

IV. Target Recommendations for Federal and State Policy

Based on the historical, scientific, and policy background covered in Chapters I-III, we developed five target recommendations for policy change in New England. Our recommendations are oriented to federal and state governments, but we do not identify what agency or state needs to do what. Rather we aim

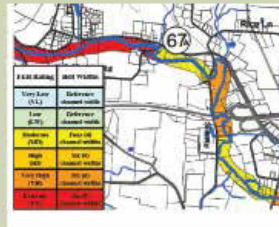
to offer guidelines and examples so different states and agencies can adopt these recommendations while creating their own particular approach.

The five recommendations cover three categories of ways to help communities become river-smart.

Information

about river and stream hazards that communities need to be River-smart

Target Recommendation #1: Develop Fluvial Hazard Assessments



P. 36

On-the-ground actions

that can help communities become river-smart

Target Recommendation #2: Upgrade Vulnerable Stream Crossing Infrastructure



P. 41

Target Recommendation #3: Support River-Smart Planning and Mitigation



P. 51

Outreach and coordination

that communities need, to make river-smart actions achievable and cost-effective

Target Recommendation #4: Provide Outreach and Training on River Dynamics and River-Smart Practice



P. 59

Target Recommendation #5: Designate, Recognize and Support River-Smart Regional Intermediaries



P. 65

Summary of Target Recommendation #1: Develop Fluvial Hazard Assessments

Municipal need:

Easy-to-use, place-specific data about local and regional fluvial hazards.
(See page 37).

Municipal need elements:

Easily accessible data and information on fluvial hazards that may affect municipal residents, property owners, buildings, or infrastructure.

Recommendation:

Develop and implement fluvial hazard assessment, mapping, and user access systems across the New England states.
(See page 38).

Recommendation elements:

Develop and implement fluvial hazard assessment protocols, systems for implementation, and user-friendly maps and information portals.



Target Recommendation #1: Develop Fluvial Hazard Assessments

Background

In many towns, long-time residents know places where there have been repeated road, stream crossing, or riverbank failures during river flood events. However, often there is not a clear understanding of why these failures happened in a particular place over and over again. When the entire river system is considered as a whole, these sites of repeated failure may be recognized as locations where the stream is confined to a narrow area, where the stream channel makes a sharp turn, or where the stream channel suddenly becomes wider and flatter. While longtime locals may know the where if not the why of common river flood hazard areas, relative newcomers, repair and assistance technicians, and developers may know nothing about these hazards at all.

Fluvial hazard assessments help identify locations where there may be damage of this sort in future floods. These are the most exhaustive form of stream hazard assessment. They can quantify the potential for erosion and deposition, in addition to inundation, with a high degree of accuracy, both locally, and across an entire state or region.

This kind of information is critical because it can help landowners, developers, municipal officials, transportation and public works staff, planners, and others, to anticipate and prepare for these possible hazards. With this information, city and town staff and others working in areas that affect municipalities can design infrastructure and locate valuable property out of harm's way, while planning for productive recreational or agricultural uses of flood-prone land. People can be safer, and their investments more secure, while living in harmony with their rivers. Without fluvial hazard information, though, we continue "business as usual" – building structures and roads in areas that are likely to be undermined by the natural movements and changes of rivers through time.

Fluvial hazard assessments identify locations of hazards, and evaluate the level of risk. They illumi-

nate two broad types of hazards: erosion and deposition (see Chapter 2 for more on river dynamics).

- **Fluvial erosion** occurs when the power of a moving river is greater than the strength of the bed, bank and/or road or culvert materials. In these areas, the river in future floods may break through land or structures. Sections of stream banks may collapse, bridges or other stream-crossing structures may wash out, or rivers may carve new meanders or channels (see photos pp. 9, 11, 12, 14, 16, 21, 36).
- **Fluvial deposition** occurs in locations where the power of moving floodwaters is suddenly reduced, for example when a very powerful stream confined in a narrow valley runs into a valley that opens up and flattens out. In these areas, large amounts of sediment and debris may be deposited by a river flood (see photos pp. 9, 10).

Once specific areas are assessed, assessment information can be put on maps. A map of fluvial hazards shows areas of high, moderate, and low risk of erosion or deposition. It can show a municipal leader or a road crew whether a planned work site is at risk of fluvial damage. It can indicate interrelated locations up and down a river, where, for example, erosion upriver might cause greater deposition downstream.

Municipal need #1: Easy-to-use, place-specific data about local and regional fluvial hazards

MUNICIPAL NEED #1 ELEMENTS: EASILY ACCESSIBLE DATA AND INFORMATION ON FLUVIAL HAZARDS THAT MAY AFFECT MUNICIPAL RESIDENTS, PROPERTY OWNERS, BUILDINGS, OR INFRASTRUCTURE

Community officials, staff, road crews, property owners and residents need consistent information in a systematic format to determine where erosion and deposition hazards are greatest, and where these exist in the context of the river system as a whole.

They also need to be able to access and understand this information. Maps are particularly user-friendly tools. Yet information about fluvial hazards is not available in FEMA flood hazard maps, which is where most people look to find out what areas of land may be vulnerable to flood damage. They have information only on likely areas of inundation (see Example 2: Inundation Versus Fluvial Hazards, p. 16).

Community leaders and members need maps with information about fluvial hazards that are just as accessible and comprehensible as FEMA flood hazard maps. They need this so they can make responsible and resilient land use management decisions, and develop river-smart plans for infrastructure and development. It is also helpful for grant or permit applications.

Recommendation #1: Develop and implement fluvial hazard assessment, mapping, and user access systems across the New England states

RECOMMENDATION #1 ELEMENTS: DEVELOP AND IMPLEMENT FLUVIAL HAZARD ASSESSMENT PROTOCOLS, SYSTEMS FOR IMPLEMENTATION, AND USER-FRIENDLY MAPS AND INFORMATION PORTALS

New England is lucky to have an excellent model of a fluvial hazard assessment system. Vermont has a widely-used, well-developed fluvial hazard assessment protocol and a number of map products that communities can access in a variety of ways and places (see Example 3: A Model for All New England). New Hampshire also has a similar protocol though it has been less used, and is also developing similar maps.

The other states and/or a federal agency should follow Vermont's lead to develop and implement fluvial hazard assessment systems. Each state may want to develop its own particular approach, due to differences in local topography, geology, political and fiscal context, and

Example 3. A Model for All New England: Vermont's Stream Geomorphic Assessment System

Vermont is the leader among New England states in developing a fluvial hazard assessment system. The Vermont Rivers Program, working together with the Fisheries Division and the Vermont Geological Survey (all within the Agency of Natural Resources), developed a series of geomorphic assessment protocols for the state starting in the early 2000s. By now the state's protocols are well tested and refined, and assessments have been carried out in over 8,000 miles of streams - including virtually all the medium to large streams in the state.



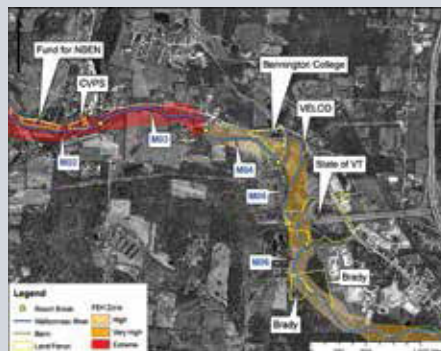
Assessments are done in three phases, following three protocol handbooks. Each requires greater time and effort and provides finer detail. Phase 1 is a watershed assessment based on existing maps and data and "windshield surveys"; Phase 2 is a rapid field assessment; and Phase 3 is a survey assessment using field surveying techniques and quantitative studies.

Towns, regional commissions, nonprofit agencies and others can take the initiative in conducting geomorphic assessments. The state offers some funding for assessments, and several federal agencies contribute as well.

Once assessments are completed, data are published in local or regional watershed assessments. They are also available online through the Vermont Natural Resources Atlas. Maps allow easy, user-friendly understanding of fluvial hazard risks. More detailed data is available through published documents.



Stream geomorphic assessment status in southern Vermont, as shown by the Vermont Natural Resources Atlas. Here, pink = Phase 1 complete; Yellow = Phases 1 and 2 complete.



This 2007 assessment of the Walloomsac River identified fluvial erosion hazard (FEH) zones and also areas where streamside lands might be conserved to allow river movement and flooding, reducing flood damage. These and other Vermont stream geomorphic assessments are on line at: <https://anrweb.vt.gov/DEC/SGA/finalReports.aspx>.

river and land management policies. Alternatively, they could borrow from Vermont, as New Hampshire has, so as not to replicate work unnecessarily. A third option would be to have a federal agency develop a fluvial hazard assessment system that could be used by all the New England states.

To create its own systems, or to adapt Vermont's for its own circumstances, a state or a federal agency must commit to providing the necessary resources to develop and conduct assessments, and make them available to communities.

To develop and implement fluvial hazard assessment systems, the essential steps are:

Develop assessment protocols

Assessment protocols should include both computer- and field-based analysis of the physical conditions of local rivers and streams. Whether uniform or distinct across the New England states, common elements should include:

- Characterization of the physical processes that govern streams
- An understanding of how human activities affect these processes over time
- An understanding of the sensitivities of these physical processes to future changes
- Types and locations of physical processes that create erosion, deposition and flood hazard risks to towns
- The relationships between physical processes and aquatic, riparian and floodplain habitats

Over time, New England should move toward a mutually comprehensible or unified assessment system so data can easily be shared across state lines.

Develop systems and support to conduct the assessments across each state's rivers and streams

Once protocols are developed, the work must be done to complete the assessments. Different states may choose to do this in different ways. Some may choose to allow towns and regional agencies to take the lead in initiating an assessment, and support them with

funding to hire private consulting agencies to do the assessments. A state or federal agency could require or provide incentives for this work to be done. This has been Vermont's approach. One advantage is that it allows communities to take the lead, and move forward at their own pace in assessments. On the other hand, New England states with large rural-urban divides may choose to conduct assessments in-house to avoid favoring towns or cities that are able to devote increased amounts of resources to the process.

Develop and support widely accessible, user-friendly maps and information portals

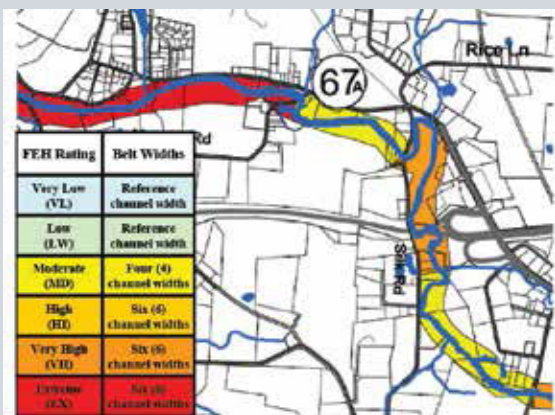
Assessments should produce maps with easy-to-understand designations of high, medium and low risk of fluvial erosion and deposition. There should also be web portals that include educational and training materials along with maps and other town-specific or river-specific data and planning information and recommendations.

One way to make fluvial hazard assessment summaries as widely accessible as possible would be to have them marked on FEMA Flood Insurance Rate Maps, though there are reasons to be cautious about this. This option should be explored, as Vermont is doing with FEMA in the town of Bennington (see Example 4: Could Fluvial Hazards Be Put on Already Widely Used Maps Such as FEMA Flood Hazard Maps?, p. 40).

Develop a quality control system

A quality control system should cross-check data inputs from varying sources to check formatting and flag inconsistencies with other data.

Example 4. Could Fluvial Hazards Be Put on Already Widely Used Maps Such as FEMA Flood Hazard Maps?



Fluvial Erosion Hazard Areas in Bennington, VT.

Stream Geomorphic Sensitivity in Bennington, VT, based on a Vermont stream geomorphic assessment completed in 2007. Higher geomorphic sensitivity means streams are more prone to erode or have their channels adjust and move.

Once fluvial erosion hazard (FEH) assessments are developed, it is crucial that they be communicated in ways that are understandable and useful. One of the ways they might be most broadly and readily communicated and understood would be by adding them to FEMA flood hazard maps.

To test the technical and communication potential of showing fluvial hazard zones on FEMA flood maps, the state of Vermont, the town of Bennington, and FEMA worked together to try out the possibilities of overlaying maps in this way.

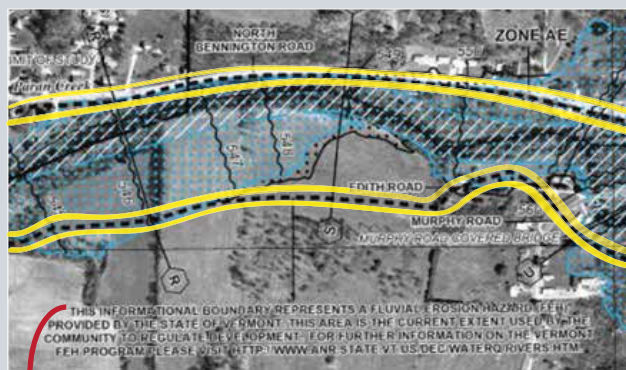
In 2009, Bennington had adopted a Fluvial Erosion Hazard Area Overlay District (FEH District) to regulate development in areas that might be subject to fluvial hazards. The area encompasses zones of high geomorphic sensitivity as revealed in a stream geomorphic assessment in 2007.

This FEH District was delineated on new FEMA flood maps created in December 2015.

Adding fluvial hazard zones to FEMA insurance maps bears caution. Some people are understandably



FEMA Flood Insurance Rate Map for Bennington, VT, December 2015, with close-up below. The blue marks the area that would be inundated by a 1% annual chance flood (100-year flood). There is a harder-to-see area of black dots that marks the 0.2% annual chance flood (500-year flood). The Bennington maps are unique in also having a border marking a Fluvial Erosion Hazard zone (we have outlined in yellow). This overlay shows clearly that some areas outside the 1% annual chance inundation zone are nonetheless highly sensitive to geomorphic change.



"This informational boundary represents a Fluvial Erosion Hazard (FEH) provided by the State of Vermont. This area is the current extent used by the community to regulate development."

concerned that there may be potential implications for insurance rates and property values, for properties that are outside current FEMA hazard delineation but inside fluvial erosion hazard zones. In these maps, the Fluvial Erosion Hazard district was marked specifically as only an "informational" boundary.

Summary of Target Recommendation #2: Upgrade Vulnerable Stream Crossing Infrastructure

Municipal need:
Upgrade vulnerable and damaged stream crossings to reduce future damage
(See page 42).

Recommendation:
Support upgrades of vulnerable stream crossings across the six New England states
(See page 48).

Municipal need elements:

a) Standards for stream crossings that ensure that crossing infrastructure is resilient to river floods

b) Simple permitting and funding processes and requirements to replace vulnerable and damaged crossings quickly and efficiently

c) Easy-to-follow guidelines for upgraded crossings that are likely to win approval and funding

d) Data and information about vulnerable stream crossings, and opportunities to share communities' knowledge

e) Financial help to plan and construct needed upgrades

Recommendation elements:

a) Improve stream crossing regulatory standards to support upgrades, be consistent across agencies, and allow site-specific flexibility (well under way in New England)

b) Streamline permit and funding processes and requirements, and incentivize replacing vulnerable and damaged crossings with upgrades

c) Develop and make available easy-to-follow design templates and guidelines for upgraded crossings which will receive quick permitting and funding review and high likelihood of approval

d) Develop and support an accessible inventory and database of stream crossings that identifies vulnerable crossings.

e) Increase and diversify funding for stream crossing upgrades.

Target Recommendation #2: Upgrade Vulnerable Stream Crossing Infrastructure

Background

One of the best, most cost-effective, and least intrusive ways to reduce damage from river floods is surprisingly mundane: use more appropriately sized and designed pipes, bridges and conduits for stream crossings that are vulnerable to flood damage and failures. Stream crossings – places where streams have to go under roads or other infrastructure – tend to be chokepoints for water, sediment and debris. At crossings, streams run through a constructed opening, often a pipe called a culvert. Culverts pass normal volumes of water easily, but they are often too small or poorly shaped to accommodate the hugely elevated flows of water in a river flood, and they can get blocked up by sediment or debris even during moderate flows, or blockages can accumulate over time.

In a river flood, an overflowing river may back up behind a crossing that is too small or is blocked. It may flow over and around the crossing onto adjacent roads and property. Worse, it may undercut banks and abutments, potentially causing sudden and complete collapse.

To avoid these problems, inadequate culverts in vulnerable and damaged stream crossings must be replaced with appropriately sized and shaped, strategically placed, culverts and other conduits. Larger crossing infrastructure is often helpful to pass high volumes of sediment and debris, avoiding blockage or damaging overflow. Open-bottomed stream crossings are especially effective – they act simply as part of the river. If not open-bottomed, then the shape and surface of the stream bottom should be replicated as much as possible to simulate the stream shape, bed material, and dynamics of the adjacent stream upstream and downstream (see Example 5: Upgrading Stream Crossings, p. 43). Larger and open-bottomed stream crossings are more expensive in terms of up-front costs, but because they last longer and reduce future flood damage, they often save money over the long run (see Example 6: Upgrading Stream Crossings Often Lowers Long-Term Costs, Adds Many Benefits, p. 44).

Upgrading stream crossings provides other benefits as well. Some of the most significant are the ecological benefits, as upgraded crossings can provide safe, adequately sized, and appropriately shaped and textured migration corridors for fish and wildlife. They also allow a more natural and dynamic movement of sediment and debris, which allows for the continual renewal of quality habitat. These benefits reduce the need for more costly artificial breeding and habitat reconstruction later on (see Example 6: Upgrading Stream Crossings Often Lowers Long-Term Costs, Adds Many Benefits, p. 44).

Many municipal officials, transportation engineers and emergency personnel in New England know their communities would be much safer during river floods if they upgraded their vulnerable stream crossing infrastructure. However, at present most towns continue to have undersized culverts under most of their roads, and too often, when they do replace them, they replace them with the same size and kind of culverts. New England towns and cities still have five needs in order to be able to upgrade their vulnerable stream crossings and dramatically reduce their future flood damage.

Municipal need #2: Upgrade vulnerable and damaged stream crossings to reduce future damage

MUNICIPAL NEED #2 ELEMENT A) STANDARDS FOR STREAM CROSSINGS THAT ENSURE THAT CROSSING INFRASTRUCTURE IS RESILIENT TO RIVER FLOODS

Municipalities need state and federal standards for stream crossings to guide them to build and maintain infrastructure that can withstand river floods. Unfortunately, regulatory standards for stream crossings have sometimes been part of the problem. Many of the culverts in our rivers and streams today were constructed based on past standards of “hydraulic design” – standards of water flow. The standards did not take into consideration the huge amount of

Example 5. Upgrading Stream Crossings



A double box culvert on Bronson Brook in Worthington, MA was long a barrier to fish due to a perched outlet, shallow water depths and excessive water velocities. It became clogged with debris during a large storm in August 2003, and failed catastrophically when it was overtopped with water and the fill around the culverts was eroded away. The stream dug a 14 ft. (4 m) wide rift between the road and the culverts.



This new crossing was installed in 2008 on Bronson Brook through a partnership of federal, state and non-profit agencies. It cost less than an in-kind replacement. During Irene, large wood and boulders passed beneath this fish-and-wildlife-passage-friendly structure without damaging it.

Traditional stream crossing infrastructure is often designed based only on how much water it should pass, with no attention to the need to pass sediment, debris, and aquatic organisms. Traditional stream crossings often have one or more of the following problems:

- Undersized – do not have the capacity to pass expectable volumes of water, sediment and debris
- Too shallow – aquatic organisms cannot safely pass
- “Perched” – hang inches or feet above the level of the stream bottom at the downstream end, making organism passage impossible and increasing chances of scour and erosion
- Unnatural bed materials – may be avoided by aquatic organisms, or may alter the natural flow of sediment, causing erosion elsewhere
- Poor positioning – changes the direction or speed of water flow to create scour or other problems

These kinds of problems frequently result in damaged or destroyed stream crossings during large flood events. Blocked culverts may flood



Old 7 foot pipe culvert. These types of culverts remain common in New England. In Vermont alone, 964 culverts were damaged, destroyed or blown-out during Tropical Storm Irene.

lands and infrastructure behind and to the side of the stream crossing, or they may break suddenly, causing catastrophic damage downstream.

Upgraded stream crossings solve these problems by:

- Being appropriately sized to pass water, sediment and debris during high flows, and to span the stream and the banks so fish and wildlife can pass through

- Having a shape to support natural depths, speed, and direction of water flow
- Being open-bottomed or sunk into the streambed to prevent perching
- Having a natural streambed (See Massachusetts Stream Crossings Handbook, www.mass.gov/eea/docs/df-g/der/pdf/stream-crossings-handbook.pdf, for more detail.)

Example 6. Upgrading Stream Crossings Often Lowers Long-Term Costs, Adds Many Benefits

It may seem that constructing an upgraded culvert for a stream crossing is necessarily more expensive than constructing one of the same size and shape. It is true that in the short term, upgraded crossings often cost more. They are often larger, and they require more care to ensure compatibility with the stream slope, bed, and flow. The materials for a larger culvert are more expensive, and the construction may involve a larger area. A more elaborate permit and design frequently add expense.

Yet despite all these costs, over the lifetime of an upgraded culvert, it often saves money. This is because it requires less maintenance, lasts longer, and reduces river flood damage from

both large and small floods. It also brings a range of additional ecological and other benefits.

Two recent studies highlight these points. In 2015, the Massachusetts Division of Ecological Restoration compared the costs of replacing three culverts with same-size structures, versus upgrading the crossings to meet the new 2014 Massachusetts Stream Crossing Standards. The crossings would be maintained over 30 years. On average, over 30 years, the upgrade was 38% less expensive than the same-size replacement because many of the same-size structures needed repair or replacement once or more within their first 30 years. In many cases, upgraded

crossings should last 50 years or more.

A 2013 study by The Nature Conservancy noted that long-term maintenance costs of smaller culverts will become more and more expensive, as extreme weather events increase in frequency with climate change.

Both studies also highlighted an array of benefits of larger stream crossings that are not often included in cost-benefit analyses: healthier rivers and streams, enhanced river-related recreation, higher property values, improved safety and mobility, improved water quality, and, of course, reduced flood damage. Considering these longer-term costs and multiple benefits shows that upgrading stream crossing infrastructure is very cost-effective, generally saving money over the long run and adding a range of benefits.

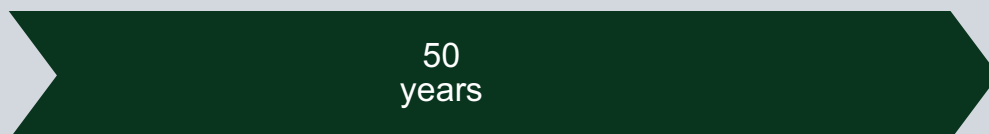


In Becket, MA, the Walker Brook double-pipe culvert had to be replaced twice in 7.5 years, following major floods in 2005 and 2011. If the culverts need to be replaced at this same rate over the next 50 years, Becket will spend a total of \$867,000 on culverts in just this one location.

If instead Becket invests in a more appropriately sized and shaped bridge-span crossing, the crossing will be more resilient to future river floods and should last 50 years or more. Aquatic organisms would also benefit. Total cost over 50 years under this scenario: \$300,000-\$400,000, much less than repeating the old-style culverts shown here and dealing with frequent replacements.



Cost of two replacements in 7.5 years: \$130K. Cost to continue replacing at this rate: \$867,000 over 50 years.



Cost of a Stream Continuity Crossing with a 50-year lifespan: \$300-\$400K

sediment and debris that a river carries when it is flooded. Also, old standards were often designed for medium-sized floods, even though very large floods are a regular part of the region's history and geography. Standards for stream crossings need to guide towns and cities to build crossings that can withstand high flows of water, sediment and debris.

Communities also need standards to be consistent across agencies. In many cases different agencies in a state (e.g. department of transportation and department of fish and wildlife) have distinct standards, and specific offices have contrasting enforcement practices. This inconsistency leads to confusion among municipal officials about which standards are necessary, as well as frustration at having to meet multiple regulatory mandates and paperwork. It also sometimes makes it harder for towns to get funding for crossing upgrades, as funders point to this regulatory inconsistency, and pay only for crossings built to lower standards (see Example 7: State Stream Crossing Standards Meet Federal Funding Requirements: How to Help Towns Not Get Stuck in the Middle, p. 46).

At the same time that towns and cities need regulatory consistency, though, they also need stream crossing standards to allow flexibility for site-specific considerations. For example, it may be inappropriate to build a large culvert on a tiny intermittent stream, and less possible in a highly urbanized area; on the other hand, it may be crucial on a small stream in a steep hill slope area where the chance of local flooding and erosion or blockage is high. Municipalities need regulations that can support and guide them to respond to differing conditions and needs, while clearly and consistently supporting upgrades of the most vulnerable crossings.

MUNICIPAL NEED #2 ELEMENT B) SIMPLE PERMITTING AND FUNDING PROCESSES AND REQUIREMENTS TO REPLACE VULNERABLE AND DAMAGED CROSSINGS QUICKLY AND EFFICIENTLY

Unfortunately, the permit process and funding requirements in most states provide easier approval

of same-size “in-kind” replacements (see Example 7: State Stream Crossing Standards Meet Federal Funding Requirements, p. 46). This is so for several reasons. When a road or bridge is washed out, permitting requirements are often waived, but only if the structure is replaced with the same kind. Required cost-benefit analyses generally look only at short-term, narrowly defined, and site-specific costs and benefits, and suggest that upgrades are not effective. Finally, funders will often not pay for the additional expense of upgrades, unless they are clearly required by all relevant state and local regulations.

These rules have perverse effects on public safety. Municipal decision makers often choose to replace damaged crossings with same-size crossing infrastructure, in order to reduce the time, complexity and cost of permit applications. Worse, towns and cities do not replace vulnerable, un-damaged crossings at all – they wait until crossings fail so they can be replaced without lengthy and expensive permitting and design approval processes. As a result, communities remain vulnerable to repeat damage in future river floods – and so do their downstream neighbors.

Towns need regulatory processes and funding requirements that expedite rather than discourage approval and funding of upgrades for damaged crossings vulnerable to repeat damage.

MUNICIPAL NEED #2 ELEMENT C) EASY-TO-FOLLOW GUIDELINES FOR UPGRADED CROSSINGS THAT ARE LIKELY TO WIN APPROVAL AND FUNDING

Many municipal officials and staff find that although they understand the key parameters of stream crossing standards, using the standards to develop design plans remains complex and burdensome. They could move much faster and with more confidence toward upgrading stream crossings if they had a set of about ten template designs that would be appropriate under different circumstances, that would enable them to get an expedited review, and that would come with high likelihood of permit and funding approval.

Example 7. State Stream Crossing Standards Meet Federal Funding Requirements: How to Help Towns Not Get Stuck in the Middle

In some New England states, there are different standards for stream crossings among different agencies, or inconsistent or uncertain enforcement. This can be a problem for municipalities, because it may be unclear which standards they need to meet. Also, when municipalities choose to upgrade crossings, funders may provide money to meet only the lowest or the fully enforceable standards – and towns may end up having to foot the bill for the upgrade.

This happened to the town of Townshend, Vermont. After Irene, Townshend had several blown-out culverts. It upgraded to wider crossings and open-bottomed ones that were required by the recent 2010 Vermont state standards. Townshend then applied to FEMA for reimbursement.

However, FEMA declined to pay for the upgrades. FEMA is required by its rules to fund projects that meet applicable codes and standards. Under Vermont regulations in place at the time, towns did not have to

report on the way their upgrades met the 2010 standards. FEMA ruled they were in effect discretionary.

The state of Vermont helped draft an appeal. FEMA ultimately reversed its decision and funded Townshend's upgraded culvert. But FEMA held firm that it could not pay for towns to upgrade to what it deemed to be discretionary standards. To meet FEMA's requirements, Vermont needed a more systematic solution. The state revised its

culvert standards and permitting processes to make sure towns were required to report on their efforts to meet upgrading standards, so that the standards would be enforceable. It also made sure they were consistent across multiple state agencies and towns, including the Vermont Department of Transportation, Town Road and Bridge Standards, and the general state permit of the Agency of Natural Resources.



Townshend road crossing. The left-hand photo shows the crossing after Tropical Storm Irene. A wire with dangling posts – the remains of a guard rail – was all that was left of the road. The former crossing had an oval pipe ("plate arch") culvert which failed catastrophically. The new crossing, built to Vermont's 2010 standards, is on the right.

MUNICIPAL NEED #2 ELEMENT D) DATA AND INFORMATION ABOUT VULNERABLE STREAM CROSSINGS, AND OPPORTUNITIES TO SHARE COMMUNITIES' KNOWLEDGE

With thousands of stream crossings in each state, municipal officials, staff, landowners and residents need to know which crossings are priorities to upgrade to reduce future flood damage. Many town staff and residents have experience with at-risk crossings, or crossings that have failed multiple times. However, few towns or states have any kind of systematic records of where culverts are located, their condition, or their past failures.

Communities need an easily-accessible inventory and database of stream crossing infrastructures to which they can add their own specific knowledge, and also collect information about vulnerable culverts and crossings. This can help them prioritize further assessments, applications for mitigation

grants, or expenditures of limited funds; and it can help them work with neighboring towns and cities to reduce hazards throughout a river system. An added benefit is that the data that would be required and documented for each stream crossing could provide much of the needed material for permit applications for crossing upgrades, expediting the upgrade permitting process (see Example 8: Stream Crossing Inventories and Databases, p. 47).

MUNICIPAL NEED #2 ELEMENT E) FINANCIAL HELP TO PLAN AND CONSTRUCT NEEDED UPGRADES

Finally, municipalities need upgrades to be affordable. Larger culverts and crossing structures are more expensive in the short run. The permit and design process adds to the cost.

Highway moneys and local budgets are the sources of funding for most culverts. But these are limited, especially for small towns. FEMA's Hazard

Example 8. Stream Crossing Inventories and Databases

An inventory of stream crossings is a way for people to record data systematically on the status of stream crossing infrastructure. A wide variety of data can go into an inventory, and a range of people may be able to enter that data.

Examples of data that could go into a stream crossing inventory, and who might put it in:

- Local public works officials record when a crossing structure was put in, its size, and maintenance dates
- River scientists record the physical measures of a stream that indicate risk of erosion or stream channel movement.
- Transportation planners input information on how many vehicles travel over the stream crossing each day, and its importance to local and regional transportation networks.
- Ecological scientists input data on habitat quality, protected fish and wildlife species, etc.

It is important that methods for acquiring and inputting data be standardized.

Once an inventory is done on many stream crossings, it can be put into a database, and this database can be made accessible via the web.

Stream crossing databases help town officials, as well as agency regulators and funders, to make informed decisions about site-specific needs. They can also help them decide which stream crossings are priorities for upgrades. A database can also be linked to geographic tools to allow visual summaries of entire stream networks and regions. Computer models can calculate whether upgrading a stream crossing in one location might have beneficial or harmful effects on other crossings, or whether upgrading two in a row at one time is necessary to reap the benefits.

The North Atlantic Aquatic Connectivity Collaborative's database is a longstanding stream crossing database (formerly called the Stream Continuity Database) in the US Northeast. Up until now, it has focused on improving stream connectivity for aquatic species. The collective has developed common protocols and trainings for assessing road-stream crossings and a regional

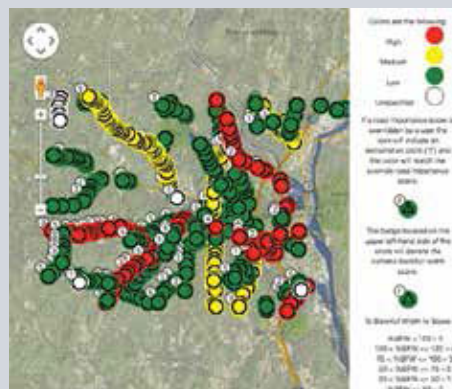
database for this information. Using these tools, crossings can be examined and prioritized for improvements within and across watersheds and borders. Currently UMass and the Massachusetts Department of Transportation are working to augment this database with assessments that examine

- 1) Geomorphic condition; 2) Ecological condition, including connectivity;
- 3) Condition of culvert or other structure; 4) Hydraulic capacity;
- 5) Importance of road to emergency response routes

Another stream crossing database already working in New England is vtculverts.org. VTrans, the Vermont Agency of Transportation, maintains vtculverts.org as an inventory of all river and stream crossings in the state. It is linked to the state natural resources atlas (see Example 3), which has data on geomorphic conditions as well as aquatic organism passage. Among other things, this allows local officials to come up with capital budgeting plans that prioritize crossing replacements based on condition and risk of failure.



NAACC's online database, showing subwatersheds in New England and beyond that may be higher priority for field survey. The prioritization criteria included fish population data, likelihood of crossing failure, and impact of crossing failure. Available at: https://www.streamcontinuity.org/assessing_crossing_structures/prioritizing_crossings.htm



Vtculverts.org's database, here indicating the importance of the roads crossed by culverts in the Town of Brattleboro. Red means high importance, yellow medium, and green low. Small numbers in white circles are a rating to indicate the size of the culvert relative to the river's bankfull width. A low bankfull number for a culvert that crosses a road of high importance may indicate a priority culvert for upgrading.

Mitigation grants can pay for bigger projects but moneys for these grants are even more limited, and available only after a declared emergency. Also, small towns often find it too cumbersome even to apply for FEMA grants, as they require baseline studies and designs that are costly for a small community. Moreover, FEMA and other funding agencies often pay only 75 percent of a culvert replacement – and that is often only for an in-kind replacement. The up-front expense of 25 percent of the cost for a crossing, or considerably more for an upgraded crossing, can be prohibitive for small towns. Very simply, New England's communities need better, easier, and more reliable funding support to pay for stream crossing upgrades for vulnerable and damaged crossings.

Sometimes, of course, towns and cities will have to pay the cost themselves. This can be cost-effective for municipalities in the long run, as there will be reductions in maintenance and repair. However, the needed 30-to-50-year budgeting is beyond the capacity of many small towns. Communities would benefit from assistance that could help them pay off the cost over time.

Recommendation #2: Support upgrades of vulnerable stream crossings across the six New England states

Building from our insights above concerning municipal needs related to upgrading vulnerable stream crossings, we identify five elements to support this recommendation.

RECOMMENDATION #2 ELEMENT A) IMPROVE STREAM CROSSING REGULATORY STANDARDS TO SUPPORT UPGRADES, BE CONSISTENT ACROSS AGENCIES, AND ALLOW SITE-SPECIFIC FLEXIBILITY (WELL UNDER WAY IN NEW ENGLAND)

All six states, in concert with the Army Corps of Engineers New England District, should continue to refine their stream crossing regulations, guidelines, and implementation. Some of the states are further along than others (see Example 9: Updating River and Stream Crossing Standards in New England, p. 49).

Stream crossing regulations should require structures that can accommodate high to extreme flows

of water, sediment and debris. Where damage from river floods is likely, stream crossing infrastructure should be wider than the normal stream, tall enough to accommodate high flows and large debris, and should pass water, sediment, debris and aquatic organisms as a normal, continuous part of the stream. Regulations should call for the shape and surface of the stream bottom to simulate natural stream shape, slope, and dynamics, matching that upstream and downstream. Open-bottomed stream crossings should be strongly encouraged.

Additionally, standards need to be made consistent and enforceable across a state's agencies, along with the Army Corps General Permit (see Example 7: State Stream Crossing Standards Meet Federal Funding Requirements, p. 46).

At the same time, state agencies, the Army Corps of Engineers, and FEMA should continue to discuss how stream crossing regulations can specify requirements for different site-specific conditions. A key may be to prioritize performance standards rather than design standards – performance standards that include not only the ability to pass water, but also the ability to pass sediment and debris, and to maintain and restore natural levels of sediment movement. In New England, only Vermont and New Hampshire presently have sediment-based performance standards of this sort, and federal agencies have yet to adopt any. New Hampshire's stream crossing performance standards require, for example, that crossings “not be a barrier to sediment transport” and “not cause erosion, aggradation, or scouring upstream or downstream of the crossing.”

Within this consistent but flexible system, all agencies should prioritize support for upgrades of crossing infrastructure at the most vulnerable crossings. These can be identified and rated with a stream crossing inventory and database (see D, p. 50).

RECOMMENDATION #2 ELEMENT B) STREAMLINE PERMIT AND FUNDING PROCESSES AND REQUIREMENTS, AND INCENTIVIZE REPLACING VULNERABLE AND DAMAGED CROSSINGS WITH UPGRADES

Regulatory agencies should change the incentive structure so that municipalities are encouraged to

upgrade vulnerable and damaged crossings rather than construct in-kind replacements. This means:

- Allow towns and cities to upgrade damaged structures during emergencies, with little to minimal permitting delay
- Fund the same proportion of the cost for upgrades of vulnerable and damaged crossings as for in-kind replacements
- Require cost-benefit analyses of designs to look at 30-year or 50-year costs, including replacement and repair, and develop systems to account for off-site benefits, including flood damage reduction downstream, and benefits to the environment, recreation, and the community economy.

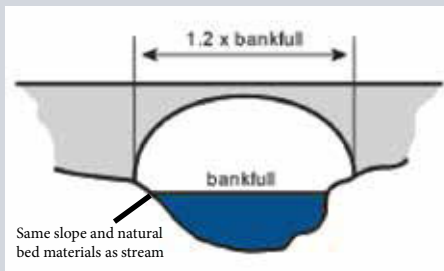
All of these measures would be aided with a stream crossing database that provided a set of design

templates (see C, below) and objective prioritization of crossings that need upgrades (see D, below). Crossings above a certain prioritization should be approved and funded for upgrades, provided the upgrades are constructed with appropriate designs. During emergencies, this should be done with little additional analysis or permitting paperwork required.

RECOMMENDATION #2 ELEMENT C) DEVELOP AND MAKE AVAILABLE EASY-TO-FOLLOW DESIGN TEMPLATES AND GUIDELINES FOR UPGRADED CROSSINGS, WHICH WILL RECEIVE EXPEDITED PERMITTING AND FUNDING REVIEW WITH HIGH LIKELIHOOD OF APPROVAL

Federal and state agencies should develop, or support the development of, template designs for upgraded stream crossings. One approach would be for state or federal agencies to develop a set of design templates

Example 9. Updating River and Stream Crossing Standards in New England: Stream Continuity and Structural Resilience



Some typical requirements in recently upgraded stream crossing standards in New England.

New England is ahead of many other regions of the country in updating its stream crossing standards, thanks to wide collaboration and learning among universities, non-profit groups, and federal and state agencies.

One key impetus was the development of a set of model standards in the early 2000s by the River and Stream Continuity Partnership, a collaborative among UMass Amherst, state and federal agencies, Massachusetts' Riverways Program, and The Nature Conservancy.

These standards initially sought to achieve three main goals: 1) Fish and aquatic organism passage; 2) River/stream continuity; and 3) Wildlife passage. The standards included both metrics and performance standards – for example, they recommend crossings be at least 1.2 times the bankfull width of the stream, and they should have the same slope and natural bottom substrate as the stream directly upstream and downstream.

In 2005 these standards were included in the U.S. Army Corps of Engineers General Permit for Massachusetts. Since then, agencies across the region have adopted portions of the standards. For example, the Massachusetts Department of Environmental Protection borrowed from the standards in its 2014 update of the state's Wetlands Protection Act. MassDOT (the Massachusetts Department of Transportation) refers to these standards in its handbook. In the most recent revisions of the Army Corps

General Permit for each of the six states, the Army Corps and The Nature Conservancy worked with state agencies and stakeholders in each of the six New England states to incorporate aspects of the stream continuity standards in all six General Permits.

Though initially written to help fish and wildlife, crossings built to stream continuity standards have also proven to be more structurally resilient, thus improving public safety, while lowering long-term costs. When Tropical Storm Irene hit Vermont, crossings that had recently been built to new stream crossing standards informed by the River and Stream Continuity standards survived the storm while other crossings failed. Improved stream crossing standards thus saved valuable infrastructure, property, and, quite possibly, lives.

and guidelines for upgraded crossings, linked to particular sets of conditions. If towns demonstrated the conditions and used the template designs, they would be guaranteed more rapid review and a greater chance of approval and funding.

An alternative would be for state and/or federal agencies to pre-design upgraded crossing structures for the most vulnerable crossings. Then, towns and cities with crossings in this most vulnerable set would not have to do the cumbersome and time-consuming design work, agencies would not have to take the time to re-examine conditions and designs, and towns could move straight to construction. This approach would depend on a well-developed inventory, database, and prioritization system for vulnerable stream crossings, as described in D, below.

RECOMMENDATION #2 ELEMENT D) DEVELOP AND SUPPORT AN ACCESSIBLE INVENTORY AND DATABASE OF STREAM CROSSINGS THAT IDENTIFY VULNERABLE CROSSINGS

State and federal agencies should develop or adopt a widely available, user-friendly inventory and database of stream crossings that includes:

1. The physical condition of crossings
2. Their risk of fluvial hazard
3. Their importance to ecological connectivity
4. The significance of the transportation corridor they cross to emergency networks

Data should be able to be input by a wide range of people, including knowledgeable municipal leaders and staff. Training should be available to make sure that community members know why they should input data, and how to input data.

Based on this inventory, the database should be able to identify which crossings are most vulnerable to flood damage. It should also include an analysis of the effect of culvert upgrades on the vulnerability or resilience of upstream and downstream crossings. Based on these analyses, the database should then be able to prioritize which crossings are most vulnerable to flood damage, and which ones, if upgraded, would

provide the greatest benefit to reducing flood damage. This should include prioritization and analysis of ways that upgrading some culverts may affect the vulnerability or resilience of others (see Example 8: Stream Crossing Inventories and Databases, p. 47).

This will require investment in building or adapting the database and a web-based platform; continual refinement of specific data that should go into the database; trainings on data collection and use; and ongoing resources to maintain and provide support for the database and its users.

RECOMMENDATION #2 ELEMENT E) INCREASE AND DIVERSIFY FUNDING FOR STREAM CROSSING UPGRADES

States and federal agencies need to recognize that investment into upgrading stream crossing infrastructure will save money in the long run. To make it possible, however, there needs to be greater investment up front. Of course, it is important to use taxpayer-provided government funds as judiciously as possible. Increasing funding for stream crossing upgrades should include mechanisms that have limited over-all effect on state and federal budgets. Some creative mechanisms to help towns undertake needed upgrades include:

- Create or expand state revolving loan funds from which towns could borrow money to pay for culvert upgrades, then pay back the loan over an extended time (e.g. 30 years)
- A portion of highway moneys could be exclusively dedicated to stream crossing upgrades and available to communities
- State-level inter-agency groups could facilitate pooling of moneys to help pay for upgrades that fulfill multiple purposes
- Target state and/or federal appropriations to upgrade the highest priority crossings (based on database criteria), e.g. extra moneys to upgrade the top 5% priority crossings. These are the most likely to save money over the long term by avoiding likely repeat replacements.

Summary of Target Recommendation #3: Support River-Smart Planning and Mitigation

Municipal need:
Prepare for and mitigate flood hazards through planning and land use
(See page 54).

Recommendation:
Support municipal efforts to prepare for and mitigate river flood hazards through planning and land use
(See page 55).

Municipal need elements:

- a) Assistance in preparing plans to address local and watershed-wide river flood hazard risks
- b) A diverse menu of mechanisms to achieve river-smart conservation, mitigation, and development; technical, financial and legal support.
- c) Ongoing support until plans are implemented.

Recommendation elements:

- a) Support municipal, multi-municipality, regional and state hazard planning that addresses river flood hazards
- b) Enable and promote a diverse menu of mechanisms for communities to achieve river-smart conservation, mitigation, and development; support with technical, financial and legal assistance.
- c) Ensure that support is available to communities on an ongoing basis, until their plans are fully implemented.



In this image from Floodready Vermont, the river has room to meander and flood its floodplain without threatening major infrastructure or property.

Target Recommendation #3: Support River-Smart Planning and Mitigation

Background

Besides helping streams and rivers flow better through culverts and other crossing infrastructure (Recommendation 2), there are three additional tangible actions that New England towns and cities need to take to become more resilient to river floods. These are: first, make sure rivers have room to move by ensuring their access to floodplains and river meander corridors; second, keep homes, property, and infrastructure as much as possible out of the way of rivers, and protect and mitigate where this is not possible; and third, direct development out of these areas to other, more river-smart locations. Thus, becoming river-smart requires several key land use management practices, each tailored for different areas of risk, opportunity, and development (see figure, next page).

- In areas at risk of river flood damage, development should be prevented and existing buildings and structures should be removed when and where possible (“protected areas” in diagram). In situations in which structures cannot be moved out of harm’s way, buildings, infrastructure and land practices should be designed or redesigned to be resilient to river floods while minimizing the redirection of damage elsewhere (“vulnerable areas” in diagram).
- In undeveloped or less developed areas near streams and rivers, floodplains, river meander corridors, and riparian buffers should be conserved and restored (“river corridors” in diagram).
- In areas at minimal risk of river flood hazards, new river-smart developments should be constructed out of harm’s way – outside of river meander corridors and floodplains (“safer areas” in diagram).

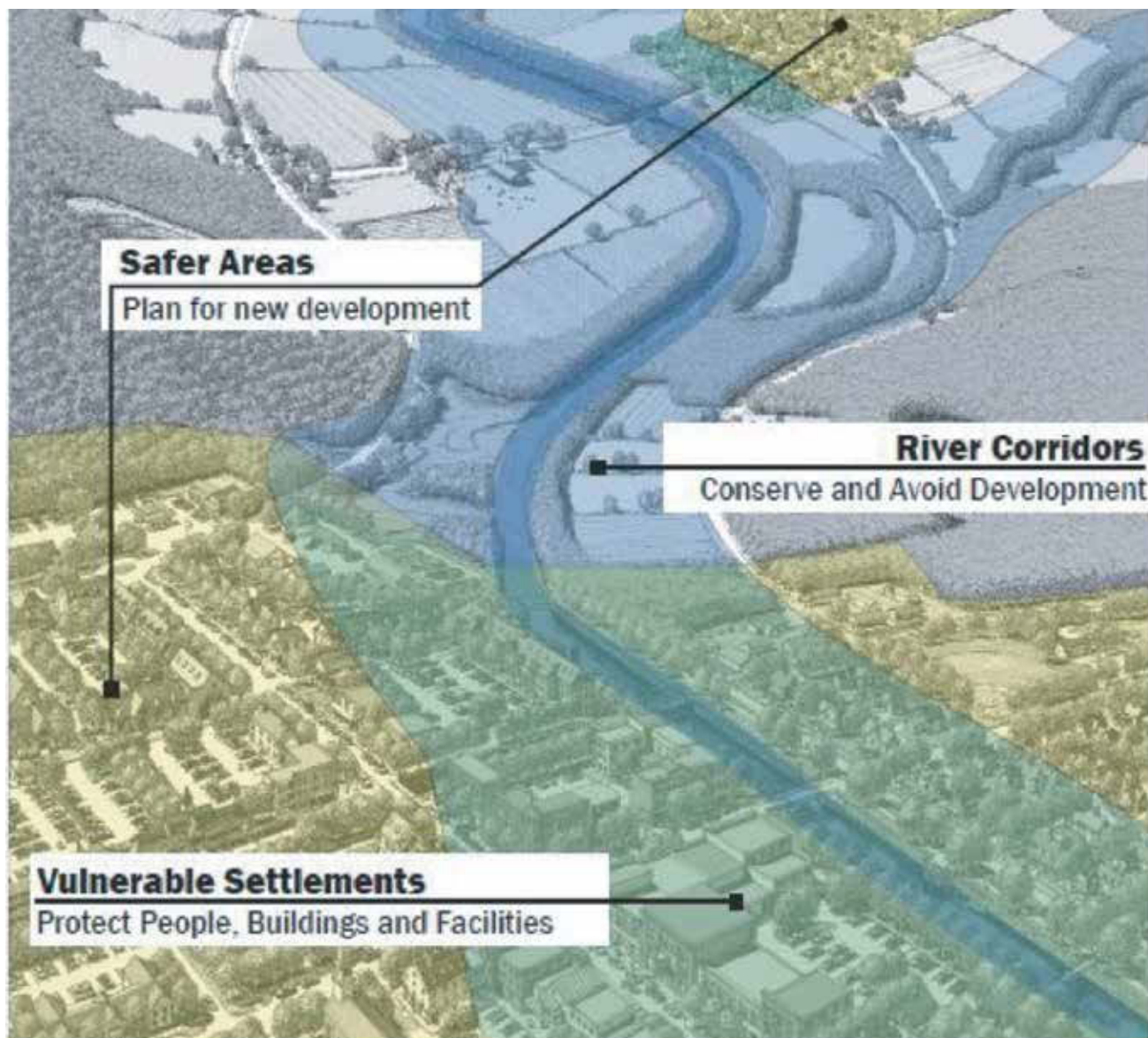
Towns need to coordinate these efforts with upstream and downstream neighbors so municipal leaders recognize and enact practices that will reduce vulnerability to flood damage for other towns and cities in their watershed.

Though these practices are crucial, New England communities face numerous challenges in putting them into action, and thus have significant need for assistance.

Among the challenges are:

- Municipalities may lack data and scientific analyses to know where and how to protect lands and waterways in their jurisdictions.
- The time and expertise needed for land use planning, mitigation and management are beyond the capacity of many small New England towns.
- Changing land use permanently is often expensive, requiring purchases, buyouts, easements, legal analyses and contracts, while reducing the municipal tax base.
- Proposals to regulate land use or purchase conservation lands are often contentious, and may require significant landowner negotiations and citizen outreach.
- There are few systems in place to facilitate and negotiate multi-municipal collaboration within watersheds, though mitigation in an upstream community can frequently reduce future flood damage in a downstream community.
- Actual work to implement new management on the ground is often expensive and requires technical expertise.

In short, changing land use to become river-smart requires numerous complex, multi-faceted tasks. New England’s municipalities, especially the small towns in New England’s more mountainous regions, cannot do these tasks without data, guidance, technical support, and financial help. The good news is that this is a sound investment for state and federal taxpayers because the land practices implemented in individual towns and cities can have watershed-wide and long-term benefits, ultimately saving many public and private dollars by reducing damage in river floods.



This diagram from the Vermont Rivers program illustrates the three on-the-ground actions besides culvert upgrades that New England towns and cities need to take to become more resilient to river floods (see Background, p. 52). 1) Make sure rivers have room to move by ensuring their access to floodplains and river meander corridors ("river corridors" in this diagram); 2) Keep homes, property, and infrastructure as much as possible out of the way of rivers ("river corridors" in this diagram) - and protect and mitigate where this is not possible ("protected areas" here); and 3) Direct development out of these areas to other, more river-smart locations ("safer areas" in this diagram).

Municipal need #3: Prepare for and mitigate flood hazards through planning and land use

MUNICIPAL NEED #3 ELEMENT A) ASSISTANCE IN PREPARING PLANS TO ADDRESS LOCAL AND WATERSHED-WIDE RIVER FLOOD HAZARD RISKS

The first step in adjusting land use in the ways listed above is for communities to plan. They need to gather scientific data, weigh costs and benefits, talk with residents about priorities and options, negotiate agreements, and coordinate with upstream and downstream neighboring towns and cities.

Key questions community leaders need to think about in order to reduce river flood hazards:

For areas at risk of river flood damage:

- What areas, properties and structures are at risk of river flood damage?
- Are there opportunities to move buildings and infrastructure out of harm's way?
- For buildings and infrastructure that cannot be moved out of harm's way, how can hazards be mitigated so these become more resilient to river floods?
- Are buildings, infrastructure, or flood control structures diverting hazards elsewhere? If so, how can these secondary effects be mitigated?

For undeveloped or less developed areas in and near streams and rivers:

- In which areas would allowing rivers room to move lessen river flood power and volume?
- Where may there be opportunities to protect or restore floodplains, river meander corridors, or riparian buffers?

For areas at minimal risk of river flood hazards:

- What areas are safe from river flood hazards and desirable for development?
- How can development be promoted in these river-smart locations?

To coordinate with other municipalities:

- Are there opportunities for conservation or mitigation by coordinating with upstream or downstream towns?

To find mechanisms:

- What mechanisms can and should be used to achieve these goals, and what strategy for action best fits local and regional culture, values, and capacities?

If communities are to take the lead in planning for river flood hazards, they can most readily do this by incorporating fluvial hazards into multi-hazard mitigation plans. Hazard Mitigation Plans are one of the most important tools used by regional and municipal planners to increase long-term flood resiliency. They are guided by FEMA, and enable towns and cities to qualify for a range of grants and insurance opportunities. However, the existing focus under flood hazard planning is inundation hazards (see Example 2, Inundation Versus Fluvial Hazards, p. 16). New England towns need fluvial hazards to be included within long-term, multi-hazard planning.

Hazard mitigation planning requires large upfront costs, time, and technical skill – for pre-studies, hazard assessments, legal analyses, facilitated community conversations, project designs, and other tasks. Few New England municipalities have the in-house expertise or staff to do all this, so they must hire consultants, while investing limited staff time to monitor the work and facilitate decision making. Towns and cities, especially small towns, need financial help and close technical guidance to make river flood hazard planning possible.

Additionally, in order to effectively mitigate river flood hazards, communities need systems of planning that can work across many towns. Unfortunately, there is no good mechanism or structure for watershed-wide planning for river flood hazards for most of New England's municipalities. FEMA's hazard mitigation planning requires local governments to individually adopt plans. Towns and cities need either facilitated coordination with other municipalities in their watershed, or else they need larger-area entities – substate regions or states – to take the lead on planning for river flood hazards.

MUNICIPAL NEED #3 ELEMENT B) A DIVERSE MENU OF MECHANISMS TO ACHIEVE RIVER-SMART CONSERVATION, MITIGATION, AND DEVELOPMENT; TECHNICAL, FINANCIAL AND LEGAL SUPPORT.

If towns and cities are to conserve and restore river floodplains and river meander corridors, promote river-smart development, and mitigate where investments cannot be moved out of areas at risk, they need to have a range of legal and administrative mechanisms to achieve these management objectives.

Towns and cities have several specific needs related to legal and administrative mechanisms:

- A robust, accessible, comprehensible menu of options
- In-depth, user-friendly technical support and legal guidance to consider and move forward with specific options
- Legal backing for land use regulations: counsel to defend chosen river-smart zoning rules and ordinances against legal challenges, and supportive state and federal laws and rules to promote or require river-smart conservation, development and mitigation.

MUNICIPAL NEED #3 ELEMENT C) ONGOING SUPPORT UNTIL PLANS ARE IMPLEMENTED.

With careful planning and preparation of options, towns and cities can move forward on changing land use management to improve river flood resilience. Unfortunately, too often federal and state agencies provide support through the preparation stages, but then town officials and staff are left largely on their own to implement the land use change. Communities need continued technical, financial and legal support and guidance.

Recommendation #3 Support municipal efforts to prepare for and mitigate river flood hazards through planning and land use

Federal and state agencies, legislatures and programs must support community fluvial hazard planning and mitigation. Federal movement on this is crucial, as

FEMA and other federal agencies are central sources of guidance and grant programs for hazard planning mitigation. However, if federal agencies are slow in including fluvial hazards, states should lead the way, as Vermont has done. It is no coincidence that almost all the Examples under this recommendation come out of Vermont, for it is far in the lead in New England.

RECOMMENDATION #3 ELEMENT A) SUPPORT MUNICIPAL, MULTI-MUNICIPALITY, REGIONAL AND STATE HAZARD PLANNING THAT ADDRESSES RIVER FLOOD HAZARDS

In order for New England towns and cities to be able to withstand and mitigate river flood hazards, federal and state agencies need to help them plan. Several measures are needed for this.

- Standardized, statewide (or nationwide) fluvial hazard assessments (see Recommendation 1).
- Federal and state agencies should recognize fluvial hazards as a primary hazard for communities, and guide towns and cities to analyze fluvial hazards in their multi-hazard mitigation planning. Vermont has taken the lead for this in New England (see Example 10: Vermont Support for Municipal Flood Hazard Planning, p. 56).
- Federal and state programs should provide reliable funding and support to towns to complete the Hazard Mitigation Plan process. One kind of limited but significant financial assistance is an incentive program in which communities become eligible for other funds if they plan (see Example 12: Vermont's Emergency Relief and Assistance Fund, p. 57). Technical support may best be provided by substate regional agencies or organizations that know federal and state policies and also the particular needs of individual towns and cities, and can act as cost-effective intermediaries. Federal and state governments could provide incentives and funding directly to these intermediaries to work with towns to develop more complete and effective plans (see Recommendation 5).

Example 10. Vermont Support for Municipal Flood Hazard Planning

In Vermont, all municipal plans written since July 2014 must consider fluvial hazards (24 VSA Chapter 117 §4382). Specifically, new municipal plans must include a flood resilience plan that:

- "identifies flood hazard and fluvial erosion hazard areas... and designates those areas to be protected, including floodplains, river corridors, land adjacent to streams, wetlands, and upland forests, to reduce the risk of flood damage to infrastructure and improved property"
- "recommends policies and strategies to protect the areas identified... and to mitigate risks to public safety, critical infrastructure, historic structures, and municipal investments."

How do these new municipal plans interact with multi-hazard mitigation plans? Vermont's municipal and flood resilience plans are not explicitly part of a town's Local Hazard Mitigation Plans, which are usually prepared



Planned future land uses in Sharon, VT Town Plan, Adopted April 6, 2015.

under guidance from FEMA. However, a municipal plan may reference a local hazard mitigation plan. It is anticipated that as communities begin to integrate hazard mitigation planning into municipal plans, and fluvial hazard plans into hazard mitigation plans, the two plans will become more integrated

and effective. Vermont provides incentives for municipalities that have undertaken flood hazard planning (see Example 12, Vermont's Emergency Relief and Assistance Fund, p.57).

http://floodready.vermont.gov/update_plans/municipal_plan

- States and substate regional agencies and organizations need to facilitate the development of multi-town hazard mitigation plans that address river interactions throughout watersheds – or they should undertake this planning themselves. Federal agencies should support watershed-scale planning by supporting towns and cities that participate in multi-municipality plans, or in state or regional plans, with access to special grants and/or insurance discounts.

Example 11. Flood Ready Vermont

Vermont has developed a comprehensive website with an array of information to help municipalities and others become more river-smart. The website includes information on community risk assessment and reports, a Vermont Flood Ready Atlas, information on River Corridors, instructions on plan updates, community efforts, sample plans, and much more to help municipalities plan and prepare in a flood resilient manner. This is designed to be particularly user-friendly, supplementing the state's resource-rich Vermont Rivers Program websites.



RECOMMENDATION #3 ELEMENT B) ENABLE AND PROMOTE A DIVERSE MENU OF MECHANISMS FOR COMMUNITIES TO ACHIEVE RIVER-SMART CONSERVATION, MITIGATION, AND DEVELOPMENT; SUPPORT WITH TECHNICAL, FINANCIAL AND LEGAL ASSISTANCE.

Federal and state agencies should collaborate to develop comprehensive systems that can provide towns and cities with a range of mechanisms to achieve river-smart conservation, mitigation and development.

Mechanisms to achieve river-smart development might include any of the following, for example:

- State or federal regulations or zoning rules
- Local zoning rules, bylaws and ordinances
- Incentives for landowners or developers, and voluntary agreements with landowners
- Land purchases, buy outs, and easements
- Negotiated agreements with other municipalities
- Targeted economic and community development programs for river-smart development.

Systems of support for these mechanisms should include the following:

- A centralized, easily accessible source of user-friendly information on a range of options and mechanisms to achieve river-smart land use. Web sources such as floodready.vermont.gov are good places to do this (see Example 11: Flood Ready Vermont, p. 56).
- Technical and legal assistance that is coordinated across relevant agencies, to help town and city leaders and staff to choose, prepare and implement river-smart options. Funds for on-the-ground assistance may be best spent by underwriting staff in substate Regional Intermediary organizations (see Recommendation 5).
- Models of bylaws, zoning ordinances, land purchases, buy-out opportunities, easements, voluntary agreements, economic development programs and other legal and administrative mechanisms that may be used to achieve river-smart land use.
- Financial assistance. There are many creative ways to provide this, including loan funds and financial incentives for river-smart planning and mitigation (see Example 12: Vermont's Emergency Relief and Assistance Fund. p. 57).

Example 12. Vermont's Emergency Relief and Assistance Fund

One innovative policy approach to finance and encourage river-smart planning and mitigation is to give additional financial support for flood recovery to towns that plan and prepare for fluvial erosion hazards. Vermont's Emergency Relief and Assistance Fund provides 30% to 70% of the non-federal match required (7.5% to 17.5% of the total project cost) for communities that receive federal disaster relief from FEMA Public Assistance. A greater portion is paid if municipalities engage in river-smart planning and adopt river-smart bylaws.

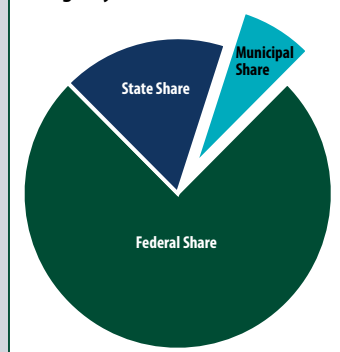
Municipalities can receive the maximum portion, with 70% of their non-federal match paid by the state, if they:

- Adopt new river-smart state Town Road and Bridge standards
- Adopt or take steps toward adopting flood hazard bylaws
- Adopt a Hazard Mitigation Plan and an Emergency Operation Plan
- Adopt a river corridor protection bylaw that meets or exceeds state model guidelines

The municipality then covers only 7.5% of the total project cost.

Funds are provided from the state's General Fund Budget Stabilization Reserve, which can be used for emergency relief and assistance. Up to 2% of this state reserve fund can be transferred to the Emergency Relief and Assistance Fund in a given fiscal year.

Project cost share for a river-smart town using Vermont's Emergency Relief and Assistance Fund



Municipalities in Vermont that have moved toward more river-smart planning and standards can receive state financial assistance that makes river-smart projects much more affordable.

http://floodready.vermont.gov/find_funding/emergency_relief_assistance

- Legal counsel and backing to defend new river-smart zoning and other ordinances. Straight-forward legal analyses of past cases, written in non-expert language, may be helpful.
- National and statewide regulations and/or programs for river-smart conservation, development and mitigation. These can provide structure and backing for localities to follow, and can more readily achieve coordination of conservation and mitigation practices up and down river systems. An excellent example of a state-based program that advances conservation and mitigation for river flood safety is the Vermont River Corridor program (see Example 13: Vermont River Corridor Program, p. 58).

RECOMMENDATION #3 ELEMENT C) ENSURE THAT SUPPORT IS AVAILABLE TO COMMUNITIES ON AN ONGOING BASIS, UNTIL THEIR PLANS ARE FULLY IMPLEMENTED.

State and federal agencies should provide close guidance and support for towns all the way until implementation of river-smart measures is complete (see Example 20: Local Support and Partnerships from Concept to Completion, p. 72). Though financial support should come from federal and state budgets, it may be most cost-effective and sensitive to individual state and town culture and needs if it is led by substate regional organizations (Recommendation 5).

Support should include:

- Consultation and advice as new issues and details arise during the implementation support
- Financial support as towns and cities undertake the significant expenditures of removing levees and berms, purchasing easements, and protecting infrastructure from risk of fluvial hazards
- Legal counsel, whether to ensure correct management on easement lands or lands with voluntary agreements, or to defend new river-smart zoning regulations against legal challenges.

Example 13. Vermont River Corridor Program

The Vermont River Corridor and Floodplain Program, established in 2011, aims to protect lands in order to allow rivers to move in ways that help maintain a stable and minimally erosive river. The river corridor contains the meander belt and a riparian buffer. Depending on the sensitivity of the river or stream, the meander belt width ranges from the existing channel width to 8 channel widths. The riparian buffer is a 50 foot setback on either side of the meander belt. The riparian buffer provides additional room for stable meanders, bank stabilization, and establishment of woody buffer that can resist lateral (sideways) erosion. River meander corridors are designed to ensure compliance with state law and the Vermont Flood Hazard Area and River Corridor Rules.

Vermont's Department of Environmental Conservation carries out the river corridor program while working with municipalities, Regional Planning Commissions, and state agencies. The first step is to map river corridor areas throughout the state. Then, the Department of Environmental Conservation provides technical assistance and works with partner agencies to complete river corridor plans and stormwater master plans. Municipalities can get help to implement site-specific best management practices, which can include avoiding and removing encroachments; slowing, spreading, and infiltrating runoff; and river and riparian management. In addition, the state provides model bylaws and incentives to assist and help municipalities in adopting river corridor protection bylaws and ordinances. The State Program also offers to review projects for compliance with local erosion hazard provisions if a municipality needs that type of technical assistance built into the bylaw.

http://floodready.vermont.gov/food_protection/river_corridors_floodplains/river_corridors



A river corridor in Vermont. The red lines mark the meander belt, and the yellow lines the 50 foot riparian buffer. On left, yellow marks municipalities that have adopted river corridor protection areas.

Summary of Target Recommendation #4: Provide Outreach and Training on River Dynamics and River-Smart Practice

Municipal need:
Information and training on river dynamics, lessons for river flood hazards, and river-smart hazard mitigation.
(See page 60).

Recommendation:
Prepare and disseminate outreach materials and training on river dynamics, lessons for river flood hazards, and river-smart best management practices.
(See page 61).

Municipal need elements:
a) Engineers and work crews that build and maintain roads and bridges need to understand river dynamics and implement best management practices

Recommendation elements:
a) Train transportation work crew personnel in New England on river dynamics and river-smart best management practices

b) General information on river dynamics and practical lessons for land managers

b) Produce easily understandable outreach materials on river dynamics and practical lessons for land management; disseminate widely, especially to land use decision makers

c) Occasional, episodic access to in-depth information and targeted trainings, on river science and best management practices

c) Prepare in-depth outreach materials; create, publicize and maintain systems to deliver these quickly and efficiently upon request

Target Recommendation #4: Provide Outreach and Training on River Dynamics and River-Smart Practice

Background

People in streamside New England communities are often shocked by the scale of damage they experience during river floods. After Irene, a common theme in media reports was people's horrified surprise that tiny brooks and familiar rivers could become torrents that could collapse bridges, houses and highways. This is not uncommon – people in many places and times have been shocked by the damage flooding rivers can do. We imagine hurricanes and tornadoes as destructive, but not the rivers we think we know so well. Nonetheless, around the world, damage from river floods exceeds that from hurricanes and tornadoes.

It would benefit the residents of New England to gain a deeper understanding of rivers as dynamic systems that flood, move, and sometimes suddenly change their landscapes. If New Englanders had this understanding, they would likely be better prepared for these events in advance. An understanding of river science could inform good decision-making as towns and cities rebuild after river floods, and as they plan and prepare for future river floods. Besides scientific knowledge, information about best management practices to accommodate natural, dynamic river processes through land and river management would assist New England's communities to become more river-smart.

It is tempting to call on federal and state agencies to undertake a wide and deep education, information, and training campaign on these topics across the communities of New England. However, given their real constraints they must work strategically, and we must all work collaboratively. Though widespread general understanding is desirable, not all residents or officials of New England towns have the time, interest or capacity to devote themselves to these subjects. Towns may find it most effective to have a few key staff people more deeply trained, who can then become resources for others as the need arises. Information may not be equally needed at all

times. When river floods are imminent or have just happened, information may be drastically needed. At other times, a host of other community needs may rise to top priority instead. Government agencies in New England need to develop, fund, and carry out education and training programs about river science and best management practices for people across the region's communities in ways that makes information available as communities need and want it most.

Three specific educational and training needs of municipalities rise to the top as most critical for long-term river flood safety and resilience. Addressing these will provide the largest “bang for the buck” for state and federal investment in education and training.

Municipal need #4: Information and training on river dynamics, lessons for river flood hazards, and river-smart hazard mitigation

MUNICIPAL NEED #4 ELEMENT A) ENGINEERS AND WORK CREWS THAT BUILD AND MAINTAIN ROADS AND BRIDGES NEED TO UNDERSTAND RIVER DYNAMICS AND IMPLEMENT BEST MANAGEMENT PRACTICES

There is one group of people who, when educated in river science and trained in best management practices, could immediately and tangibly improve the resilience and preparedness of New England communities in the face of river floods. These are the engineering and construction workers who build, maintain, and repair the roads, bridges, and other infrastructure on which New England's towns and cities depend. They include staff from local departments of public works, state Department of Transportation crews, federal transportation workers, and transportation contractors. These crews are often first on the scene in a flood emergency, and every day they maintain towns' access to a host of resources and connections.

New England's municipalities need transportation engineering and construction workers to be able to construct, maintain and repair infrastructure in ways that will reduce, rather than increase, future river flood damage. They need these work crews to be able to do this fast, right away. For these reasons, towns need the people in their road crews to be educated in river dynamics, especially how rivers interact with built structures, and to be trained with a toolbox of best management practices.

MUNICIPAL NEED #4 ELEMENT B) GENERAL INFORMATION ON RIVER DYNAMICS AND PRACTICAL LESSONS FOR LAND MANAGEMENT

Most town and city residents do not need as much knowledge about river dynamics, or skills in best management practices, as transportation crews working in and around towns and cities. However, municipalities would be able to prepare and deal with river floods better if their officials and residents had some general knowledge about river science and practical lessons for land management, and if one or a few long-term staff had some deeper knowledge.

Two kinds of information are key. First, information is needed on the general dynamics and impacts of river floods – in other words, a general sense of how rivers act during floods, and some of the practical implications for property and infrastructure, such as the key insights covered in Chapter 2. Second, information is needed on how to predict, prepare for, and mitigate river flood damage. Most importantly, community leaders and residents should know they can reduce their own vulnerability to damage, and others' vulnerability downstream and elsewhere, by managing lands in ways that allow flooded rivers to dissipate their force and volume.

Towns' land use decisionmakers are in particular need of this general information. These include planning commissioners, zoning board members, and conservation commissioners. Landowners of streamside areas, tenant-occupants of those areas, and other municipal officials, staff and decision makers of various kinds also need to be recognized

as land use decision makers. Finally, towns may also find it easiest to designate one or a few staff members who become more deeply trained, and can become resources for others in the community.

MUNICIPAL NEED #4 ELEMENT C) TOWN LEADERS, STAFF, AND PROPERTY OWNERS NEED OCCASIONAL, EPISODIC ACCESS TO IN-DEPTH INFORMATION AND TARGETED TRAININGS, ON RIVER SCIENCE AND BEST MANAGEMENT PRACTICES

There are times when officials, landowners, or residents of New England communities may suddenly need or want to gain deeper knowledge about river flood hazards or best management practices for mitigating river floods. These times might include during a flood emergency, when preparing for a construction project, or when a municipality engages in more in-depth planning for flood hazard mitigation.

There is no easy way to predict when this need will arise. Communities need information to be available and easy to access at all times. They need a number to call, and a website to search – and they must know where to find that number and website. On the other end of that call and website, they need useful information that can be dispatched efficiently, in forms that can support rapid, easy learning of new material. They also need staff from outreach organizations to be ready to act quickly to take advantage of a learning moment, and guide the range of construction and reconstruction activities that may follow a flood.

Recommendation #4: Prepare and disseminate outreach materials and training on river dynamics, lessons for river flood hazards, and river-smart best management practices

We recommend that federal and state agencies prepare and distribute outreach materials and training on river dynamics, lessons for river flood hazards, and river-smart best practices. This should be done in targeted ways in order to be the most cost-effective. We identify three key elements to support this recommendation.

RECOMMENDATION #4 ELEMENT A) TRAIN TRANSPORTATION WORK CREW PERSONNEL IN NEW ENGLAND ON RIVER DYNAMICS AND RIVER-SMART BEST MANAGEMENT PRACTICES

Educating and training New England's transportation personnel is worthy of significant targeted investment from state governments and federal agencies. This is because it can bring immediate improvements in public safety, and in the long run will significantly reduce costs to the taxpayer. All transportation personnel who work on the region's roads and bridges – federal, state, local, and private – should receive training on river science and river-smart best management practices, with more in-depth training given to engineers, foremen, and other crew leaders. Once established, transportation agencies should incorporate this as part of their ongoing education and training programs.

Education and training content should include:

- Background on river science. This should explain the ways in which roads, bridges and other structures influence, and are impacted by, river dynamics and floods
- Best management practices for construction and maintenance of bridges and roads that will reduce rather than increase future river flood damage

Delivery mechanisms should include:

- Hands-on field trainings and practice, especially on best management practices
- Classroom and/or web-based presentations on background information
- Web-based materials for self-guided education and practical training that can supplement more direct seminars and trainings

Programs could be modeled or built on the Vermont Rivers and Roads Program, developed since 2011's Tropical Storm Irene (see Example 14: Vermont Rivers and Roads Program, facing page). Building on an existing program would save other states and federal agencies time and costs of program development. Vermont has also developed on-line materials that might potentially be used by others,

such as the Vermont River Management Principles and Practices, a technical guide on how communities can evaluate alternatives and design post-flood projects to recover quickly, while also advancing long-term resiliency.

RECOMMENDATION #4 ELEMENT B) PRODUCE EASILY UNDERSTANDABLE GENERAL OUTREACH MATERIALS ON RIVER DYNAMICS AND PRACTICAL LESSONS FOR LAND MANAGEMENT; DISSEMINATE WIDELY, ESPECIALLY TO LAND USE DECISION MAKERS

State and federal agencies should develop and make widely available outreach materials that cover general, practical lessons on river science and river-smart land management. The essential content should be background on river dynamics, with practical lessons for land management (such as the key insights emphasized in Chapter II); and guidance on how to manage lands in river-smart ways. Particularly important for this guidance is information on how lands can be managed in ways that will allow flooded rivers to dissipate their force and volume.

Possible products and outlets include fact sheets, web portals, pamphlets and posters, public media announcements, public and community television and radio programs, and information tables at events. It is essential that the information be clearly and engagingly presented, that it should seem both respectful and immediately useful to its targeted audience (see Example 15: Community-Friendly Outreach Materials, p. 64).

There should be targeted outreach to land use decision makers – land owners, occupants of rented lands, and a range of community officials and staff who make decisions related to land use, from issuing permits to passing ordinances to appropriating town funds for construction activities. The most cost-effective way to do this may be to enlist state, federal, regional and nonprofit agencies that already work with these groups to include these materials in their outreach activities.

Example 14. Vermont Rivers and Roads Program



After swollen rivers damaged hundreds of road sites in Vermont during Tropical Storm Irene, leaders of both the Vermont Rivers Program and the Vermont Agency of Transportation (VTrans) realized there was a problem. Roads needed to be built better, with river-smart construction, so they could have a greater likelihood of withstanding major floods. Yet immediately after Irene, in the rush to get things working again, many roads and bridges were reconstructed with the previous designs, ensuring repeated vulnerabilities into the future. This was because on-the-ground personnel did not always recognize the river dynamics at

work, and there was neither the time nor the availability of staff from the Vermont Rivers Program to provide assistance at the hundreds of repair sites across the state.

The Vermont Rivers Program and the Vermont Agency of Transportation decided to develop a training program in which VTrans employees would be trained to understand, identify, and plan for river processes that might affect future structural resilience, and to request and provide needed assistance. The goals were for on-the-ground transportation crews to increase their capacity to rebuild river-smart structures themselves during less difficult situations, whether after a storm event or during normal maintenance operations; and to recognize challenges and request assistance in more difficult situations. It was hoped that VTrans design staff and others would also be better prepared to provide assistance on these more difficult sites.

The result was the Vermont Rivers and Roads program. The training includes

information on fluvial geomorphology, hydrology, and aquatic habitats of rivers. Participants learn how instream construction interacts with these dynamic aspects of rivers. The training series includes multiple tiers:

Tier 1: Online introduction to river processes. This is publicly available to everyone.

Tier 2: A 3-day classroom and field-based training on accommodating river processes and aquatic habitat.

Tier 3: Advanced class and field training on the application of the Vermont Standard River Management Practices.

By February 2015, over 200 VTrans employees had already completed the intensive 3-day Tier 2 training, as had over 300 municipal, regional, and private-sector personnel.

<http://wsmd.vt.gov/rivers/roadstraining/>



RECOMMENDATION #4 ELEMENT C) PREPARE IN-DEPTH OUT-REACH MATERIALS; CREATE, PUBLICIZE AND MAINTAIN SYSTEMS TO DELIVER THESE QUICKLY AND EFFICIENTLY UPON REQUEST

State and federal agencies need to have more in-depth information on river floods and river-smart hazard prevention readily available. This information should be easy to find and disseminate so that when town and city officials, residents, or landowners have a sudden need for it, they can find it quickly and simply.

In-depth written and interactive materials should be organized in clear, useful topics, such as: river dynamics; preparing and mitigating for river floods; best management practices for land management to reduce future river flood damage; funding sources for flood mitigation; regulations on building in flood

hazard zones (see Example 16: StormSmart Communities, next page).

Because there may not be regional-scale river floods like those brought by Irene for another 20 or 30 or 50 years, public interest in this material may wane. When a flood does come, though, these educational materials should be immediately available, and immediately useful. To make this possible, federal and state governments need a system for updating this information, and for maintaining its accessibility and availability for years and decades to come. There are multiple ways to do this, but we suggest the following strategies:

- Identify one or two federal or state agencies that will be responsible for updating the information,

Example 15. Community-Friendly Outreach Materials: UMass RiverSmart Fact Sheets

Outreach materials need to be clear, informative, concise, and easy to access. UMass Amherst's RiverSmart Communities project is producing a series of informational pamphlets and packets with these goals in mind. These materials are geared to an audience of local government officials, community leaders, public works and highway staff, landowners, and the general public.

They are designed to help enable informed decision-making around river flood management, and to provide



information about a broad array of river management topics. They are available in hard copy and also on the web.

<https://extension.umass.edu/riversmart>

and for maintaining information offices and technical experts who can provide it upon request.

- Identify regional offices of these agencies, Regional Intermediaries (Recommendation 5), and/or central state offices and designate them as centers of these materials and related expertise. Hire and train one expert on river processes and

flooded hazards for each of these offices, who can provide additional depth and expertise when requested beyond the prepared materials.

- Maintain informational materials, websites and expert personnel with funding that is reliable year after year.

Example 16. StormSmart Communities Program

An excellent example of a broad education effort to help communities prepare for future natural hazards is the Massachusetts StormSmart Communities program. Originally called StormSmart Coasts, the StormSmart Communities program was developed by the Massachusetts Office of Coastal Zone Management to help local officials prepare for and protect their communities from coastal storms and flooding—both now and in the future, when sea levels are expected to rise with ongoing climate change. The program aims to provide Massachusetts communities with tried-and-true actions and practical information that can be used to reduce risk. Whenever possible, the program taps into existing resources. Information

resources are available in hard copy and on the StormSmart Communities web site. This program also provides ongoing assistance with local implementation of StormSmart strategies. See: <http://www.mass.gov/eea/agencies/czm/program-areas/stormsmart-coasts/stormsmart-communities/>



Who to Contact and What to Do Before Building or Rebuilding

The coast, with its beach access and beautiful views, can be an attractive place to build a home or cottage—but it is important to be prepared for coastal storms and flooding. To protect public safety, coastal development, and natural resources, Massachusetts has enacted regulations that set minimum construction standards for coastal areas. These regulations cover various projects, including new buildings, repair of storm-damaged properties, additions, substantial improvement to existing or damaged buildings, septic systems, piers, and shoreline stabilization structures such as seawalls and revetments. In addition, building—or rebuilding after a storm—provides an excellent opportunity to maximize storm damage protection for your property. Through thoughtful planning and design, you can go beyond the minimum regulatory standards and use the best available techniques to minimize future property damage, significantly reduce your flood insurance rates, and preserve the capacity of natural landforms to buffer storm waves and flooding to further protect your property.

To help property owners with the permitting process, this fact sheet provides information on who to contact about applicable regulations, an overview of the most common permits needed, and recommendations for StormSmart building techniques to protect your property.



From Coastal Zone Management website

Excerpt from StormSmart Communities Factsheet

Summary of Target Recommendation #5: Designate, Recognize and Support River-Smart Regional Intermediaries

Municipal need:

Integrated and ongoing assistance to become river-smart; improved delivery of related state and federal programs.
(See page 66).

Recommendation:

Designate, recognize and support river-smart Regional Intermediaries to provide low-cost and no-cost technical assistance to municipalities, and to guide and assist with federal and state programs.
(See page 70).

Municipal need elements:

a) Locally available agents who can provide integrated and ongoing assistance to help New England communities become river-smart.

b) Improved provision and delivery of state and federal programs and resources that aim to help New England communities become river-smart.

Recommendation elements:

a) Ensure that all municipalities in New England have access to a river-smart Regional Intermediary, whose mission includes low-cost service for municipalities and which has capable, reliable staff who respect towns' authorities and support towns' capacities.

b) Use river-smart Regional Intermediaries to guide and assist with delivery of flood assessment, planning, mitigation and response services to local governments and landowners, and to gather and understand information on local needs and conditions.

All New England states have regional planning councils or agencies of some kind. This map shows Regional Planning Agencies in Massachusetts.



Target Recommendation #5: Designate, Recognize and Support River-Smart Regional Intermediaries

Background

In this recommendation, the final one in this report, we identify several municipal needs that go beyond the specific content of federal and state programs, and instead emphasize the way these programs could be better communicated, offered and delivered.

Municipalities in New England have tremendous autonomy and responsibility in relation to rivers, riverside lands and river floods. They bear the primary authority for land use regulation and planning, are responsible for local-level emergency response, and maintain locally owned infrastructure like roads and bridges. New England communities also benefit from a deep culture of civic responsibility and independence. Innumerable town and city government officials and staff serve their communities knowledgeably and responsibly in ways that help their communities prepare for and respond to floods. After flood events, residents across New England repeatedly step up to help their fellow townspeople and neighboring communities recover from damage.

Yet New England communities do not by themselves have the resources or capacity to do all that is needed to become river-smart. Small towns in particular commonly have a very limited paid staff, and volunteer government. When hit by major river floods, municipalities need help to deal with the enormous scale of damage. They can become easily overwhelmed with the surge of communication and data needs, requests for help, and visiting teams of out-of-town would-be helpers. They often need outside technical expertise and financial assistance to recover effectively. They need help to plan and prepare effectively for future floods, and, as they become river-smart, they may need extra assistance to help them build new knowledge and adopt new practices.

The federal government and the New England states have programs that aim to help communities and landowners. Many of these offer important

financial and technical resources. However, many municipalities, especially smaller towns, have difficulty accessing these programs. Town leaders and staff may not be experienced with the often elaborate rules for applying to or administering the programs, or may not have the technical expertise to run them. They may have limited capacity and funds to prepare long and involved applications, undertake required baseline studies, or implement complex management or regulations. And they cannot by themselves take on watershed-wide assessment, planning and action.

Even when federal and state programs and staff do direct outreach to municipalities, or offer special assistance, it is often less effective than intended. This problem can be particularly acute during and after a flood emergency. Damage and needs are often widespread, and state and federal staff are over-stretched. Locals with little training may suddenly find themselves needing to work with state and federal personnel and information systems. Emergency and post-emergency crews are often brought in temporarily, sometimes from distant parts of the region or country. They are not always aware of and sensitive to New England towns' distinct needs, responsibilities and challenges, nor to the peculiarities of New England's dynamic and varied natural environments (see Example 17, River Flood Response and Recovery, p. 68).

These situations create a disconnect between the municipalities that are on the front lines of flood planning, preparation and response, and state or federal agencies charged with providing assistance. Neither town-by-town federal and state outreach, nor increased municipal staffing is likely to solve this problem in a cost-effective way. There needs to be someone between towns on the one hand, and state and federal agencies on the other. In states outside New England, counties often play that role. But in much of New England, counties are weak; in some states, they are nonexistent.

Left to fill in the gap (sometimes) are other organizations that work in sub-state regions – areas covering a few to maybe two or three dozen towns. They operate on relatively small budgets, with just enough overhead to maintain a consistent office and a few long-term administrative staff to provide continuity. We call these crucial, often underappreciated organizations “Regional Intermediaries” – groups that can help communicate between local towns on the one hand, and state and federal agencies on the other. Successful Regional Intermediaries have one or more long-term staff who have relevant expertise in technical matters, who are able to think and act integratively to address multi-sectoral needs and problems, and who know, understand and work well with municipalities and landowners, as well as with state and federal agencies. A river-smart Regional Intermediary has the technical training and skills, knowledge of management and policy tools, and familiarity with relevant federal and state programs, to help towns assess, plan, mitigate for, and respond to river floods in river-smart ways.

The six New England states all have designated regional councils of some kind that fulfill at least some of these roles. The names and exact functions of these vary across New England, but they include Regional Planning Commissions, Regional Planning Agencies, Planning Councils, Regional Councils of Government, and Development Commissions. They are commonly given some responsibilities and some funding by state legislatures. Additional funding may come from pass-through federal funds, with transportation funding a significant source; federal, state, or nonprofit grant programs; or membership or service fees contributed by towns. These sub-state regional bodies provide a range of services that relate to the goal of becoming river-smart, including mapping, transportation planning, community development, public safety, smart growth, hazard mitigation, and environmental planning.

In some places, other entities also serve as river-smart Regional Intermediaries. These include particular federal or state agencies (see Example 20,

Local Support and Partnerships, From Concept to Completion, p. 72), and some non-government organizations (see Example 21, The White River Partnership, p. 73).

Our research has shown that towns that are able to access a strong, functional river-smart Regional Intermediary are often aided in moving toward river-smart scientific assessments, planning, management, and response. We have also found that these river-smart Regional Intermediaries have knowledge and experience that can help state and federal agencies deliver more effective and successful assistance.

Municipal need #5: Integrated and on-going assistance to become river-smart; improved delivery of related state and federal programs so they are more efficient and useful.

MUNICIPAL NEED #5 ELEMENT A) LOCALLY AVAILABLE AGENTS WHO CAN PROVIDE INTEGRATED AND ONGOING ASSISTANCE TO HELP NEW ENGLAND COMMUNITIES BECOME RIVER-SMART.

If state and federal policy makers adopt our first four recommendations, they will provide a range of services and supports that can make a tremendous difference for New England’s communities in helping them become river-smart. However, these programs need not only to be available, but also to be accessible and useful.

In order for assistance programs to be more accessible and useful, something rather less technical is required: people. Towns and cities need locally available programs and one or a few technical support staff who provide practical, useful assistance. These technical staff should be outreach agents who can become a consistent point of contact for a range of needs.

Example 17. River Flood Response and Recovery: The Practical Limits of Federal and State Government Aid

During Tropical Storm Irene, river floods impacted 223 of Vermont's 251 towns and cities, 45 severely. Thirteen towns were entirely cut off from the state road system by road and bridge collapses. More than 1500 families were displaced from their homes.

Federal and state agencies offered unprecedented response. Nonetheless, the gaps among federal, state and local action proved almost as damaging as the rivers themselves.

For example, many people, including many local town officials, suddenly tried to use the State's disaster management system. Many had little experience using it, and it was not always intuitive. As a result, some inputted data incorrectly, while others gave up trying.

Town officials found themselves overwhelmed with requests for information – from the Federal Emergency Management Agency (FEMA), the Vermont Department of Transportation, the State Police, the State Department of Health, the National Guard, and others. Often there were repeat requests.

The State's road condition information system, phone number 511, was overwhelmed, and not consistently up to date for several days. Even then, it covered only State roads, not local ones. Federal and state agencies and volunteer groups delivering supplies and services to remote rural areas often found they could not get there by the routes they planned.

When FEMA teams came into town after the storm, offering to assess damage and offer possible financial support for repair and reconstruction, they commonly brought temporary

staff from other parts of the country. Many were unprepared to work with volunteer government officials, a lack of county governments, or a large number of gravel roads--all typical conditions in rural New England. Often three or more teams would come in succession to a single town, each with a slightly different set of definitions or requirements for processing claims. This caused headaches for local officials.

In many cases there were strong local relationships that towns used to recover – but even then, the gap between local, state and federal governments caused troubles. Towns that were hardest hit and least prepared received considerable help from their neighboring towns. They found out after the fact that the helping towns would have difficulty getting reimbursement from FEMA unless the two towns had a pre-existing Memorandum of Understanding. Also, many rural Vermonters with useful equipment such as tractors, dump trucks, and backhoes helped with local emergency restoration of roads, debris removal, etc. Some people sought guidance from the Vermont Agency of Natural Resources, but they found the state's river engineers were overwhelmed trying to help both municipalities and the state Department of Transportation repair hundreds of miles of roads and bridges. Then, the governor, intending to be supportive, encouraged locals to



start digging gravel out of rivers. Soon, there were back hoes in rivers across the state, destructively undermining the long-term stability and adjustment processes of rivers.

These kinds of problems cannot be solved simply by better state and federal programs or staffing. As Vermont's Tropical Storm Irene After-Action report noted, "Both the federal and the State governments have limits to their response and recovery efforts and the reimbursement levels that they can achieve.... Because these limitations are not well known by municipalities and citizens... there were unrealistic expectations." In the face of inevitable limitations in federal and state capacity, an in-between set of Regional Intermediaries is often best able to fill the gaps (see Example 18).

Source: State of Vermont 2012: Tropical Storm Irene After Action Report / Improvement Plan. Final Draft, April 9, 2012. https://gmunited-way.files.wordpress.com/2012/04/ts-irene-aar-ip-2012_0409_final.pdf.

Example 18. River-Smart Regional Intermediaries Fill the Gaps: Vermont's Regional Planning Commissions During And After Irene

When communication and assistance between federal, state and local governments broke down after Tropical Storm Irene (see Example 17), Vermont's Regional Planning Commissions (RPCs) stepped into the breach. When RPC staff learned that the state road information system was not keeping up, RPCs used their technical skills and their extensive knowledge of roads and communities to get up-to-date road conditions onto user-friendly Google Maps. Soon, towns, the state police, and emergency responders were using the RPCs' maps. When communication between state agencies and local towns proved inadequate, RPC staff used their familiarity with both the state Emergency Operations Centers, and many towns' emergency plans, to facilitate smooth information flow. When RPC staff recognized that personnel from the state's Emergency Operations Center were becoming exhausted, RPCs from less hard-hit areas sent their own trained personnel to relieve them.

Soon, state and federal agencies began to request RPC assistance. Then, they formally recognized, supported, and boosted the RPC role. The Vermont Department of Transportation (VTrans) gave the RPCs official responsibility for road mapping. With support from the Governor, VTrans gave the RPCs the job of helping municipalities get needed resources to repair local roads. The State set up a central office for the RPCs called a Regional Coordination Center. The RPCs across the state set up Mutual Aid Agreements, and RPCs from less overwhelmed areas provided shared staffing for the coordination center. The Regional Coordination Center developed an assessment form and distributed updated maps and other

information. The RPCs undertook other tasks: helped FEMA administer its Public Assistance Program, accompanied FEMA staff to visit local areas, coordinated meetings, and helped towns with applications for assistance. They worked with property owners who had the worst damage to find the best resources for possible buy and continued to assist for the ensuing months.

People from all levels of government recognized the invaluable role the RPCs had played. Vermont instituted a program to train three staff members from each RPC to function in an emergency. To help RPCs reduce the damage from river floods, the Agency of Natural Resources and VTrans trained RPC staff on how to deal with damage in and near rivers through their new "Rivers and Roads training" (see Example 14, p. 63). RPC staff have also attended webinars on how municipalities will be authorized to conduct emergency instream protective measures, so they can assist municipalities with this during future disasters. In the future, RPC staff may also be trained as floodplain technicians who can help review floodplain and river corridor developments and reparations. This will help rivers to be less damaging during floods, and will help head off damaging interventions into rivers before and after disasters.



Source: NADO Research Foundation 2012: Lessons learned from Irene: Vermont RPCs address transportation system recovery. Center for Transportation Advancement and Regional Development with support from the Federal Highway Administration, Washington, DC. <http://www.nado.org/wp-content/uploads/2012/06/IreneVT.pdf>

Assessment form developed by Vermont's Regional Planning Commissions after Tropical Storm Irene

Irene Flood Response - Regional Resource Coordination
Local Road Initial Damage Assessment Data Form Version 4
 Fill out One Form for Each Damage Area

Town: _____ RPC: _____

Road Name/ Number and Location Description (provide adequate detail to locate project on a map such as road name, route number, GPS coordinates (Lat, Long in dec. degs), ERI/ Address, Mile Marker): _____ Town Contact: _____

Recorded by: _____ Title/Position: _____

Date: _____

Bridge/Culvert Number: _____ Municipal Repair Priority: _____

Length (feet) of Segment (for roads): _____ ☐ High ☐ Medium ☐ Low

Residences Stranded: ☐ Yes ☐ No

How Many: _____

Facility Type: (check all that apply): ☐ Road ☐ Bridge* ☐ Culvert ☐ Other Highway

*Will a Temporary Bridge be needed before Winter? ☐ Yes ☐ No Length in feet if known: _____

Status: ☐ Closed ☐ Emergency vehicle only ☐ Open with lane/weight restriction ☐ Open, repair needed ☐ Open, Fixed

If facility is closed, is a detour route in place? ☐ Yes ☐ No

Will the detour be in place for more than one week? ☐ Yes ☐ No

Damage description: _____

Have temporary repairs been made: ☐ Yes ☐ No Cost of Temporary Repairs: _____

Describe temporary repairs: _____

Does Town need assistance in getting repairs started? ☐ Yes ☐ No

Describe resources needed: _____

Specifically, municipalities need technical assistants who are:

Locally available and knowledgeable

- Available throughout New England, year after year, with a clear commitment to serve rural, remote and small towns
- Able to work closely with and guide municipal leaders, landowners and residents as they learn new science and best practices, perform assessments, prepare plans, implement projects, and conduct evaluations
- Knowledgeable about and respectful of the municipalities, lands, and people with whom they work
- Familiar with town ordinances, Town Meeting, voluntary government, and other New England approaches to local policy change and funding

Technically skilled and knowledgeable about river science and river-smart management

- Trained in river science; technically skilled and experienced in accessing, producing and recording relevant data
- Well versed in a range of river-smart best practices, including the complexities of and opportunities for river-smart land use management

Familiar and experienced with federal and state programs, data systems, grants, resources, and regulations, and can help municipalities navigate tasks such as:

- Preparing documents for federal and state regulations, plans, and applications, e.g. flood hazard mitigation grants
- Accessing and inputting data from and to state and federal information systems
- Reviewing floodplain development or protection plans for compliance with new river-smart regulations

Able to think and act integratively

- Can provide integrated river-smart information and technical assistance, thinking and acting across a range of sectors

- Can facilitate multi-town coordination to address river processes, land use, and flood hazard risk across watersheds

MUNICIPAL NEED #5 ELEMENT B) IMPROVED PROVISION AND DELIVERY OF STATE AND FEDERAL PROGRAMS AND RESOURCES THAT AIM TO HELP NEW ENGLAND COMMUNITIES BECOME RIVER-SMART.

In addition to more reliable and useful local assistance, municipalities also need federal and state programs to be more attuned to local needs and conditions. After Tropical Storm Irene, this need was particularly apparent. Various state and federal agencies reached out directly to local communities and property owners, offering augmented help. However, some of these agencies sent staff who sometimes lacked knowledge of local needs, conditions, and constraints. Communication was sometimes inadequate and other times excessive, and local officials, staff and residents were frequently left with inefficient and uneven assistance, and contradictory or unclear guidance (see Example 17, River Flood Response and Recovery, p. 68).

Recommendation #5: Designate, recognize and support river-smart Regional Intermediaries to provide low-cost and no-cost technical assistance to municipalities, and to guide and assist with federal and state programs.

River-smart Regional Intermediaries are invaluable resources for New England. More than any other kind of institution, they have tremendous potential to help New England's small towns access useful, supportive assistance, resources and programs to become river-smart. By using these organizations to help New England communities become river-smart, we can avoid having to re-invent new levels of government, or new funding programs. Vermont did exactly this during and after Irene, with considerable success (see Example 18, River-Smart Regional Intermediaries Fill the Gaps, p. 69).

If Regional Intermediaries can be supported with the science, technical skills, policy tools and training to be river-smart Regional Intermediaries, they will in turn train, support and do outreach to municipalities across New England to help them, too, become river-smart. In short, supporting river-smart Regional Intermediaries more widely and more reliably would be a particularly cost-effective, adaptable way to improve New England municipalities' access to and success with river-smart flood assessment, planning, mitigation, emergency response, and recovery.

RECOMMENDATION #5 ELEMENT A) ENSURE THAT ALL MUNICIPALITIES IN NEW ENGLAND HAVE ACCESS TO A RIVER-SMART REGIONAL INTERMEDIARY, WHOSE MISSION INCLUDES LOW-COST SERVICE FOR MUNICIPALITIES AND WHICH HAS CAPABLE, RELIABLE STAFF WHO RESPECT TOWNS' AUTHORITIES AND SUPPORT TOWNS' CAPACITIES.

States should designate river-smart Regional Intermediaries across New England. Every town and city in the six states should be assigned to a river-smart Regional Intermediary. These river-smart Regional Intermediaries should be authorized, instructed and funded to provide service to all towns in their district, including and especially small towns, while respecting their authorities and supporting their capacities.

In many cases, these river-smart Regional Intermediaries will be already-existing state-designated regional councils. The Franklin Council of Regional Governments in western Massachusetts provides a strong example (see Example 19, Guiding River-Smart Hazard Mitigation Plans, p. 71). These need not be made uniform; there are many good reasons for the varying structure of regional councils in New England. It may be new, however, to assign them a primary role and function in helping municipalities become river-smart, or to require them to provide service to all towns, including very small towns, in their district. These changes may require new administrative rules at the state level, or at the level of the Regional Intermediary itself, and/or revised statutory authorities.

In states like Maine with relatively strong counties, counties may be supported to step into this role. Maine's counties already have Emergency Management Agencies, and work on health and public safety. In parts of Maine where there are no organized municipalities – something that is uncommon in the other five states – Maine's counties also provide bridge and road maintenance services, and thus are very appropriate institutions to take on the role of river-smart Regional Intermediaries in relation to transportation infrastructure.

Example 19. Guiding River-Smart Hazard Mitigation Plans: Franklin Regional Council of Governments

Towns often struggle with finding the resources and expertise to develop Hazard Mitigation Plans. It can be especially difficult if they want to include an understanding of the fluvial hazards of river floods, and to mitigate these successfully. River-smart Regional Intermediaries can help. In western Massachusetts, the Franklin Regional Council of Governments (FRCOG) has worked with 26 towns to complete Hazard Mitigation Plans.

FRCOG has been able to assist towns in applying for needed grants and hiring consultants, and has coordinated among towns to improve the impact of each Plan. Employees at FRCOG have been working especially to improve flood resiliency. Many of the Hazard Mitigation Plans in their region now include fluvial erosion hazards in their flood hazard planning and projects.

THE TOWN OF DEERFIELD 2014 MULTI-HAZARD MITIGATION PLAN



Prepared by:
The Deerfield Local Multi-Hazard Mitigation Planning Committee
Mark Gillmore, Emergency Management Director
Chester Yarzinski, Jr., Old Deerfield Fire Chief
Gary Stokarski, Jr., South Deerfield Fire Chief
William J. Swasey, South Deerfield Fire Chief
Michael Wozniakiewicz, Deerfield Police Chief
Harold Eaton, Jr., Highway Superintendent
Carolyn Ness, Board of Selectmen
Steve Barrett, Conservation Commission
Lynn Rose, Planning Board
Marti Barrett, Frontier Regional High School
and

The Franklin Regional Council of Governments
Peggy Sloan, Director of Planning & Development
Patricia A. Smith, Senior Land Use Planner
Gretchen Johnson, Planning Grant Administrator
Ryan Clary, GIS Specialist

This project was funded by a grant received from the Massachusetts Emergency Management Agency (MEMA)

In a few places, other governmental or non-profit organizations may fill the role of river-smart Regional Intermediary better than regional councils or counties, or may work in a complementary way. The Natural Resources Conservation Service is a federal agency with extensive outreach staff, and in many locations its staff are able to act, or have the potential to act, as river-smart Regional Intermediaries (see Example 20, Local Support and Partnerships, From Concept to Completion, at right). The White River Partnership, a nonprofit working in central-eastern Vermont, has played a particularly active and focused role helping municipalities and landowners in its watershed to become more river-smart, often by building extensive networks with federal, state, regional, local and non-profit organizations (see Example 21, The White River Partnership, p. 73). States may designate other organizations like these as river-smart Regional Intermediaries. These should, however, still be accountable to states' goals of providing municipalities with cost-effective assistance to become river-smart.

To ensure that Regional Intermediaries provide the needed services to help communities become river-smart, states and federal agencies should:

Hire and train staff whose job description includes providing assistance to towns to become more river-smart.

Train these staff in river science, fluvial hazard assessment, river-smart best management practices, river-smart planning, policy and economic tools to achieve river-smart land use and development, and evaluation of implemented programs, structures, zones, or practices. A statewide training program something like the Vermont Rivers and Roads training could be a good start (see Example 14, Vermont Rivers and Roads Program, p. 63).

Clarify the role and functions of river-smart Regional Intermediaries in relation to helping municipalities become river-smart. Suggested roles and functions include:

- Conduct or facilitate technical studies: fluvial hazard assessments, surveys, baseline studies, GIS analyses, initial designs, etc.

Example 20. Local Support and Partnerships, From Concept to Completion: Technical Assistance From the Natural Resources Conservation Service



Tropical Storm Irene Damage, West Branch Deerfield River, Readsboro Vermont. NRCS VT Engineering Staff coordinated with NRCS employees from around the country to form teams who performed damage survey reports throughout the state. In 2011, NRCS VT investigated 193 damaged sites and determined 153 of them eligible for the Emergency Watershed Program. (Photo from NRCS, Conserving Natural Resources in Vermont, January 2012).

Though a federal agency, the Natural Resources Conservation Service (NRCS) does a remarkably good job providing local-level assistance and support. Some of this support can be used for river flood mitigation and damage response. The NRCS is able to be effective at the local level because it has regional offices with staff who work hands-on in communities, and because it works closely with Conservation Districts, which are local units of government that promote voluntary conservation practices among farmers, ranchers and other land users. Often Conservation Districts are co-located with NRCS regional offices.

Partnerships among NRCS, Conservation Districts, regional, state and federal agencies, and nonprofit organizations help NRCS pool expertise, leverage funds and maintain close connections with landowners and municipalities. NRCS helps identify federal and state programs and resources that can work for towns and landowners, and helps them learn about conservation practices that can enhance property values, protect against floods, and satisfy federal and state program grant program requirements.

When floods occur, NRCS is often first on the scene, performing damage assessments that help the affected parties obtain eligibility for disaster reimbursement programs. NRCS continues to work with them throughout the recovery process, through project planning all the way to implementation.

- Facilitate river-smart municipal and multi-municipality planning, including transportation planning, flood hazard planning, emergency response planning, and economic development planning. In small towns, river-smart Regional Intermediaries may do much of the actual work conducting river-smart planning studies and preparing planning documents, though they must do this with close communication with town officials and landowners.
 - Help towns prepare grant applications and other paperwork for federal or state agencies.
 - Provide guidance to towns and cities on how to adapt to floodplain, stream crossing, and other river-smart regulations without undue burden; and in the development of easements, buy-outs and other voluntary approaches to land use change.
 - Train municipal staff, leaders, and volunteers – for example, in river science or best management practices.
 - Help evaluate river-smart structures, projects, economic development, etc. – from start to finish and beyond, to evaluation and maintenance.
 - Conduct or guide outreach among town residents and property owners; assist with public communications with residents, the media, and other audiences.
- Ensure that river-smart Regional Intermediaries have access to stable funding to keep core staff and programs over time.* There are several ways to provide more consistent funding, including:
- Structure federal and state grant programs to ensure wider funding for the work of river-smart

Example 21. The White River Partnership: A Nonprofit River-Smart Regional Intermediary Connects Communities to Their River and to Government Resources

The White River Partnership in Vermont is a watershed-based nonprofit organization that acts as a remarkably successful river-smart Regional Intermediary. Working closely with communities, landowners, state and federal agencies, it supports environmental, social and economic benefits of resilient lands, rivers and watersheds. Stakeholders across the watershed and beyond speak highly of the Partnership's ability to navigate the complex science and policy of river management while maintaining close ties to the residents of the watershed.

Strategies of the White River Partnership:

- **Studies and Mapping:** The White River Partnership has assisted or completed seven geomorphic assessments of the White River Watershed.
- **Outreach and Education:** After Tropical Storm Irene, WRP
- conducted many door-to-door visits. WRP works with over 600 teachers and students each year to monitor water quality, assist on restoration projects and bring kids out into the watershed
- **On-the-Ground Projects:** WRP has completed over 200 restoration projects, ranging from private land bank restoration to improving local river recreation access.
- **Supporting River-Resilient, People-Protective Land Use Change:** After Tropical Storm Irene, the White River Partnership facilitated outside federal agency assistance with flood recovery, helped raise federal funds to improve FEMA public assistance projects, and helped towns apply for FEMA buyout funds.
- **Networking:** The White River Partnership works with a host of



A White River Partnership restoration project at Hurricane Flats Farm, VT.

federal, state and regional agencies, as well as other nonprofits. Among these are the Green Mountain National Forest, the Vermont Agency of Natural Resources, the US Fish and Wildlife Service, and the Two Rivers-Ottawaquechee Regional Commission.

whiteriverpartnership.org/

Regional Intermediaries. Ensure that Regional Intermediaries count as eligible applicants; that their administrative, support, outreach and facilitation work can be funded; and that river-smart activities are funding priorities. Also, augment flood preparedness and response grants.

- Specify that transportation funding (which is often a relatively stable and ample source of funding for regional councils) can be used for river-smart planning, construction and training – e.g. roadway fluvial hazard assessments, better culvert and bridge design, transportation plans that keep infrastructure away from fluvial hazard zones, or fluvial hazard training for transportation crews.
- Encourage river-smart Regional Intermediaries to collect small, regular membership fees from

member towns that give it a small core of funding, flexibility, and a mandate to serve all the towns in their district. (see Example 22, Toward Stable Core Funding for River-Smart Regional Intermediaries, p. 74).

- Provide direct appropriations from state and federal governments for river-smart Regional Intermediaries. For example, the Massachusetts' District Local Technical Assistance program provides funding through the state budget for distribution among the state's 13 regional planning agencies for the purpose of providing technical assistance to member communities. This does not cover a large portion of the regional councils' budgets, but it gives them a small consistent funding source with which they can maintain core staff and offices. (see

Example 22. Toward Stable Core Funding for River-Smart Regional Intermediaries: Massachusetts Examples

One challenge for many regional councils, as well as for the states and municipalities they serve, is that their funding sources are unreliable and variable, coming as they do from grants and fees. Because much of the work of regional councils is funded by grants, many of their programs last only for a few years. Regional councils that depend on fees have a different problem: they may end up assisting disproportionately those municipalities that pay the largest amount in fees – often leaving the smaller, more remote communities with little help.

River-smart Regional Intermediaries with at least a small amount of stable funding can maintain a reliable, consistent office, a few core administrative and technical staff, and creative or important programs even when no other funding is available. They can also more reliably maintain service to small communities with few resources of their own – especially when their small but stable core funding comes with a mandate to serve those communities.

For example, the Franklin Regional Council of Governments in western Massachusetts (see Example 19) is able to fund 5% of its budget from membership fees. This supports some core staffing, as well as providing resources to projects that don't have other funding sources. It also makes the Franklin Regional Council of Governments accessible and accountable to every one of its members.

In Massachusetts the generic term for regional council is "regional planning agency." Every regional planning agency in Massachusetts has another reliable small pot of money. In 2006, the Massachusetts legislature recognized the important role of the thirteen regional planning agencies in assisting the Commonwealth's 351 cities and towns, and created a fund called the District Local Technical Assistance. The legislature has allocated a small but crucial amount of reliable state funding to this district local assistance fund every year since.

Currently, a total of \$2 million per year is distributed among the state's thirteen regional planning agencies so they can provide technical assistance to member communities. Most regional planning agencies receive \$150,000 base funding, with an additional (approximately) \$1 million divided among them according to population and number of towns in each region. The regional planning agencies use the money to provide member cities and towns with technical assistance in two key areas: sustainable development and preservation, and regional collaboration in service delivery or procurement. Both of these are consistent with helping municipalities become more river-smart, and the reliable state funding can help carry these programs over time, and even into remote rural areas.

Example 22, Toward Stable Core Funding for River-Smart Regional Intermediaries, p. 74).

RECOMMENDATION #5 ELEMENT B) USE RIVER-SMART REGIONAL INTERMEDIARIES TO GUIDE AND ASSIST WITH DELIVERY OF FLOOD ASSESSMENT, PLANNING, MITIGATION AND RESPONSE SERVICES TO LOCAL GOVERNMENTS AND LAND-OWNERS, AND TO GATHER AND UNDERSTAND INFORMATION ON LOCAL NEEDS AND CONDITIONS.

Federal and state agencies that do not have a presence in substate regional offices should coordinate with and through river-smart Regional Intermediaries in their outreach to municipalities.

Federal and state programs that aim to assist or guide local municipalities and property owners in becoming more river-smart should work with and through river-smart Regional Intermediaries as much as possible. They will be better attuned to local needs and capacities, more effective, and more efficient in terms of costs and personnel. This is true with a wide range of activities – educating towns about new regulations, training town staff with new skills, assisting towns with planning or river-smart economic development, getting feedback on new policies, facilitating inter-town discussions, promoting grant programs, etc.

Coordinating with and through river-smart Regional Intermediaries is especially important during and after river flood emergencies. At these times, federal and state agencies temporarily ramp up outreach and support to municipalities and local property owners – but to do so they necessarily bring in staff who have much less familiarity with local New England towns and environments. In this situation, it is essential that they build on the knowledge, skills and relationships of someone who has ongoing experience working with local communities. For example, when the Federal Emergency Management Agency sets up regional assistance centers after declared emergencies, outreach to communities would be much more effective and efficient, both for the federal agents and for local town officials, if they ask an effective river-smart Regional Intermediary to help guide and facilitate their work (see Example 18, River-smart Regional Intermediaries Fill the Gaps, p. 69).

Federal and state emergency responders should plan ahead to use river-smart Regional Intermediaries to deliver federal and state emergency response and post-emergency support. They should formalize expectations for this coordination and assistance as part of state emergency planning.

State emergency plans should include the role of river-smart Regional Intermediaries. This will enable states and collaborating federal agencies to clarify the role of river-smart Regional Intermediaries, and hammer out the details, with forethought. Particular functions, supported by modest funding, can be set up ahead of time through Memorandums of Understanding and Memorandums of Agreement. Technical requirements such as communication systems and networks can be acquired or built. Federal and state agencies should support these functions as needed with additional training and resources.

Some possible emergency tasks that could be assigned formally to river-smart Regional Intermediaries in state emergency plans include:

- Conduct initial emergency outreach and support to towns that have been cut off from transportation routes.
- Assess local roads, needs, priorities and input into databases. Prepare for a backup data gathering system in case databases break down or software becomes unusable.
- Serve as a communication conduit between federal agencies and local communities during and after emergencies.
- Accompany federal and state officials when they go out to local towns and properties, helping to orient them and explain their work to local residents.
- Keep track of different crews from different agencies that go out to communities, so that federal and state agency staff know who else has been to which communities, and what they have said and done. Act as a centralized clearinghouse of action and information in the local region.

- Conduct emergency environmental assessment, guidance and permitting, or support municipal officials to do so.
- Provide support to local emergency managers so that as they suddenly have to step up to large and wide sets of responsibilities, they are able to fulfill these functions confidently and successfully.

In addition to using Regional Intermediaries to deliver their programs, federal and state agencies should consult with river-smart Regional Intermediaries on an ongoing basis, to shape federal and state policies, programs and resources that aim to assist New England municipalities.

Federal and state agencies should consult with river-smart Regional Intermediaries to help inform and shape their programs and resources that are targeted to assist New England towns and cities. This is true even for many programs and resources that may not be conceived as related to river floods – for example, agricultural and forestry programs, which shape riverside land use; economic development programs, which need to avoid development in fluvial hazard zones and support development in river-smart locations; transportation programs, so transportation infrastructure is built to be resilient to river floods; and fish and wildlife programs, which should work to protect river habitat, and

support aquatic, riparian and floodplain species in ways that can accommodate and support natural river dynamics.

In all these cases, river-smart Regional Intermediaries will recognize the relation between these programs and community river flood resilience, and be able to help advise. Other agencies that have state-wide or federal expertise on river flood hazards will also will be essential. The crucial contribution of River-smart Regional Intermediaries will be to provide the intimate knowledge and experience of working with local communities and landowners that can guide state and federal programs, regulations and resources to become more efficient, effective with, and accessible to local communities.

Agencies should use feedback from Regional Intermediaries to revise, target, streamline and support these programs and resources so they are as effective and accessible as possible in helping New England communities become river-smart.

It may be that funding and working with a central state-wide coordinating office of Regional Intermediaries in each of the six states, like Vermont's Regional Coordination Center created after Tropical Storm Irene could be particularly effective for this purpose (see Example 18, River-smart Regional Intermediaries Fill the Gaps, p. 69).