Franklin Regional Council of Governments

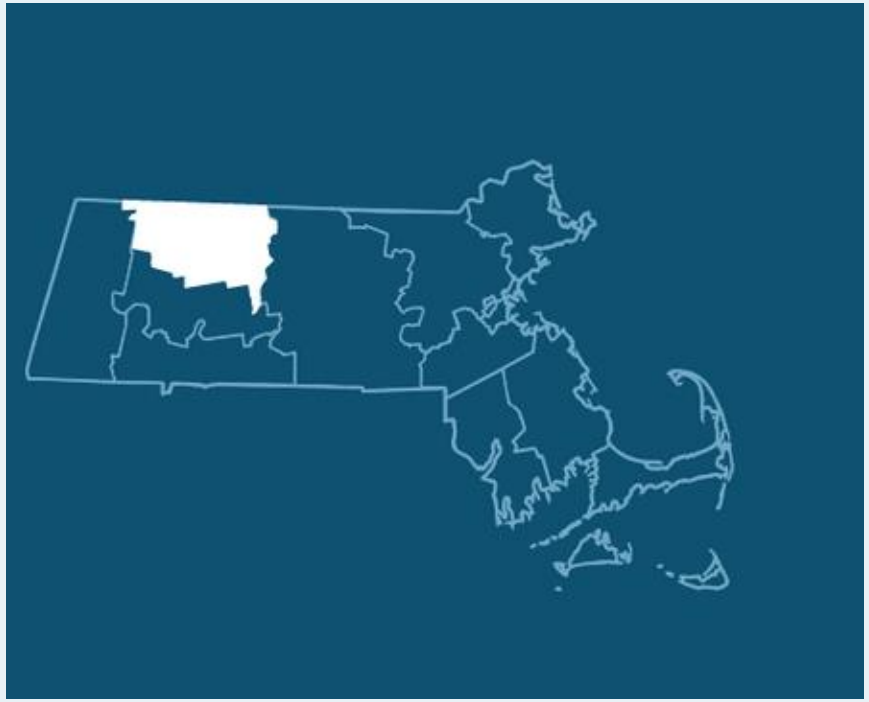
River Restoration Design and Permitting in Massachusetts: A Guide for Inland Rivers

Massachusetts Water Resources Commission

July 10, 2025

Funding provided by the Long Island Sound Study

Franklin Regional
Council of Governments



FRCOG Land Use & Natural Resources Program

https://frcog.org/program-services/climate-resilience-land-use/

Projects focus on building climate resiliency at multiple scales – site, municipality and watershed

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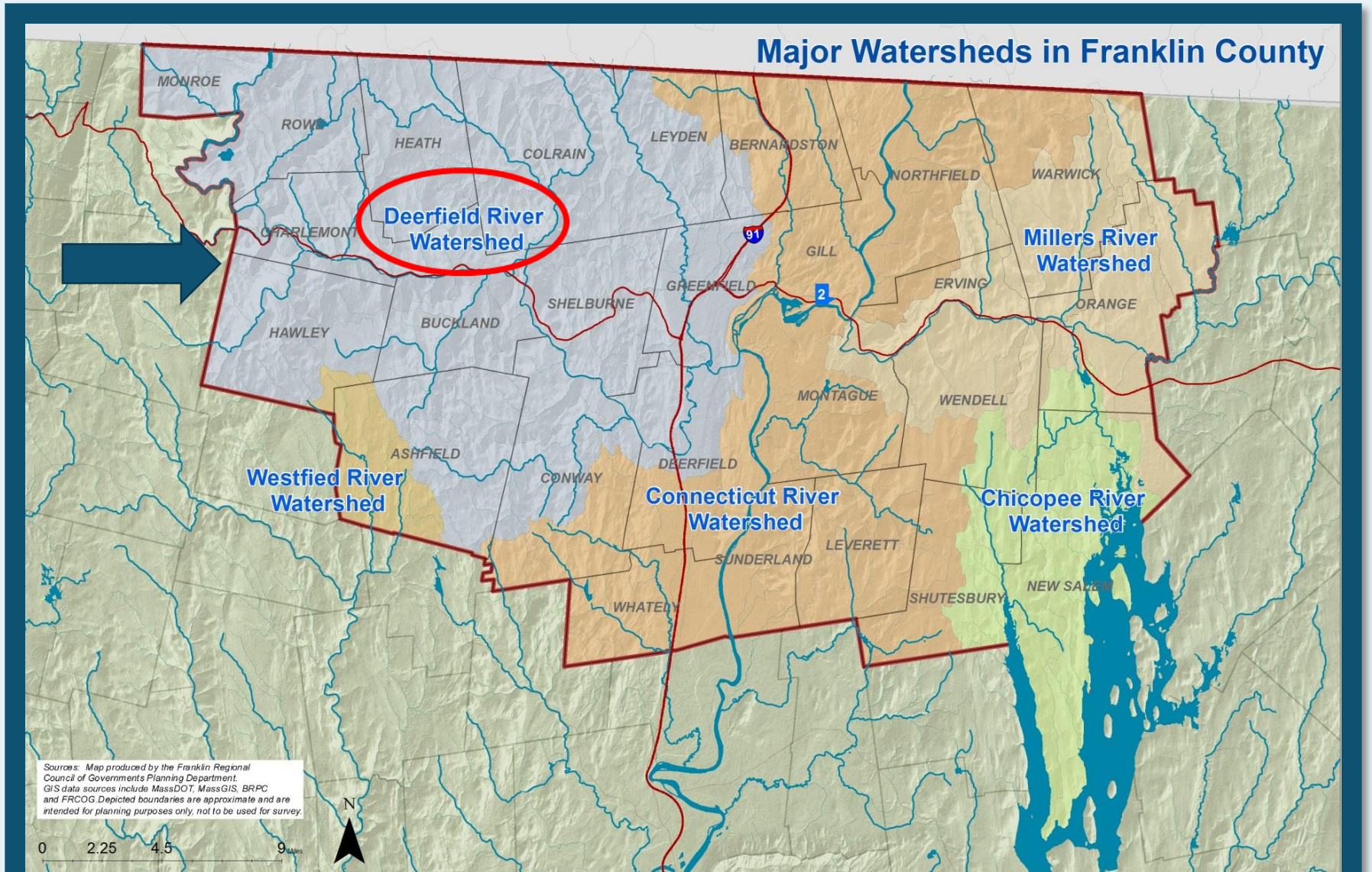
Project Background – It Started with the Deerfield River Watershed

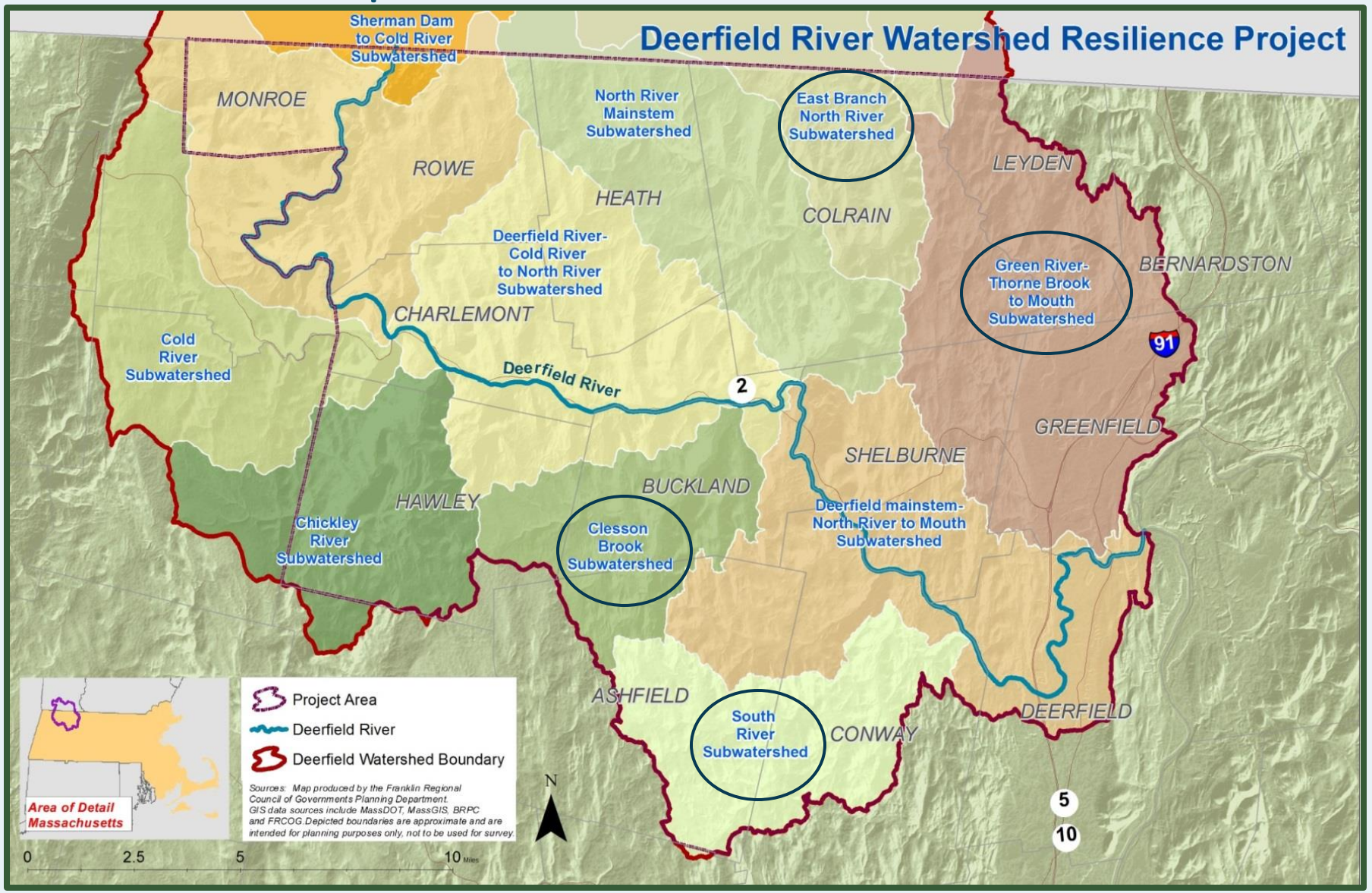


Science of Fluvial Geomorphology and Work of the VT Rivers Program

Fluvial geomorphology: the study of the form and function of rivers and the interaction between rivers and the landscape around them.

According to the USGS, "*understanding river - channel responses to various human-caused and natural disturbances is important for effective management, conservation, and rehabilitation of rivers and streams to accommodate multiple, often conflicting, needs.*"

Fluvial Geomorphic Assessments for four HUC-12 watersheds



- Collect baseline habitat and fish community data.
- Identify and prioritize potential restoration projects for the watershed.
  - Address site specific concerns (eroding banks, threatened infrastructure)
  - Address water quality concerns (sediment)
- Develop conceptual designs and identify river and land use management techniques that are consistent with river processes.

Fluvial Geomorphic Assessments

The major tributaries and smaller headwater streams in the Deerfield Watershed are adjusting to decades, even centuries, of human manipulation of the river and the watershed lands.

- Historic dams and legacy sediments
- Channel straightening, berming and armoring
- Lack of wood and channel roughness
- Floodplain disconnection
- Channel incision
- Headcuts
- Eroding banks
- Mass failures/landslides

River Restoration Projects

Treatment Types Mimic Natural Rivers

Since 2010, FRCOG has identified over 40 projects and developed site designs that use principles of FGM and nature-based techniques –

- floodplain reconnection
- bank stabilization
- riparian buffer plantings
- In-stream structures such as large woody debris, boulder deflectors and v-shaped weirs.

River Restoration Projects

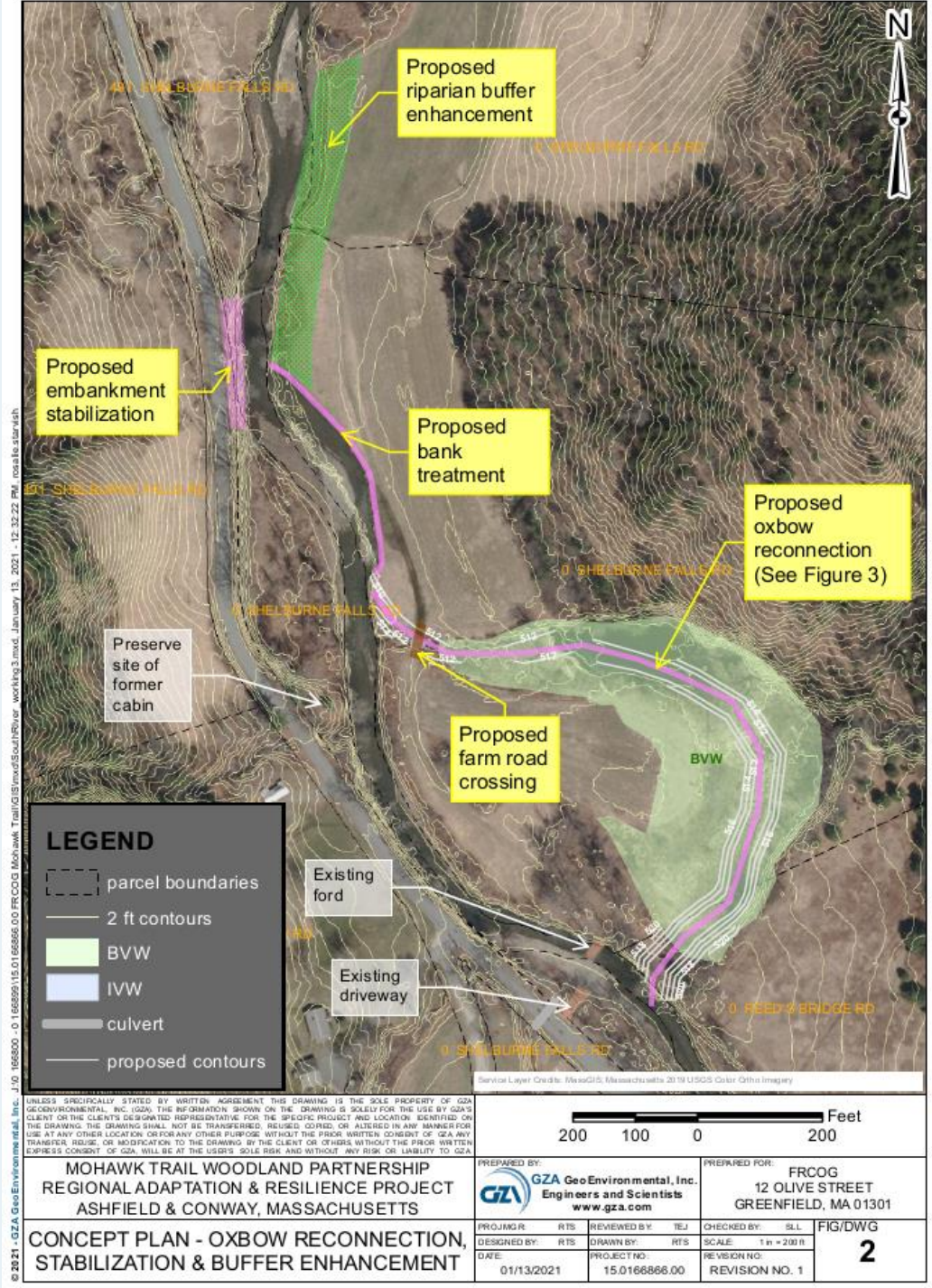
Benefits:

- Reduce sediment and nitrogen loading
- Restore and protect water quality and fluvial geomorphic functions
- Protect healthy waters
- Provide habitat and flood resiliency co-benefits
- Address local site-specific concerns
    - stabilizing an eroding bank
    - reducing threats to roads, houses, farmland
- Address causes of channel instability in order to reduce stresses on adjacent stream segments
- Move river towards a stable condition

River Restoration Projects

Challenges:

Environmental permitting is costly and uncertain and can be the biggest barrier to implementation of complex, watershed-scale projects.



Degraded channel function in straightened reach leading to increased risk to road and downstream properties	Re-activate abandoned oxbow meander to increase stream sinuosity and decrease sediment transport downstream
Active mass failure threatens Shelburne Falls Road at top of slope	Stabilize mass failure with instream boulder and log deflector structures
Wide shallow channel and lack of riparian buffer	Riparian planting and establishment of a no mow zone

What can we do?

River Restoration Design and Permitting in Massachusetts: A Guide for Inland Rivers

Presentation to the Massachusetts Silver Jackets Team

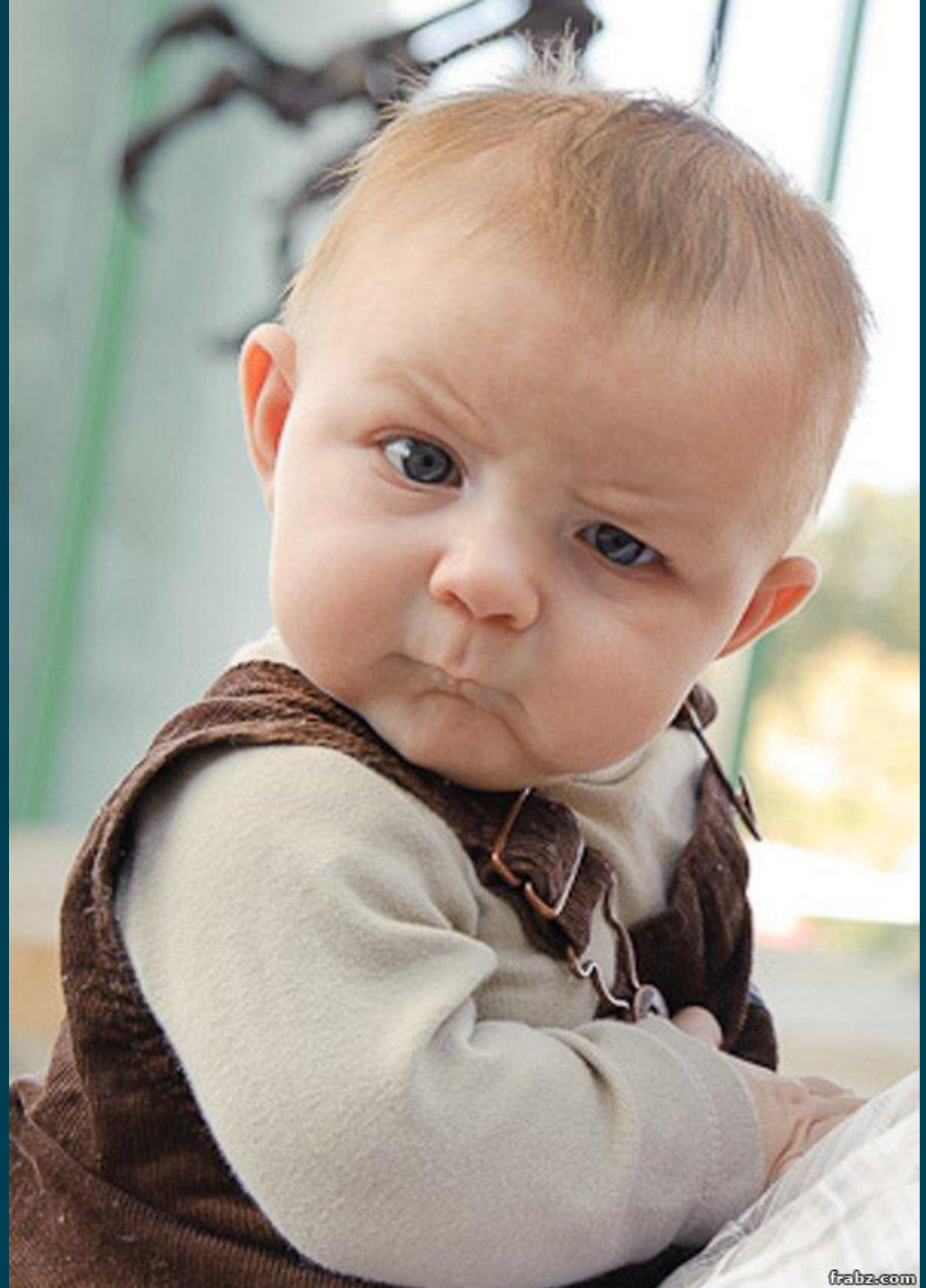
June 11, 2025

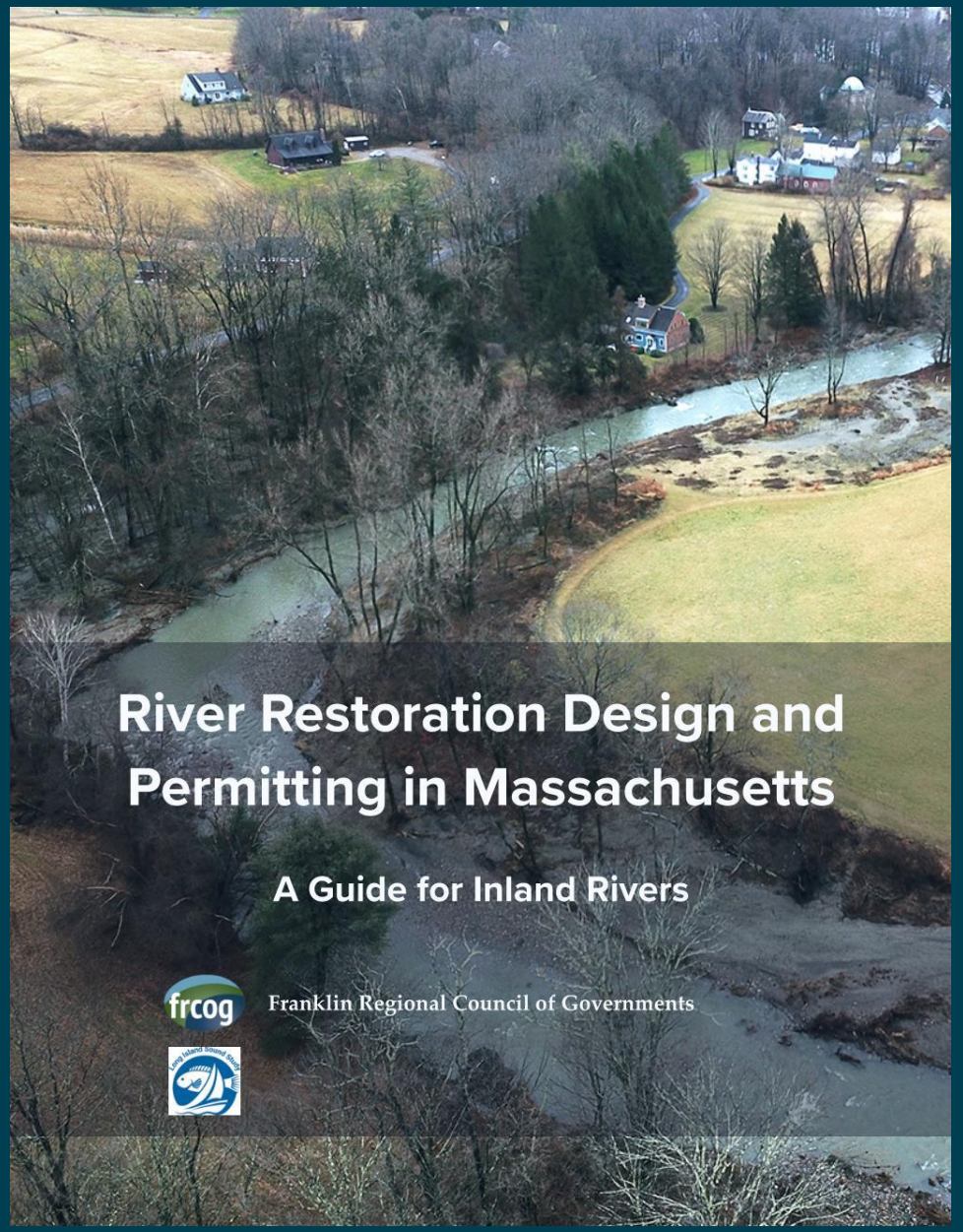
Do you ever wonder…What's a good resource to design and permit river restoration projects?


Are your constituents concerned about how to reduce flooding?
POLAR


Have you ever asked yourself… Have the applicants properly designed this river restoration?

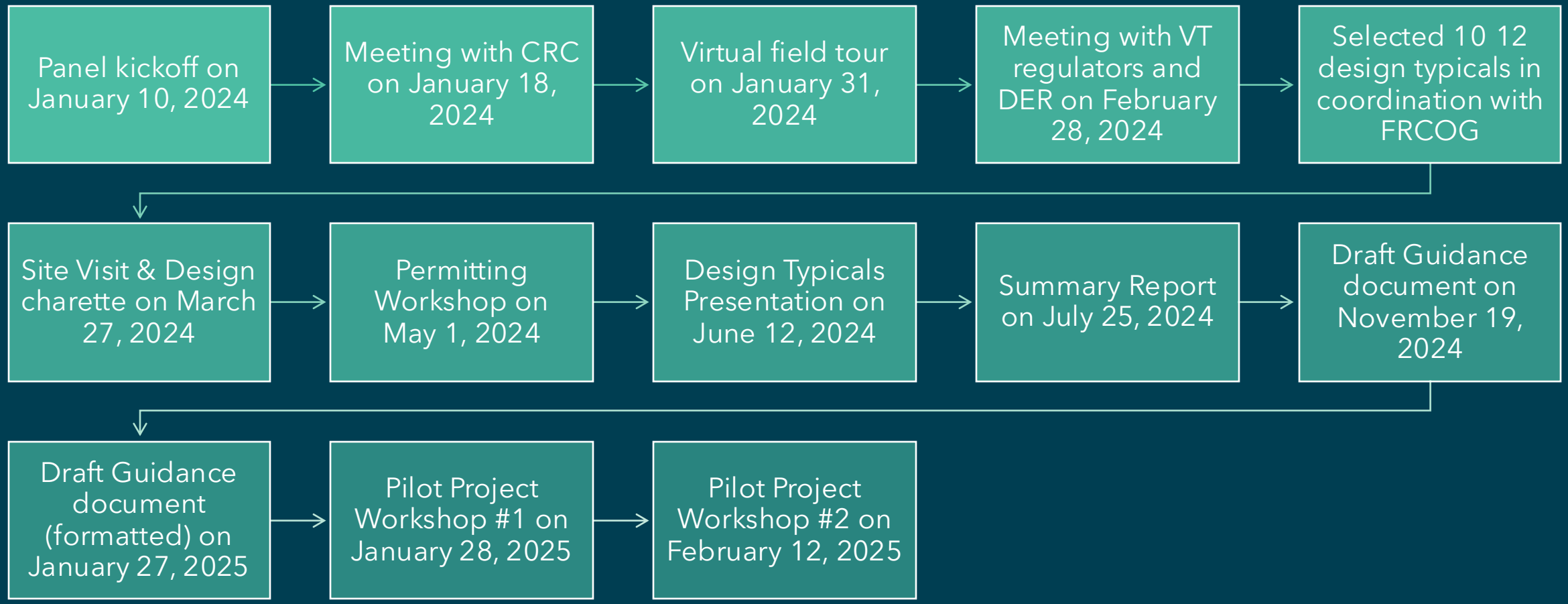
Are you curious about river restoration yourself?





- How do I initiate a project?
- What permits do I need?
- How do I prepare permit applications?
- What can streamlined permitting look?
- What are typical restoration treatments and how do I design them?
- What are key constructability considerations?
- What monitoring may be required?

Site Visits, Workshops, Meetings



Design Charette Site Visit

March 27, 2024

Permitting Workshop

May 1, 2024

Pilot Project Workshop

February 12, 2025

Franklin Regional Council of Governments

Land Use and Natural Resources

River Restoration Design and Permitting in Massachusetts

A Guide for Inland Rivers

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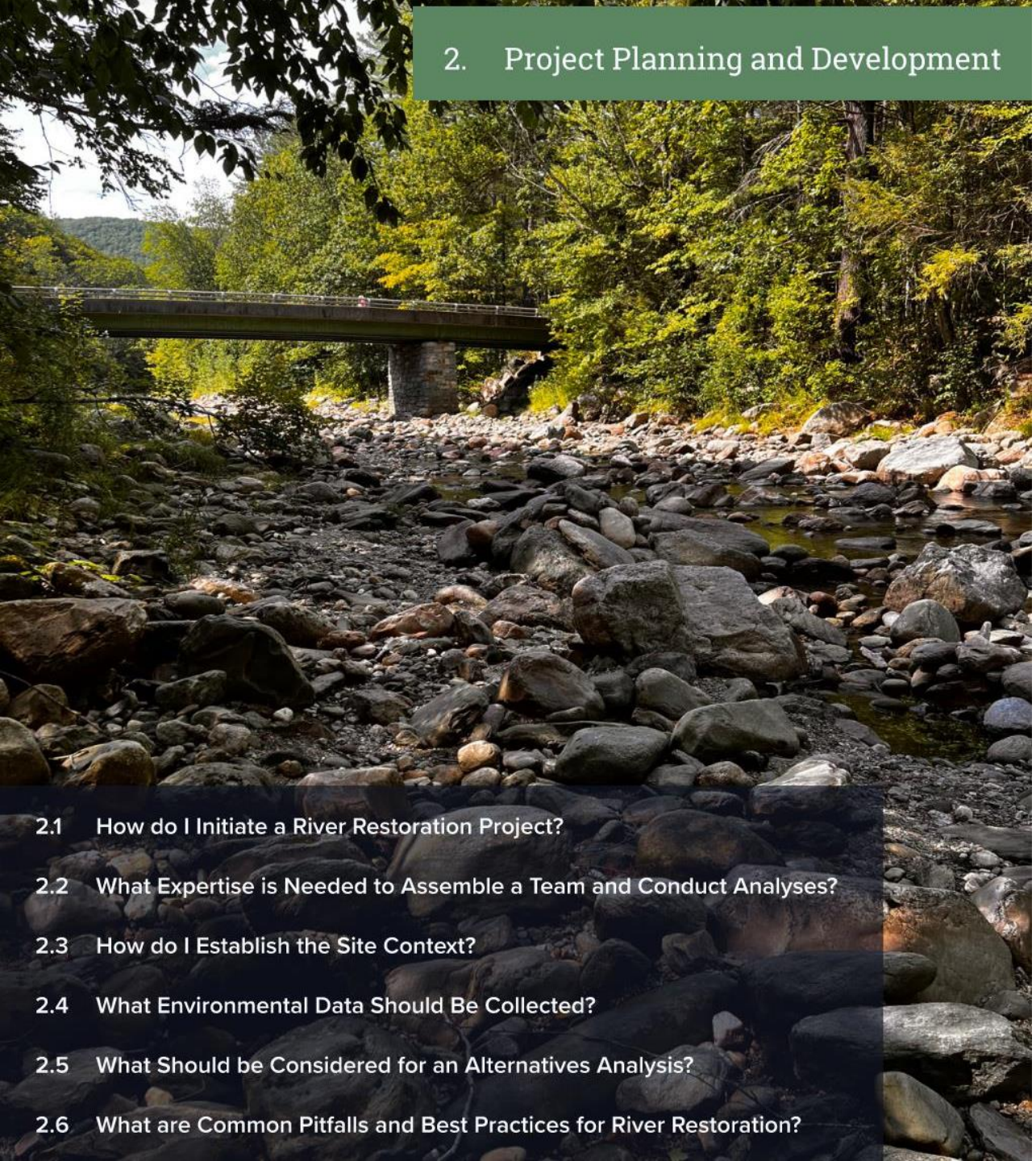


2. Project Planning and Development

2.1 How do I Initiate a River Restoration Project?

2.2 What Expertise is Needed to Assemble a Team and Conduct Analyses?

2.3 How do I Establish the Site Context?

2.4 What Environmental Data Should Be Collected?

2.5 What Should be Considered for an Alternatives Analysis?

2.6 What are Common Pitfalls and Best Practices for River Restoration?

The following series of categories and questions will help the project team think through the specific context of the project to set goals and develop a cohesive narrative about the why, where, and how of the river restoration project:

Project Type

- What issue does the project aim to resolve?
- What is the history of the site and areas upstream?
- What is the impaired riverine process and how does the project intend to restore that process?
- Is the project purely for the purposes of ecological enhancement? Or does it perform a protective stability function?
- Is the stability function intended to protect public or private property or infrastructure? Or is it intended to reduce erosion or to preserve or improve water quality?
- What additional co-benefits may be possible to achieve?

Design Life

- Is it important for the project to remain static and unchanged for a long period of time? Or is it allowable or even preferable for the project to evolve into conformity with the natural surroundings?
- Alternatively, are the project goals and objectives best met by an adaptive management approach requiring various actions over time to meet performance objectives?

Materials Type

- What materials are appropriate given the geomorphic context?
- What materials are necessary to meet the project goals and objectives?
- Are the natural building blocks (i.e., large wood, stone, earth, vegetation, and biodegradable coir fabric) appropriate for meeting project goals and objectives?

reuse, off-site disposal). Although cost should not be the primary factor in selecting a preferred alternative, alternatives with prohibitively high costs may need to be eliminated. Detailed design of a project may begin once a preferred alternative has been identified. Some additional data collection and analyses may be required to support detailed design and develop permit applications.

2.6 What are Common Pitfalls and Best Practices for River Restoration?

At each phase of a project, there are opportunities to plan ahead and mitigate common pitfalls that can lead to delays or increased costs. Table 2-1 provides a summary of these pitfalls along with recommended best practices to avoid them. To ensure the project progresses smoothly, the project team should familiarize themselves with these potential challenges and best practices from the outset.

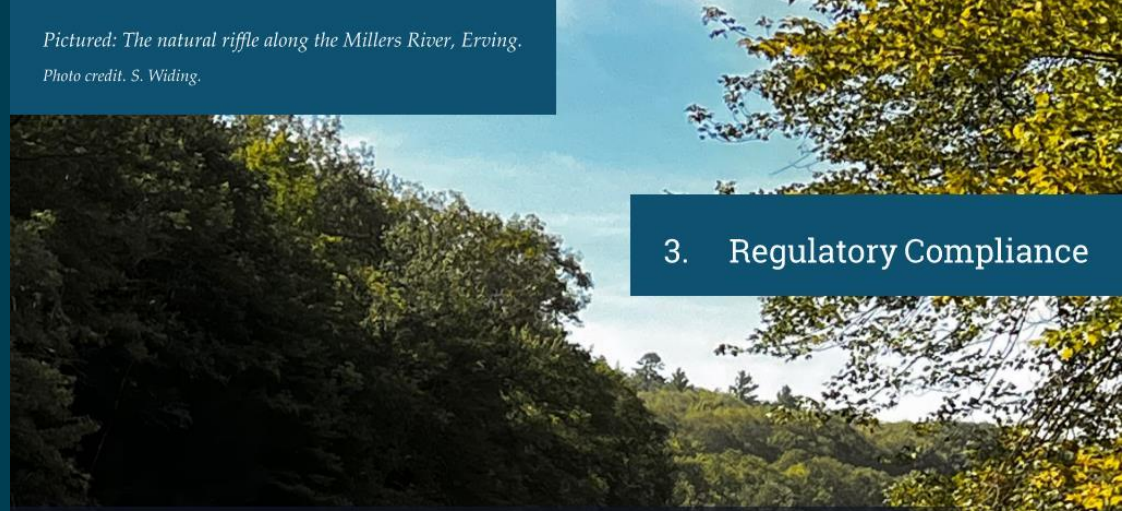
Table 2-1: Common Pitfalls and Best Practices for River Restoration

Common Pitfalls	Best Practices to Avoid Common Pitfalls
Planning and Conceptual Design	
Failure to review background information on sensitive environmental conditions within the limits of work, including Natural Heritage Atlas for Priority and Estimated Habitats.	Perform a desktop review of existing conditions utilizing publicly available information on MassMapper or MassWildlife's Natural Heritage and Endangered Species Program (NHESP) website to view the limits of mapped habitats.
Proponent does not understand landowner needs or preferences.	Engage and discuss with the landowner early in the planning process. Continue communication with landowner throughout concept design to make sure landowner needs and preferences are addressed.
The effects of the project on downstream properties or infrastructure has not been considered.	As part of the desktop review, identify at-risk properties or infrastructure downstream. Consider visiting properties or infrastructure downstream, if possible, to get a better understanding on the existing condition. If needed or possible, consider extending survey to these properties. The project team should consider extending the limits of the hydraulic and hydrologic analysis to understand how the proposed design may affect downstream properties and infrastructure.
Requirements on how to qualify for exemptions/streamlined processes have not been identified and communicated with engineers/design team.	Potential exemptions/streamlined processes may influence design and should be considered during conceptual design to increase the likelihood they can be met. Maintain check-ins with the design team to make sure applicable regulatory standards are being considered as the design progresses.

Table 2-1: Common Pitfalls and Best Practices for River Restoration (continued)

Common Pitfalls	Best Practices to Avoid Common Pitfalls
Detailed Design Phase	
Required sediment sampling not performed or methodology does not satisfactorily meet the 401 Water Quality Certification application requirements.	When dredging as defined by 314 CMR 9.00 (i.e., repositioning of sediment) is proposed for greater than 100 cubic yards, review 314 CMR 9.07(2) Sampling and Analysis Requirements. Submit a Sediment Analysis Plan to MassDEP Dredge program as a best practice for approval prior to sampling.
Failure to plan any requisite state-listed species and/or habitat surveys required by MESA may result in project delays.	Depending on the state-listed species, the project may require a time-of-year specific survey. The survey must be performed by a MA NHESP approved scientist. The results of the survey may impact project design and, therefore, should be considered prior to advancing to permitting-level design. Communicate with MA NHESP to ascertain what type of survey or species protection plan may be required and to confirm any time-of-year requirements and submit survey protocol for review and approval as soon as possible. Note: Winter submittals in advance of the growing season are helpful to the review and scheduling process.
Early dismissal of design concepts because of perceived permitting challenges.	Use best practices in geomorphology, ecology, and engineering to provide the concepts that provide greatest benefit. Design can be adjusted from there based on cost or other considerations. Discuss the design with regulatory agencies to understand techniques that may not meet regulatory requirements. Consider the conversation as a collaborative approach to find the best solution to ensure design meets regulatory requirements, while also meeting the project goals.

Failure to plan any requisite state-listed species and/or habitat surveys required by MESA may result in project delays.	Depending on the state-listed species, the project may require a time-of-year specific survey. The survey must be performed by a MA NHESP approved scientist. The results of the survey may impact project design and, therefore, should be considered prior to advancing to permitting-level design. Communicate with MA NHESP to ascertain what type of survey or species protection plan may be required and to confirm any time-of-year requirements and submit survey protocol for review and approval as soon as possible. Note: Winter submittals in advance of the growing season are helpful to the review and scheduling process.



Pictured: The natural riffle along the Millers River, Erving.
Photo credit. S. Widing.

3. Regulatory Compliance

3.1 Existing Permitting Framework

3.2 What Permits Do I Need for River Restoration?

- 3.2.1 Massachusetts Environmental Policy Act (MEPA)
- 3.2.2 Massachusetts Endangered Species Act (MESA)
- 3.2.3 401 Water Quality Certification (401 WQC)
- 3.2.4 Public Waterfront Act (Chapter 91)
- 3.2.5 Section 106 of the National Historic Preservation Act and Protection of Properties included in the State Register of Historic Places (Section 106)
- 3.2.6 Section 404 of the Federal Clean Water Act (Section 404) / Section 10 of the Rivers and Harbors Act (Section 10)
- 3.2.7 Federal Emergency Management Agency National Flood Insurance Program (FEMA NFIP)
- 3.2.8 Massachusetts Wetlands Protection Act (MAWPA)
- 3.2.9 Local Floodplain Regulations and/or Local Wetlands Bylaw/Ordinance

3.3 How Do I Prepare Permit Applications?

3.4 What is the fastest way to permit a large-scale river restoration project?

3.5 What can streamlined permitting for an ecological restoration limited project or ecological restoration project look like?

3.2.1 Massachusetts Environmental Policy Act (MEPA)

Regulation Name	Massachusetts Environmental Policy Act (MEPA)
Statute	M.G.L. c. 30, §§ 61-62L
Regulations	301 CMR 11.00

What is the purpose?

To provide meaningful opportunities for public review of the potential environmental impacts of projects for which state funding is received and/or state permits are required. The MEPA review process also provides a uniform system for state agencies to review and comment on projects to ensure measures have been considered and implemented to avoid, minimize, and mitigate environmental damage to the maximum extent practicable.

When does it apply?

Projects for which agency action, as defined in 301 CMR 11.02, is required (e.g., state funding or state permits) and a threshold specified in 301 CMR 11.03 is exceeded. In some cases, actions by municipal authorities may qualify as agency action under MEPA. See M.G.L. c. 30, s. 62 and 301 CMR 11.02 for definition of "Agency." For additional information on permit applicability, common thresholds, data collection requirements, and permit preparation cost ranges, refer to *Appendix A*.

What resources are subject to jurisdiction?

Where there is agency action, the need for MEPA review is determined by the review thresholds in 301 CMR 11.03, which define minimum levels of environmental impacts that require review. Review threshold categories include, but are not limited to, land, state-listed species, and wetlands, waterways and tidelands.

What activities are subject to jurisdiction?

Any activity that exceeds a threshold specified in 301 CMR 11.03 provided that an agency action is required.

Who is the issuing authority?

Massachusetts Environmental Policy Act (MEPA) Office within the Executive Office of Energy and Environmental Affairs (EEA).

3.2.1 Massachusetts Environmental Policy Act (MEPA - continued)

During the MEPA review process, agencies have the opportunity to identify issues, provide comments, and allow applicants to adjust the project design well before permit application submissions. The MEPA Office recognizes that ERPs align with the purpose of MEPA. The updated MEPA regulations provide exemptions and streamlined processes for ERP applicants.

Provision 301 CMR 11.01(2)(b)4. states that:

> *"Any Project seeking to qualify in its entirety as an Ecological Restoration Project, but not including an Ecological Restoration Limited Project under 310 CMR 10.24(8) and 10.53(4), shall not be required to undergo MEPA review, provided the requirements of 301 CMR 11.01(2)(b)4. are met…"*

As further described under this provision, the applicant must fulfill other submission requirements and engage with local EJ populations, but this exemption process is a substantially lighter effort than preparation and submission of an Environmental Notification Form (ENF) or an EIR. The streamlined process under 301 CMR 11.01(2)(b)4 is completed by filing a Notice of Ecological Project with MEPA (but not a full ENF) for public comment. More information is available at https://www.mass.gov/info-details/streamlined-process-for-ecological-restoration-projects.

As described in 301 CMR 11.05(9), ERP or ERLPs are eligible for the Dual Expanded ENF and Proposed EIR (sometimes called Rollover EIR) process which can reduce the total review time period of projects requiring both an ENF and EIR:

> *"A Project seeking to qualify in its entirety as an Ecological Restoration Project or Ecological Restoration Limited Project may file a dual Expanded ENF and Proposed EIR under this 301 CMR 11.05(9) and may provide the analysis in 301 CMR 11.07(6)(n) in a checklist format as determined by the Secretary."*

Although this process is available, it is not automatically granted. For a filing to be considered for a Rollover EIR, the applicant must check the box for 'Rollover EIR' on the Environmental Notification Form. An applicant requesting a Rollover EIR should also check the box for 'Single EIR' in case the Rollover EIR is not granted. MEPA will determine whether the Rollover EIR will be accepted and will include that determination in the Certificate on the Expanded ENF. Although this process may save time, the effort and cost of application preparation is generally comparable to the effort and cost involved in submitting a separate Expanded ENF and Single EIR. The main difference is that if the Rollover EIR request is granted, the Proposed EIR will automatically republish for an additional comment period.

River Restoration Design and Permitting in Massachusetts: A Guide for Inland Rivers

3.2.1 Massachusetts Environmental Policy Act (MEPA - continued)

Utilizing best practices from project inception to implementation is another important way to make permitting process as efficient as possible. Refer to ***Table 2-1*** for information on common pitfalls and best practices for river restoration projects.

What are some application submission timing considerations?

- The MEPA process must conclude before any state permits are issued. Therefore, it's recommended to wait to submit any state permit application until the MEPA process is complete.
- Because of the potential for re-design resulting from comments issued during the MEPA process, it is best practice to wait to submit local or federal permit applications until the MEPA process is complete.
- Refer to ***Section 3.5*** for representations of a submittal sequence and review timeline for three project scenario which require multiple applications. These scenarios are only applicable for projects that meet the criteria as an ERLP or ERP under MAWPA.

Overall River Restoration Permitting Process Guide

Overview

1. Planning and Conceptual Design: Pre-Permitting Process

1. Have the ecological problems and/or environmental degradation been identified? Have the ecological restoration goals and environmental benefits been defined?
2. Have alternative concept designs been considered?
3. Has the maximum extent of the limits of work been defined?
4. Has data collection begun?
5. Has outreach to affected property owners, stakeholders, and environmental justice communities been initiated?
6. Will any of the proposed work occur within an area subject to jurisdiction of environmental or rare species regulations?
7. Are the proposed activities subject to jurisdiction or are they likely to exceed a regulatory threshold?
8. Are there any regulatory exemptions or streamlined permitting processes for the project or certain proposed activities?
9. Has a list of anticipated permits been developed?
10. Has an early coordination meeting with regulators been conducted?
11. Has the list of anticipated permits been updated based on regulatory feedback?
12. Has a detailed alternatives analysis been performed and documented?

2. Detailed Design Phase: Pre-Permitting Process

1. Has all data collection been planned or completed?
2. Have design requirements for anticipated permits been considered and incorporated into the design?
3. Have impacts to wetland resource areas or sensitive habitats been avoided, minimized, and mitigated to the maximum extent practicable?
4. Has documentation of the design been developed?
5. Have impact areas and the anticipated permit list been re-evaluated?
6. Have regulatory agencies been contacted for clarification on certain requirements?

3. Permitting Phase: Permitting Process

1. Has a sequence of permit application submittals been developed?
2. Have all pieces of information been obtained or developed to support permit applications?
3. Have the problems and ecological and/or habitat benefits been effectively communicated in permit applications?
4. During regulatory review of applications, have all additional application requirements been planned or completed?

After permit approvals or authorizations have been issued:

5. Have all permit conditions been reviewed by the project proponent?
6. Does project implementation funding include costs for compliance with permit conditions?

4. Construction and Post-Construction Phase: Permitting Compliance Process

1. Have approved compliance and/or environmental monitors been identified and funded?
2. Have regulators been informed of non-compliance situations or project changes that vary substantially from the permitted activities?
3. Are permit conditions being followed and associated reporting submitted?
4. Have the permits been formally closed out?

Overall River Restoration Permitting Process Guide

Planning and Conceptual Design: Pre-Permitting Process

1. Have the ecological problems and/or environmental degradation been identified? Have the ecological restoration goals and environmental benefits been defined?

Identifying the Problems and Goals: Identifying the problems being addressed by the project is key to justifying the work and obtaining permits. The type and extent of environmental or ecological issues should be understood and documented and should inform the ecological restoration goals and strategies. Defining goals focused on addressing these problems and communicating the net environmental benefits of the project will frame the project in a manner that facilitates permitting and provides a basis for assessing the project for potential exemptions or streamlined permitting processes. Refer to ***Section 2.1.1*** for information on identifying the problems and goals.

2. Have alternative concept designs been considered?

Brainstorm Concept Designs: Refer to ***Section 2.5*** for recommendations on what to consider while brainstorming conceptual design alternatives. Development of formal documentation of the alternatives analysis is recommended as a future step during planning and conceptual design as the preferred alternative may change based on input from regulators. When brainstorming alternative designs, refer to the co-benefits ***Table 4-2*** to understand how restoration treatments can add additional value to the project. Consider engaging a contractor to perform an initial constructability review on potential concepts. Refer to ***Section 5*** for more information on key constructability considerations a contractor can weigh in on.

3. Has the maximum extent of the limits of work been defined?

Defining the Review Area: At the conceptual stage, the exact limits of work are not well defined, but the anticipated maximum extent of these limits should be identified. Identifying the anticipated maximum extent will inform the scope of the desktop review of potentially affected environmental resource areas. Once a preferred concept design has been selected, the approximate limits of work can be determined.

River Restoration Design and Permitting in Massachusetts: A Guide for Inland Rivers

Overall River Restoration Permitting Process Guide (continued)

Detailed Design Phase: Pre-Permitting Process

1. Has all data collection been planned or completed?

Data Collection (continued): Based on the list of anticipated permits and feedback from the early coordination meeting, confirm that all required data collection has been or will be completed, and associated documentation prepared prior to submitting permit application. Certain types of data collection may be seasonal (e.g., rare species surveys) or require specialized consultants and should be planned accordingly. If the project is subject to the MEPA review, environmental justice outreach may be required well in advance of submittals. Refer to ***Appendix A: Permit Applicability*** for data collection requirements for each permit.

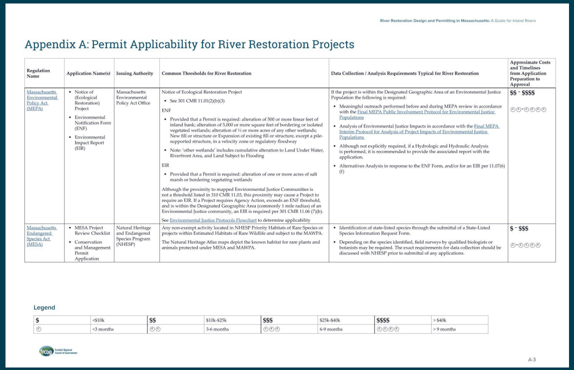
2. Have design requirements for anticipated permits been considered and incorporated into the design?

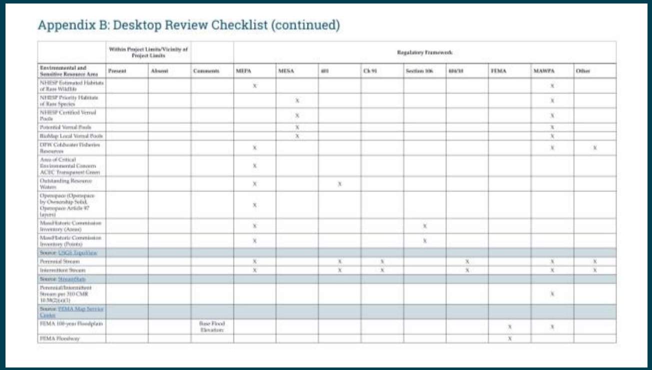
Design Requirements: Certain permits have design criteria that must be met for approval. These criteria may be required to qualify for exemptions or streamlined permitting process or may be related to compliance with permit conditions or standards. When applicable, additional coordination with NHESP is strongly recommended to identify species-specific design limitations prior to submitting permit applications. If rare species are present, designing to avoid, minimize, or mitigate impacts to the species is commonly a primary factor in the design approach. Refer to the ***MESA-Specific Permitting Process Guide*** in ***Section 3.3.2*** for rare species and habitat-specific considerations. Requirements may also entail specific formatting, sizing, or data be shown on design plans. Refer to ***Appendix C: Permit Application Preparation*** for permit application submittal requirements and ***Section 3.2*** for information on requirements for exemptions and streamlined permitting processes. If possible, engage a contractor for input related to feasibility of the design, site specific considerations, and a potential construction sequence. Refer to ***Section 5*** for information on the benefits of engaging a contractor and key constructability considerations.

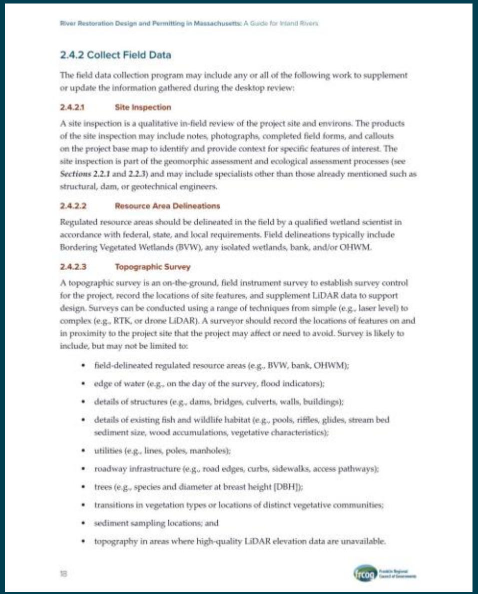
Planning and Conceptual Design: Pre-Permitting Process (continued)

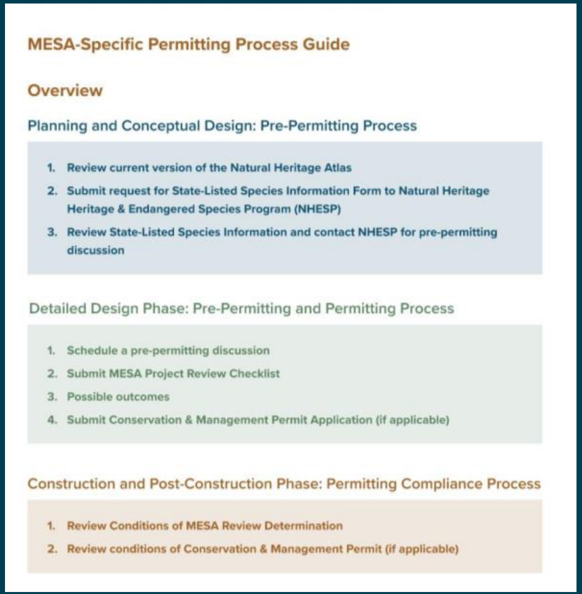
6. Will any of the proposed work occur within an area subject to jurisdiction of environmental or rare species regulations?

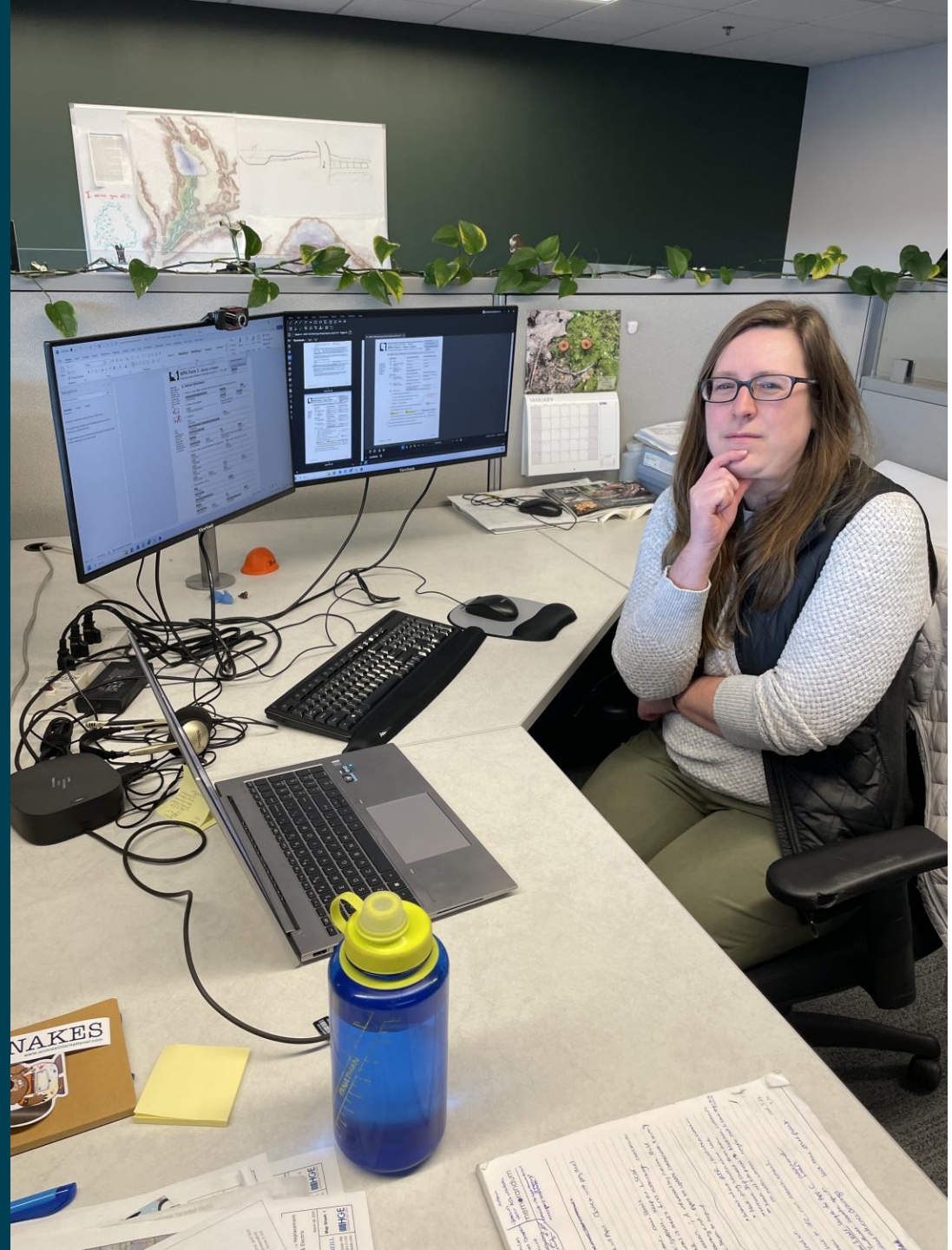
Area Subject to Jurisdiction: A desktop review should be carried out to assess the existing environmental conditions within the anticipated maximum extent of the limits of work. For a description of environmental resource areas subject to jurisdiction, refer to *Appendix A: Permit Applicability*. The *Desktop Review Checklist* in Appendix B can be used together with publicly available data to identify the presence or absence of environmental resource areas. Confirmation of jurisdictional wetland resource areas requires a field wetland delineation. Refer to the data collection requirements in *Appendix A: Permit Applicability* and *Section 2.4.2* for additional information on data collection. Refer to the *MESA-Specific Permitting Process Guide* for instructions specific to state-listed species (see Section 3.3.2).











3.4 What is the fastest way to permit a large-scale river restoration project?

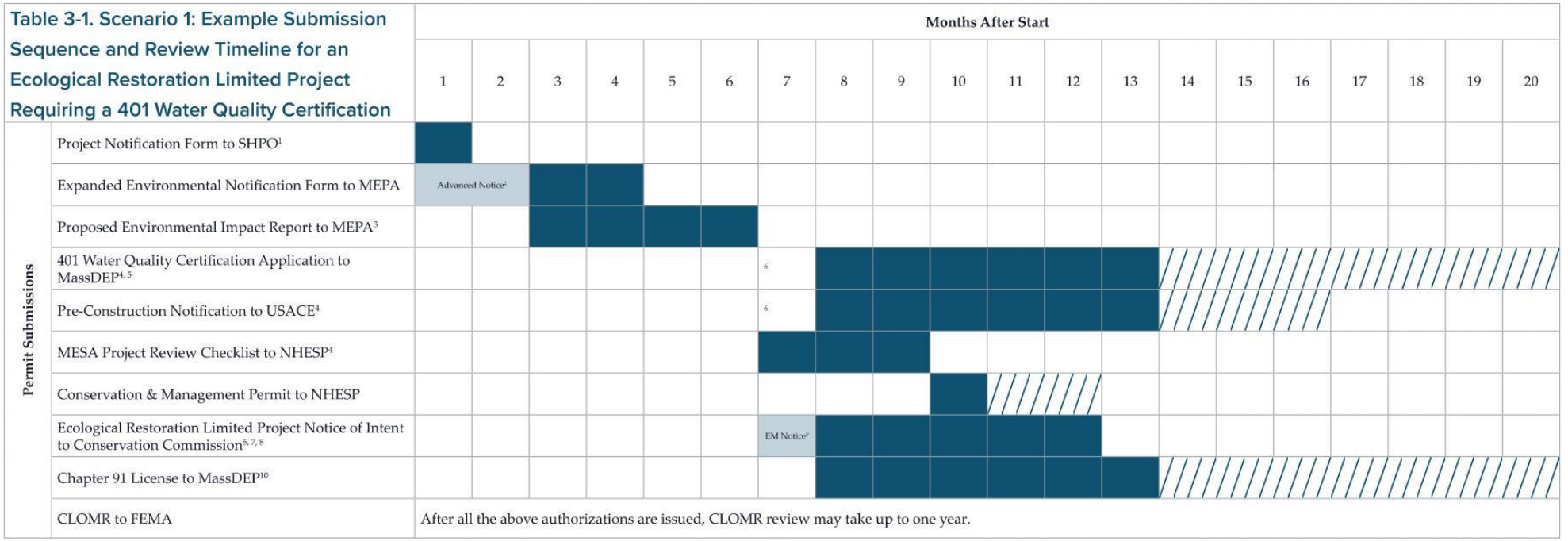
To minimize the amount of permitting, projects should be designed to meet all criteria as an ERP under MAWPA. As an ERP, a project shall not be required to undergo MEPA review, provided the requirements of 301 CMR 11.01(2)(b)4 are met. In addition, if a project does not include greater than 100 cy of dredging, work within an ORW, or include any activities described in 314 CMR 9.04, the project also will not require a 401 WQC. An ERP that does not require a 401 WQC is the most streamlined way to permit a river restoration project, but this pathway not be available for all projects due to site constraints or the proposed design.

If a project cannot be designed to meet all criteria of an ERP, the project should be designed to meet the criteria as an ERLP. Although an ERLP will still require going through the MEPA process, if applicable, the project is eligible to file for a more streamlined MEPA process (i.e., dual Expanded ENF and Proposed EIR under this 301 CMR 11.05(9)) and may provide EJ analysis in a checklist format as determined by the Secretary. If the Proposed EIR is accepted, this can shorten the MEPA review timeline by about a month. Refer to the following section for permitting scenarios for projects qualifying as an ERP and ERLP.

3.5 What can streamlined permitting for an ecological restoration limited project or ecological restoration project look like?

Although there are multiple options for permitting pathways, this section includes three potential scenarios to streamline permitting for projects that meet the criteria as an ERLP and ERP under MAWPA. **As mentioned in *Section 3.4*, qualifying as ERLP or ERP is the first step a project team should consider to be eligible for streamlined permitting options.** The scenarios outlined in this section each maintain the same assumptions about review timelines and permitting application preparation time periods. The actual list of required applications and associated review timelines will vary by project and can be affected by project complexity and risk, project funding, application completeness, information requests, agency staffing, and public engagement and outreach schedules. The scenarios do not include duration if a CLOMR

Table 3-1. Scenario 1: Example Submission Sequence and Review Timeline for an Ecological Restoration Limited Project Requiring a 401 Water Quality Certification



Legend

	Pre-submittal requirement, as applicable.
	Duration of review period from submittal to approval/authorization. Review period indicated is minimum or expected timeframe.
	Duration of potential extension of review period as a result of additional information requests from issuing authority.

1 The State Historical Preservation Officer in Massachusetts, the Massachusetts Historical Commission (MHC) reviews all MEPA ENFs. An additional PNF is not required to be submitted to MHC if the MEPA process is completed. Because the ENF may not be submitted to the Massachusetts Board of Underwater Archaeological Resoruces (MBUAR), or pertinent Tribal Historic Preservation Officers (THPO), this step is intended to make sure the PNF is sent to all required parties, including MBUAR and pertinent THPOs.

2 If required, the Advance Notification must be provided no later than 45 days, and no earlier than 90 days prior to submittal of the ENF per 301 CMR 11.05(4)(b).

3 Submittal time assumes the applicant will submit for the dual Expanded ENF and Proposed EIR simulataneously and will receive approval for the streamlined Rollover process per 301 CMR 11.05(9).

4 The 401 WQC, PCN, and MESA Project Reivew Checklist do not need to be submitted all in the same month; the timing represents the earliest potential time for submittal.

5 The 401 WQC application needs to be submitted prior to ERLP NOI submittal.

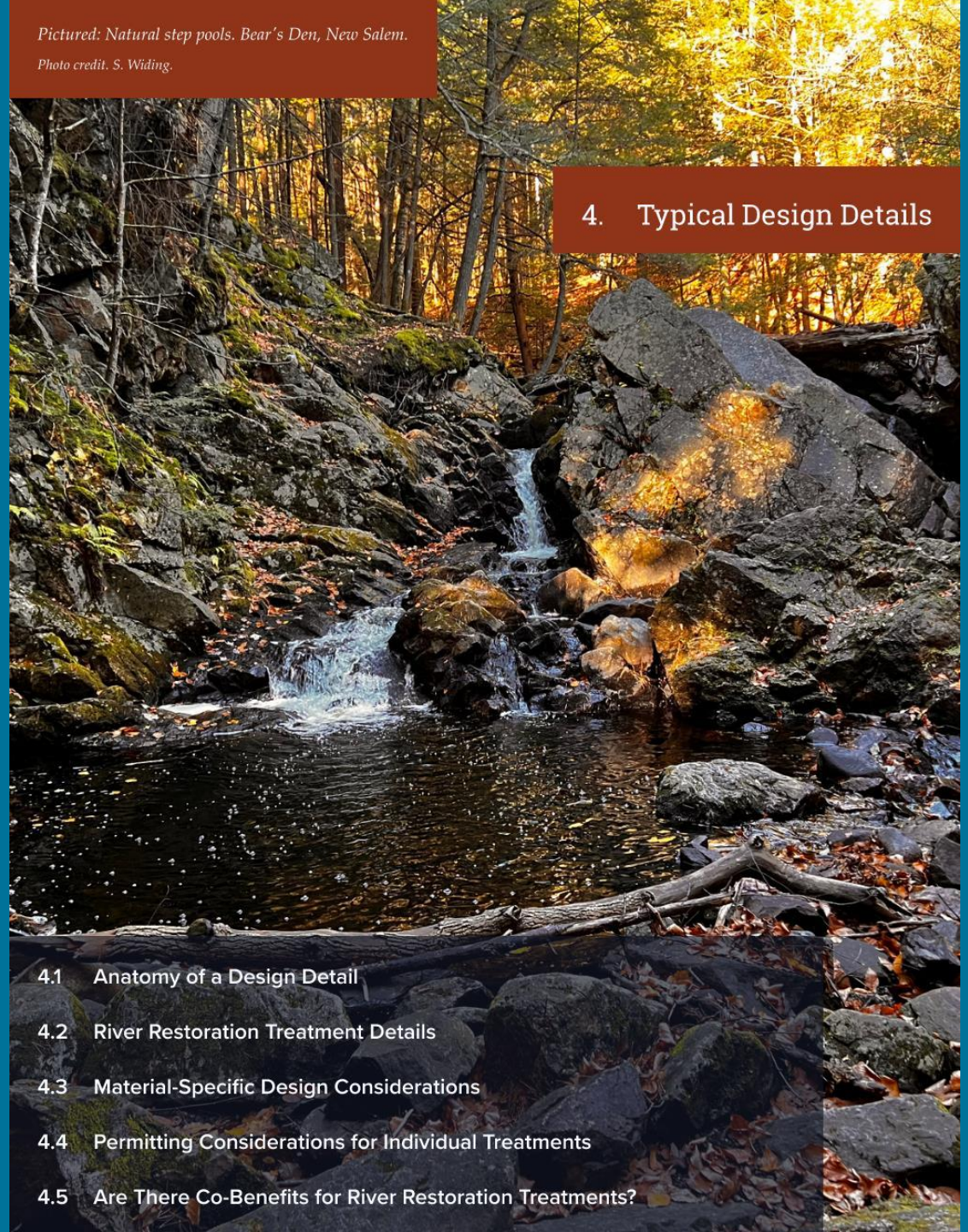
6 One (1) month has been provided for application prepartion after commencement of the MEPA process. If more time is required (which is common), the total review timeline would be extended accordingly.

7 ERLP NOIs in Estimated Habitat are required to be submitted to NHESP for issuance of a preliminary determination prior to NOI submittal to the Conservation Commission, if applicable. The ERLP NOI may also be reviewed for compliance with local wetland bylaws/ordinances, if applicable. NOI review timeframe assumes NHESP will issue a preliminary determination within 1 month of receipt of the NOI and 2 public hearings with the Conservation Commission are required.

8 If NHESP determines the project will result in an Adverse Effect (310 CMR 10.58(4)(b) or 10.59), the Commission may not issue the Order of Conditions until the CMP is issued.

9 At least 14 days prior to the filing an ERP NOI, the applicant shall submit written notification of the proposed NOI filing for publication in the Environmental Monitor per 310 CMR 10.11(1).

10 A copy of the NOI is required as part of a Chapter 91 License application.



Pictured: Natural step pools. Bear's Den, New Salem.

Photo credit. S. Widing.

4. Typical Design Details

4.1 Anatomy of a Design Detail

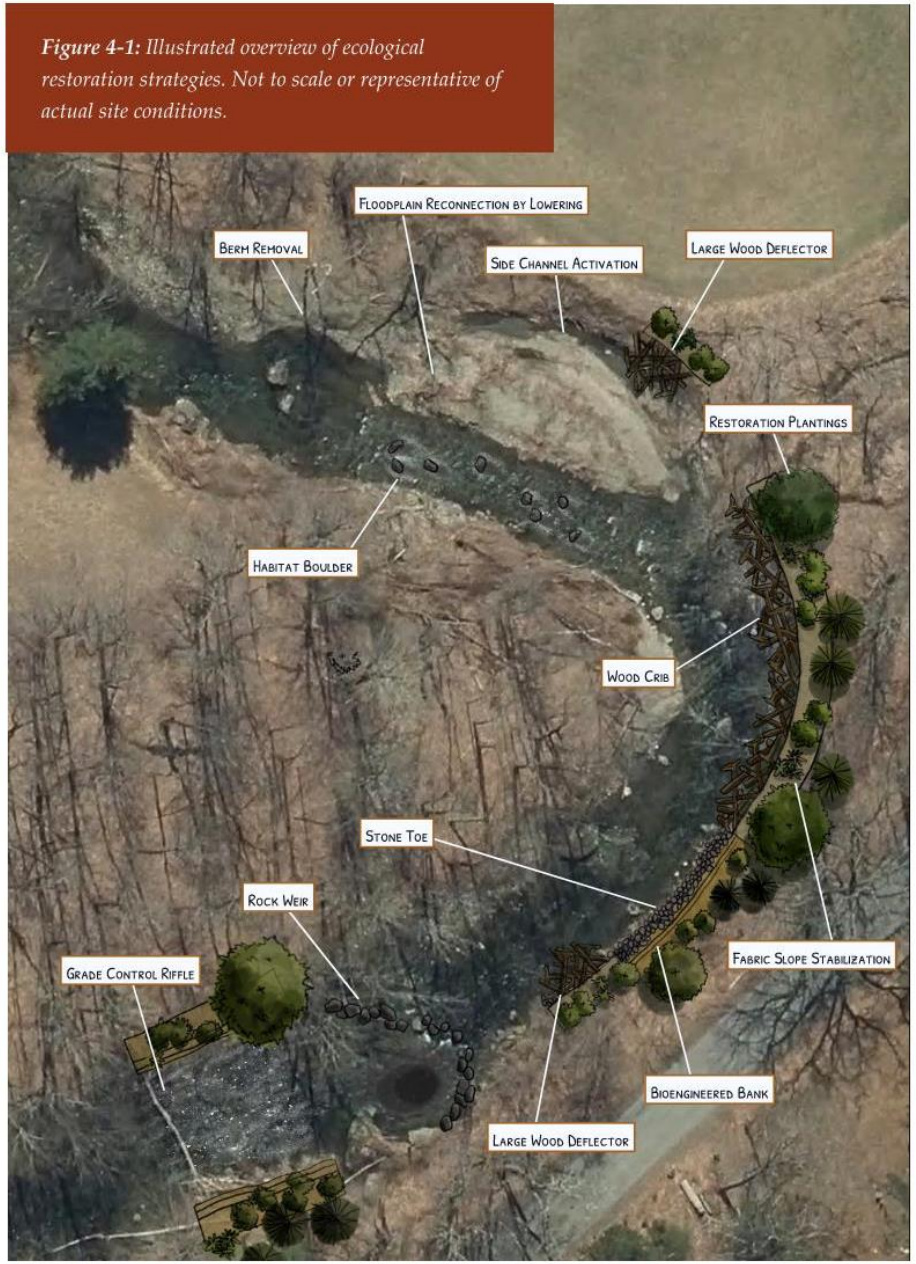
4.2 River Restoration Treatment Details

4.3 Material-Specific Design Considerations

4.4 Permitting Considerations for Individual Treatments

4.5 Are There Co-Benefits for River Restoration Treatments?

Figure 4-1: *Illustrated overview of ecological restoration strategies. Not to scale or representative of actual site conditions.*



Special Instructions

These items identify suggestions and common pitfalls to avoid in the design and specification process.

Installation Notes

These items identify common pitfalls to avoid in the construction process.

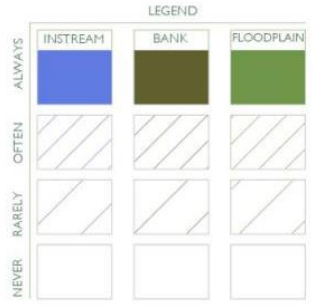
Design References

These items identify technical resources that provide comprehensive technical design guidance for specific elements of the treatment.

4.2 River Restoration Treatment Design Details

The typical details are presented here according to the area where they are most often used: within the channel, on the bank, or in the riparian zone. Some treatments may be used within more than one area depending on specific conditions at the project site.

Each design detail includes icons to indicate the relative frequency that a treatment interacts with the in-stream, bank, and riparian areas.



In-Stream

- Habitat Boulder or Boulder Cluster
- Rock Weir
- Grade Control Riffle
- Engineered Log Jam Deflector

Bank

- Stone Toe
- Bioengineered Bank
- Wood Crib

Riparian Zone

- Berm Removal
- Floodplain Reconnection by Lowering
- Side Channel Activation
- Restoration Planting Plan
- Fabric Slope Stabilization

Figure 4-1 shows each of the restoration treatments in relation to the river channel, bank, and floodplain. Work with the design team to select and place treatments that are appropriate for the site context and meet project goals.

The typical details are presented here according to the area where they are most often used: within the channel, on the bank, or in the riparian zone. Some treatments may be used within more than one area depending on specific conditions at the project site.

Each design detail includes icons to indicate the relative frequency that a treatment interacts with the in-stream, bank, and riparian areas.

LEGEND
INSTREAM
BANK
FLOODPLAIN
ALWAYS
OFTEN
RARELY
NEVER

In-Stream

- Habitat Boulder or Boulder Cluster
- Rock Weir
- Grade Control Riffle
- Engineered Log Jam Deflector

Bank

- Stone Toe
- Bioengineered Bank
- Wood Crib

Riparian Zone

- Berm Removal
- Floodplain Reconnection by Lowering
- Side Channel Activation
- Restoration Planting Plan
- Fabric Slope Stabilization

4.2.4 Engineered Log Jam Deflector

What is it?

An **engineered log jam deflector** is an in-stream habitat enhancement treatment, constructed out of large wood, slash, and earth fill (e.g., rocks, soil) that can be used to create desirable hydraulic, erosive, and depositional conditions in a river or stream.

The **engineered log jam deflector** simulates a naturally occurring log jam, which is a normal, transient in-stream feature. Logs jams are less common today than they have been in the past. Our history of land clearing for wood harvest and agriculture has reduced the source of large wood in riparian areas. Furthermore, we often deliberately remove large woody debris from our waterways to prevent damage to bridges and culverts that have not been designed to accommodate debris transport.

Why is it used?

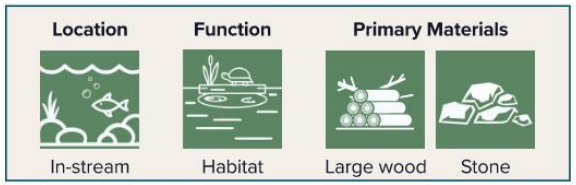
An **engineered log jam deflector** is a naturalized alternative to a structural flow deflector. An **engineered log jam deflector** can be used to create habitat, to protect eroding banks, and to manage sediment by encouraging deposition. Natural log jams can also help restore the hydrologic connection between the channel and the floodplain by raising the water profile.

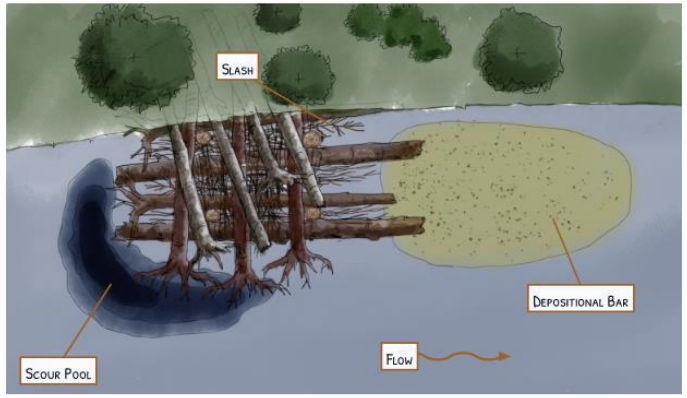
How does it evolve?

Immediately after installation, the **engineered log jam deflector** is structurally stable. The treatment resists hydraulic forces, retains soil in place, and supports vegetative growth. In-stream flow patterns result in localized scour pockets and deposition bars. The installed wood will eventually decay—the rate of decay depends on the species of wood and the local moisture conditions. Over time, the decaying wood is replaced by living wood as herbaceous and woody vegetation proliferate the structure.

What are the co-benefits?

- Rootwads and slash extending into the water column create flow complexity that leads to channel bedform and bank complexity.
- Complexity provides refugia for aquatic species, basking areas for amphibians, and substrate for vegetation and fungi.





How is this treatment designed?

The **engineered log jam deflector** is designed by a civil engineer. It can be scaled to fit the size of the bank. It can be a simple 1- to 2-layer treatment, or it can be a complex 3+ layer structure. Because this feature causes a local change in cross-sectional flow area, consider pairing this feature with projects that will require a corresponding cut, such as pool excavation, **berm removal**, or **floodplain reconnection**.

Siting and Placement

An **engineered log jam deflector**:

- Is appropriate for use along riverbanks that are currently experiencing erosion or may be susceptible to future erosion.
- Can be placed in an excavation void as a component of a newly constructed channel bed and bank. This may require construction of complementary adjacent streambed and bank features.
- Can be placed waterward of an undisturbed bank. This may result in an encroachment into an existing flow path and may require construction of complementary compensation for the encroachment.
- Is generally suitable in channels with a slope of 4% or less.
- May present an unacceptable safety hazard in recreational areas.

Design Considerations

- The hydraulic conditions in response to the designed, placed deflector should be evaluated at a range of design flows. The feature varies in vertical profile, so its effect on hydraulic conditions, erosion, and deposition will vary with water level.
- The species and dimensions of wood used will affect design elements including ballast countermeasures and design life. Use dense, decay-resistant species in critical applications (e.g., timber piles). Large wood can be sourced specifically for the project. However, opportunistic use of salvage material may also be desired. See design references for sources of information regarding engineering properties of various species.
- Wood that cycles between wet and dry will decay more quickly. Wood that is submerged in a low-oxygen environment will decay more slowly.
- Earth fill materials, including rock and soil, installed and compacted between individual pieces of large wood, can provide stability and resistance to erosion if a piece of large wood decays before reinforcement by living vegetation has been achieved.
- When possible, design the treatment to provide secondary benefits and limit potential adverse effects on state-listed rare species.

Design Process

- Determine design flow conditions by hydrologic and hydraulic modeling.
- Determine the top elevation of the large wood layers using hydraulic modeling results.
- Determine shear forces on the bank and design the fill material.
- Determine the quantity and spacing of large wood by layer.
- Determine buoyancy forces on the large wood and design ballast countermeasures. Consider ice effects where applicable.

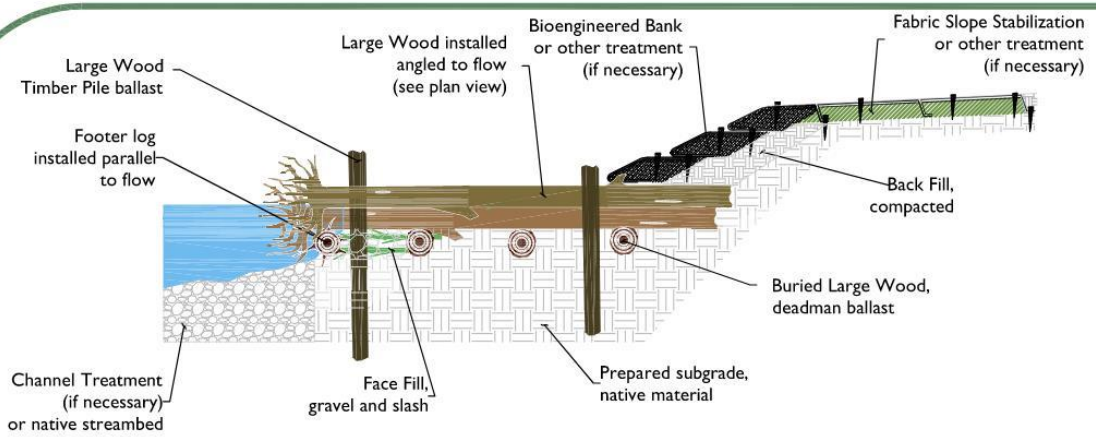
Design Considerations

- Site the treatment and orient the layers to create desirable responsive erosional features (i.e., scour pools) and depositional features (i.e., bars).
- Design adjacent channel and bank treatments, if necessary.

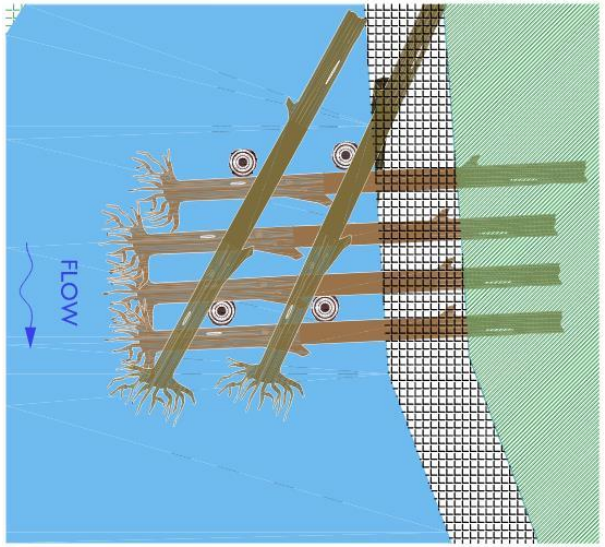
Design Life

- Large wood subjected to wet and dry cycles: 10 to 30 years
- Large wood submerged: 100+ years
- Herbaceous and woody vegetation: Varies

Construction of an engineered log jam deflector.



ENGINEERED LOG JAM DEFLECTOR: SECTION VIEW



ENGINEERED LOG JAM DEFLECTOR: PLAN VIEW

Specify:

- Height of treatment:
  - bottom elevation,
  - top elevation,
  - number of layers.
- The orientation of each layer. Orientation will be site specific.
- Large Wood (logs with rootwads, logs):
  - quantity,
  - species,
  - dimensions (length, diameter),
  - orientation and layout (in plan view).
- Slash: volume.
- Face Fill and Back Fill (rock, cobble, gravel, and soil):
  - volume,
  - size,
  - gradation.
- Boulders (optional):
  - quantity,
  - size.
- Hardware and Fasteners (optional):
  - type,
  - materials,
  - strength.
- Site access, water management and erosion and sedimentation controls.

Calculate:

- Shear forces
- Buoyancy forces (include buoyancy due to ice, if applicable)
- Ballast forces
- Footprint of feature, total and by resource area
- Volume of feature, total and by resource area

Special Instructions:

- This feature must be designed for resistance to hydraulic forces including drag, lift, and buoyancy; use ballast to counteract these forces. Ballast may be provided by placement of earth overburden or by anchoring to timber piles or buried wood or buried boulders.
- Avoid using cable fasteners in any application where the attachment may become exposed. It presents a safety hazard.

Installation Notes:

- This is a field-set item. Place materials in coordination with the on-site project representative.
- Installed using heavy construction equipment.

Associated Features:

- Include a detailed restoration planting plan to include emergent, transitional, and upland vegetation.

Design References:

1. U.S. Bureau of Reclamation and U.S. Army Engineer Research and Development Center (USBR and ERDC). 2016. *National Large Wood Manual: Assessment, Planning, Design, and Maintenance of Large Wood in Fluvial Ecosystems: Restoring Process, Function, and Structure*. 628 pages + Appendix. Available: www.usbr.gov/pn/ and http://cw-environment.usace.army.mil/restoration.cfm (click on "River Restoration," then "Techniques").
2. U.S. Bureau of Reclamation. *Pacific Northwest Region Resource and Technical Services. Large Woody Material - Risk Based Design Guidelines*. September 2014.
3. Matweb.com provides material strength and density properties for many wood species.

TYPICAL DETAIL
NATURE BASED SOLUTIONS FOR RIVER RESTORATION

INSTREAM | BANK | FLOODPLAIN

CONCEPT DRAWING NOT SUITABLE FOR CONSTRUCTION

ENGINEERED LOG JAM DEFLECTOR

Pictured: Constructed streambank with gravel and cobble face fill. East Branch North River, Colrain.

Photo credit. A. Donlon.

5. Construction

5.1 When should a contractor be engaged and how do I select a contractor?

5.2 What are some key constructability considerations?

These measures should be proposed in alignment with the engineered design, the overall budget and the allowable permit conditions. The project owner, engineering team and other interested parties should be informed of such measures and provide approvals where required.

5.2 What are some key constructability considerations?

5.2.1 Site Preparation and Access

As noted above, early and ongoing public outreach and engagement should be conducted as part of project planning (see ***Overall River Restoration Process - Planning and Conceptual Design, Step 5***). Abutter and general public notifications are often required as part of the regulatory review process. Refer to ***Appendix C*** for more information on application preparation requirements (see MEPA and MAWPA). Additional voluntary outreach campaigns prior to the construction phase—using mailers, door-to-door outreach, or similar measures—may also be beneficial to a project's success. If the project will be on a publicly accessible site, permanent signage—describing the project, its proponents, funding sources and/or other site specific details—can help build the public's understanding of the project's need and importance. The installation of agency-required signs (e.g., MassDEP File Number for WPA OOC compliance; signage required under USEPA's NPDES Construction General Permit [CGP] for Stormwater Discharges from Construction Activities) should be completed prior to the start of construction.

Riverine and riparian projects often have challenging site-access requirements. Project access should generally follow those routes identified during the planning or detailed design phases. Ideally, these routes will have been vetted with a contractor to confirm feasibility of use prior to permitting. Project teams should clarify for contractors and for permit reviewers which roadways and other access measures are temporary in nature and which should be left in place for longer term site access, monitoring or other needs. Signed access agreements, which should be secured prior to construction, may be required from landowners to facilitate project access or works.

5.2.2 Erosion Controls and Site Stability

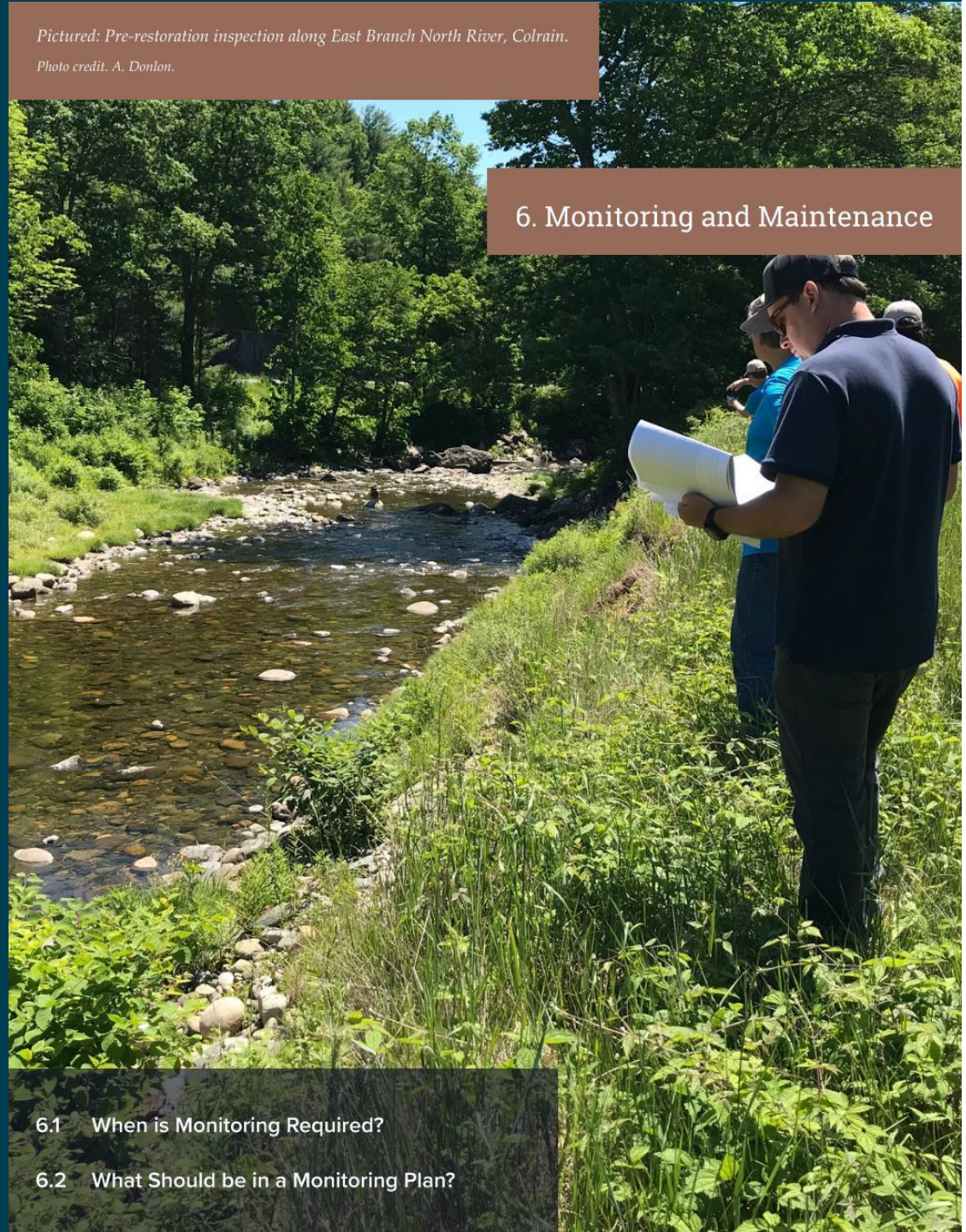
Stormwater management measures will be required as part of the project's regulatory approvals process. Signed access agreements, which should be secured prior to construction, may be required from landowners to facilitate project access or works. See ***Section 3*** and Appendix A for additional details on permit applicability.

Regardless of the regulatory program(s) driving the need for stormwater controls, project proponents, applicants and contractors should anticipate incorporating stormwater Best Management Practices (BMPs) during construction and ensure that post-construction site stability is attained. Stormwater management measures identified during the planning

Pictured: Pre-restoration inspection along East Branch North River, Colrain.

Photo credit. A. Donlon.

6. Monitoring and Maintenance



6.1 When is Monitoring Required?

6.2 What Should be in a Monitoring Plan?

MOST RESTORATION PROJECTS WILL REQUIRE SOME LEVEL OF monitoring in association with permit conditions to document their success or failure to meet project goals and objectives. And, while some projects will be self-sustaining, other projects may require interventions and maintenance to prevent or repair unanticipated outcomes.

This section identifies regulatory requirements that may trigger monitoring and maintenance activities and identifies types of monitoring plans that may be required. Treatment-specific maintenance activities depend on specific project goals and objectives and are not included in this document. Depending on the monitoring required, the monitor may need to have certain expertise or qualifications.

6.1 Maintenance

When submitting the NOI to the Conservation Commission in compliance with MAWPA, applicants should review maintenance requirements. Per 310 CMR 10.12(1)(k) and 310 CMR 10.53 (7) any NOI, including for an ERP or ERLP, shall include an operation and maintenance (O&M) plan when proposed activities include construction, repair, replacement or expansion of infrastructure. The applicant should coordinate with the project design team to develop an appropriate O&M plan, when required. In addition, funding agencies may require an O&M plan. Implementation of the O&M plan shall be a continuing condition in the OOC and COC.

An applicant may consider developing an adaptive management plan in lieu of a standard O&M plan for river restoration projects incorporating multiple restoration treatments. An adaptive management plan takes into account the self-sustaining nature of the treatments, but recognizes unexpected circumstances, like large storms, may cause damage to restoration treatments and necessitate repairs.

6.2 When is Monitoring Required?

Construction period and post-construction monitoring of wetlands and waterways may be required as a part of approvals issued under the MAWPA, MESA, NPDES, or Sections 401 or 404 of the CWA. Although monitoring requirements may vary by project type or regulatory framework, following sections below describe key considerations for monitoring organized by regulatory framework.

6.2.1 Stormwater Monitoring

Monitoring of project sites for stormwater ESC effectiveness may be required under various regulatory approval programs (e.g. MAWPA, NPDES, local conservation bylaws). Construction

BUT WAIT – THERE'S MORE

Pictured: A wood turtle (Glyptemys insculpta).
Photo credit. E. Stockman.

Appendices

Appendix A: Permit Applicability for River Restoration Projects

Appendix B: Desktop Review Checklist

Appendix C: Permit Application Preparation for River Restoration Projects

Appendix D: Template Tables for Permitting

Appendix A: Permit Applicability for River Restoration Projects

Regulation Name	Application Name(s)	Issuing Authority	Common Thresholds for River Restoration	Data Collection / Analysis Requirements Typical for River Restoration	Approximate Costs and Timelines from Application Preparation to Approval
Massachusetts Environmental Policy Act (MEPA)	• Notice of (Ecological Restoration) Project • Environmental Notification Form (ENF) • Environmental Impact Report (EIR)	Massachusetts Environmental Policy Act Office	Notice of Ecological Restoration Project • See 301 CMR 11.01(2)(b)(3) ENF • Provided that a Permit is required: alteration of 500 or more linear feet of inland bank; alteration of 5,000 or more square feet of bordering or isolated vegetated wetlands; alteration of ½ or more acres of any other wetlands; New fill or structure or Expansion of existing fill or structure, except a pile-supported structure, in a velocity zone or regulatory floodway • Note: 'other wetlands' includes cumulative alteration to Land Under Water, Riverfront Area, and Land Subject to Flooding EIR • Provided that a Permit is required: alteration of one or more acres of salt marsh or bordering vegetating wetlands Although the proximity to mapped Environmental Justice Communities is not a threshold listed in 310 CMR 11.03, this proximity may cause a Project to require an EIR. If a Project requires Agency Action, exceeds an ENF threshold, and is within the Designated Geographic Area (commonly 1 mile radius) of an Environmental Justice community, an EIR is required per 301 CMR 11.06 (7)(b). See Environmental Justice Protocols Flowchart to determine applicability	If the project is within the Designated Geographic Area of an Environmental Justice Population the following is required: • Meaningful outreach performed before and during MEPA review in accordance with the Final MEPA Public Involvement Protocol for Environmental Justice Populations • Analysis of Environmental Justice Impacts in accordance with the Final MEPA Interim Protocol for Analysis of Project Impacts of Environmental Justice Populations • Although not explicitly required, if a Hydrologic and Hydraulic Analysis is performed, it is recommended to provide the associated report with the application. • Alternatives Analysis in response to the ENF Form, and/or for an EIR per 11.07(6)(f)	$$ - $$$$ 🕘🕘-🕘🕘🕘🕘
Massachusetts Endangered Species Act (MESA)	• MESA Project Review Checklist • Conservation and Management Permit Application	Natural Heritage and Endangered Species Program (NHESP)	Any non-exempt activity located in NHESP Priority Habitats of Rare Species or projects within Estimated Habitats of Rare Wildlife and subject to the MAWPA. The Natural Heritage Atlas maps depict the known habitat for rare plants and animals protected under MESA and MAWPA.	• Identification of state-listed species through the submittal of a State-Listed Species Information Request Form. • Depending on the species identified, field surveys by qualified biologists or botanists may be required. The exact requirements for data collection should be discussed with NHESP prior to submittal of any applications.	$ - $$$ 🕘-🕘🕘🕘🕘

Legend

$	<$10k	$$	$10k-$25k	$$$	$25k-$40k	$$$$	> $40k
🕘	<3 months	🕘🕘	3-6 months	🕘🕘🕘	6-9 months	🕘🕘🕘🕘	> 9 months

Reviews

"I'm loving the paper copy. This is the most fun I've had with a manual."

- FRCOG

"It's great that there will be a resource for applicants to reference and guide them towards using nature-based solutions."

- Regulator

"This is great information. I can't wait to share with DER staff and others!"

-DER

"This manual is great – it will be so useful for communities"

-DCR

"Thank you for all this work, this is a wonderful resource for our staff and customers and I hope it will lead to more stream restoration projects!"

- NRCS

ACT **NOW** AND GET YOUR COPY

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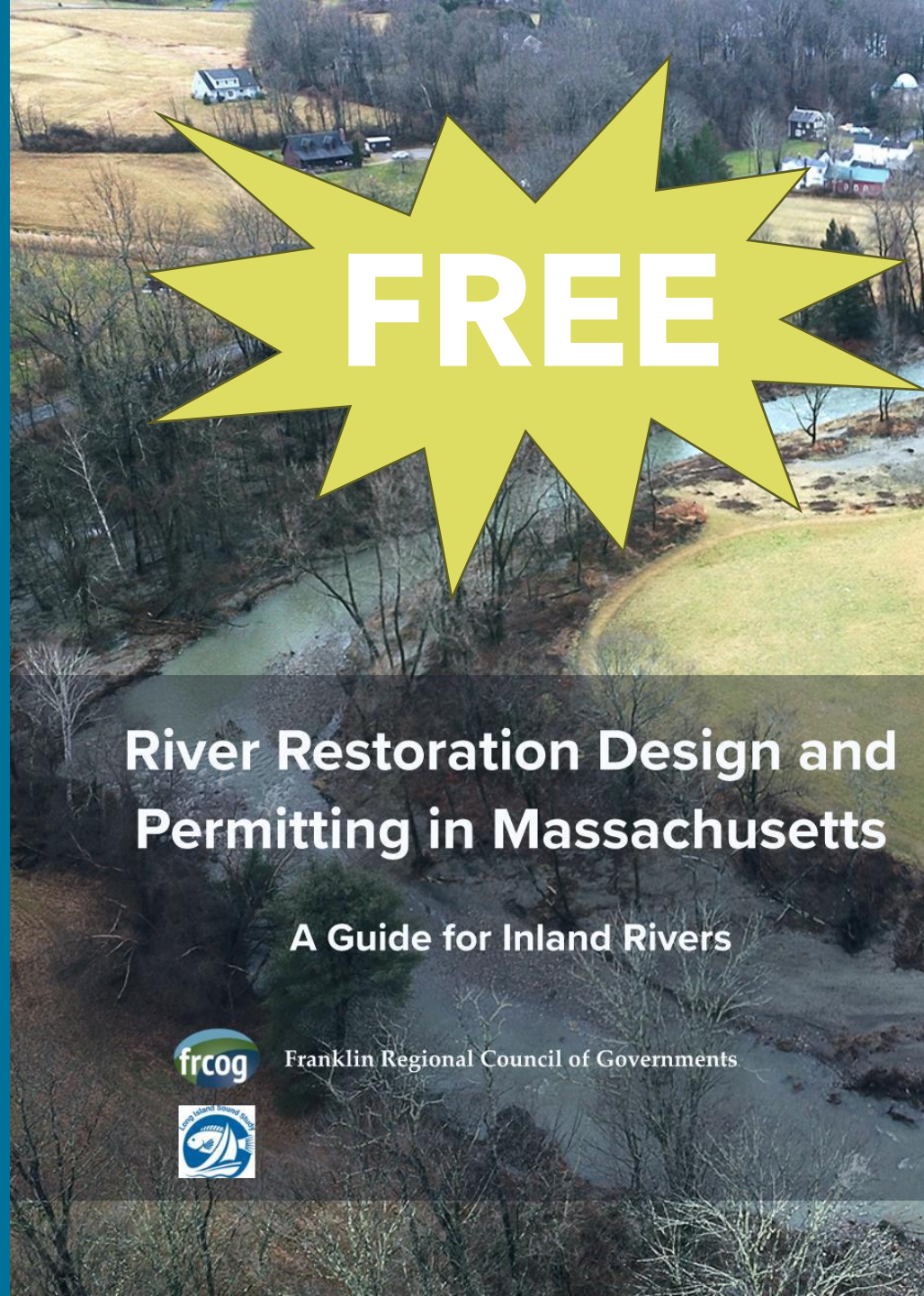

Questions?