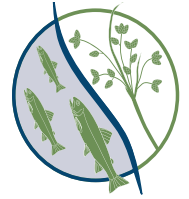


The Commonwealth of Massachusetts
Charles D. Baker, Governor
Karyn E. Polito, Lieutenant Governor

**Executive Office of Energy and
Environmental Affairs**
Matthew A. Beaton, Secretary

Department of Fish and Game
George N. Peterson, Jr., Commissioner
Mary-Lee King, Deputy Commissioner

Division of Ecological Restoration
Tim Purinton, Director



COMMONWEALTH OF MASSACHUSETTS
Department of Fish & Game
Division of Ecological Restoration

2015 Annual Impact Report

Resiliency

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“...a healthy marsh. Our Great Marsh acts as a last defense against flooding and damage from coastal storms and imminent sea level rise.”

“... the ability to spring back into action.”



“...ecological diversity and complexity. By promoting healthy, resilient natural systems, human communities will be better able to withstand the dramatic changes in weather patterns anticipated.”

Left - Geoff Walker, Sportsman & Town of Newbury Selectman; Top Right - Marion Stoddart, Nashua River Advocate; Bottom Right - EkOngKar Singh Khalsa, Mystic River Watershed Association



Dear Partners,

The premise is simple: the healthier you are, the quicker you can recover from illness. The same applies in the natural world. Higher-functioning ecosystems can better deal with, and recover from, stress.

For example, wetlands, and specifically salt marshes, are a large-scale landscape in Massachusetts where the impacts of climate change are being seen. Unhealthy marshes are less able to keep up with sea level rise; if marshes remain unhealthy, they are more prone to permanent inundation and the lands, cities, roads and homes that they buffer and protect are more exposed to extreme weather.

The Division of Ecological Restoration (DER) and partners are working hard to restore vitality to salt marshes and other aquatic ecosystems that protect our communities and economies. As the threats of climate change become more pronounced, resiliency is essential to the functioning of our natural communities. The more resilient nature is, the more resilient our cities and towns will be given a future where change will be the constant.

Sincerely,

Tim Purinton, *Director*

George N. Peterson, Jr., *Commissioner*

Hunt Durey, *Deputy Director*

Mary-Lee King, *Deputy Commissioner*

BY THE NUMBERS - 2015 ACCOMPLISHMENTS

DER provided technical support and guidance in more than **202 communities** in Massachusetts in 24 of the 27 major watersheds.

Using Commonwealth funds to the fullest, we leveraged **10.25 million** in external funds.

Volunteers worked in **124** communities, devoting more than **\$69,325** worth of labor towards protecting and restoring our rivers and wetlands.

We removed 3 dams and completed 1 wetland restoration project, restoring **16.5** acres and opening up **41** river miles.

We advanced work on multiple projects that have recently initiated construction or will begin construction next year – including **9** dam removals reconnecting nearly **400** river miles and **3** wetland projects restoring over **524** acres.

Volunteers worked in 124 communities	
Completed 16.5 Acres 41.0 River Miles	Leveraged \$10.25M external funds
Planned 524 Acres 400 River Miles (2016 Construction)	Provided Technical support to 202 communities

Restoration Economy - Cost Avoidance

Dams and culverts exist in abundance across Massachusetts. Many of these structures are in poor condition and have outlived their design life. Although removing or upgrading these structures may require significant up-front costs, stream restoration efforts will mitigate flood risks, improve ecosystem function, and relieve long-term financial burdens for decades into the future.

In 2015 we commissioned a study to see how the costs of removing a dam or replacing a culvert to meet the higher Massachusetts Stream Crossing Standards compared against maintenance or replacement with an in-kind structure. The study looked at costs for completed projects and used engineers' analyses to develop estimates of what the costs would have been if the dams had been repaired or culverts had been replaced in-kind.

In short, we found that the average cost of the six stream barrier removal projects was significantly less than the expense of repairing and maintaining existing structures over a 30-year period. On average, removal of the dams in the study was 60% less expensive and upgrades of the culverts was 38% less expensive.

In addition to the cost comparison, other additional

community benefits were investigated, including avoided costs of flood damage and improved aesthetic conditions of the landscape. Here are some key findings from two of the project sites:

Drift Road Culvert Upgrade, **Westport**

- Avoided costs to the municipality of up to \$150,000 for active management of flooded roads for 4 to 10 days per year.
- Avoided travel delays for 12,000 to 30,000 travelers annually.
- Improved habitat conditions for recreational and commercially valuable fish species, such as American eel and brook trout.

Whittenton Dam Removal, **Taunton**

- Removed public safety threat.
- Avoided costs of emergency response due to dam failure potential of at least \$600,000 over the next 30 years.
- Avoided costs to regional businesses of closures due to flooding or evacuations.
- Increased habitat connectivity for native, fish species, including river herring and American eel.

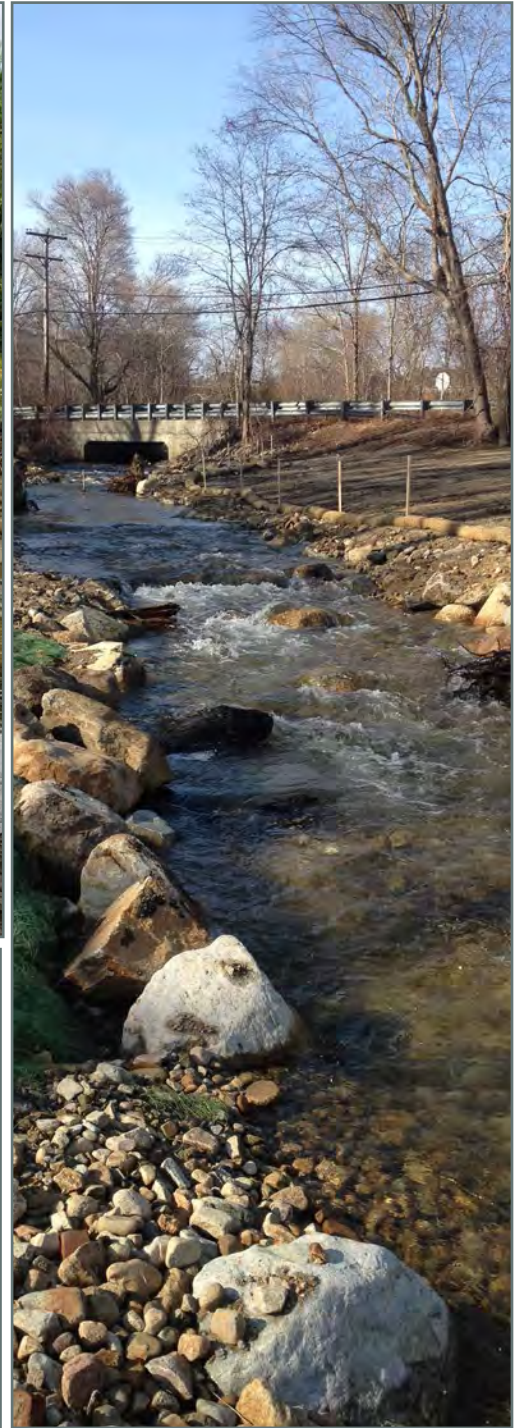
The full study of findings are available in the report *Economic & Community Benefits of Stream Barrier Removal* found on our website (mass.gov/der).

We found that the average cost of six stream barrier removal projects was significantly less than the expense of repairing and maintaining existing structures over a 30 year period.

Tidmarsh Farms Restoration - large wood pile ready for installation in the wetland and streams for habitat improvement.



Ecological Restoration brings Community Resilience



*Top: The removal of the Millie Turner Dam on the Nissitissit River, **Pepperell**.
Bottom: Volunteers help relocate endangered mussels during the Millie Turner Dam removal.
Right: Town Brook flowing after the Plymco Dam removal, **Plymouth**.*

DER's work restoring the rivers, wetlands, and salt marshes of Massachusetts increases the resilience of communities to the growing risks from coastal storms, sea level rise, flooding, erosion and associated threats.

Over the last two years, DER has been awarded \$14 million in Hurricane Sandy Disaster Relief-Coastal Resilience Grant funds from the Department of the Interior and the National Fish and Wildlife Foundation for ecological restoration projects that increase community resiliency. In 2015, six of DER's ecological restoration projects were under construction (two with support from Hurricane Sandy funds). Each of these projects involved DER, municipalities, non-profit partners, property owners, and federal, state, and local agencies working together:

- The Town of **Plymouth**, with the help of DER and other partners, removed Plymco Dam from Town Brook in January. This project is part of a long-term effort to restore and revitalize Town Brook by restoring fish passage, addressing stormwater pollution, and increasing public access. Town Brook was the source of fresh water for the Pilgrims who settled at Plymouth Harbor in 1620. Despite many decades of damming and pollution, surveys by the Massachusetts Division of Marine Fisheries have found that Town Brook supports a remarkably strong run of river herring.
- In August, AD Makepeace began restoring the headwaters of Red Brook, a small coldwater stream that runs through **Wareham** into Buttermilk Bay. Stream channel restoration is the first step in this long term collaborative project between the Division of Fisheries and Wildlife, DER, and AD Makepeace to restore 60 acres of wetland, improve access for river herring to over 300 acres of spawning habitat in White Island Pond and enhance 1.6 miles of Red Brook.
- In September 2015, DER, the Division of Fisheries and Wildlife, the National Fish and Wildlife Foundation, and Trout Unlimited removed the Millie Turner Dam on the Nissitissit River in **Pepperell**. Removal of the dilapidated dam reconnects 40 upstream river miles on a beautiful trout stream in northeastern Massachusetts.
- In October, the Town of **Gloucester** broke ground with DER assistance on the Little River Restoration Project. This project re-naturalizes a small coastal stream that had been channelized into a concrete channel/fishway and run through the settling basin of a now-defunct water treatment plant.
- Also in October, construction began at the 250-acre Tidmarsh Farms / Beaver Dam Brook wetland and river restoration project in **Plymouth**. Future conditions here will include a mosaic of wetland habitat types, free movement of fish from ocean to headwaters, and restored connectivity with the surrounding forests. Most importantly, this work will promote dynamic, self-adjusting conditions that will allow the site to evolve with climate change and sea level rise.
- Construction began in December to restore Muddy Creek, a 55-acre tidal wetland that borders **Harwich** and **Chatham**. Two undersized culverts located under Massachusetts Route 28 restrict tidal flow from Pleasant Bay, a tidal estuary, into Muddy Creek. DER, **Harwich**, **Chatham**, and other partners worked together to replace the antiquated culverts with a 94-foot bridge, thus restoring full tidal flow to Muddy Creek.

Over the last two years, DER has received \$14 million in Hurricane Sandy Disaster Relief-Coastal Resilience Grant funds from the Department of the Interior and the National Fish and Wildlife Foundation for ecological restoration projects that increase community resiliency.

Where We Work Out West

Dave Bloniarz



**Abbey Brook Restoration
Springfield**

Tucked into a corner of the urban fabric of **Springfield** is Abbey Brook. The long forgotten stream is about to get a great deal of attention from a broad partnership working together to help restore the brook. A varied list of activities are already in the works and include monitoring and field assessment by local students, assessment and restoration planning, and community outreach.



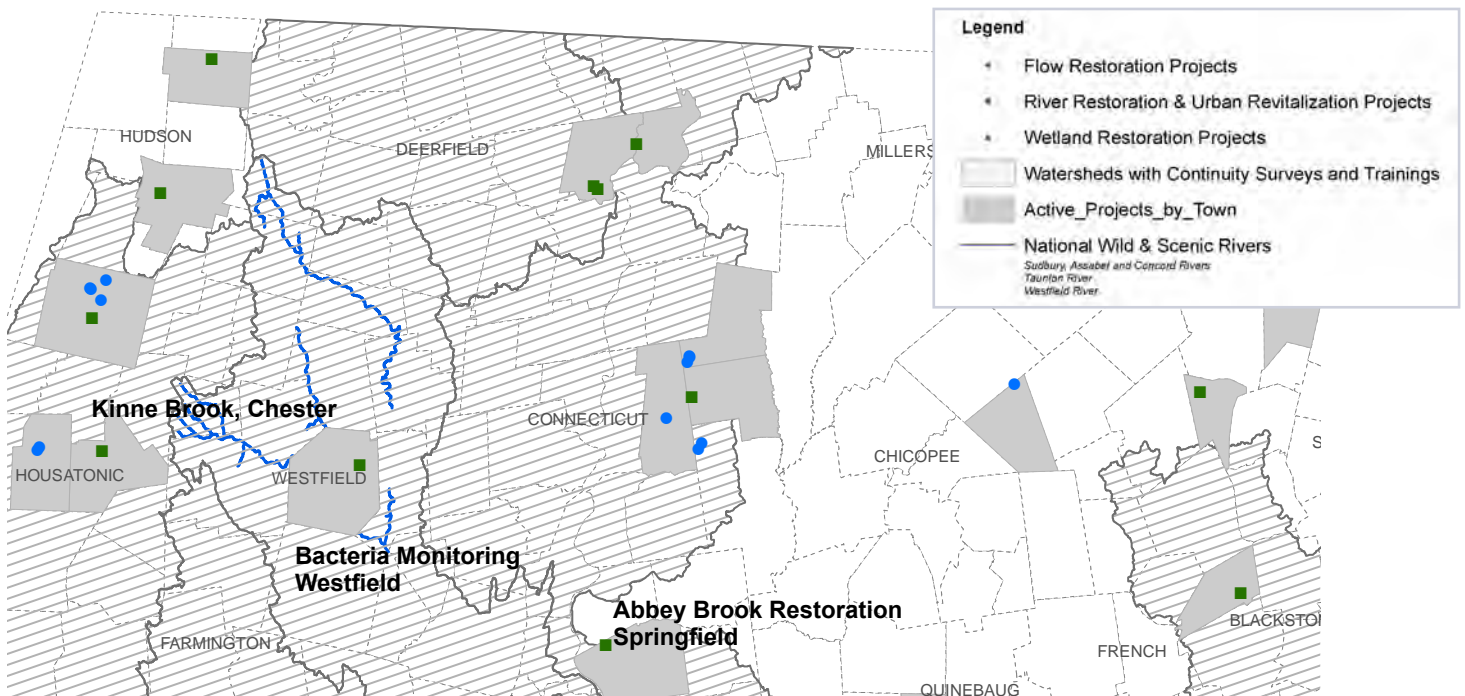
**Bacteria Monitoring
Westfield**

Six students at Westfield State University are being mentored by DER to assist the City of **Westfield** in investigating bacteria sources in their stormwater collection system. The students are learning field and laboratory skills as they work to identify possible problem areas in the collection system using bacterial testing for E. coli.

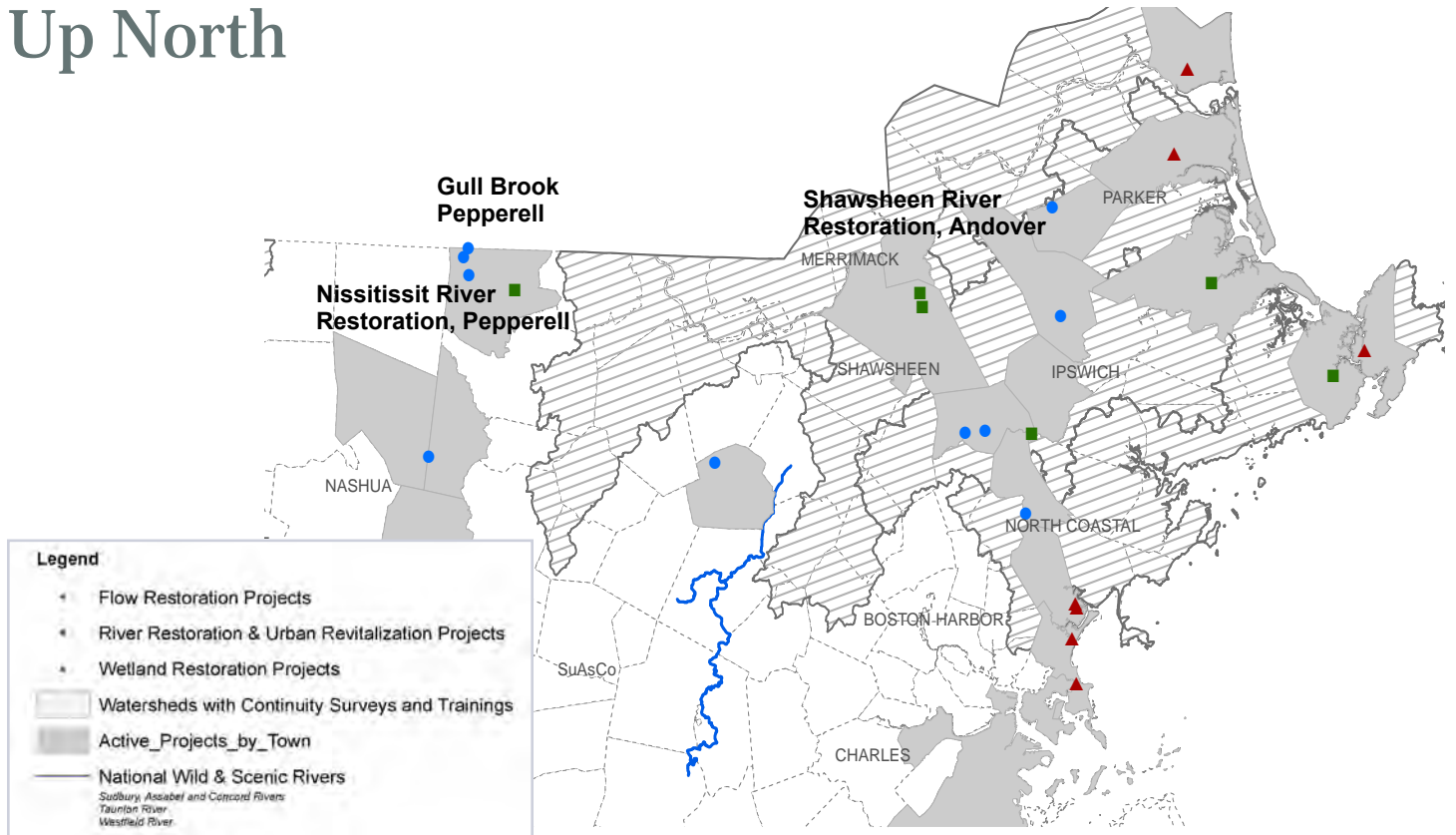


**Kinne Brook
Chester**

Westfield State University led volunteers through a fish sampling exercise on Kinne Brook. Volunteers and Westfield State University students are helping to conduct pre- and post-restoration monitoring on this brook where a dam was removed (fall 2014) and two culverts will be replaced to restore access to over 10 miles of coldwater habitat in the Kinne Brook watershed.



Up North



**Nissitissit River Restoration
Pepperell**

In the fall, DER and partners removed the Millie Turner Dam eliminating a safety hazard, reducing the risk of floods and enhancing the resiliency of the local community. Home to endangered mussels and native brook trout, the river is considered some of the most viable habitat for rare species and natural communities in Massachusetts.



**Shawsheen River Restoration
Andover**

DER is working to remove the Balmoral Dam and the Marland Place Dam on the Shawsheen River in **Andover**. Both aging dams pose a threat to infrastructure if they fail. Additionally, removing both dams has high ecological benefits for the river and surrounding area.



**Gulf Brook
Pepperell**

DER is working with partners to monitor low flow conditions in Gulf Brook, a small but valuable tributary to the Nissitissit which provides habitat for coldwater fish as well as water for the Town of **Pepperell**.

Where We Work Down South



Tri-Basin flow initiative
Halifax & Kingston

DER is supporting detailed hydrologic modeling to inform management decisions in an effort to improve flow regimes in the Jones River and Stump Brook and enhance water quality in associated lakes and ponds used for drinking water supply and recreation.



Rattlesnake Brook Restoration
Freetown

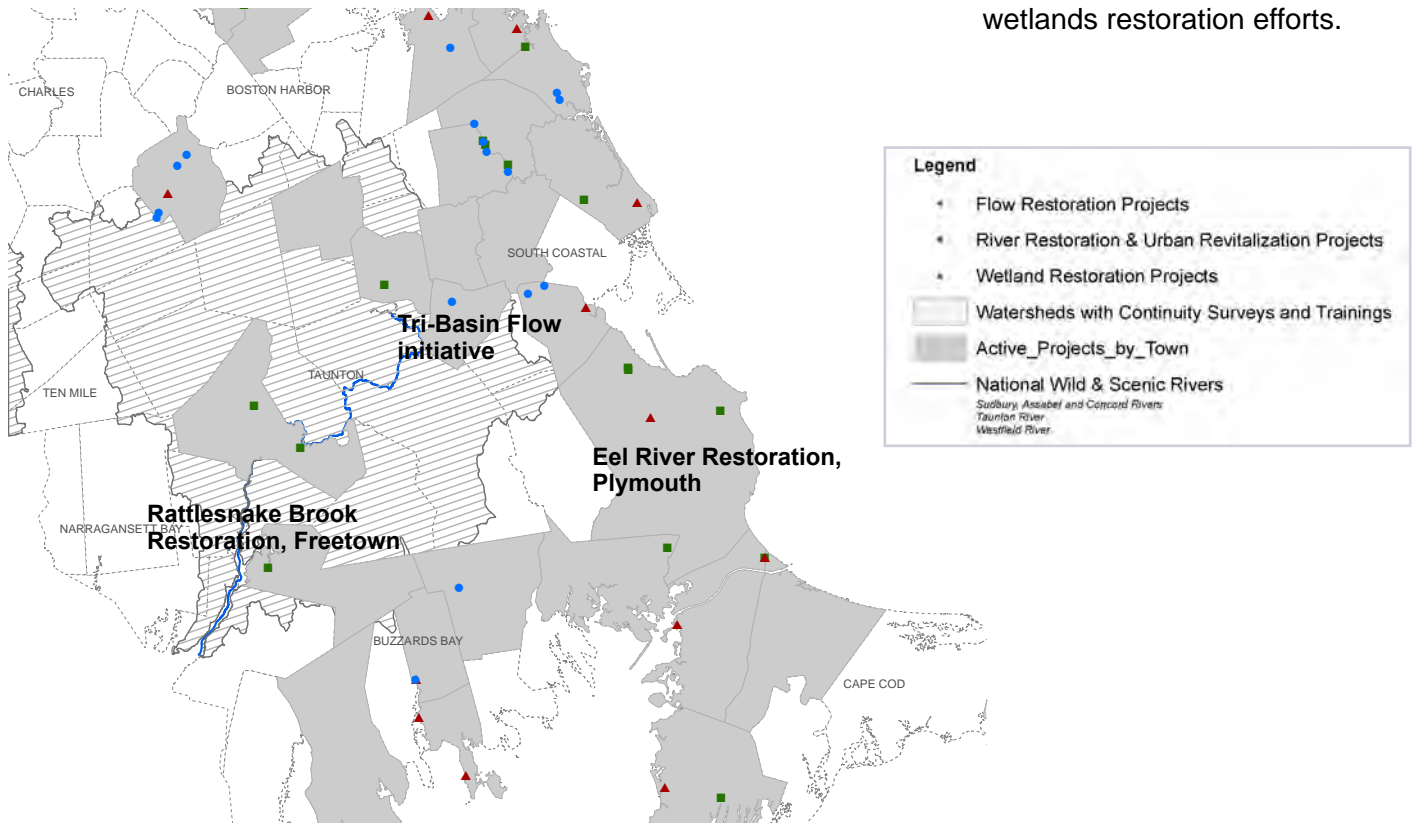
Removal of the Bleachery Dam on Rattlesnake Brook will restore critical ecological processes such as fish passage and sediment transport to enhance ecosystem resiliency to climate change. Removing the dam will also eliminate the threat that its failure might have on adjacent roads.



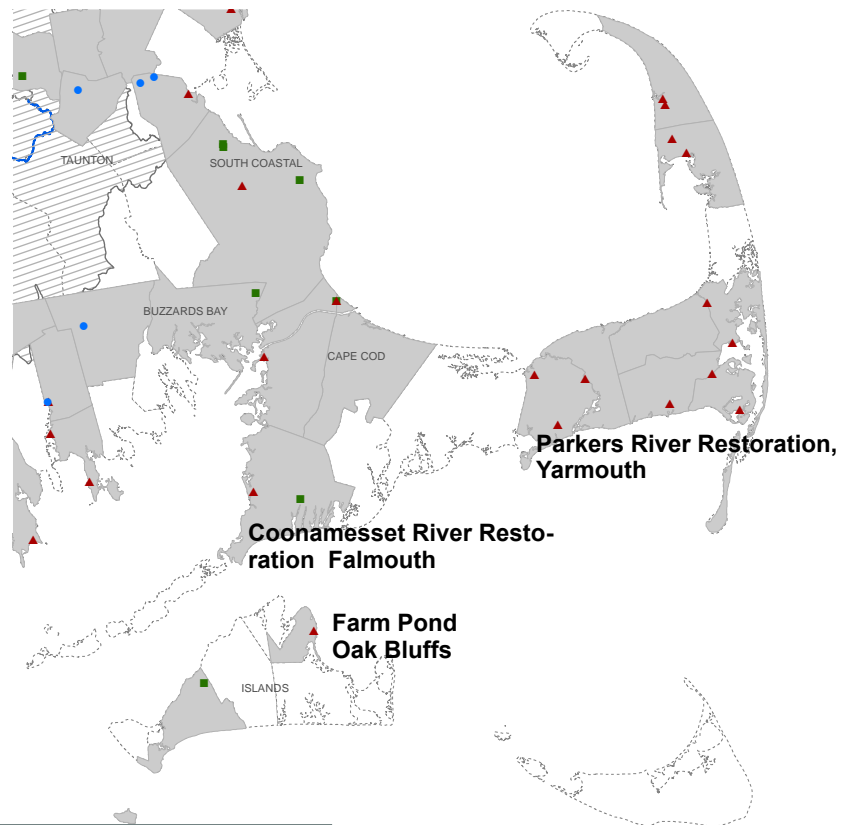
Eel River Headwaters Restoration
Plymouth

This year volunteers assisted DER and the Town of **Plymouth** in an assessment of the Atlantic white cedar trees planted as part of this project (completed in 2010). Many of the 17,000 trees originally planted are thriving, with maximum heights now over 10 feet. The study will continue well into the future and inform other similar wetlands restoration efforts.

Frank Mead



On the Cape & Islands



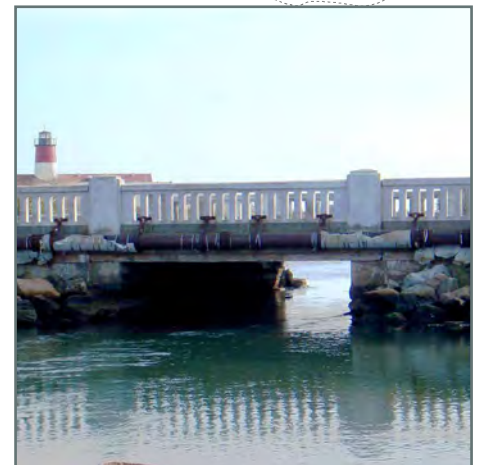
Coonamesset River Restoration Falmouth

DER is working with **Falmouth** to remove an obsolete dam near the mouth of the river, restore 17 acres of former cranberry bog to floodplain wetlands, and create a sinuous, natural river channel through the former bog. The project will improve water quality and habitat for migratory and resident fish including river herring and eastern brook trout.



Farm Pond Oak Bluffs

DER is working with the Town of **Oak Bluffs** to replace an undersized culvert at Farm Pond to reestablish tidal flushing. This will enhance fish and wildlife habitat, improve storm resiliency and increase recreational opportunities.



Parkers River Restoration Yarmouth

Replacing the existing tidally-restrictive bridge over the river on Route 28 with a larger structure will restore natural tidal hydrology to this 219-acre estuarine system. This will greatly improve ecosystem health and enhance water quality for fish and wildlife. This project is expected to be complete by 2017.

Strengthening Road-Stream Crossings

Assessing what is suitable for fish and other aquatic life may appear far removed from the needs of cars and communities, but when it comes to roads crossing over streams, both fish and Fords can benefit from work DER has been involved in for the past decade.



The Massachusetts River and Stream Continuity Partnership works to reduce the adverse impacts of road-stream crossings on ecosystem health and increase infrastructure and community resilience to storm damage. DER staff have been key players since the partnership's inception. The Partnership has now expanded to encompass organizations working in thirteen states in the Northeast and Mid-Atlantic through the North Atlantic Aquatic Connectivity Collaborative.

The importance of improving stream crossings is evident in the wake of severe storms such as Tropical Storm Irene and Hurricane Sandy. When a road crossing is undersized, the considerable force of constricted flood waters may undermine and even wash away a road crossing, leaving people stranded and a community scrambling with emergency repairs.



A decade ago DER staff and The Nature Conservancy launched a comprehensive assessment of the road crossings over streams in the Westfield River watershed. The findings showed over 50% of the road-stream crossings surveyed were moderate to significant barriers for fish. Despite the relatively rural nature of the watershed, many streams

Top: Interns survey a road-stream crossing. The manufacture date of the crossing suggests it likely washed out during storm events in the Summer of 2013 and was replaced. The replaced culvert is still vulnerable to clogging and may be susceptible to failure during future high flow events.

*Bottom: Stream Continuity Specialist Tim Chorey standing under a new road-stream crossing that is part of the Town Brook Restoration Project, **Plymouth**.*

had interruptions in their connectivity preventing fish from using the entire river and even isolating some populations.

This past summer more than 150 road crossings in the Westfield River watershed were revisited in a collaborative effort by DER and the Wild & Scenic Westfield River Committee to assess conditions a decade later. The new data will provide insight into how well crossings age with respect to ability to pass fish and their vulnerability to failure. Westfield State University student interns completed the field surveys.

The crossings targeted for re-survey were based on the North Atlantic Aquatic Connectivity Collaborative priority subwatersheds. These subwatersheds were identified based on the importance for brook trout, where the likelihood of culvert failure is higher, where the passability of crossings is less certain, and where culvert failure would have the largest impacts on communities and infrastructure.

Although the data is still being analyzed, the interns did identify a number of crossings which appeared to have been replaced since 2005. Often these crossings were found to still pose a failure risk and continued to present barriers to fish and aquatic organisms.

In addition to surveying road-stream crossings, DER is working to help municipalities replace undersized, unsafe culverts with those that are resilient to floods while also being fish and wildlife friendly. New regulatory standards in Massachusetts call for larger and better designed culverts, but few culvert

replacement projects have been completed to the higher standards.

DER recently conducted a survey of local road managers across Massachusetts to identify the major barriers they face when trying to upgrade culverts for safety and habitat. More than 100 municipalities across Massachusetts responded to DER's survey. The survey revealed that municipalities face barriers at all steps in the culvert replacement process, including a lack of in-house expertise with design of culverts; inability to identify which culverts are most vulnerable to washouts; difficulty with the permitting process and lack of funds for engineering, design and construction.

Following the survey, DER's Stream Continuity Specialist, Tim Chorey, has been meeting with municipal Department of Public Works directors from around the Commonwealth who participated in the study. Tim has observed ongoing projects, toured problem culvert sites, and learned in depth about the problems municipalities face when attempting to upgrade culverts. Based on identified needs, DER will develop tools, approaches, and funding sources that will help towns replace at risk, vulnerable road-stream crossings with larger, safer structures.

Towns interested in seeking technical assistance for culvert replacement projects can reach the DER Stream Continuity Program and Tim Chorey by email at Timothy.Chorey@state.ma.us or at 617-626-1541.

A decade ago DER staff and The Nature Conservancy launched a comprehensive assessment of the road crossings over streams in the Westfield River watershed. The findings showed over 50% of the road-stream crossings surveyed were moderate to significant barriers for fish.

Healthy Streamflows Support Stronger Communities



*Top: The Beaver Brook watershed supports aquatic species and the Town of **Sharon's** water supply.
Bottom: Mussel habitat exposed as Silver Lake drops to 3rd-lowest levels recorded in the last 20 years. Photo by Pine duBois, Jones River Watershed Association.
Right: George Comiskey of the Parker River Clean Water Association stands in a stretch of the Parker River in **Georgetown** which was observed to be dry for much of the fall of 2015.*

Instream flow restoration is an essential part of building resiliency into our interdependent natural and human systems.

Climate scientists tell us that in the future we will see lower and more prolonged low streamflows in the summertime, leading to higher water temperatures and limiting aquatic habitat and migration potential, as well as increasing physical constraints to drinking water supplies.

DER's River Instream Flow Stewards program documents flow stress conditions around the state, due to water withdrawals near headwater streams, impervious surfaces that reduce the potential for rain to recharge aquifers, and changing precipitation patterns that bring us more intense storms and prolonged dry spells. These data informs our flow restoration work.

DER's Flow Restoration program works with water managers across the state on ways to provide more natural flow regimes. Natural flow patterns can improve the resiliency of aquatic ecosystems despite climate stress, keeping streams cooler as air temperature warms, ensuring habitat connectivity, and providing habitat reserves.

For example, the City of **Pittsfield** is using our guidance to ensure more adequate summer flows and less dramatic changes in flows associated with management of Onota Lake. We are working with the City of **Brockton** to determine

alternative approaches for releasing flood water from Monponsett Pond in **Halifax** and **Hanson**, benefiting downstream resources in Stump Brook while protecting water quality in Silver Lake.

Recent studies highlight the importance of flow restoration for fish species in the face of climate change, showing strong and immediate responses of fish populations to instream flow restoration. In our work with the Scituate Water Division we have seen a similar response, as herring returned to First Herring Brook for the first time in decades shortly after the Water Division began releasing water downstream in consultation with DER and other partners.

We also need to know what normal looks like, as normal changes. DER continues to work with partners in Massachusetts and throughout the country on a regional monitoring network to detect impacts of climate change by monitoring flow, temperature, and macroinvertebrates.

We are conducting long-term flow monitoring at two relatively un-impacted reference sites in **Oakham** and **Holland** to provide a point of comparison for streams that are under greater stress from human impacts to ensure their resiliency in the face of climate change.

DER's Flow Restoration program works with water managers across the state on ways to provide more natural flow regimes. Natural flow patterns can improve the resiliency of aquatic ecosystems despite climate stress, keeping streams cooler as air temperatures warm, ensuring habitat connectivity, and providing habitat reserves.

DER In The News

For more information on DER restoration work this year view some of the following news stories:



This article reports the ongoing effort by DER, the Nature Conservancy and others to identify and remove obsolete dams and **restore free-flowing rivers**. **State working to demolish deteriorating dams**, *Taunton Daily Gazette*.



An update on the pilot restoration project along the Hoosic River as step one of the **Hoosic River Restoration**. **A Major Project on a small river**, *Berkshire Eagle*.



The benefits of the restoration of the **Herring River**. **Redesigned dike will enable a sick river to recover**, *Provincetown Banner*. Also see this article on a researcher who has spent hundreds of hours canoeing the Herring River to document marsh birds seen there, **Rare rails captivate researcher**, *Provincetown Banner*.



Talks about the collaborative restoration efforts happening along the Housatonic River in Pittsfield including DER's work to remove the **Mill Street (Tel Electric) Dam**. **Part Of Housatonic River In Pittsfield To Get A Makeover**, *New England Public Radio*.



This great article sums up DER's **restoration work** in Massachusetts. **Mass. DER plays key role for state's waterways**, *The Berkshire Eagle*.



For year round news on DER's restoration work follow us on Twitter **@MassEcoRestore**.



2016 Preview

The Division of Ecological Restoration looks forward to working with partners in 2016 on many exciting projects:

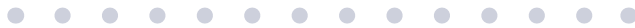


Students in Dam Removal Practicum visit the site of the recent Millie Turner Dam removal.

In September 2015, DER and the University of Massachusetts Amherst began a year-long for-credit Dam Removal Practicum to guide graduate and undergraduate students through dam removal projects - from inception to construction. Few opportunities have previously existed for students to learn what is needed to carry out an ecological restoration project. DER hired an Ecological Restoration Specialist, Kris Houle, to lead the practicum and meet with the students to provide training on each step of the dam removal process. The goal of the program is to create a hands-on experience for the next generation of river restoration practitioners. Funding for this program is provided in part by the Department of Interior's Hurricane Sandy Disaster Relief-Coastal Resilience Grant program via the National Fish and Wildlife Foundation.



In 2016 DER is initiating a research project that will help inform strategies to encourage water-saving behaviors during summer months. Conserving water can be a meaningful way for each of us to ensure resiliency of our water systems – both drinking water supplies and stream flows.



In 2015 DER partnered with the Executive Office of Energy and Environmental Affairs to include ecological restoration in the Massachusetts Clean Energy and Climate Plan Update. The plan recognizes the greenhouse gas fluxes of certain wetland and river restoration actions. Included in the plan is a standalone “Blue Carbon Calculator” that quantifies the carbon and methane budgets pre and post-restoration. (Blue carbon refers to the vast amounts of carbon stored in aquatic environments.) In 2016, DER will share the Blue Carbon Calculator with partners and other states to help strengthen the case for coastal wetland restoration as both an important climate mitigation and adaptation tool.



Commonwealth of Massachusetts

Division of Ecological Restoration

Invested in Nature and Community

The Division of Ecological Restoration restores and protects the Commonwealth's rivers, wetlands, and watersheds for the benefit of people and the environment.

Website: www.mass.gov/der

Twitter: [@MassEcoRestore](https://twitter.com/MassEcoRestore)

Flickr: http://www.flickr.com/photos/der_riverways/

RESILIENCY IS...

“Resiliency is the ability to tolerate great pressure and to return to form once that pressure has subsided. Here on Martha’s Vineyard, our natural areas give the island its resiliency.”

Adam Moore, Sheriff’s Meadow Foundation



Ray Ewing for The Martha’s Vineyard Gazette



“In the context of the Department of Interior-National Fish and Wildlife Foundation Hurricane Sandy Coastal Resiliency program, resiliency means assessing, restoring, enhancing or creating wetlands, beaches and other natural systems to help better protect communities and to mitigate the impacts of future storms and naturally occurring events on fish and wildlife species and habitats.”

Amanda Bassow, Northeastern Regional Director
National Fish and Wildlife Foundation

Tim Purinton
Director

Hunt Durey
Deputy Director

Eileen Goldberg
Assistant Director

Carrie Banks
Stream Team & Wild & Scenic
Westfield River Coordinator

Timothy Chorey
Stream Continuity Specialist

Russell Cohen*
Rivers Advocate

Michelle Craddock
Flow Restoration Specialist

Cindy Delpapa
Riverways Program Manager

Kristen Ferry
Habitat Restoration Specialist

Alex Hackman
Restoration Specialist

Kris Houle
Ecological Restoration
Specialist

Franz Ingelfinger
Restoration Ecologist

Georgeann Keer
Project Manager

Beth Lambert
Aquatic Habitat Restoration
Program Manager

Laila Parker
Flow Restoration Program
Manager

Megan Sampson
Program Administrator

Nick Wildman
Restoration Specialist

*Retired as of July 1, 2015