with non-profits such as the River Alliance of Wisconsin and Trout Unlimited, the state can contact these groups to help inform the dam owner of the pros and cons of both repair and removal.

The River Alliance can help people organize around their river, point people in the right direction, and navigate through what will be required. River Alliance has specifically developed a toolkit and resources which the state takes advantage of when dealing with dam owners. The state is able to rely on the bias of the non-profit to influence the dam owner, rather than encourage removal directly from the state. As an arbitrator between the DNR and the communities, River Alliance may be able to mediate a discussion and convince both parties to compromise (H. Sarakinos, personal communication, April 7, 2009).

Outlook

Even with dam safety regulations that are conducive to dam removals, there is no "wish list" of projects or dams that the state would like to see removed. Such a document was initiated by the River Alliance, but was never used as a "wish list" by the non-profit or the state. Without a strong position on dam removal the Bureau of Dam Safety is opportunistic, relying on dam owners rather than on ecological or watershed management approaches. Still, the state has the public education, outreach, funding, collaborations, and outlook to support dam removal. Currently The Department is drafting a statement on dam removal, which could help guide dam owners through the decision making process (M. Galloway, personal communication, February 26, 2009).



4: Recommendations

4.1 Connecticut

As in many states, there is no centralized program that handles dam removal in Connecticut. A coordinated program would help streamline permitting and dam removal overall. However, Connecticut benefits from having Steve Gephard in the DEP's Inland Fisheries Division. He has taken dam removal on as a personal interest.

Inland Fisheries is not regulatory. It plays an advisory role in the DEP and is considered the authority on dam removal. The division regularly advises regulatory colleagues when an issue is pertinent, and tries to promote fish passage via dam removal whenever possible. Inland Fisheries also distributes standards in regards to road crossings and fish passage to local towns (S. Gephard, personal communication, February 23, 2009).

Recently The Inland Water Resource Division recently did an inventory of state owned dams and realized that not all of them are needed. Prioritization will likely be based on its management burden including dam condition, cost of removal, and practicality. However, Inland Fisheries is going to advise looking at ecological points of view as well, with a focus on prioritizing downstream dam removal (S. Gephard, personal communication, February 23, 2009). Inland Water Resource Division has expressed interest in having a conversation with Inland Fisheries about ecological motivations for dam removal (D. Ruzicka, personal communication, March 5, 2009). This would be a good opportunity for TNC to facilitate this conversation.

The regulations and processes for dam removal are the same as building a dam in Connecticut. They need to be considered separately. This would remove some of the hurdles for someone who wants to remove a dam. Removal benefits the environment in most cases; therefore, it should not be subject to a permitting process that is geared towards preventing environmental harms. Along with streamlined permitting for

dam removal there needs to be more realistic views on the disposition of sediment behind the dam. It is not realistic to expect that there will be no sediment released (S. Gephard, personal communication, February 23, 2009). However, currently, landowners are fully responsible for paying for sediment removal. This is expensive and often tips the balance between weather a landowner decides to repair or remove a dam (D. Ruzicka, personal communication, March 5, 2009).

In Connecticut, NGO involvement is necessary to have a dam removed, unless the state owns the dam.[1] If a state owned dam needs work (or possibly removal), funding comes from the bonding commission. However, there are no grants or loans from the state for a private dam owner who is being told they must remove the dam (S. Gephard, personal communication, February 23, 2009).

Most importantly, all parties need to work to educate the public on the environmental impacts of a dam removal. Many people think that a turbine should be attached to an existing dam to generate power, but don't realize that many of the ones that exist cannot maintain that. The general public has other naïve misperceptions about the results of dam removal such as that it will cause flooding, muddy waters, etc. Public education about these general ideas would go a long way towards dam removal and fish passage (S. Gephard, personal communication, February 23, 2009).

1 The state of Connecticut has 5500 dam, 3000 of which are large enough to be regulated, and only 264 of which are state owned (D. Ruzicka, personal communication, March 5, 2009).

4.2 Delaware

State agencies, non-profits, and individuals landowners should use the lack of dam safety permitting for small dams as an opportunity to remove dams while jumping through fewer hoops. Although less permitting offers a simpler removal process, the impetus for dam removal in many states has been brought on by dam safety. Without dam safety as a driver, Delaware will have to consider other innovative methods to encourage interest in removals when owners are not faced with the removal/repair dilemma.

Because dam safety will not be a driving force for dam removal within Delaware, the state's Division of Fish and Wildlife should consider a barrier prioritization strategy. The Division already had a GIS database of roughly 100 dams in the state. Such a prioritization strategy could weigh social, ecological, and economic issues related to dam removal and assist either the state or interested non-profits in understanding how to best approach dam removal. A prioritization document could help focus energy, encourage collaboration between groups with different goals (specifically Dam Safety and Fish and Wildlife), and could be used to leverage fund for dam removal projects.

A conversation between agencies and organizations interested in barriers, specifically dam removal, would bring together Dam Safety, Fish and Wildlife, and potentially non-profits such as the Brandywine Conservancy that are interested in river restoration. A conversation could also identify what/which state agencies or non-profits might be able to take on the role of public education and outreach. Even identifying one point person as the main liaison between agencies and non-profits such as American Rivers or Trout Unlimited could greatly assist dam owners interested in removal but lacking resources.

The more removals that occur in the state, the more successful case studies there are to model future removals on. This builds public trust and community support, which has not been tested or established in Delaware.

4.3 Maine

Maine could benefit from dedicated staff to assist non profits and dam owners when procuring federal or state funding or resources. Currently, state resources are stretched thin, and an additional DEP staff member dedicated to river restoration and dam removal is not an option.

The Maine DEP could also use an additional staff person dedicated to focus on acquiring funding for dam removal, since the state frequently manages or is represented in such projects. Greater access to funding would allow Maine to pursue further steps towards dam removal and aquatic habitat restoration.

4.4 Maryland

Open communication between the Fisheries Services and Dam Safety might allow for collaboration, or in the least, the passing of information between the two departments. Dam Safety has a large volume of information about dams in the state, while Fisheries Services has a clear understanding of which dams would have the highest ecological, social, and economic benefit if removed. If Dam Safety had a clear understanding of how, why, and which dams Fisheries Services wanted to remove, Dam Safety may then be more comfortable informing dam owners that removal and repair are both viable options. Research on economic and environmental impacts of dam removal exist and are available for both state staff and individual dam owners to make informed decisions.

Although it is not Dam Safety's job to remove dams, the work of Dam Safety directly relates to whether dam owners consider economic, ecological, and social implications of their dam before repairing it, and whether removal is seen as a viable and permanent way to make some dams safe. Dam safety should consider providing owners with information about both repair and removal. If they feel uncomfortable, consider directing them to Fisheries Services or non-profits able to assist them. In many cases the dam may need to remain for safety reasons, but if there is an unsafe dam that is a high priority for removal according to Fisheries Services, Dam Safety could play a huge role in facilitating a conversation about removal.

Lobby for the re-authorization of the Chesapeake Bay Program. The one staff member in Fisheries Services who worked on dam removals was funded through the CBP program. Now that funding was cut from the 2009 budget, all CBP states have had to struggle to replace funding.

4: Recommendations

The state should continue to share, implement, and refine its project prioritization. It is a very progressive document that other states would find extremely useful and influential. The document will also play a huge role in how Maryland approaches dam removal in the coming years.

4.5 Massachusetts

When asked what they would like to see improved, the director of the Riverways Program mentioned that they would like to cut the removal time from three years to one and a half years and to remove more dams per year. Massachusetts already has contractors that are familiar with the dam removal process. The state would benefit from having project managers who really know how to get a project from start to finish, including piecing together funding and addressing all technical aspects of dam removal (T. Purinton, personal communication, March 13, 2009).

Massachusetts, like most states, would also benefit from a public education campaign. There is a growing interest in hydropower, which may create resistance back dam removal projects. Dam removal and green energy can be conflicting areas of interest, forcing river restoration advocates to justify the benefits of removal in the context of climate change and interest in renewable energy (T. Purinton, personal communication, March 13, 2009).

In general, it seems the Massachusetts public is largely in favor of dam removal. After its presentations to the community, the NepRWA had 90% of the community's support in favor of removing the dams. However, those people interested in historical conservation and maintaining the aesthetics of the dams created resistance, slowing an already slow process.

The NepRWA has collaborated with the Riverways program on the planning of the removal of two dams near the mouth of the Neponset River. The Riverways Program has been functioning as a dam removal steward and has helped to raise funds towards a feasibility analysis.

4: Recommendations

Looking at dam removal from a watershed association perspective shed light on some of the weak points and political aspects involved in dam removal in Massachusetts. Recent regulation changes have caused significant investments in maintaining dams that serve no function and are actually damaging the river. These investments tend to be the largest investments of a municipality; the money would be better served in other areas of the community or to fund a dam removal (I. Cooke, personal communication, April, 2, 2009).

While the Riverways Program has dam removal as a priority, the DCR Office of Dam Safety, which is charged with administering dam safety law, is understaffed and does not have the overarching authority to mandate dam removal. Philosophically, dam removal is not embraced as part of the job. Their main focus is to make sure inspections are happening and that dams are safe. The DCR Engineering and Operations Department is also involved in dam removal. This unit maintains and operates the dams that the DCR owns. Communication and involvement in dam removal discussions needs to be improved in these two departments in the DCR.

In the discussion of dam removals on the Neponset River, NepRWA pulled together a steering committee of municipal and state agencies in order to help resolve any disagreements between state agencies. After many meetings, DCR acknowledged that they did not have any credible objection to the dams being removed (I. Cooke, personal communication, April, 2, 2009). DCR staff needs to better understand the benefits of dam removal and to develop a clearer stance on in the issue. This would allow more dam removal discussions to happen throughout the state since watershed associations and municipalities could avoid the long and hard work that NepRWA had to go through in order to secure DCR's consent.

The Neponset River project exposes difficulties in working with the US Army Corps of Engineers (USACE). Massachusetts partnered with the USACE to complete

a feasibility study of the dams to be removed on the Neponset River many years before the NepRWA and Riverways took over the effort. USACE did not engage the community in its assessment and ended up creating more work for restoration advocates to overcome before dam removal could be considered. In addition, due to funding constraints, USACE did not publish the results of their study (I. Cooke, personal communication, April, 2, 2009).

4.6 New Hampshire

New Hampshire has many of the key elements that define a successful dam removal program; successful collaboration of state and private agencies, stake holder involvement, and active and knowledgeable state employees dedicated to dam removal and river restoration. Additional employees that handle the funding and dam owner assistance portion of The New Hampshire River Restoration's duties would play an integral part in allowing the task force to take on more projects and complete those already underway more quickly.

Currently dam removal initiations rely heavily on dam safety inspection processes. This has generated and excellent data base of dams in New Hampshire has played a role in opening lines of communication between engineers and river restoration staff within the New Hampshire Dam Bureau. However, moving forward New Hampshire may want to focus on contacting dam owners that have dams that do not fall into the high or significant hazard categories, since from a habitat restoration perspective, these dams could be currently posing the greatest threat. An inspection process that utilizes the current infrastructure, but focuses on habitat health assessment and benchmarks that consider species health and biodiversity could target dams for removal consideration that will yield more significant results for wetland habitat restoration within the state of New Hampshire.

4.7 New Jersey

Currently dam removals in New Jersey are opportunistic experiences that occur when a combination of dam owner interest, non-profit support, and permitting success combine to allow a dam to be removed. Within the DEP there is no emphasis on dam removal as a tool for ecological mitigation, and within the Bureau of Dam Safety there is no emphasis on dam removal as a tool for removing owner liability for relic dams.

There does seem to be a thorough inventory of dams within the state, and the DEP already has the authority to require frequent inspections and EAPs. The state could take advantage of its regulatory authority by not only enforcing its safety inspections but by providing basic information regarding cost, ecological issues, and social implicatations of both repair and removal. This information could help a dam owner make a difficult decision that comes with a Dam Safety Order.

Since Dam Safety staff are generally well-versed in the many issues associated with dam removal and suggest that dam owners consider removal when appropriate, the next step may be to include a state liaison to direct interested dam owners to resources, non-profits, and information to consider removal. Having a point person with the department, or having a working relationship with a local non-profit could be a huge help to a dam owner. Understandingly, much research needs to go into whether and how the department and bureau could address dam removals in a way that would not add additional job responsibilities.

4: Recommendations

For those owners who do take the initiative to remove a dam, the permitting process may not be as simple to navigate as it may appear at first glance. Perception of dam removal (whether it is considered a mitigation method or a type of construction) varies within the DEP and slows the permitting process. Dam removal is not for most dams, but for some it is the most practical option financially and ecologically. In those situations that may favor removal, states should be able to facilitate, or at least guide, a dam owner through their alternatives, and share their expertise related to the health and safety of their state.

4.8 New York

Although many states point to Pennsylvania's strict owner liability as the reason for the state's successful dam removal program, other states have similar laws with fewer removals. States hoping to increase the number of dam removals should remember that other issues, such readily available funding sources, streamlined permitting process, and assistance/facilitation by state agencies also play a major role in successfully removing dams. As New York addresses not just owner liability but streamlining the permitting and providing educational materials to dam owners, the state seems to have the foundation for a successful dam removal program, but currently lacks the outreach and funding incentives.

Many of the recommendations of the state's own report, "A Strategy for Removing or Mitigating Dams in New York" (2008) can be re-emphasized here. State agency assistance for dam owners interested in removal could greatly increase the likelihood that a dam owner would consider removal as an option (9). DEC staff have a thorough understanding of the role that dam removal can play in barrier mitigation within their state, this would allow them to share that professional knowledge with a wider audience. The recommendation for a state-wide permitting checklist for DEC staff involved in permitting was also mentioned during our interviews as a way to make the permit application review process more efficient. However, developing this tool is not a simple task given impoundment toxicity and other significant issues to address and draw consensus on from the regulatory community. It was decided to complete the applicant's guide before this task could begin (L. King, personal communication, April 9, 2009).

In addition to an ongoing interagency collaborative effort known as the Inter-Agency Connectivity Team (InterACT) which involves several federal agencies (e.g. USACE, USFWS, SWCD, and FHWA), several state agencies and authorities (e.g. DEC, DOT,

4: Recommendations

Thruway Authority, and the Canal Authority) and interested non-governmental agencies (e.g. Trout Unlimited), there is a need for enhanced collaboration and communication between the DEC, the state Department of Transportation and local governments on road crossings within river/stream corridors, especially if new and existing crossing sites become impacted by the draft dam safety regulations. Communications could develop into a more collaborative and constructive work relationship, where each entity is able to approach the other with project ideas and concerns.

4.9 Ohio

Ohio has a lot of the pieces in place to continue to remove dams. At the current moment they seem to have the funding to manage the projects that come in and manpower to manage the projects. What is missing is the initiation from the public. With all of the innovative strategies for fundraising and researching dam removal projects in Ohio, their public relations strategizing on this issue has not encouraged landowners to seek out removal.

There is a preception with the state officials that public outreach on this issue is analogous to taking a more authoritative form of regulatory enforcement. This does not have to be the case. Informing angler groups about how removals can work to restore aquatic quality combined with their regulatory advantages has proven to galvanize public opinion towards dam removal over time, as in the Pennsylvania case study. Between OEPA and the Scenic Rivers program, Ohio has a lot of information gathered on how removals have improved river quality. Disseminating that information to the right people and providing materials that bring past successes to light whenever a removal project gets underway could reframe dam ownership in a more positive light to Ohio dam owners.

4.10 Pennsylvania

Pennsylvania has all of the evaluation criteria working in favor of dam removal. This has resulted in a large number of dam removals compared to the other states in TNC's Eastern Region. Though budget cuts due to the current economic crises have limited available funding across the board, Pennsylvania has the infrastructure to recover.

Landowners have become a third partner of sorts in removals alongside state agencies and non-profits in Pennsylvania. How this happened would be an excellent topic for further research. Landowners' active pursuit toward removal in Pennsylvania is unique. Without landowner interest, it is very difficult to initiate a removal process. Pennsylvania currently has 130 potential removal projects on their wait list (V. Humenay, personal communication, February 26, 2009). No other state that we looked at cited such rampant landowner initiative and most struggled to get any landowners at all involved. This report uncovered some overarching reasons that might account for this anomaly – namely an active dam safety program that explicitly favors removal to repair, outreach efforts that included a major removal and governor support for dam safety. However, Pennsylvania might serve as an opportunity to go in and find out the reasoning behind landowners' decision making process for choosing the removal option.

Pennsylvania's success on a state level in prioritizing removals could be used as an asset. One staff member within Dam Safety (V. Humenay, personal communication, February 26, 2009) explicitly stated interest in articulating Pennsylvania's successes with removals to other states. Pennsylvania could be a partner in arranging a multi-state connectivity summit on prioritizing dam removal in a way that is consistent with the states' other goals. A number of states that we interviewed identified landowner skepticism and attachments to their dam/impoundments as the major obstacles towards using regulatory authority to push for removal of small dams. Through dam safety

campaigning, collaboration with angler groups, proactive discussions with potentially opposing groups, and smart utilization of their regulatory "stick," Pennsylvania seems to have been able to turn the tide and get citizens on board with their dam removal mission.

Though Pennsylvania certainly understands the dual benefit of fish passage with dam removals, to date and has removed several for environmental purposes, Pennsylvania Dam Safety has not prioritized potential projects from the prospective of fish passage. Human safety would remain the primary force of prioritization, but TNC could have a role to play in collaboration with the Division of Fish and Boat to identify projects that would make the biggest difference for fish restoration.

4.11 Rhode Island

An overall change in focus is necessary in Rhode Island to facilitate dam removal. Dam removal is currently based around dam safety; dams are not removed based on fish passage or other ecological reasons. Currently, advocates from Save the Bay are working on changing the regulatory process. They are working to establish policies that address social, cultural, environmental issues specific to dam removal projects. The wetlands regulations are currently in favor of the status quo. The regulations need to take into account the ecological benefits of dam removal. A change from the status quo would involve educating the government agencies on ecological benefits.

Currently, there is no difference between dam removals and construction projects of other kinds. The general sentiment is that this prevents dam removals. The state needs a streamlined permitting process that takes into account handling the effects of contaminated sediments in a responsible manner.

Both the regulatory process and the permitting process would benefit from a small team created within the regulatory agencies to facilitate restoration projects. This group would be familiar with the processes necessary for dam removal and would be able to streamline efforts.

Specific to Rhode Island, a common grievance from non-profits was the need for abutter approval in order to apply for a dam removal. While the regulations did not state this explicitly, it was evident from interviews that in order to submit an application to alter a wetland, a signed letter of consent from abutters was necessary. The state would benefit from a comprehensive GIS dam database. This would enable the state to place a distance limit on the abutters who need to approve the removals. A database that included dam ownership would also benefit the state.

4.12 Vermont

Vermont could benefit from additional staff committed to river restoration, dam removal, and communication with dam owners. This would give DEC with a representative voice in state conversations about restoration of aquatic habitats. Having staff committed to working with dam owners would facilitate partnerships between individual dam owners, communities, non-profits, and state agencies, and would make Vermont more competitive for grants that require collaboration.

A comprehensive statewide inventory of dams should be developed, as should a prioritization system based on public safety or ecological impact criteria. Currently the DEC does not have a list of dams targeted for removal. Instead, dam removals occur opportunistically. Geographic location, proximity to town centers, and issues of fish passage and habitat restoration become priorities, not only because funding is easier to acquire for these types of projects, but also because these are frequently endorsed (or not opposed) by local communities. Collaborating with environmental programs at local universities or colleges could make a prioritization project or comprehensive inventory financially feasible.

4.13 Virginia

With the looming budget cuts over the EPA's Chesapeake Bay Program, the capabilities of the Division of Game and Inland Fisheries (DGIF) to spearhead dam removal projects has become limited. Support staff and funding for many projects are likely to be lost in this process. This turn of events will likely halt the standard methods for dam removal in Virginia.

However, the current downturn may provide an opportunity for DGIF to collaborate with the Dam Safety Program on removals and test what political will between these two agencies exists. To date, the revolving loan fund has been an underutilized resource for removals. Utilizing the fund would require a base of landowners proactively pursuing it, which to date has also not been the case. TNC's role could be as arbiter between these two groups to design an outreach strategy to increase owner awareness about the options they have with their dams.

Getting the Dam Safety program more explicitly involved with removals could also be a gateway towards changing Virginia's laws to be more favorable towards removals. Drafting legislation that gives the Dam Safety Program the ability to grant a permit waiver, mimicking Pennsylvania's system, or categorically excluding removals from construction permit requirements could start making landowners choose removal if their dams are deemed unsafe.

4.14 West Virginia

The first step towards dam removal would be to identify potential existing collaborators in the state or advocate for a position within the Department of that would pursue removals for environmental purposes, such as a river restoration coordinator. West Virginia's Dam Safety Program is currently the sole actor initiating a removal. Typically, though not universally, this report found that states begin moving towards advocating removal over repair when officials outside of dam safety have a stake in the environmental benefits of removals. A good dam safety program is judged by its protection of human life, whereas a good restoration program is measured by its protection of targeted resources. When those programs start sharing goals, the potential for removals increases. Programs within the Division of Natural Resources, such as Fish Management, may have relevant positions but none were identified in this report.

A functioning revolving loan would be a first step towards providing state aid to any removal projects. The amount is slated to be around $350,000. The fund would be a one shot deal. No recurring funding has yet been proposed, but it would be a huge help to Dam Safety if it were.

States that have working revolving loan funds are not only able to offer support to landowners through that funding source. These state funds also open the door to allow states to pursue federal matching funds and elicit non-profit involvement. They can be the first steps towards identifying more sustainable funding for projects even though this particular funding source is not particularly large or recurring. Once state funds are secured for a project, agencies can become more motivated to seek out other sources of funding – federal, mitigation funds, state grants, etc, to supplement that money. TNC could keep an eye on West Virginia's revisions to 47 CSR 34 to make sure that there is a clear mechanism to use the authorized funds.

4.15 Wisconsin

A recommendation for Wisconsin would be to lobby to encourage the state legislature to refund of state's the two grant programs that directly support dam removal. The state would also benefit from a completed statement on dam removal from the Department of Natural Resources to allow Dam Safety staff to further facilitate and advocate for dam removals.

In addition, the state should continue collaborative work between the University of Wisconsin-Madison and the River Alliance of Wisconsin that has provided evidence and science to promote dam removal as a viable tool. Working to integrate the River Alliance's dam prioritization system (which was based on ecology) into dam safety's own priority ranking system to have a well-rounded list of dams whose removal would have the greatest effect on both public safety and ecological systems.
The DNR Dam Safety Bureau website contains large amounts of useful information for dam owners, but it is currently outdated. Maintaining the website should be a priority, because it allows the Bureau to communicate to the public while requiring few additional responsibilities.

Conclusions

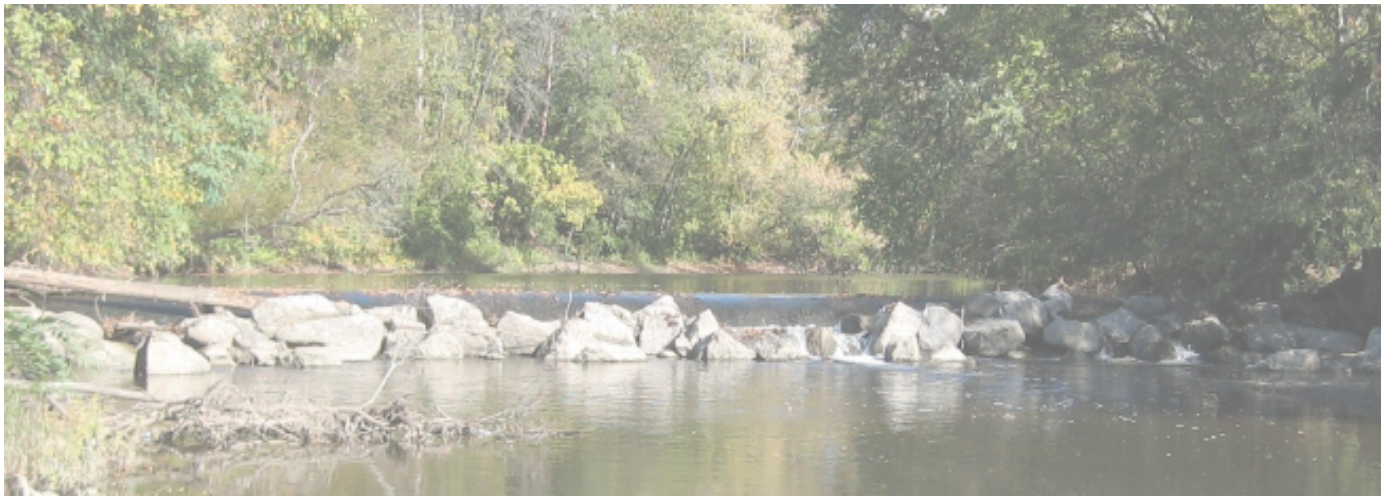
States within The Nature Conservancy's Eastern Region currently take a wide range of approaches and have differing commitments towards dam removal. While each state's interest and resources to dedicate towards dam removal differ widely, the five evaluation criteria identified in this report: regulatory authority, collaboration, funding, education and outreach, and outlook, provide a consistent means to gauge a state's current capacity to address this issue. Our exemplary case study states were able to excel at each of these criteria and have been successful at removing dams. Using these criteria, the report was able to identify key, pragmatic ways in which each state could address one or more of these criteria and in turn better equip itself to take on more removals.

Pennsylvania and Wisconsin's exemplary model involved both a streamlining of permitting through a dam safety program dedicated to removals and an active environmental agency. This commitment and collaboration gave them the resources to inform landowners and the general public about their options, responsibilities, and a regulatory process that makes dam removal a more palatable option. The role of a general public that is informed and engaged in the benefits of removals cannot be overlooked. More energy focused towards removals also meant more resources and initiative to pursue diverse sources of funding to help bring these projects to life. New Hampshire and Massachusetts are examples of states whose developing task force has allowed them to fast approach this model in a similar manner.

This model, while the most consistent for getting dams removed, is dependent upon a dam safety program that is willing to specifically advise the benefits of removal and has the resources to aggressively enforce its safety objectives. While this, in part, can be addressed making the state's statutory language more favorable towards removals changing the will or stature of a government program may not be an immediately achievable goal.

Conclusions

Should a dam safety program prove to be an untenable partner on dam removals, ecologically focused collaborations may be able to take the initiative. While ecological considerations of removing specific dams may be outweighed by short term consequences, there seems to be a growing consensus through state agencies managing fish, natural resources, and environmental resources that out of use dams generally pose a threat to fish species that is larger than any harms caused by removing the dam. A second approach has developed in the mold of the Maine and Virginia examples that has pooled together a variety of voices from various ecological stakeholders at the state, federal, and non-profit levels. Knowing where a state fits within these evaluation criteria and where the appropriate agencies stand on dam removals are key steps for parties looking to advance state dam removal efforts.



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Appendix A: Team Introduction

Tufts UEP Team

Jasmine C. Bird [redacted]

The Nature Conservancy Client

Mark P. Smith

Eastern U.S. Freshwater Program

The Nature Conservancy

11 Avenue DeLafayette

Boston, MA 02111

Steering Committee

Josh Royte [redacted]

Su Fanok [redacted]

Tufts Professors and Teaching Assistants

Rusty Russell, Professor Rusty.Russell@tufts.edu

Rachel Bratt, Professor Rachel.Bratt@tufts.edu

Appendix A: Team Introduction

The Nature Conservancy

TNC is a global organization working in all 50 states and in 30 countries, whose mission is to preserve plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive. TNC is dedicated to preserving biological diversity and their values compel them to find ways to ensure that human activities can be conducted harmoniously with the preservation of natural diversity. The Nature Conservancy's core values go far beyond issues of ecological preservation, to include concepts such as respect for people, communities, cultures, and diversity. TNC works closely with partners and stakeholders in a non-confrontational manner to develop long-lasting solutions that meet the needs of people and the environment. TNC also focuses on science-based and creative problem-solving approaches to environmental issues, and work closely with communities to develop approaches and solutions that work socially as well as ecologically. Need to cite this paragraph- tnc website? Mark?

Tufts UEP Field Projects

Field Projects: Planning & Practice is a required course for all M.A. students in the department of Urban and Environmental Policy and Planning at Tufts University. The course integrates the theory and practice of planning and policy analysis by exposing students to substantial, real-world challenges while also providing partnering organizations and agencies, such as The Nature Conservancy, with assistance on priority projects that they otherwise may not have the time or resources to complete.

Appendix B: State Contacts

Connecticut

TNC Shelly Green, Lower Connecticut River Program Director, TNC
[redacted]

State Agency Stephen Gephard, Supervising Fisheries Biologist, Inland Fisheries Division, Connecticut Department of Environmental Protection
[redacted]

State Agency Denise Ruzicka, Inland Water Resources Division, Connecticut Department of Environmental Protection
[redacted]

Delaware

TNC Andy Manus, Assistant State Director, TNC
[redacted]

State Agency Craig Shirey, DE Department of Natural Resources and Environmental Control, Division of Fish and Wildlife
[redacted]

State Agency Frank Piorko, Department of Natural Resources and Environmental Control, Environmental Manager 2, Dam Safety
[redacted]

Maryland

TNC Mark Bryer, Director, Chesapeake Bay Program, TNC
[redacted]

Appendix B: State Contacts

State Agency Jim Thompson, Lead Fisheries Biologist, Maryland Department of Natural Resources, Fish Passage Program

[redacted]

State Agency Bruce Harrington, Projects Engineer, Maryland Department of the Environment, Dam Safety Division

[redacted]

Maine

TNC Joshua Royte, Conservation Planner II, TNC

[redacted]

State Agency Slade Moore, Coastal Program Gulf of Maine Restoration Coordinator

[redacted]

State Agency Dana Paul Murch, Dams and Hydropower Supervisor, Maine Department of Environmental Protection

[redacted]

Massachusetts

TNC Alison Bowden, Director, Freshwater Program in Massachusetts, TNC

[redacted]

State Agency Tim Purinton, Acting Director Massachusetts Riverways Program

[redacted]

Appendix B: State Contacts

NGO Ian Cooke, Executive Director Neponset River Watershed Association
[redacted]

New Hampshire

TNC Douglas A. Bechtel, Director of Freshwater Science and Conservation, TNC
[redacted]

State Agency Deb Loiselle, New Hampshire River Restoration Task Force
[redacted]

New Jersey

TNC Ellen Creveling, Conservation Science Coordinator, TNC
[redacted]

State Agency Darin Shaffer, Primary Engineer, Department of Environmental Protection, Bureau of Dam Safety
[redacted]

NGO Beth Styler Barry, Executive Director, Musconetcong Watershed Association
[redacted]

New York

TNC David Braun, Director of Conservation Science, TNC
[redacted]

Appendix B: State Contacts

State Agency Doug Sheppard, New York State Department of Environmental Conservation, Division of Fish, Wildlife and Marine Resources, Bureau of Habitat

[redacted]

State Agency Louise King , Environmental Program Specialist II, New York State Department of Environmental Conservation, Division of Water, Nonpoint Source (NPS) Management Section

[redacted]

Ohio

TNC Anthony Sasson, Freshwater Conservation Coordinator, TNC

[redacted]

State Agency Robert Gable, Ohio Department of Natural Resources

[redacted]

NGO

[redacted]

Pennsylvania

State Agency Vince Humenay, Pennsylvania Department of Environmental Protection, Dam Safety

[redacted]

Rhode Island

TNC Kevin Essington, Director of Borderlands Landscape Program, TNC

[redacted]

Appendix B: State Contacts

State Agency Phillip Edwards, Freshwater and Anadromous Fisheries Biologist, Rhode Island Department of Environmental Management, Fish and Wildlife
[redacted]

State Agency Andrew Lipsky, State Biologist, US Department of Agriculture, National Resource Conservation Service
[redacted]

NGO Rachel Calabro, Community Organizer/Advocate, Save the Bay
[redacted]

NGO Chris Fox, Executive Director, Wood Pawcatuck Watershed Association
[redacted]

Vermont

TNC Phillip Huffman, Director of Conservation Programs, TNC
[redacted]

State Agency Brian Fitzgerald, Ecologist, Vermont Department of Environmental Conservation
[redacted]

Virginia

State Agency Alan Weaver, Virginia Department of Game and Inland Fisheries
[redacted]

Appendix B: State Contacts

NGO Jason Halbert, Oak Hill Fund
[redacted]

West Virginia

State Agency Brian Long, Dam Safety Program Section Manager, Department of Environmental Protection
[redacted]

Wisconsin

TNC Hannah Spaul, Director of Conservation, Land Management, TNC
[redacted]

State Agency Meg Galloway, Dams and Floodplain Section Chief, Department of Natural Resources
[redacted]

NGO Helen Sarakinos, River Restoration Programs, River Alliance of Wisconsin
[redacted]

Appendix C: Laws, Regulations, and Statutes

Federal Regulations

33 CFR 222.6
The National Program for Inspection of Non-Federal Dams
Available: http://cfr.vlex.com/vid/222-6-national-program-inspection-non-dams-19766273

State Regulations

Connecticut

Chapter 446j, § 22a 401 to 22a 415
Dams and Reservoirs
Available: http://law.justia.com/connecticut/codes/title22a/chap446j.html

Delaware

Title 7, Chapter 42
Dam Safety
Available: http://delcode.delaware.gov/title7/c042/index.shtml

Maryland

Code of Maryland Regulations
26.17.04.05
Dams and Reservoirs
http://www.dsd.state.md.us/comar/26/26.17.04.05.htm

Environment Article 5-503
Permit Process
Available: http://www.mde.maryland.gov/Programs/WaterPrograms/Dam_Safety/permit/dampermit.asp

Maine

Title 37-B, Chapter 24
Dam Safety
Available: http://www.mainelegislature.org/legis/statutes/37-B/title37-Bch0sec0.html

Appendix C: Laws, Regulations, and Statutes

Massachusetts

Mass.G.L Chapter 253
Mills, Dams, and Reservoirs
http://www.mass.gov/legis/laws/mgl/gl-253-toc.htm

302 CMR: Dam Safety Regulations (DCR)
Available: http://www.mass.gov/dcr/pe/damSafety/downloads/DCR%20Dam%20Safety%20Regulations.pdf

Chapter 29: §2FFF:
Dam Safety Trust
Available: http://www.mass.gov/legis/laws/mgl/29-2fff.htm

New Hampshire

Chapter 482
Dams, Mills, and Flowage
http://www.gencourt.state.nh.us/RSA/html/NHTOC/NHTOC-L-482.htm

New Jersey

Title 7, Chapter 20
Dam Safety Standards
Available: www.state.nj.us/dep/damsafety/standard.pdf

Title 58, Chapter 4
2007 Revisions: Safe Dam Act
Available: www.state.nj.us/dep/damsafety/safe_dam_act.pdf

New York

§608.3
Dams and impoundment structures (Specific parts of the regulation have been superseded by an amendment.)
Available: http://www.dec.ny.gov/regs/4438.html#15887

Appendix C: Laws, Regulations, and Statutes

Ohio

Chapter 1501 §§ 21-13 – 1501:21-24
Division of Water
Available: http://codes.ohio.gov/oac/1501%3A21

Pennsylvania

PA Code 25 P.S. §105
Dam Safety and Waterway Management
Available: http://www.pacode.com/secure/data/025/chapter105/chap105toc.html

PA Code 30 C.S. § 3501
Dams, Bar Racks, and Migration Devices
Available: http://law.onecle.com/pennsylvania/fish/00.035.001.000.html

PA Code 32 P.S. §693.1
Dam Safety and Encroachment Act

Rhode Island

Chapters 42-17.1, 42-17.6, 42-35, and 46-19
Dam Safety Regulations and Dam Inventory:
Available: http://www.dem.ri.gov/pubs/index.htm#dam
Pursuant regulations available: http://www.dem.ri.gov/pubs/regs/regs/compinsp/dams07.pdf

Vermont

Chapter 43 §§ 1080 – 1106
Dams
http://law.justia.com/vermont/codes/title10/chapter043.html

Title 24, Chapter 120
Special Environmental Revolving Fund
http://www.leg.state.vt.us/statutes/sections.cfm?Title=24&Chapter=120

Appendix C: Laws, Regulations, and Statutes

Virginia

Title 10.1 Chapter 6
Flood Protection and Dam Safety
Available: http://www.dcr.virginia.gov/documents/dsfinregs092608.pdf

§10.1-603.16
Summary of: Virginia Dam Safety, Flood Prevention & Protection Assistance Fund
Available: http://www.dcr.virginia.gov/forms/DCR199-183.pdf

§ 29.1-532
Dams and Fishways
Available: http://law.justia.com/virginia/codes/toc2901000/29.1-532.html

West Virginia

Title 47 CSR 34
Dam Safety Regulations
Available for download at: http://www.wvsos.org/csr/verify.asp?TitleSeries=47-34

§22-14-19
Dam Safety Revolving Loan Fund
Available: http://www.legis.state.wv.us/WVCODE/22/code/WVC%2022%20%20-%20 14%20%20-%20%2019%20%20.htm

Wisconsin

Chapter 30
Regulation of Navigable Waters, Harbors and Navigation
Available: http://www.legis.state.wi.us/statutes/Stat0030.pdf

Chapter 31
Regulation of Dams and Bridges Affecting Navigable Waters
Available: http://www.legis.state.wi.us/statutes/1993/93Stat0031.pdf

Appendix D: MOU

Memorandum of Understanding
between
Tufts University Field Projects Team No. 10
and
The Nature Conservancy

I. Introduction

Project (i.e., team) number: 10
Project title: Back to the Future: Building Healthy Aquatic Ecosystems by Reversing 300 Years of Stream Fragmentation
Client: The Nature Conservancy

This Memorandum of Understanding (the "MOU") summarizes the scope of work, work product(s) and deliverables, timeline, work processes and methods, and lines of authority, supervision and communication relating to the Field Project identified above (the "Project"), as agreed to between (i) the UEP graduate students enrolled in the Field Projects and Planning course (UEP-255) (the "Course") offered by the Tufts University Department of Urban and Environmental Policy and Planning ("UEP") who are identified in Paragraph II(1) below (the "Field Projects Team"); (ii) The Nature Conservancy , further identified in Paragraph II(2) below (the "Client"); and (iii) UEP, as represented by a Tufts faculty member directly involved in teaching the Course during the spring 2009 semester.

II. Specific Provisions

(1) The Field Projects Team working on the Project consists of the following individuals:

1. Jessica Soule [redacted] email address: [redacted]

(2) The Client's contact information is as follows:

Client name: The Nature Conservancy, Eastern Regional Office
Key contact/supervisor: Mark P. Smith, Director, Eastern U.S. Freshwater Program
Email address: [redacted]
FAX number: [redacted]
Address: 11 Avenue de Lafayette, 5th floor, Boston, MA 02111-1736
Web site: www.nature.org

(3) The goals of the Project are:

This project will help to engage state agencies in the stream barrier and dam removal issue by:

- Developing case studies of at least two states that have effective dam removal and mitigation programs. It is expected that the UEP Field Projects team will focus on Pennsylvania and Wisconsin – both of which have strong programs – although additional state case studies could be included;
- Identifying the key elements that explain why these programs have been successful;
- By reference to these elements, assessing the current dam removal and mitigation policies and programs of the 14 states with which TNC is working in the mid-Atlantic region, particularly each state's ability to effectively engage in systematic and strategic dam removal. The states are: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Ohio, Pennsylvania,[1] Rhode Island, Vermont, Virginia, and West Virginia.

(4) The methods and processes through which the Field Projects Team intends to achieve this goal/these goals is/are:

This project will involve substantial contact with state and federal agency personnel to document the status of their existing dam removal programs. It will require identifying the key mechanisms used to encourage dam removal, including the ways in which states have overcome common obstacles with cutting-edge programs. For example, Pennsylvania has enacted statutes that establish clear liability for dams, and it requires the owners of property on which dams are located to post these structures as hazards. As a result, owners have a strong incentive to

1 Pennsylvania is both a model case study state and a member of the study group of 14 states because the "keys to success" criteria arising from the case studies may identify additional issues that need to be addressed when these criteria are applied – even to a model state.

remove relic dams. Pennsylvania has also worked closely with regulatory agencies to ensure that the impacts associated with dam removal are compatible with the state's wetland and stream protection statutes – often a stumbling block elsewhere.

Through structured interviews with state and federal agencies and key non-governmental organizations, the UEP Field Projects team will develop a checklist of policy and program "keys to success." It will then produce a scorecard for each state in the region, assessing current programs and recommending improvements. In the process, the team will attempt to identify innovative policy and funding sources for states that seek to strengthen their dam removal and mitigation programs.

(5) The work products and deliverables of the Project are (this includes any additional presentations for the client):

1. Draft and Final Reports. The final report should be in both paper and electronic format.
2. Report Card for each state in TNC's Eastern Region, evaluating existing state policies and programs, and making specific recommendations for changes and improvements.
3. Copies of source materials used for the project.

   The final products will include a report for The Nature Conservancy, as well as summaries – to be shared with individual states – describing how each state can improve its approach. Recommendations will extend to changes in law, regulation, policies, programs and funding sources.

(6) The anticipated Project timeline (with dates anticipated for key deliverables) is:

Friday, January 15	Initial Meeting with The Nature Conservancy
Thursday, February 5th	Submit Interview Questions to TNC Steering Committee
Friday, February 20th	Interview Questions Finalized
Tuesday, March 24th	All Data Gathered and Completed
Friday, April 17th	Draft Report
Friday, May 1st	Final Report including Report Card for each state in TNC's Eastern Region and copies of source materials used for the project.
Ongoing:	**Phone and in person communications as necessary to ensure timely delivery of a product that best meets the scope described above.**

(7) The lines of authority, supervision and communication between the Client and the Field Projects Team are (or will be determined as follows):

Primary point of contact at TNC is Mark Smith. Primary point of contact for Tufts Field Projects Team is Jessica Soule.

(8) The understanding with regard to payment/reimbursement by the client to the Field Projects Team of any Project-related expenses is:

The Field Projects Team does not expect payment/reimbursement by the client.

III. Additional Representations and Understandings

A. The Field Projects Team is undertaking the Course and the Project for academic credit and therefore compensation (other than reimbursement of Project-related expenses) may not be provided to team members.

B. Because the Course and the Project itself are part of an academic program, it is understood that the final work product and deliverables of the Project (the "Work Product") – either in whole or in part – may and most likely will be shared with others inside and beyond the Tufts community. This may include, without limitation, the distribution of the Work Product to other students, faculty and staff, release to community groups or public agencies, general publication, and posting on the Web. The final product will be a public document. Tufts University and the Field Project Team may seek and secure grant funds or similar payment to defray the cost of any such distribution or publication. It is expected that any issues involving Client confidentiality, use of the Clients name or logo, or proprietary information that may arise in connection with a Project will be narrow ones that can be resolved as early in the semester as possible by discussion among TNC, the Field Projects Team and a Tufts instructor directly responsible for the Course (or his or her designee).

Field projects team and representatives from Tufts University will, to the greatest extent possible, inform the Client of intended use and distribution of the report prior to its use and distribution, with the exception of the report's use within the Tufts community by faculty, students and staff.

C. The Nature Conservancy can review all research data and notes. TNC can use without limitations the information gathered and use or alter the text of the final report as long as conclusions and original ideas are appropriately cited as work by the team. The intended use is for TNC to use internally and externally in conjunction with state agencies and other nonprofits.

D. It is understood that this Project may require the approval (either through full review or by exemption) of the Tufts University Institutional Review Board (IRB). This process is not expected to interfere with timely completion of the project.

IV. Signatures

Mark P. Smith

For The Nature Conservancy
By: Mark P. Smith
Date: 2/3, 2009

Jessica Soule

Representative of the Field Projects Team
By: Jessica Soule
Date: 2/3, 2009

Tufts UEP Faculty Representative
By: Rusty Russell
Date: Feb. 3, 2009