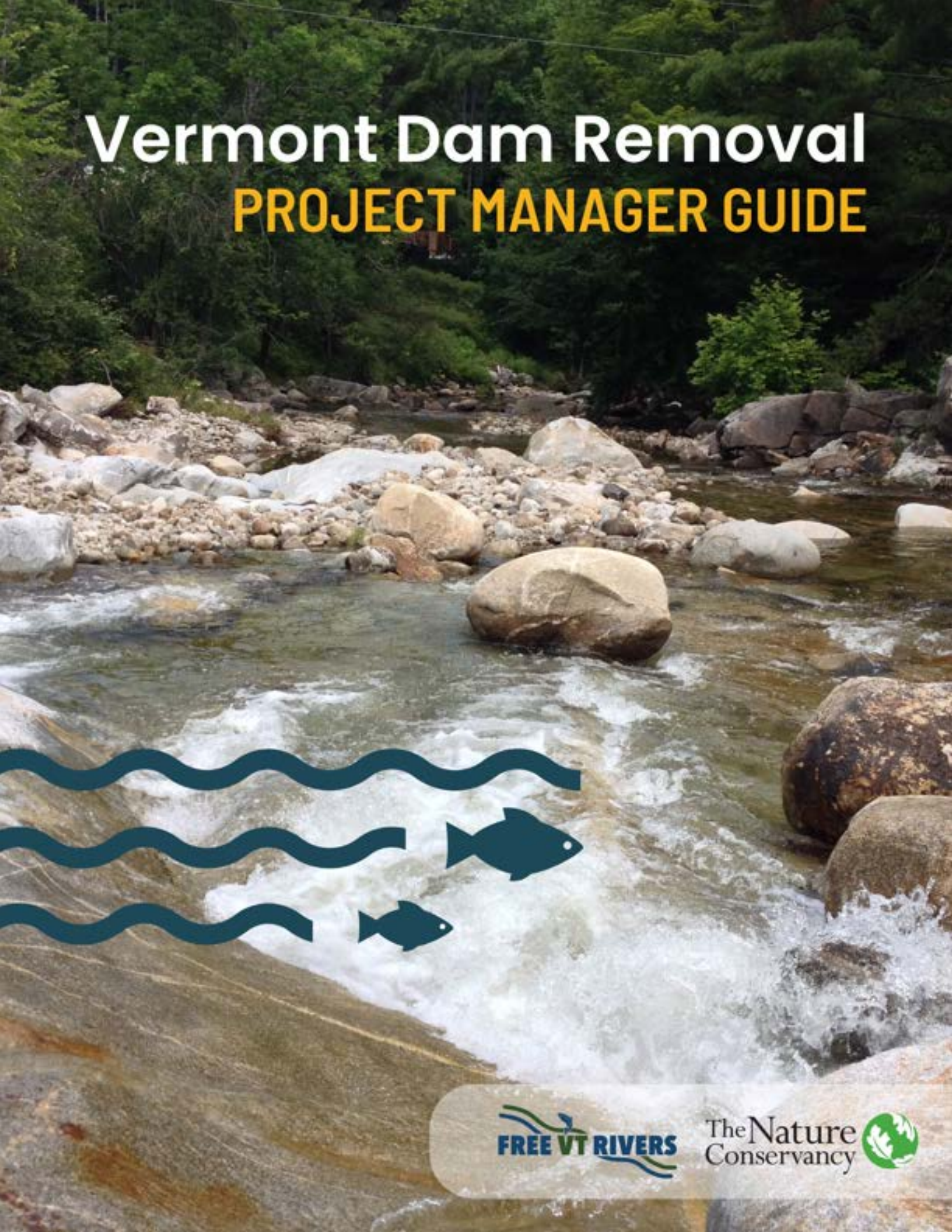
Vermont Dam Removal
PROJECT MANAGER GUIDE



FREE VT RIVERS

The Nature Conservancy

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ACKNOWLEDGEMENTS

The guide in before you is an effort of the Vermont Scaling up Dam Removal Initiative in partnership with the Dams Task Force, both voluntary partnerships of environmental nonprofits, local commissions, Natural Resource Conservation Districts, state and federal agency staff.

This guide is a compilation of content from existing sources and newly developed material. Many people contributed to the development of the original 2009 Vermont Dam Removal Guide that formed the basis for this effort. Additional work for this guide also was pulled from The Nature Conservancy's online Dam Removal Toolkit.

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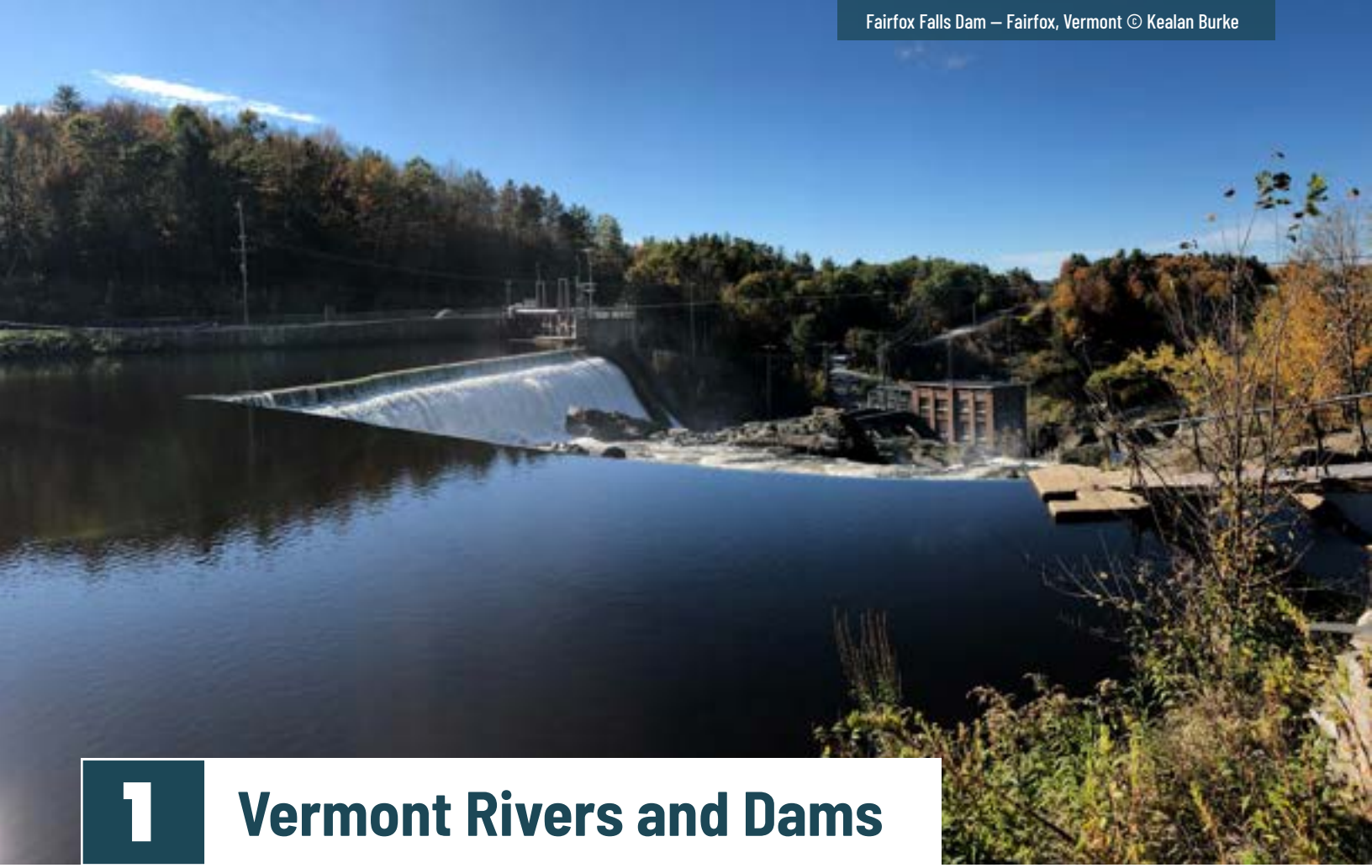
Green River Resevoir – Hyde Park, Vermont

Introduction

Dam removal has become an increasingly popular practice in recent years, as communities and environmental organizations recognize the many benefits of restoring natural river systems. While the benefits of dam removal are well-documented, the process of removing a dam can be complex and challenging, requiring careful planning, coordination, and execution. The benefits of this work are proven time and again to be worth the effort, as seen in restored fisheries, healthy rivers, and communities reconnected to their rivers.

This guide is intended for a broad audience, including project managers, engineers, contractors, community members, and anyone else involved in dam removal projects. It takes thoughtful planning and engagement with partners to identify opportunities for dam removal and design those projects through to construction leading to healthy rivers and communities. The science and practice of dam removal has grown tremendously, and we are still learning from each project. This guide reflects that knowledge from many people and cumulative decades of experience removing dams to restore rivers. Whether you are working on a large-scale project or a smaller community-based effort, this guide will provide you with the tools you need to successfully manage a dam removal project in Vermont.



Fairfox Falls Dam — Fairfox, Vermont © Kealan Burke

1 Vermont Rivers and Dams

River Ecology

Vermont's extensive network of more than 7,000 miles of rivers and streams plays a crucial role in shaping the state's environment and benefiting its residents by ensuring clean water sources, supporting diverse ecosystems, and providing recreational opportunities. Rivers are dynamic in nature, constantly reshaping their channels and meandering across the landscape and transporting sediment across the landscape. These complex dynamics provide necessary functions that provide critical services needed to support the health and integrity of Vermont people and ecosystems.

Prior to European colonization, the rivers of the northeast flowed unobstructed by human development. This natural state allowed rivers to function optimally, supporting a wide range of ecological processes and contributing to the resilience of local ecosystems. The impacts of agriculture and industrialization disrupted these natural stream processes in many places and reduced the ability of our rivers to efficiently respond to increased flows and sedimentation.

Rivers in Vermont are essential to our state's reputation as a destination for outdoor recreation, offering opportunities for activities like fishing, boating, and swimming. As the increase in the density of humans on the landscape continues to restrict the movement of these rivers and the species that live in and around them, these recreational opportunities grow more and more limited to the few unimpacted streams that can still maintain healthy fish populations, whitewater rapids, and deep, cold swimming holes.

Recognizing the importance of restoring and preserving healthy river systems, conservation efforts are underway to enhance river connectivity, remove unnecessary barriers, and promote the restoration of natural stream processes whose efforts aim to ensure the health and vitality of Vermont's valuable river systems.

Dam impacts on rivers

Vermont has over 1,100 known dams. Dam construction began in Vermont in the 18th century and continues to this day. The earliest dams were built to power mills, while later uses include water supply, hydroelectric power, flood control, and recreation. While some of the dams are actively managed for water supply, hydropower, or recreation, the vast majority no longer serve their original purpose and are not being maintained, creating significant concerns for public safety. Many

dam owners are unaware of these legacy structures on their property and the potential hazards they present to communities downstream. These dams also have impacts on river health, including reduced water quality and degraded habitat for fish and wildlife.

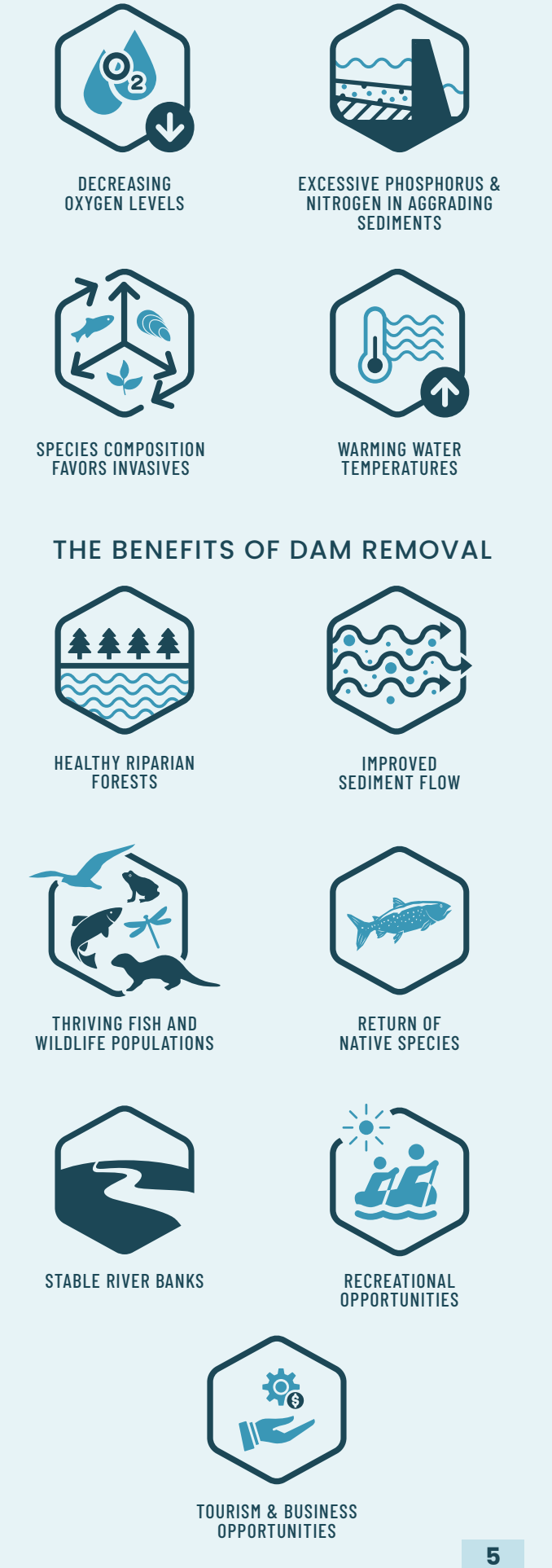
Dam removal in Vermont

Dam removal was once unusual, today it is considered one the fastest and most effective ways to restore a river. Dozens of unnecessary dams have already been removed from the rivers in Vermont. Removing unnecessary dams improves habitat and water quality, creates new opportunities for recreational fishing and boating, and improves safety by reducing the potential for an unplanned failure that could damage downstream infrastructure. As climate change is causing waters to warm, water quality to degrade, and river flows to become more unpredictable, river reconnection practices, like dam removal, are an important climate change adaptation strategy. A connected and free flowing river allows aquatic & terrestrial species to seek suitable habitat and refugia, helping them to survive and become more resilient to the climate change impacts on rivers. Restoring natural river ecosystems through dam removal benefits native fish, birds, mammals, reptiles, amphibians, and people!

Using this guide

This guide is intended to help dam removal project managers understand and begin the process of removing a dam. Between evaluating infrastructure concerns, fundraising, managing sediment, hiring experts, and wading through the regulatory process, completing a dam removal project can be a complex task for most would-be river restoration advocates. The benefits of a free-flowing river at each of these sites shows time and again that the effort is worth it. Use this guide as a reference to manage a project, support a partner, or excerpt the graphics and Frequently Asked Questions to begin talking with your community about removing a dam to restore your local river.

FIGURE 1.



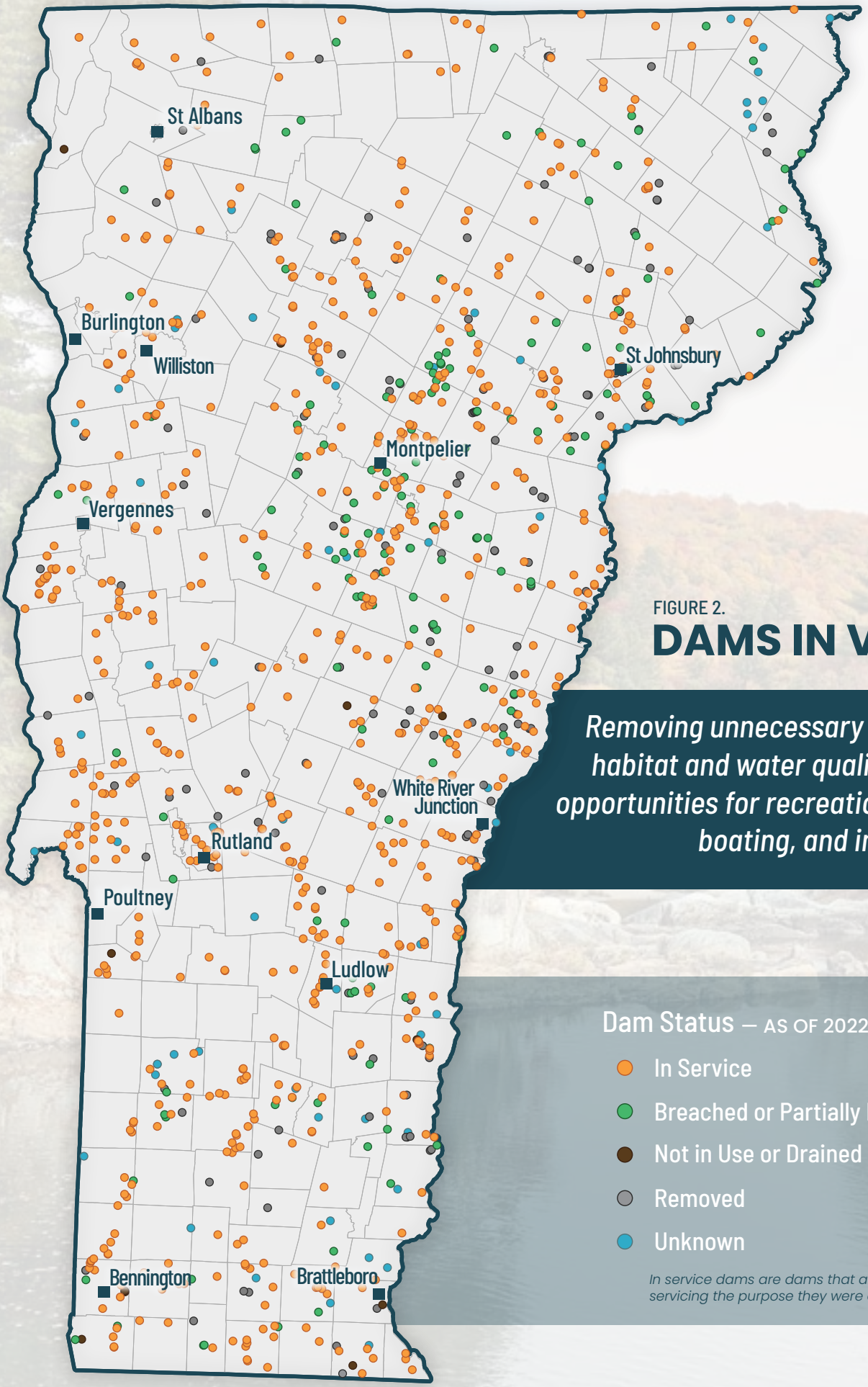


FIGURE 2.

DAMS IN VERMONT

Removing unnecessary dams improves habitat and water quality, creates new opportunities for recreational fishing and boating, and improves safety.

Dam Status — AS OF 2022

- In Service
- Breached or Partially Breached
- Not in Use or Drained
- Removed
- Unknown

In service dams are dams that are currently servicing the purpose they were designed for.

White River Restoration site walk © Amy Singler

2 Project Roles & Responsibilities

Who does what work?

Developing a project team can be very helpful for some projects, particularly when managing more complex issues and multiple objectives. Even so, it is good to determine who is the central project manager and is responsible to be on point for coordinating and tracking activities and how each partner is contributing.

This does not need to be a formal or written structure, but the project manager should consider the following:

1. What is the role of agencies and partners?
2. Do partners want to meet regularly or do some prefer to be simply included when there are particular types of questions?
3. Who will hire engineers or construction contractors?
4. Who will be responsible for fundraising?

Different project phases will require different expertise, including a local group for managing community concerns, biologists for survey, environmental and structural engineering firms for design, historic specialists, and permit specialists. The project team members may be able to complete some of these tasks or more easily access information from local or state databases.

If agency personnel are able, it can be beneficial to have them on the partner team, or consult with them occasionally, to help with data collection or assist with early review of designs and the permitting process. For instance, state biologists may already have species information or are able to do the necessary biological inventory. Similarly, someone on the team may have experience with completing and submitting permits and be able to offer advice on complex issues.

There is no right group of partners to have on your project team. Some projects are straight forward enough that one organization can manage the project and fundraising. An overview of typical roles and responsibilities follows.

PROJECT ROLES & RESPONSIBILITIES

Project Manager

The **project manager** is responsible for overseeing the entire dam removal project. This includes coordinating with all stakeholders, managing the budget, ensuring that the project is completed on time, and overseeing the construction phase. The project manager is the point person for communication and is responsible for ensuring that everyone is working together effectively.

Engineers

Engineers play a critical role in dam removal projects. They are responsible for assessing the technical feasibility of the project, developing design plans, and ensuring that the project meets all safety and environmental standards. Several types of engineers may be involved in dam removal projects, including civil, mechanical, and environmental engineers.

Contractors

Construction contractors are responsible for the actual physical work involved in the dam removal project. This includes demolition, site preparation, and construction. Contractors must have the appropriate licenses and insurance, and they must follow all safety and environmental regulations.

Community Members

Community members are an essential part of the dam removal project team. They provide valuable input on how the project will impact the community and the environment. They can also assist in identifying potential funding sources and help to raise public awareness about the project.

State & Federal Agency Partners

A diversity of permits and approvals are needed for dam removal projects, and **state agency staff** are available to assist project managers navigate these regulatory processes. Additionally, many non-regulatory state resource agencies have a vested interest in the outcomes of dam removal projects and can be engaged to assist in various aspects of project development and management.

Working Together Effectively

It is critical that all members of the project team work together effectively to ensure that the project is completed successfully. Regular communication and collaboration are essential. Each team member should understand their role and responsibilities and be accountable for their work. The project manager should facilitate regular team meetings to discuss progress, address any issues or concerns, and ensure that the project is moving forward according to plan.

In addition to the roles and responsibilities outlined above, there may be other professionals involved in dam removal projects, depending on the project's specific requirements. These may include geologists, hydrologists, and ecologists, among others. Each member of the team brings their unique skills and expertise to the project, and it is essential that they work together effectively to ensure its success.

Wells River, Vermont — following Franconia Paper Mill Dam removal

Franconia Paper Mill Dam removal site — Wells River, Vermont © Amy Singler

3 Project Phases Overview

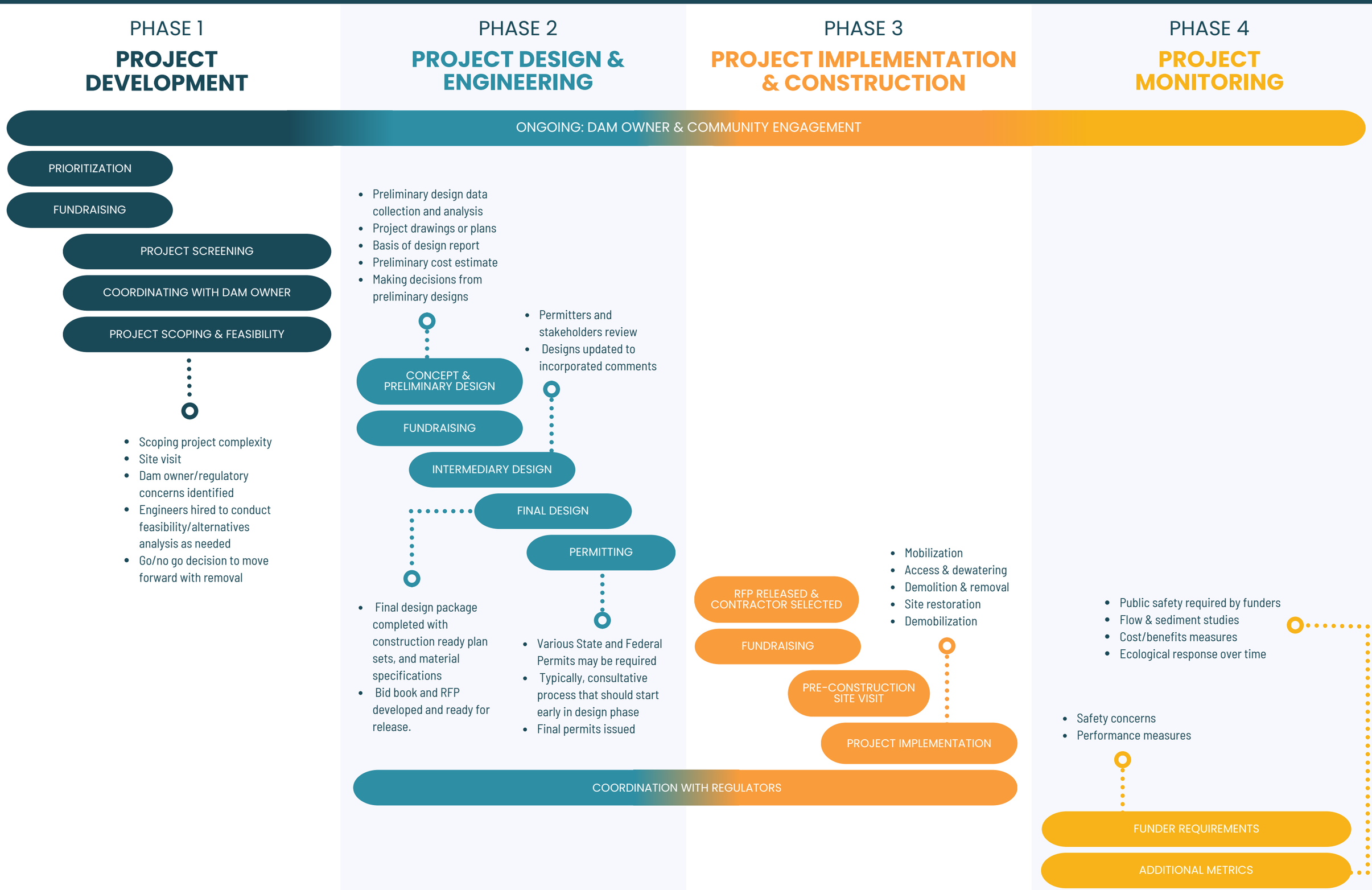
The following section lists the general steps in a dam removal project. These steps are intended to be very general because every dam removal process will have differing site-specific engineering, environmental, and community issues. In general, the phases include project identification, scoping, feasibility, final design, demolition/construction, site restoration, and monitoring.

In some cases, not all of these steps will require the same level of intensity or detail. Evaluate each step presented here to determine if it is necessary for your project. Also, these steps do not always conform to a set order. For example, stakeholder and pre-permitting meetings may need to be held earlier in some cases.

While different projects have different timeframes, in general, expect projects to take two to three years or more from conception to completion. Year one for project identification, scoping, and coordinating with the dam owner; one to two years for engineering design and permitting; and a final year for implementation. Fundraising is typically throughout the project to meet costs as the project progresses. The level of community engagement will vary depending on the project location and impact and may require meetings with different local groups and site visits throughout the project.

The following pages describe many of these steps in more detail.

FIGURE 3. Phases of a typical dam removal project



Phase 1 Project Development

Dams of all sizes and types have similar impacts to rivers, as discussed earlier. Any given project will improve river habitat to different degrees depending on the scale of the impact. Where we work and how we spend limited resource dollars increasingly calls for us to be strategic when choosing which projects to move forward.

Environmental agencies or non-profit organizations may seek out potential dam removal projects that will improve fish passage, water quality, and river health. Often a dam removal project will be initiated by a dam owner looking to eliminate a costly maintenance or safety issue at their aging dam. As discussed earlier, dam removal can have additional benefits for the community, which may elevate the project in priority, including safety and improved paddling or fishing.

Prioritization

There are several decision-support or prioritization tools to assist with identifying Vermont dams for potential removal. These tools estimate the relative benefits of a potential project. Common prioritization metrics for ecological restoration include projects that connect a high number of river miles in areas with good habitat and projects that will improve water quality and support community resilience by reducing flood risk and reconnecting the floodplain. Often these decision-support or prioritization tools are developed at a watershed or basin scale. By working at a watershed scale, agencies and partners can identify multiple projects that may advance established goals to restore rare or important riverine species. In these cases, possibly several removals together will create a large network and could have a greater impact that one project alone or projects across multiple watersheds.

Project screening

It's possible to learn a lot from a desktop review of existing databases. If you have identified a dam for possible removal, make use of online maps to see aerial imagery and street views, as well as historic atlases to understand the current and past conditions at the site.

Consult Vermont ANR Atlas and Vermont Dams Inventory Database

The Vermont Agency of Natural Resources (ANR) maintains an online database of dams throughout the state. The Vermont Dams Database is a useful tool for identifying and locating dams, as well as accessing information on their ownership, condition, and other important details. The ANR Atlas provides interactive maps that can help you identify the location of dams, stream channels, and other features.

Determine the Purpose of the Dam

Determine the purpose of the dam and whether it is still serving that purpose. Dams are typically built for one of several reasons, including flood control, hydroelectric power generation, recreation, or water supply. If the dam is no longer serving its intended purpose, it may be a good candidate for removal. Even dams listed as actively in use may no longer be necessary or there may be alternatives that would allow for removal. For instance, communities may have secondary water supply dams that are no longer in active use, or fire suppression ponds could be replaced by other, more reliable, sources. As dams age and require higher maintenance costs, dam owners may consider alternatives that would allow for dam removal.

Dam Owner Coordination

Permission to remove a dam is a critical early step. Dams may be owned by the government, businesses, nonprofit organizations, or individuals. Determine who owns the dam and what their long-term interests and liabilities are in the dam and the associated uses of the impoundment. Dam owners often have concerns and need design answers before they are able to decide. In such a case it is not uncommon to do a certain level of research or limited analysis to help answer some of these questions or agree that the design will meet a certain set of criteria.

Publicly owned dams may require a longer process to reach a decision for removal. You can start a conversation with the appropriate agency or local representative in order to determine interest, answer your scoping questions, and then develop a process for moving forward.

Project Scoping and Feasibility

An important step in a dam removal project is choosing a project that will be successful and meets its ecological objectives. The project scoping phase is intended to determine the overall breadth of the project and the likely project challenges. At this phase, you will determine whether the project is simple and straightforward or complex, requiring more extensive community outreach, contaminated sediment remediation, or comprehensive environmental impact studies. Many seemingly complex issues can be easily addressed, but it is important in the early stages to understand the issues in order to build them into the project.

Site visit

As much as we can learn through our online tools and conversations, getting out to see the dam in person and meet with the landowner is critical. Take time to view the dam itself from multiple angles. Walk along the impoundment and also notice adjacent buildings, roads, bridges, and retaining walls. Look for sediment in the impoundment – note if you see sand and gravel or finer substrate with plant growth. Look at the upstream and downstream reaches to envision the river without a dam. Talk with the landowner about their goals and concerns, what is important to them. Allow them the space to point to what they see at the dam and how the dam or the landscape has changed over time. Ask about what maintenance has been done in the past. In-person observation and history can go a long way to understanding the complexity of the project and can help shape critical discussion in the design process as well. *See the site visit check list in the appendix for a full list of what to look for while at a dam.*

Scoping Project Complexity

Desktop research, discussions with the dam owner, and site visits all provide information to understand the scope and complexity of the project. When screening potential dam removal projects consider how each of the issues below will affect the cost and scale of the project.

1 *ECOLOGICAL BENEFITS AND IMPACTS*

Dams can have significant ecological impacts on rivers and streams, including changes to water temperature, flow, and sediment transport. Understand what species, particularly if state or federally listed, would be impacted positively or negatively by the project. Benefits will include reconnected stream miles for fish and aquatic species and restored natural river processes, such as reduced water temperature and improved sediment transport.

2 *SAFETY BENEFITS*

Dams that are in poor condition or that pose a safety risk to people or property should be considered for removal. Removing these dams can eliminate the risk of dam failure and reduce the potential for flooding downstream. Often the removal of the dam can reconnect a river to its historic floodplain, restoring its natural ability to attenuate high flows during rain events.

3 *EXISTING USE*

Determine the existing uses of the dam and the impoundment to understand what uses may be affected and how that will impact the design. In many cases, the existing uses will not all go away or can be mitigated for in the design. For instance, a pond that is used for fire suppression could be replaced by an in-river hydrant. For some dams, the listed use is no longer active. For instance, some municipal water supplies include secondary reservoirs that are not needed and may be possible to remove.

4 *INFRASTRUCTURE AND UTILITIES*

Identify any infrastructure adjacent to, or within the limits of impact of your project early in the project. This includes bridges upstream and downstream of the dam,

roads or walls along the river, and water or sewer pipes under the stream bed or in the adjacent riverbank. Not all infrastructure will be affected by the removal, and it is often a good outcome to move or upgrade infrastructure as part of the project. But you want to determine this in advance in order to plan for it.

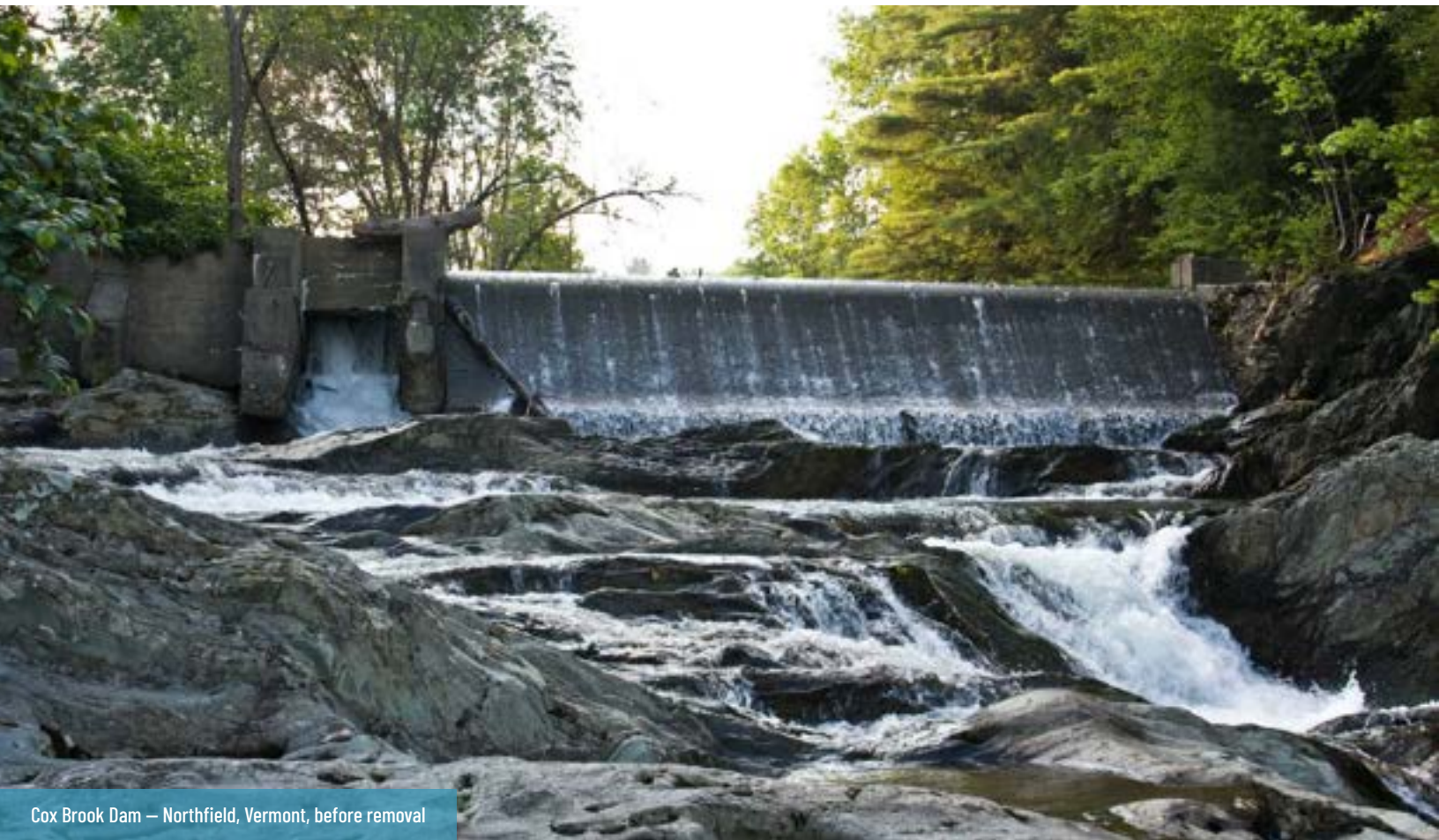
5 *COMMUNITY AND CULTURAL FACTORS*

Local connections to the dam or impoundment go beyond existing uses. Members of the community may feel a strong emotional connection tied to existing uses for recreation, scenery, or history. This fear of change can be a difficult hurdle to overcome as community members may perceive impacts to property values and the local economy. Seek a baseline understanding of current use and perceptions of the dam and impoundment.

6 *SEDIMENT QUANTITY AND QUALITY*

Sediment type, quality, and quantity play a large role in project design. In recent years, resource agencies and the dam removal community have come to better recognize that rivers naturally move sediment and nutrients every day, and even more so during high flow events. While sediment is a natural component of the system, releasing a large volume of sediment or contaminated sediment can have environmental and infrastructure impacts. During this scoping phase, a simple visual assessment is enough. For instance, notice if the impoundment is obviously full of fine sediment or courser gravel and cobble. And considering if the surrounding landscape has a history of industry or is in a natural area will help to determine if you may need to perform testing.

During this initial phase, the goal is to identify if these issues may be part of your project scope, not find solutions to the above issues. Keep in mind that a project with complex infrastructure or community issues to manage is still worth doing if the project benefits match your goals. This type of scoping allows partners to anticipate the project costs and timeline in order to raise funds, anticipate project workloads, and build the best partner team.



Cox Brook Dam — Northfield, Vermont, before removal

Phase 2 Project Design & Engineering

Defining goals

Determine goals for all project partners at the beginning of a project design. Fish passage, healthy water quality, improved safety, and reduced maintenance may all be part of the suite of issues that a dam owner and partners bring to a project. Replacing an existing use or creating recreational opportunities may also be part of the project. Even if discussed during the scoping phase, ensuring that your engineering team understands the goals and objectives upfront will save time and ensure a better design and outcome.

Design phases

Design should address the previously discussed issues through the project planning and site assessment, as well as those identified by the owner, partners, and agencies. Keep in mind that not all projects need to design for, or consider, all issues.

Engineering design is not only a technical exercise, but also how you understand and find solutions to project challenges. It forms the basis for conversations with stakeholders. Working during this phase will also answer questions for permits.

Concept or Preliminary Design

The conceptual or preliminary design lays the foundation for the design. Often, a project manager will initiate the project by collecting enough information to inform key decisions about the project. This process provides concept-level or preliminary designs and quantitative information on environmental and engineering feasibility necessary to make final decisions on the project approach. These terms may be used interchangeably along with 30% design. Key decisions include construction methods; approaches to managing sediment trapped behind the dam; how best to protect nearby infrastructure; and approaches to restoring the formerly impounded area.

While this work is the first part of the design process, in some cases, it may be considered a Conceptual Phase so that project partners and the dam owner can make decisions about the project's approach before proceeding to final design.

1 *PRELIMINARY DESIGN DATA COLLECTION AND ANALYSIS*

Engineers and river scientists will complete a series of field work and analyses necessary to develop alternatives for removing the structure, protecting infrastructure, restoring instream and riparian habitat, and managing sediment. While every case is site-specific, below are some general items that are frequently included in the scope of work. Qualified engineering firms will understand the work that needs to be completed. Note that not every step is necessary for every project and a site-specific evaluation must be completed:

- ☑ **Background Data Collection.** Collect and synthesize all available existing data on the dam, the river, and the surrounding landscape. This could include existing maps and plans, past dam inspections, FEMA flood mapping, air photos, historic maps, fisheries data, planning department reports, and utilities mapping.

- ☑ **Survey and Base Mapping.** A site survey is usually necessary to create a base map and provide information necessary to assess hydraulics and sediment management. In order to completely survey the site, the surveying team must be on site.

  The surveying should include:

  - ☐ Cross sections of the river, adjacent land in the impoundment, the dam itself, downstream, and upstream
  - ☐ Survey of the deepest part of the stream through the impoundment, downstream, and upstream (longitudinal profile)
  - ☐ Survey of the impoundment bottom and the depth of soft sediment throughout the impoundment (bathymetry and depth of refusal)
  - ☐ Delineate and survey the resource areas that will be affected as required in the Army Corps of Engineers regulations, including wetland boundaries and ordinary high and low water lines.

- **Sediment Management Plan.** Quantitatively assess sediment quality and quantity. Complete a due diligence study to identify potential contaminants; use this to inform a sediment sampling and testing plan. Develop a conceptual plan to manage sediment movement and any contaminated sediments. Fundamental to this analysis is determining what portion of the sediment will transport downstream as a result of different management approaches. The consulting team must know how to complete this type of analysis and it is integral in the decision of who to hire for the work.

- **Hydrology and Hydraulics Assessment.** Hydrology involves assessing the volume and frequency of flows in the river. Hydraulics involves assessing the velocity, scour potential, and depths of these flows. Assessing both is necessary to determine how effectively the dam removal will allow for aquatic species passage; to assess potential flood impacts; and to assess potential impacts to surrounding infrastructure.

- **Channel and Riparian Restoration Plan.** Determine the likely width and path of the restored channel. Assess alternatives for the structure and habitat within the stream channel and on exposed land in the former impoundment. This should include assessing whether the site will provide fish passage and other benefits, and should provide alternatives for habitat improvements if needed.

- **Preliminary Structure Removal Plan.** The final approach for removing the structure will be completed during the final engineering design, but several issues should be considered during the preliminary phase as they can have a significant effect on the scope of the design. These include:
  - ☐ The condition of the dam structure for safety concerns, potential demolition approaches, and whether there are usable gates or removable boards that can be used during the dam removal.
  - ☐ Access to the site for construction equipment and staging areas.
  - ☐ Site limitations, such as utilities, topographic constraints.

- **Site-Specific Issues.** There are many additional site-specific issues that may need to be evaluated during this phase on a case-by-case basis. These could include:
  - ☐ Fish and wildlife habitat studies and wetland impact assessment.
  - ☐ Infrastructure protection or replacement plan – consider potential effects on utilities, bridges, culverts, retaining walls, wells, withdrawal pipes, etc.
  - ☐ Assessment of replacing the current uses of the dam and impoundment.
  - ☐ Historic/archaeological assessment of the dam and surrounding area.
  - ☐ Photo renderings of project alternatives if desired for community work (see section on community issues).
  - ☐ Recreation plan for parks, river walks, boating/fishing access.
  - ☐ Sediment removal

- **Pre-Project Monitoring.** The analysis done during the feasibility study should provide the baseline for project monitoring once the dam has been removed. See the section on 'project monitoring' for more information.

2 *PROJECT DRAWINGS OR PLANS*

Engineers will produce a series of plansheets that pull together all of the information collected and analyzed. Plansheets will show the existing conditions and then the proposed restoration conditions following removal, as well as proposed construction access areas. Plans will detail the river, adjacent properties and infrastructure, and wetland resource areas. These will include an overhead "planview" and "long-profile" and "cross-sectional" views of the site.

Basis of Design

The results of the site analysis, data collection, and technical analysis can all be captured in a report. Often this is called a Basis of Design Memorandum or Technical Memorandum and it provides the rational for the design, alternatives considered, and explains the technical reasons behind the design decisions in plain language. It is useful to share with regulatory agencies and you can reference the information to answer questions in permit applications.

1 *PRELIMINARY COST ESTIMATE*

Engineers are able to develop a preliminary cost estimate, often called the Opinion of Probable Cost (OPC). This estimate includes the cost of final design, permitting, construction, and construction observation by the engineer. Depending on the level of design and alternative considerations, the estimate is likely to include a range. The estimate is based on the consulting team's best judgment and past experience.

2 *MAKING DECISIONS FROM THE PRELIMINARY DESIGN*

Once the work described above is completed, partners will meet with the design team to discuss the plans and make decisions on any alternatives. Some projects may require a more thorough alternatives analysis to address critical issues that are outstanding at this phase. This is the opportunity to ask critical questions and decide on the direction of the project. It is also the time to address any errors, minor or otherwise, in the plans or documents.

Who should be involved in the design review and how to incorporate feedback will depend on the project. Consider the sensitivity of the issues surrounding the project when planning a public meeting and hold the initial discussion with the smaller group of project partners to answer questions and plan how to present to the public. In some cases, public information may be for informational purposes, not decision making, and you may wait until the designs are further along to share with community members.

SUSTAINABLE RESTORATION PROJECT DESIGN

All restoration projects should be designed to meet ecological goals and match the situational context, while maintaining the health and safety of the community. Consider the following three keys when approaching your project design.

1 Simple vs. Complex Projects

Projects will need a different level of design and analysis depending on the issues at the site and the surrounding context. For instance, a project in the middle of a city with adjacent water pipes and a high volume of potentially contaminated sediment will require greater study and likely a more complex design than a project on a bedrock dominated stream in a natural area.

2 Removal for Restoration

In order to restore river function and processes, any dam removal should always remove the full vertical extent of the dam and as much of the horizontal span as possible, but at least to the width of the channel and stream banks. If any of the dam is left in the stream bed, the river will erode downstream of the remaining structure and create a scour pool with a new dam at a lower level. Similarly, a river constricted by the width of the removal will create higher velocities and scour the riverbed as well as limit fish passage.

3 Passive vs. Active Restoration

Given the dynamic nature of rivers, less is often more when it comes to river restoration. Understand the project goals and determine how best to meet those through the design process. Passive restoration recognizes that the site will adjust over time and minimizes in-channel work, focusing on full removal of the dam and allowing for the river to self-adjust. Active restoration may be more appropriate in a case where infrastructure and sediment management require some direct channel reconstruction, or installation of infrastructure protection measures.

Intermediary Designs

Following the first phase of the design, the design team will build out the design to include any decisions from discussions around the design alternatives as well as incorporate edits. This phase will bring the project almost to final design and provide an opportunity to discuss the plans with the permitting agencies in advance of submitting the final plans for review. Depending on your project, this phase may have 60 and 90% design plans to allow for more thorough review by different parties or regulatory agencies, but it is not required. The format of the plans at this phase will include most of what is listed in further detail in the Final Designs below, however, will not include the specifications for construction.

Reviewing the plans with regulatory agencies prior to submitting them for formal review allows project managers and the design team to incorporate changes and clarifications into the design. This allows for a smoother and more timely permit review.

Final Design

The final design plans are the culmination of the effort to date, including the data collection and site survey, preliminary design, stakeholder input, and regulator input. The final design plans typically will not change much from the previous phase but will include additional construction details if not previously included. The design typically includes a set of drawings (the design plansheets), a set of detailed specifications, and a technical memorandum describing the analysis and approach. Engineering design plans and specifications should be completed in sufficient detail that a contractor could take the plans and complete the work. Your engineer will be familiar with what is needed to ready a project for construction.

- ☑ **Engineering Design Plan.** The design drawings should show both dam removal and stream restoration plans. Plan sheets typically include base maps and drawings of:
  - ☐ Existing site conditions
  - ☐ Staging areas and access
  - ☐ Removal plan and construction limits
  - ☐ Dewatering plan (sometimes completed by the contractor)
  - ☐ Delineation of resource areas
  - ☐ Proposed plan view
  - ☐ Proposed cross sections
  - ☐ Proposed longitudinal profile
  - ☐ Erosion prevention and sediment control practices
  - ☐ Infrastructure replacement/ protection
  - ☐ Habitat feature schematics
- ☑ **Project Specifications.** The project specifications detail the construction work that will be completed. Typically, specifications detail:
  - ☐ Construction equipment needs
  - ☐ Material specifications and quantities
  - ☐ Project sequencing
  - ☐ Staging area treatment
  - ☐ Site access
  - ☐ Dewatering
  - ☐ Other site-specific details such as planting plans, traffic control, infrastructure protection, etc.

  Design plans and specifications are required to be stamped by a State-licensed Professional Engineer if the dam is considered statutory to the state or if there is infrastructure that could be impacted by the project.
- ☑ **Basis of Design/Technical Memorandum.** The Basis of Design will be updated from preliminary design and describes the analysis that went into the design and details the rationale behind the project approach.
- ☑ **Cost Estimate.** The design team will update or develop an itemized cost estimate based on the design and specifications. The cost estimate is considered an Engineer's Opinion of Probable Cost (OPC) based on the project specifications, until contractors bid on the project.

Phase 3 Project Implementation & Construction

All of the work to develop and plan a project becomes a reality when implementation, typically called construction, begins. This section provides an overview of some of some of the issues during the construction phase.

Construction approaches

The specific approach for construction at a dam removal project will be determined by the issues identified during your design, such as your sediment management plan and avoiding sensitive species impacts. Project construction most often takes place during the low water months of summer and early fall. Some dams may have working control mechanisms that allow for lowering the water level even before construction formally begins. Some projects are able to be completed with the equipment partially in the water, and in other cases, work needs to take place with extensive water control measures to keep the work area dry. Project engineers and permit requirements will ultimately establish the parameters on how the work is completed.

Keep in mind that restoring river habitat can be messy. Understand that the river and landscape will look dramatically different during the construction phase and will need time to adjust. Large equipment will create short-term impacts exposing soil and as the river carves a new channel. It may take a couple of seasons for the site to revegetate and fully realize the long-term benefits. A restored river will have a range of complex habitats to benefit aquatic species at different life stages. And while the change may be dramatic, the species and the local community will adjust to the restored and reconnected river.

Working with a contractor

Construction is most commonly bid out to qualified contractors. In some cases, town departments of public works or partnering corporations have qualified personnel and the appropriate equipment to complete some or all of the work. Determine who from your team, partners, or the engineering design firm will be on site to help direct the contractor. Consider having the design engineer on site for phases that include technical issues such as complex water management or building infrastructure protection measures or a rock rifle. Many of the nuances of infrastructure protection and habitat construction must be relayed on-site during construction. Having the design engineer on site also ensures they are liable for their designs if they oversee installation.

Safety

Develop and follow a safety plan both for the safety of the contractors and for the partners and visitors to the site. Common elements include restricting public access with posted signs, wearing safety vests and hard hats, requiring visitors to check in when arriving on site, and posting proper signs to direct traffic. Sometimes a traffic management plan will need to be approved by the local jurisdiction, such as the police department, helping to ensure the right placement of signs or detours. Keep in mind that the equipment operators are focused on the work at the site and cannot manage access or people on site. Site visits should be carefully coordinated with safety measures and personal safety equipment.

Hiring and working with engineering and construction contractors

This section provides guidance on how to select and work with engineering and construction contractors, including how to write effective requests for proposals and how to evaluate bids.

Basics of hiring engineering and construction contractors

When it comes to dam removal projects, hiring the right engineering and construction contractors is important to ensuring the success of the project. The process of selecting and working with contractors can be complex, but following some basic guidelines can help ensure a successful outcome.

Before hiring any contractors, it is important to establish a clear understanding of the project goals and scope of work. This will help ensure that potential contractors have a clear understanding of the project and can provide accurate bids. It is also important to establish a clear timeline for the project, including deadlines for submitting bids, starting work, and completing the project.

Note that the following is an overview of the process, and your organization may have additional requirements or processes to what is described below.

Request for Proposals (RFP)

A *request for proposal* (RFP) is a document that outlines the scope of work, project requirements, and evaluation criteria for potential contractors. Engineering and construction firms will respond to an RPF with a *bid*. An effective RFP should provide enough detail for contractors to understand the project and develop accurate bids. The RFP should include the following information:

- ***Project introduction and background:*** A summary of project information to date, project partners, and environmental and community goals.
- ***Scope of work:*** A description of the work needed, including any special requirements or constraints. More information will allow potential contractors to develop accurate bids. For engineering services, request that responses provide detail on how their team would approach each task.
- ***Deliverables:*** List the expected deliverables, including reports, drawings, or other documentation. Responses should tie deliverables to the scope of work and budget.
- ***Timeline:*** A timeline for the project, including milestones and deadlines. Request a detailed timeline tied to deliverables in the response.
- ***Budget:*** Request the total project budget and a breakdown of expenses by task or another preferred format.
- ***Personnel and references:*** Request a list of personnel assigned to the project and their roles. Also ask for examples and contact information for similar completed projects.
- ***Evaluation criteria:*** Set clear evaluation criteria that will be used to select the winning bid. It is common to require that bidders demonstrate experience with similar types of projects. Unless otherwise required, note that the winning bid will be chosen based on best value in reviewing demonstrated understanding and approach to the scope of work, experience, and cost.
- ***Instructions for submitting a proposa***l: Include the deadline for submissions and required forms or documentation.

Soliciting potential contractors

It is often required and typically beneficial to solicit bids from multiple companies. Ask for recommendations from other organizations or individuals who have experience with dam removal or similar projects. Word-of-mouth recommendations can be invaluable in identifying qualified contractors. You may also be able to contact professional organizations and trade associations in the engineering and construction fields. These organizations may be able to provide a list of qualified contractors in your area.
In some cases, organizations will need to follow a public bidding process. While we are not covering specifics of this process, much of the guidance about ensuring companies have the appropriate experience and how to evaluate bids will remain the same.

Evaluating Bids

Once the deadline for submitting bids has passed, it is time to evaluate the bids and select a contractor. The evaluation process should be based on the evaluation criteria established in the RFP. Keep in mind that in most cases you are able to choose the contractor based on best value in reviewing demonstrated understanding and approach to the scope of work, experience, and cost. In some cases, the lowest bid may not meet the requirements in the RFP.

Begin by reviewing each proposal to ensure that it meets the requirements outlined in the RFP. Create a list of the top candidates and schedule interviews to further evaluate their qualifications. During the interviews, ask questions to clarify their bid responses as needed and ensure you understand their approach. Confirm each contractor's level of expertise and experience with similar projects. Be sure to ask for references and follow up with those references to verify the contractor's experience and qualifications.

After the interviews have been conducted and references checked, select the contractor that best meets the project's needs. Before making a final decision, review the contractor's proposal and negotiate the terms of the contract.

Additional note on hiring for construction

The implementation phase, typically called construction, has some additional consideration. When you are ready to begin construction, you want to bring in the right expertise to fit the project, however many construction companies may not yet have experience with dam removal specifically. Look for firms with experience working in water, particularly in rivers, for work on bridges or even repairing dams. These types of firms will know how to watch and manage for rain events and will have operators comfortable working in wet environments. Many of these firms are also often able to suggest construction approaches that save time and money. It is helpful to provide flexibility within the design and permits to allow for the contractor to suggest new approaches to save time and funding.

Recognize that more complex projects may require hiring a construction firm with significant structural building experience if you need to replace a bridge or water infrastructure. And do not be surprised if a construction company subcontracts some of the work to a specialized or local company, for instance for excavation or trucking services. These types of subcontracts can save the project money and keep more of the economic benefits locally.

Working with construction contractors

Communication is an important part of working with any contractor. The contract itself should call out a main point of contact for each party. Agree on a schedule of meetings to discuss progress, any issues that arise, and any changes to the project scope.

It is also important to establish clear lines of responsibility and authority with the partner team and the contractor. Whoever holds the contract should be the one to communicate most directly about timelines and progress and to confirm any changes just to ensure that the contract stays within the budget and scope of work. This will help ensure that everyone is on the same page and that the project moves forward smoothly.

Throughout the project, it is important to monitor the contractor's performance and manage the timeline. This includes ensuring that the work is completed on time and within budget, and that the work is being done to the required standard. Unexpected issues can arise that delay the timeline or require additional effort. It is important to address issues promptly and work with the contractor to find a solution, including modifying the scope or timeline. This will help ensure that the project is completed successfully.

A final note that while bringing on an engineer or construction contractor may feel intimidating due to the process and legal aspects, you can also view this as expanding your team to bring on additional expertise to complete the project. Engineering and construction firms are essential to completing dam removals and many of their staff are invested in seeing positive outcomes for the river and adjacent communities. Following these guidelines, you can ensure that you select the right contractor for the job and that the project is completed successfully.

Montague Dam removal, 2022 — Ompompanoosuc River, Vermont

MITIGATING IMPACTS OF DAM REMOVAL

Dam removal will change the existing landscape, which may impact plants and animals at the site. There are several common approaches to limit impacts and benefit species.

CONSTRUCTION TIMING: AVOIDING IMPACTS

- Biologists may want to avoid construction during the migratory season for fish. Thus, the construction can be timed to start after migration.
- Avoid nesting and spawning season for a particular species, or have a biologist identify specific sites to be avoided or protected during construction.

PRE-CONSTRUCTION METHODS: MINIMIZING IMPACTS

- Biologists may be able to collect and relocate individuals from the impoundment before construction starts if there may be impacts to sensitive species.
- Install barriers to prevent species from moving into the construction site. For example, a low-barrier can be put in place around the site to prevent wildlife, like turtles, from entering the construction zone and being injured by moving equipment.

IMPROVING HABITAT: MITIGATING FOR IMPACTS

- Native plants can be added to kick start a restoration, such as trees to add shade to reduce water temperature.
- Habitat features could be added for sensitive species that may be impacted. Examples could include installing large trees removed during construction in the river as aquatic habitat features or piling brush in the floodplain to create shelter for mammals or bird nesting sites.

Phase 4 Project Monitoring

We learn from our successes and our challenges with each project and the right monitoring contributes data to our understanding of river restoration techniques. There are two types of monitoring that occur at dam removals. The first is project evaluation to determine if the engineering design was constructed properly and that the project is performing successfully in terms of infrastructure and public safety concerns. The second is environmental monitoring to determine if the project is meeting habitat goals over the long-term. Build monitoring into your project scope in order to collect baseline data before the removal and account for costs.

Funders often require monitoring of one or two factors to ensure the project met the funding goal. For instance, evidence that migratory fish are using the site and continuing upstream following restoration, or improvements in water quality and temperature.

In other cases, partners have reason to complete a longer and more comprehensive study to include physical and biological metrics such as plant communities, fish and wildlife presence, substrate type, water quality, and more. For most projects, you'll want to determine an appropriate time span, including sufficient pre and post restoration data collection. Partners should determine the monitoring goals and what metrics should be monitored as not all projects necessarily warrant the same level of monitoring.

Project Evaluation

The contractor and construction manager should complete a project evaluation immediately following project completion. However, the project manager should also complete regular project inspections of the site. The manager can develop a checklist of issues to visually inspect with the assistance of the project design team. The checklist might include a visual assessment of vegetation growth, erosion, and scour around infrastructure, such as pipes, retaining walls, and abutments.

Environmental Monitoring

Environmental monitoring involves evaluating changes in several ecological, hydrologic, and geomorphic parameters to determine if the project is meeting long-term ecological goals. A monitoring plan should be developed during the project development phase, as most monitoring parameters must be pre-measured prior to project implementation in order to establish pre-project baseline conditions. Trained personnel from universities, environmental consulting firms, or scientific staff from various nonprofits can complete environmental monitoring activities. In some cases, state agencies can provide assistance with project monitoring, such as by evaluating fish populations before and after dam removal.

The Gulf of Maine Council has published a Guide to Barrier Removal Monitoring, available at http://www.gulfofmaine.org/streambarrierremoval/. This guide recommends seven critical monitoring parameters and outlines methods for each parameter. It also provides data sheets, equipment lists, etc. It is important to consider the monitoring needs in the context of the size and scope of the project and not develop a monitoring plan that is overly ambitious.

The most basic approach to project monitoring is to develop photo stations to photograph the site from the same location repeatedly over time. In addition, there are a number of parameters that can be monitored to track the ecological success of a project, and they fall in some broad categories:

Ecological response

- ☐ Evaluate changes in fish, macroinvertebrate, and other aquatic species distributions and abundance.
- ☐ Evaluate vegetation regrowth in exposed lands, particularly assessing invasive and exotic species.

River channel response

- ☐ Evaluate sediment movement, erosion, and habitat structure by surveying channel structure and analyzing bed material samples.

Water quality response

- ☐ Evaluate changes in water quality, including such parameters as water temperature, dissolved oxygen, and suspended solids.

Hydraulic response

- ☐ Evaluate changes in flow velocities as this impacts aquatic species movement and recreational boating safety in the river.

Recreation on the Passumpsic River after the East Burke Dam removal, Vermont © Ron Rhodes

4 Working with the Community

Many Vermont villages developed around sites that provided water power for mills, so dams have been a central part of these communities since their earliest days. Some are considered historic and scenic structures, and decisions surrounding dams often raise strong feelings of sense of place and connection to the current landscape. Native Americans have occupied present day Vermont extending back 13,000 years. And there is significant cultural heritage along and within rivers that also needs to be considered.

Many impoundments are used for recreation or simply provide a pleasing view for adjacent landowners. In some cases, communities will strongly oppose the notion of dam removal. In other cases, the community will have no interest in the dam at all. In still other cases, the surrounding community may support improved water quality and the return of fish runs and riverine recreational opportunities. Whatever the case, it is important to talk with the dam owner and consider the level of community involvement in the early stages of the project. Based on this initial assessment, the project team should develop a plan for community presentations and participation.

Clear, proactive, and consistent communication with the parties interested in the current and future condition of the river may be necessary across all phases of a project from planning through construction and post-construction monitoring. Any project can get off to a bad start when there is a sense that information is being withheld or decisions have already been made without public input. Keep in mind that public engagement may not always include public decision making if the dam is privately owned, however a project may still benefit from communicating with the public and proactively addressing questions.

Depending on the complexity of the project, this may include a combination of announcements in local newspapers, community forums, or social media, public meetings and an accountable and accessible point of contact for stakeholders to reach with any questions or concerns.

Some smaller projects with fewer noticeable changes may not require the same intensity of outreach. Communicate the anticipated benefits of the project, any anticipated negative impacts, and a plan to manage those impacts. Often, an illustration of the site before and after construction, can help with communication.

Public Participation

There are two primary ways to involve the community in dam removal projects: through mandatory regulatory hearings and through proactive public participation. If the community has an interest in the dam, then proactive approaches are critical to help the community through the change that is occurring in the landscape. Having community members as active managers of a dam removal will help ease the fear of change, will help create new community norms, and will smooth local decision making.

In towns with a conservation commission, reaching out to that body can be a good first step to engage the local community. Ideally, members of the conservation commission can serve as members of the project team by participating in planning meetings and other aspects of the project. The commission can also host public meetings in the local community, serving as a bridge between project managers and local residents.

If the dam itself is owned by the city or town, those public conversations may be managed through the board or committee with the management responsibility, namely, public works, or the selectboard, etc.

Public Visioning

A sense of loss is inherent in the notion of dam removal: an object is being removed and the land and river may change. But dam removal projects can also bring a great deal of gain in terms of new recreation opportunities, restored ecosystem health, and a renewed connection to a free-flowing river. With some creative community visioning, the fear of loss can be turned into a sense of gain. A proactive discussion or visioning around community concerns and goals of the site, may allow project managers to adjust the design or add elements to the project to address community needs. Installing benches, possibly made from pieces of the dam, or improving fishing access could provide new opportunities to enjoy the site.

Renderings

Renderings can help the community gain a better vision for how the restored river will look when a dam is removed. These can be drawings or digitally altered photographs showing "before" and "after" images of the site. Renderings have been successfully used in situations where there is apprehension about the "look" of the restored river or where different removal options are being considered.

Photosimulation of removal of Mill Pond Dam (top) and existing conditions (bottom) during normal flow.

These types of renderings can be scoped into the engineering design work and can be exceedingly helpful when communicating the impact of removal to a communities and owners.

Framing Effective Messages

While many river advocates care deeply about the river and the fish and wildlife it supports, for others these are small concerns. The perception of an idea such as dam removal is more important than the actual science that backs it up. It is important to think about the perceived benefits of dam removal for your audience. For many communities, public safety and the financial burden of failing infrastructure present a strong economic argument, while in other places social or recreational interests may be important. It is also important that community visioning is led by someone from the community and not by state or federal agency staff who will be perceived as outsiders. Agency partners can provide valuable scientific backup and support, including producing renderings and talking about alternatives, but local decisions should be made by those who will be affected by the outcome.

A good initial exercise in planning a community outreach strategy is to write down perceived benefits and barriers as viewed by the community so that they can be adequately addressed. Barriers might include the perceived loss of property values, the loss of a pond and recreational amenity, or simply fear of change. With every loss, there can be a real or perceived gain, such as increased fishing opportunities or increased recreational opportunities in the form of a new walking trail through the old impoundment. Using examples and case studies from other Vermont communities or from other states can also help spread the knowledge that dam removal is becoming a community norm.

Site Walks

Getting out to look at the site and discuss concerns and opportunities can be a great way to build understanding for everyone. Some people may not have seen the site in recent years and understand the degree to which it has changed. Moving the discussion outside can also take some of the angst out of public comments and allow people to better share their concerns. And indoor engineering presentations and pictures are not always sufficient for everyone to understand the site. Standing near the dam, pointing out specific locations or deficiencies in the dam can help everyone get on the same page.

Finally, the Q&As in the appendix are a great place to start when talking with the community. They can also be customized to meet your project needs.

Passumpsic River – East Burke, Vermont © Amy Singler

Bull Run post dam removal © Michele Braun, FWR

5 Funding for Dam Removal

Funding overview

Funding is always a big question with any project. Based on your project goals and the types of benefits you may be eligible for different types of funding. Determine what species will benefit from your restoration, including metrics like how many miles of habitat will be accessible. Also consider project benefits for recreation, public safety, reduced flood impacts, and climate change resiliency as funders are increasingly aware and interested in the larger benefits of dam removal.

Also look into infrastructure funding, considering that removing aging infrastructure has a public safety benefit and reduces future maintenance costs. When developing a budget for your project, be sure to include these key elements.

Projects are typically funded in phases. Depending on the amount of funding available and the readiness of your project you may be able to fund project scoping and a preliminary design, or even full design and permitting. It is common for funders to require completed designs and permits before providing implementation funding. It can be tricky to time applications with project phases, but often if a project is showing progress in the design and permitting, a funder may be willing to review an application for implementation, even if the design is not finalized.

When applying for funding, it is important to carefully review the grant guidelines and requirements to ensure that the project is eligible. Many grants require a detailed project proposal and budget, as well as a match from non-federal sources. Have a clear understanding of the project scope and budget before applying for funding, as many grants have strict deadlines and limited funds available. Most funders welcome questions from potential applicants. Take advantage of opportunities to talk through your project and a potential application with a funder.

Types of funding

In this section we review several types of funding as well as note specific funders. Information on eligibility, deadlines, and available funding changes year to year, therefore links are not included here. A web search or conferring with an experienced project partner should help you find the most recent contact information.

In Vermont, there are several state grants available for dam removal projects:

- ***The Vermont Department of Environmental Conservation (DEC)*** offers the several funding opportunities, which provides funding for river restoration projects, including dam removal.

- ***The United States Fish and Wildlife Service (USFWS)*** offers grants for dam removal projects that benefit priority aquatic & terrestrial species. USFWS The National Fish Passage Program provides funding to remove dams and other barriers to fish migration. USFWS grants require a matching contribution from non-federal sources. Contact the Vermont office of the USFWS for more information on deadlines and how to apply.

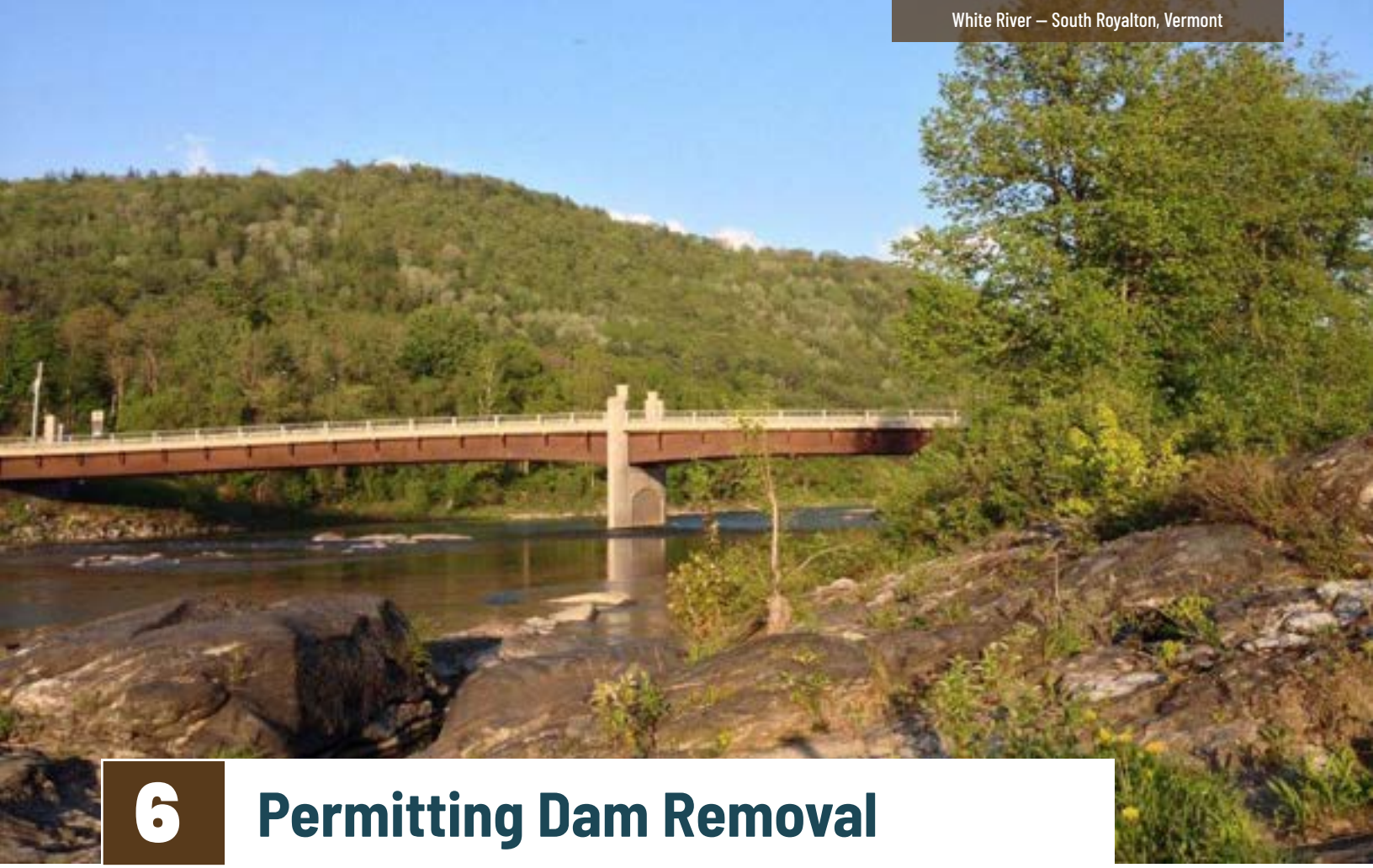
- ***The Federal Emergency Management Agency (FEMA) Hazard Mitigation Grant Program (HMGP) & Building Resilient Infrastructure in Communities' Program*** can also be a potential source of funding for dam removal projects. HMGP & BRIC provide funding for projects that reduce the risk of future damage from natural disasters and can be leveraged toward dam removals that significantly reduce flood risk to communities. Both of these programs are administered by the Vermont Emergency Management Agency with oversight from FEMA and must meet strict benefit-cost ratios.

- ***The Lake Champlain Basin Program*** is able to support dam removal project development, design, and implementation. Contact their office or review the website for more details on specific types of grants.

- In addition to grants, there are also low-interest loans available for dam removal projects. ***The Vermont Municipal Bond Bank*** offers loans to municipalities for water-related projects, including dam removal. ***The Clean Water State Revolving Fund (CWSRF)*** also provides low-interest loans that can be leveraged toward dam removal projects that demonstrate water quality benefits.

- Many private foundations also support restoration projects. Some family foundations may offer smaller grant amounts, which could be used to support staff to manage the project, while larger foundations can support design and implementation.

Wells River, Vermont — after dam removal



White River – South Royalton, Vermont

6 Permitting Dam Removal

Local, state, and federal agencies have authority over dams, dam removal, and any impacts to wetlands, lakes, and rivers. As a result, multiple permits are often required to remove a dam. Each permit has a regulatory threshold that specifies whether it is required for a specific project. Not all permits may be required at all dam removals depending on site-specific actions. Timing for each permit varies. Usually, the more thoroughly prepared the design and permit application, the less time it takes to receive approval. In some cases, regulators may require additional analysis during the permitting process.

Project permitting costs vary widely depending on project complexity. If the work is entirely completed by consultants (including completing paperwork, filing forms, and attending hearings, meetings, and site visits), permitting can cost thousands of dollars depending on site-specific permit requirements. The manager can realize significant cost savings by handling the filings and any hearings.

Removal of operating hydroelectric dams that are regulated by the Federal Energy Regulatory Commission (FERC) is a more complex subject. The manager's best course of action is to contact the DEC Rivers Program while the project is still in the conceptual stage to ascertain the regulatory status and requirements.

Some recommendations:

- ☐ Consult and work cooperatively with regulatory agencies.
- ☐ Your design should consider sensitive species, water quality requirements, and other regulated issues. Be sure to check into these requirements during the design process.
- ☐ Invite state and federal agency personnel to the site prior to beginning the permitting process. If you anticipate impacting sensitive species, it is best to initiate a conversation and/or site visit early in your design.
- ☐ Plan sufficient time to complete all the necessary consultations and regulatory processes. Early coordination will limit design changes and make for a smoother process.

The DEC Rivers Program can provide more detail on the dam removal permitting process.

Overview of each permit in Vermont

The following reviews the permits that may be required. While some of the language may seem technical or intimidating, it is important to understand that agency staff are able to help walk applicants through the process.

Local Permits

Depending on the local zoning regulations, a zoning permit may be required. In addition, towns that participate in the FEMA National Flood Insurance Program are responsible to permit projects in a mapped Special Flood Hazard Area. The effects of dam removal on published flood elevations and mapped flood hazard areas will need to be analyzed and documented. Consult with your local zoning administrator following your preliminary design to determine what the local regulatory requirements may be for both zoning and floodplain management.

State Permits

Depending upon the size and location of the dam, the State of Vermont will require one or more permits or approvals. Key issues that determine which permits will include if there are impacts to wetlands protected by the state, the volume of water or other material impounded by the dam, the volume of sediment or fill that will be excavated, and any discharges from the site during construction.

Each permit is briefly described below. For the most up to date information, a search of the state website will provide links and copies of forms. In all cases, a call to DEC staff will help navigate what is required for your project. As of the writing of this guide, the state also provides a comprehensive Permit Navigator to assist with identifying applicable permits for your project, permit details, and contact for information for each agency.

www.permitnavigator.my.vermont.gov/s/

- *Wetlands Permit – DEC Wetlands Program*
  Dam removals and other river restoration projects most likely affect protected state wetlands. Permits are required for most activities within a wetland or its buffer zone (50-feet for Class II wetlands, 100+feet for Class I wetlands). Activities in wetlands and buffers likely to need a permit include filling, draining, cutting, or removing vegetation, removing soil, or grading.

- *Dam Order – DEC Dam Safety Program*
  Dams that impound at least 500,000 cubic feet of water or sediment (or both) require an order prior to any construction, including reconstruction or removal.

- *Stream Alteration Permit – DEC River Management Program*
  This permit regulates alteration of streams, including excavation or fill of 10 or more cubic yards in any perennial stream, or construction or maintenance of a berm in a flood hazard area or river corridor. Dams that fall below the 500,000 cubic foot threshold for a dam order may require a stream alteration permit.

- *Lake Encroachment Permit – DEC Lakes Program*
  Any encroachment, including dredge or fill, within a regulated lake or pond will require this permit.

- *Construction Stormwater Permit – DEC Stormwater Management Program*
  Construction projects involving 1 or more acres of land disturbance require a permit for the discharge of stormwater from the construction activities.

- *Water Quality Certification – DEC Water Quality Division*
  Any project which must obtain a permit from the Army Corps of Engineers must first obtain a Section 401 Water Quality Certification from the state.

Depending on your specific site and project approach, these additional permits may be required:

- *Section 1272 Order – DEC River Management Program*
  Projects that do not require a stream alteration permit may be authorized by one of these orders, which focus on prevention or control of a downstream discharge of sediment or other pollutants. Permitted activities may include construction of cofferdams to manage sediment, which is common for dam removals.

- *Insignificant Waste Management Event Approvals (IWMEA) – DEC Solid Waste Management Program*
  An IWMEA is required for one-time, on-site disposal of solid wastes such as untreated wood, masonry, concrete or other inert materials. Removing a dam may generate solid waste from the dam material.

- *Act 250 Permit*
  In certain unusual circumstances, a dam removal project may fall within the jurisdiction of Act 250 which is a law that evaluates the impacts of many times of land uses.

Historic Resources Review – Division for Historic Preservation

www.accd.vermont.gov/historic-preservationl

Any projects that are subject to state or federal permits can be reviewed by the Division for Historic Preservation to identify potential impacts on historic or archaeological resources. Projects that involve a federal permit, such as the Army Corps Permit, or that will use federal funding are subject to a more prescribed process mandated by Section 106 of the National Historic Preservation Act. This process includes written notice to federally recognized tribes. It is worthwhile to engage division staff early in the design phase to understand if there are historic or archaeological resources that need to be avoided, managed, or mitigated.

Federal Permits

- *Army Corps of Engineers Permitting*
  The U.S. Army Corps of Engineers will likely have jurisdiction over a dam removal project through two federal laws:
  - Clean Water Act – Section 404 requires a permit for discharge of dredge or fill material into all waters of the United States, including wetlands. This phrasing is interpreted to mean any sediment removal or release into rivers or wetlands.
  - Rivers and Harbors Act of 1899 – Two sections of this act require a permit for work in navigable waters of the United States. Section 9 requires a permit for construction of new dams, and Section 10 requires a permit for other structures or work. The extent of navigable waters in Vermont is defined in Army Corps regulations.

  In most cases, Section 404 will be the trigger that requires a federal permit. The application and review process are the same regardless of which statute triggers Corps jurisdiction. As noted in the state permits section, any project that requires a federal (Corps) permit under Section 404 of the Clean Water Act will require a Section 401 Water Quality Certification from the state. Projects seeking authorization under Section 404 or Section 10 also require consultation with the Division for Historic Preservation under Section 106.

  Projects that meet certain criteria and would result in "minimal impacts" may be eligible for coverage under the Vermont General Permit, resulting in a simpler and faster permitting process.

  More information on Corps of Engineers permitting is available at: www.nae.usace.army.mil/reg/index.htm. The Vermont Project Office in Essex Junction can be reached at 802.872.2893.

Federally Endangered Species Permitting

If your project may impact any federally listed endangered species, then you may be required to apply for an incidental take permit. An incidental take permit is issued under Section 10 of the Federal Endangered Species Act to private parties undertaking otherwise lawful projects that might result in the take, or impacts to individual animals or the habitat, of an endangered or threatened species. Application for the permit is subject to certain requirements, including preparation by the permit applicant of a conservation plan, generally known as a "Habitat Conservation Plan" or "HCP."
All projects should be screened using the United States Fish and Wildlife Service (USFWS) Environmental Conservation Online System to determine if project activities will impact a listed species and assess what permits and mitigations may be needed.

You can find the Online Screening Tool here: https://ecos.fws.gov/ecp/.

More information on USFWS permitting in Vermont is available by contacting the USFWS, Endangered Species Permit Office:

300 Westgate Center Drive
Hadley, MA 01035-9589
Phone: (413) 253-8212

FIGURE 4. Chart of State & Federal permits required for dam removal projects

FEDERAL PERMITS

ENDANGERED SPECIES REVIEW

Will the project impact a federally-listed endangered species?

YES — Coordinate with U.S. Fish & Wildlife Service

NO — No coordination required

USACE

Will the project have more than "minimal impacts" as defined by the Army Corps of Engineers?

YES — Army Corps Pre-Construction Notification or Individual Permit required

NO — Project may be eligible for Self-Verification under the Vermont General Permit

HISTORIC RESOURCES REVIEW

All projects require review by the State Historic Preservation Office.

YES

STATE PERMITS

WETLANDS PERMIT

Are there Class 2 wetlands on the site?

YES — Allowed use wetland review required

NO — No review by wetlands program

CONSTRUCTION STORMWATER PERMIT

Is the disturbance outside the impoundment greater than 1 acre?

YES — Construction General Permit (CGP) coverage required

NO — No review by stormwater program

DAM ORDER

Is the dam regulated under the Dam Safety Program (DSP)?

YES — Dam Order required

NO — No review by Dam Safety Program

STREAM ALTERATION PERMIT

Is there channel restoration on a perennial stream?

YES — Stream Alteration General Permit (SAGP) required

NO — No permit required

LAKE ENCROACHMENT PERMIT

Does the dam impound a regulated lake or pond?

YES — Lake Encroachment Permit required

NO — No review by Lakes and Ponds program

WATER QUALITY CERTIFICATION

All projects require an Army Corps Permit. 401 Water Quality Certification required.

YES

Depending on your specific site and project approach, these additional permits may be required:

SECTION 1272 ORDER

Will the project discharge sediment or pollutants, but does not require a stream alteration permit?

YES — Review by River Management Engineer

NO — No order required

INSIGNIFICANT WASTE MANAGEMENT EVENT APPROVALS (IWMEA)

Will the project need to dispose of solid waste (e.g. dam material) on-site?

YES — Review by Solid Waste Management Program

NO — No review by Solid Waste Management Program

ACT 250 PERMIT

Does the project fall within Act 250 jurisdiction?

YES — Project review by the Natural Resource Board

NO — No review required

Dam Removal Initial Reconnaissance Checklist

Dam name	Location
Dam owner	Land ownership around impoundment
Ecological benefits	Community benefits
Existing dam uses	Infrastructure issues
Rare species	Sediment quality
Community concerns	Funding possibilities