

# Disaster Recovery and Long-Term Resilience Planning in Vermont

U.S. EPA Smart Growth Implementation Assistance Project

Policy Memo for the Mad River Valley

August 2013



*Credits: (Top) Richard Amore, Courtesy of the State of Vermont; (Bottom) Lars Gange & Mansfield Heliflight.*

*Caption (Clockwise from Top Left): Downtown Waitsfield, Vermont; Moretown Town Hall; Flood damage in Waitsfield, Vermont from Tropical Storm Irene.*

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## Background on the Project

The U.S. Environmental Protection Agency (EPA) Office of Sustainable Communities and the Federal Emergency Management Agency (FEMA) partnered to provide technical assistance to the state of Vermont and local communities in the Mad River Valley (MRV) through the EPA's Smart Growth Technical Assistance (SGIA) program. The SGIA program helps state, local, regional, and tribal governments that need tools, resources, and other assistance to achieve their growth- and development-related goals. The state of Vermont requested assistance after many communities across the state experienced damage from Tropical Storm Irene in 2011. The state was specifically interested in obtaining assistance so they could help communities throughout the state plan and prepare for future flooding events.

The goal of this assistance is to help communities incorporate smart growth and sustainable community approaches into their development plans, regulations, and hazard mitigation plans (HMPs) to increase their flood resilience. As used in this memo, "flood resilience" means measures taken to reduce the vulnerability of communities to damage from flooding and to support recovery after an extreme flood. "Smart growth" describes development patterns that create attractive, distinctive, and walkable communities that give people of varying age, wealth, and physical ability a range of safe, convenient choices in where they live and how they get around. Growing smart also means using existing resources efficiently and preserving the land, buildings, and environmental features that shape our neighborhoods, towns, and regions. Implementing smart growth approaches to development can help communities become more resilient to future flooding events by locating development in safer locations and designing development so it is less likely to be damaged during flooding events.

To provide assistance, EPA hired consultants to review local development regulations, community plans, and HMPs for two communities in the MRV—Waitsfield and Moretown. In October 2012, the consultant team completed an initial review of relevant local and state studies, plans, development regulations, and documents; conducted a series of interviews with state and local officials and organizations; and participated in a site visit and community meeting in the MRV to receive community feedback on an initial list of policy, strategy, and regulatory options. The consultants then refined a menu of policy options that Waitsfield and Moretown officials, and officials from communities throughout the state, can consider as they update and strengthen their policies and strategies to improve flood resilience.



*Credits: Lars Gange & Mansfield Heliflight (left), Jeff Knight, The Valley Reporter (right).*

*Caption: Images of the flood damage in the Mad River Valley from Tropical Storm Irene: a damaged home along Vermont Route 100 between Middlesex and Waitsfield (left) and a damaged building in Waitsfield (right).*

This work is being coordinated with a parallel project funded by FEMA. FEMA hired a consultant team from the University of North Carolina at Chapel Hill's Department of Homeland Security Coastal Hazards Center of Excellence (CHC). The CHC team conducted an analysis of barriers to flood disaster response and recovery at the state level, including the degree to which state programs and policies support or hinder local governments' ability to incorporate smart growth approaches and flood resilience measures into their planning at the local and regional levels.

## Purpose of the Document

The impetus for this project was the widespread flood-related damage that Vermont, and the MRV in particular, sustained in the wake of Tropical Storm Irene (Irene) in 2011. Damage estimates to roads, homes, and crops ran into the millions of dollars.<sup>1</sup> Although Irene caused tremendous damage, losses from flooding have recurred decade after decade in the MRV, underscoring the need for improved hazard mitigation and comprehensive planning at the state and local levels.

Fortunately, the MRV has already begun to revamp its hazard resilience policies and strategies and has a solid foundation upon which to make changes. For example, MRV communities have access to critical flood-related fluvial erosion data, thanks to organizations like the Vermont Agency of Natural Resources (ANR), Central Vermont Regional Planning Commission (CVRPC), and the Friends of the Mad River (FOMR). Moreover, Waitsfield has recently completed a town plan and is poised to undertake implementation actions related to flood resilience. Similarly, Moretown is beginning a major update of its town plan, thus creating the opportunity to incorporate hazard resilience planning and smart growth practices. Both communities have zoning regulations that include important hazard resilience elements such as specialized flood hazard area overlay districts with protective regulations. However, there are significant opportunities for both communities and other MRV towns to continue to improve their flood resilience by strengthening their policies, plans, development regulations, and technical capacity.

This memo is intended to outline the assessment process the consultant team took to review Waitsfield and Moretown's policies and regulations and to describe a menu of policy options that the MRV towns can consider as they seek to enhance their flood resilience in the future.

## Overview of the Assessment Process

The consultant team used the following assessment approach in order to review Waitsfield and Moretown's development regulations, community plans, and HMPs. This process is outlined in more detail below.

1. Initial discussions with state, regional, and local officials to identify key issues and documents for review.

The consultant team held a series of conference calls with officials from the State of Vermont, regional planning organizations, and local governments to identify: 1) major flood hazard issues in the MRV; 2) key documents to be reviewed relating to flood resiliency (such as zoning codes, regional land use plans, and local HMPs); and 3) current development trends in the MRV. Project staff provided a comprehensive list of relevant documents (Internet links to those documents or hard copies) for review by the consultant team. The team also reviewed data on flood damage in the MRV, studies relating to the Mad River and stormwater, and demographics of the MRV.

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<sup>1</sup> In the MRV, 1,300 acres of crops were destroyed. According to the Mad River Valley Planning District, damage to roads and bridges in Vermont exceeded \$170 million. FEMA and the U.S. Small Business Administration provided more than \$36 million in federal disaster assistance.

2. Review of key documents and initial plan/code assessment from a flood resilience perspective.

Based on discussions with state, regional, and local officials, the consultant team undertook a thorough review of relevant documents from the perspective of flood resilience. This assessment was broken down into four geographically-oriented categories of options typically available to communities to enhance flood resilience in the future:

- a. **River Corridors<sup>ii</sup>**: Conserve land and avoid development in particularly vulnerable areas such as floodplains and river corridors;
- b. **Vulnerable Settlements**: Where development already exists in vulnerable areas, protect people, buildings, and facilities to reduce future flooding risk;
- c. **Safer Areas**: Plan for and encourage new development in areas that are less vulnerable to future flooding events; and
- d. **Upland and Everywhere**: Implement stormwater management techniques to slow, spread, and sink floodwater.

The key documents for review included town plans and local HMPs, local zoning and subdivision regulations (including floodplain development standards), and regional plans. Typically, the consultant team would have also reviewed local building codes, but MRV towns do not have free-standing building codes. Some building code-type regulations are incorporated in the local zoning and subdivision regulations. Additionally, some jurisdictions have stand-alone stormwater management ordinances that can contribute to local flood hazard mitigation. Neither Waitsfield nor Moretown has comprehensive stormwater management ordinances, although stormwater management is addressed in some sections of the towns' zoning and subdivision regulations.

For each of the four categories, the team looked for specific policies, regulations, or non-regulatory approaches that have been employed successfully in other jurisdictions. For example, in the first category (River Corridors: Conserve land and avoid development in particularly vulnerable areas such as floodplains and river corridors), the team assessed whether local zoning regulations addressed development on steep slopes or included stream buffer standards. In the second category (Vulnerable Settlements: Where development already exists in vulnerable areas, protect people, buildings, and facilities to reduce future flooding risk), the team searched for policies in HMPs that address relocation of vulnerable structures. The team assessed each document in detail, section-by-section. A full list of key areas the team explored is discussed in the sections of this policy memo below.

3. Initial plan and code assessment results.

Based on the analysis and review described above, the team prepared a detailed assessment in PowerPoint format that identified a range of policy options and implementation tools (both regulatory and non-regulatory) that the two MRV towns might consider to improve their flood resilience. These initial policy options were distributed to state, regional, and local officials prior to an in-person visit to the MRV as summarized below.

4. Site visit to the Mad River Valley.

The consultant team, accompanied by federal and state officials, made a two-day trip to the MRV to assess conditions on the ground, view the extent of prior flood damage, and present the results of the initial policy/code assessment to local officials. The team also met with town officials in

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<sup>ii</sup> For the purposes of this project, "River Corridors" are areas of land that include the river channel and adjacent lands needed for the river to adjust laterally over time and still maintain its natural stable form.

Waitsfield and Moretown (e.g., zoning administrator, town manager, local elected officials) as well as representatives from regional planning and non-profit organizations to discuss the policy options and receive feedback. The site visit also included a community stakeholder meeting that provided an opportunity to present the policy options to stakeholders from the MRV and receive feedback on those ideas.

#### 5. Draft policy options.

Based on the initial assessment and feedback from the site visit, the consultant team prepared a draft memo outlining revised policy and regulatory options to improve flood resilience in the MRV. The consultant team also developed a checklist that communities can use to assess resilience and identify actions to strengthen their plans and policies. Completed draft checklists for Waitsfield and Moretown can be found at the end of this Policy Memo. These checklists are intended to help these two towns start the process of self-assessment and should be reviewed for accuracy and completeness.

### Context of Waitsfield and Moretown

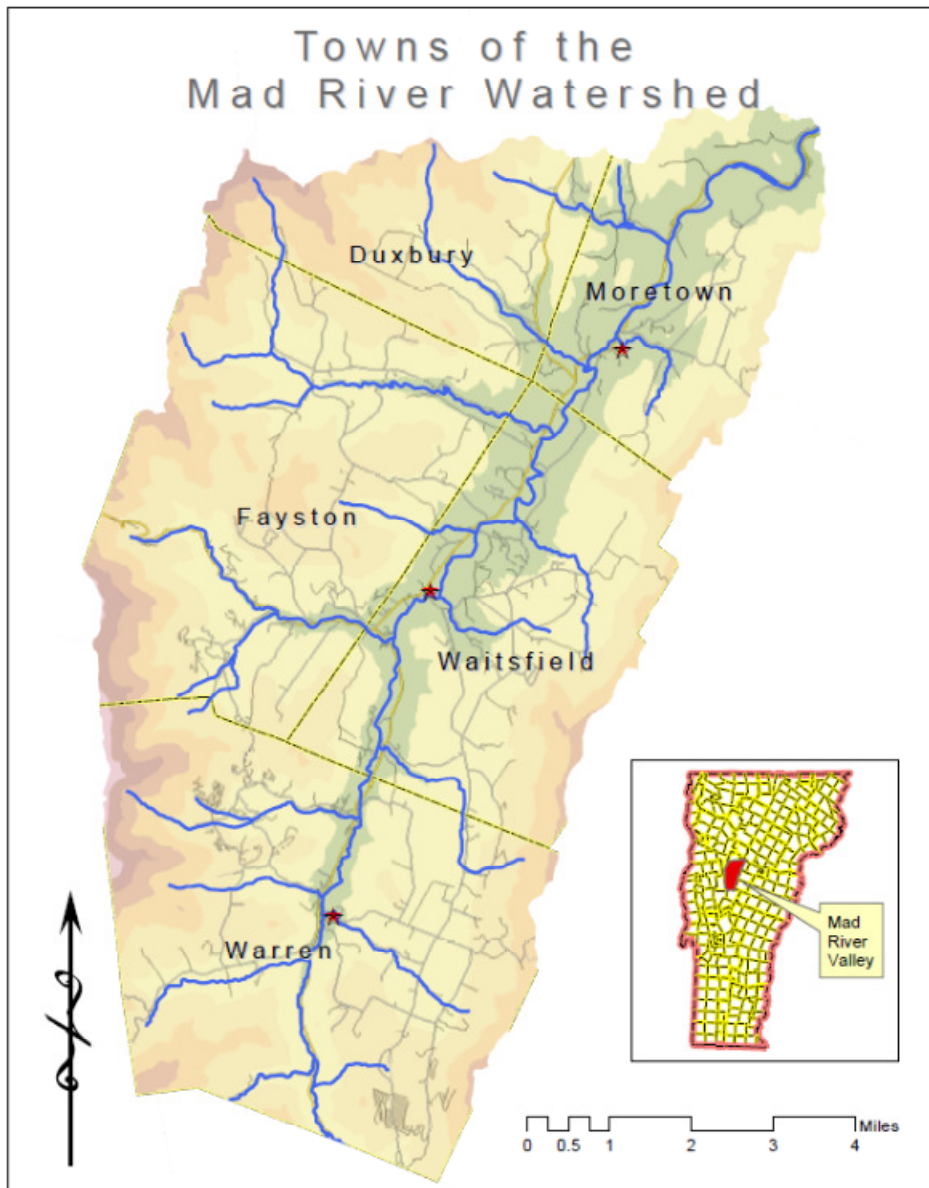
In many respects, Waitsfield and Moretown are typical of many smaller communities in Vermont. They have compact, historic village centers located adjacent to a river (in this case, the Mad River) in high flood hazard areas. Because there is very limited county government in Vermont, towns have land use planning and regulatory authority over the surrounding large tracts of forests and open space. For example, Waitsfield is 73% forested and 17% agriculture/open space.

Although both Moretown and Waitsfield have grown faster than the state of Vermont as a whole over the past two decades, their growth rates have been less than one percent annually—a very modest pace. Located at the northern end of the valley away from the area's ski resorts, Moretown has had little population growth or second-home development over the past two decades. Although Waitsfield has had little actual year-round population growth, it has experienced more second-home and commercial development attributable in part to the nearby ski resorts. Its recent residential development has primarily occurred in the more rural areas of the town on one-to-five acre lots and often on steep slopes outside the historic villages. Most new commercial development has occurred in the town-designated Irasville growth area just south of the historic downtown, which has become the retail center of the MRV with two grocery stores and supporting shops. Only one-third of Moretown is located in the Mad River watershed, and the town has little commercial development outside its historic downtown. Moretown has witnessed some development in its more rural reaches on larger lots. Both towns rely on groundwater for domestic supply and largely on-site septic for waste treatment, although Waitsfield is currently constructing a municipal water system for approximately 150 parcels in Irasville and Waitsfield Village and is pursuing a wastewater system for the same area.

Being adjacent to the Mad River, both Waitsfield and Moretown's historic downtowns experienced heavy flooding when Irene swept through the region. Such extreme flooding has occurred repeatedly over the past century. According to the FOMR and ANR, most flood damage in the towns, the region, and in Vermont is the result of erosion rather than inundation. In Vermont, two-thirds of flood damages occur outside of mapped floodplains and flood areas, compared to only one-third of flood damages nationally, indicating that erosion, rather than inundation, causes the majority of damage in the state.<sup>1</sup> Significant work has been done in the MRV to map the most significant erosion hazards, and both communities have adopted special zoning to limit development in such areas.

Waitsfield and Moretown both have small municipal staffs with multiple responsibilities. In our interviews and meetings, local officials frequently mentioned limited local capacity regarding financing

and staff resources. MRV towns, however, are fortunate to have three organizations that provide professional expertise and manage data useful for planning purposes. They include the Mad River Valley Planning District (MRVPD), the FOMR, and the CVRPC. The Executive Director of the MRVPD, who assists three MRV towns (Waitsfield, Fayston, and Warren, but not Moretown) in their planning-related activities, has valuable hands-on experience as a planning and zoning administrator in Vermont. The FOMR brings extensive environmental planning expertise to the table, has completed a number of flood-related studies, and works closely with the Vermont Land Trust to protect open space in the MRV. The CVRPC has an extensive GIS database and has completed several major planning reports for the MRV. In developing the policy options outlined in this memo, the consultant team took into consideration the capacity and expertise of the local town staff, recognizing that staff have multiple, competing priorities and that any policy options must be realistic and pragmatic.



*Credit: Mad River Watershed Conservation Partnership.*

*Caption: This project focused on two of the five communities in the Mad River Valley of Vermont – Waitsfield and Moretown.*



## Overall Strategies to Enhance Resilience in the Mad River Valley

This section outlines a set of policies and priority actions that all Mad River Valley communities could consider to improve their resilience to flooding. It is followed by specific suggestions for Waitsfield and Moretown to consider and a draft resilience checklist for each of the two communities.

### **1. Update hazard mitigation plans (HMPs) and coordinate these plans with town plans and capital improvement plans.**

Each jurisdiction in the MRV could make sure its HMP has been updated to reflect experience with the flooding associated with Irene in 2011. All towns could consider adding elements to their HMPs related to pre-disaster mitigation beyond focusing on structural repairs and solutions. Examples of such elements include improved stormwater management and controls on development in floodplains. Town zoning and planning staff could be involved in these HMP updates to ensure the plans are coordinated with town plans and capital improvement plans in terms of implementation actions such as regulatory amendments and priority capital improvement projects. The towns could also consider amending their HMPs to identify specific projects they would like to implement and they could develop pre-disaster grant applications in anticipation of future funding. HMPs could also explicitly discuss land use tools that can be used to guide future development away from known flood hazard areas.

While all MRV communities can begin to enhance their flood resilience by ensuring their HMPs, town plans, and capital improvement plans are coordinated, there are some specific next steps that Waitsfield and Moretown could consider.

The recently-completed Waitsfield town plan addresses hazard resilience in several sections related to transportation and environmental resources, but it does not contain a comprehensive section on this critical topic. The town's pre-disaster HMP was initially drafted in 2005, and by 2010 some of the action items—such as adding a flood hazard area overlay district to the zoning regulations and stabilizing eroding banks—had been completed, but many had not. Moreover, the HMP contains no cross references to the town plan. Waitsfield could consider adding a supplementary section to its town plan addressing natural hazards and could update its HMP to focus more on non-structural pre-disaster mitigation measures such as upgrades to its local zoning regulations as discussed in more detail below. Neither the town plan nor the HMP (which focuses heavily on structural improvements such as flood proofing buildings and engineering solutions such as floodwalls) appear to be coordinated with the town's capital improvement plan. While the town maintains and updates its capital budget program on an annual basis, it could be better coordinated with the town plan and HMP. This could provide decision-makers with information about specific infrastructure that will need to be in place to foster safe rebuilding and to accommodate future growth in safe areas. Waitsfield could also situate new or reconstructed roads outside of river corridors, when possible, to avoid conflicts with river dynamics.

Similarly, the Moretown HMP focuses primarily on rebuilding or replacing damaged facilities, not on pre-disaster planning or mitigation and avoidance. Moretown is just beginning a rewrite of its 2008 town plan and thus has an opportunity to incorporate hazard mitigation projects (capital and non-capital) identified in its HMP into the updated town plan as well as into the town's annual capital budget.

While each town's HMP makes mention of critical facilities that need protecting, neither has defined what they consider to be a critical facility. Critical facilities are those that are essential for the towns to recover quickly after a flood. If new critical facilities are planned for the future, the towns could consider locating them outside the 100-year flood hazard zone and mapped fluvial erosion hazard



areas. Waitsfield's zoning regulations include a definition of Critical Public Facility and prohibit new facilities within the area of the 0.2% annual chance flood hazard. This standard complements Federal Executive Order 11988,<sup>2</sup> barring federal capital funding for critical facilities within the extent of that risk area.

The Mad River Valley Erosion Study<sup>3</sup> (completed in May 2012 for the FOMR) and the River Corridor plans provide a solid foundation for understanding and documenting erosion in the Mad River Valley and a wealth of information that could be used by the towns when they update their HMPs. The Erosion Study includes a constraints analysis conducted by the CVRPC using ArcView GIS. Using GIS allows for the overlay of fluvial erosion areas, Flood Insurance Rate Maps (FIRMs), steep slope areas, stream buffers, wetlands, farmland, downtown corridors, and other features. The aggregation of all layers can help inform towns where development could be sited based on smart growth and resilience principles. This information could also potentially be used to integrate siting criteria or incentives into the town's land use regulations to help shift development to safe areas. This is particularly important in terms of critical public facilities. For example, the Erosion Study helped identify areas of the road network that are susceptible to erosion and sedimentation. Having this information will allow local road crews to target road segments subject to erosion and take steps to prevent reoccurrences. It will be important to use this information in conjunction with available River Corridor and Fluvial Erosion Hazard maps. Geomorphic assessments and fluvial erosion hazard corridor delineations have not yet been completed for Moretown, but should they become available in the future, they could be used to inform a similar process.

Effective HMPs also require involvement of a broad cross-section of the community. Waitsfield's HMP development process involved a variety of people including municipal officials such as the emergency management coordinator and local citizens. The makeup of this HMP committee could be expanded to reflect additional stakeholders including those that represent farmland preservation, tourism, agricultural interests, and environmentalists. Reportedly, Moretown had very limited participation in its HMP development, with only the Select Board administrative assistant, planning commission chair, and a representative of the CVRPC involved. Both Waitsfield and Moretown could include representation from local school district(s), the medical community, American Red Cross, agencies responsible for transportation facilities, the agricultural community, and others, in future HMP updates.

## **2. Conduct thorough regulatory audits (including the resilience checklist).**

An important implementation action for each community will be to undertake a thorough assessment of their zoning, subdivision, and stormwater management regulations in light of key goals and policies contained in their town plans and HMPs. These kinds of analyses are typically called capability assessments in HMPs. Waitsfield has a good start in this effort with the detailed implementation section of its recently adopted town plan that identifies a host of potential regulatory amendments in general terms that are necessary to achieve key goals. Key provisions to assess include flood hazard/floodplain districts, steep slope standards, stream and wetland buffer requirements, and stormwater-related regulations. The partially-completed checklists included in Appendix A (for Waitsfield) and Appendix B (Moretown) can provide a starting point for this audit. Other scorecards and checklists, such as the Vermont Natural Resources Council's *Resilient Communities Scorecard*, may also help Waitsfield, Moretown, and other Vermont communities assess their resilience in key areas including transportation, energy, housing, land use, and healthy community design.<sup>4</sup>

**3. Address the management and regulation of roads and driveways.**

Roads and driveways are usually comprised of impervious surfaces that don't allow stormwater to sink back into the ground. The towns could consider a variety of ways to reduce the potential risk that existing and new roads and driveways will exacerbate flooding and degrade water quality. The Vermont Agency of Transportation (VTTrans), along with ANR, developed minimum town road and bridge standards ("codes and standards"), and they incentivize towns to adopt these by reducing the local funding match required for certain transportation grant programs.<sup>5</sup> These codes and standards have three main purposes: 1) they serve as the codes and standards that FEMA considers in its funding decisions concerning to what extent it will pay for rebuilding to a larger size a road, bridge, or culvert damaged in a storm; 2) they reduce runoff and improve water quality; and 3) they improve safety. Towns could also require adequate culvert sizing on private roads and manage town roads to a level that protects roads from damage during flooding. Improved management also keeps more roads in use despite flooding.

**4. Explore valley-wide stormwater management.**

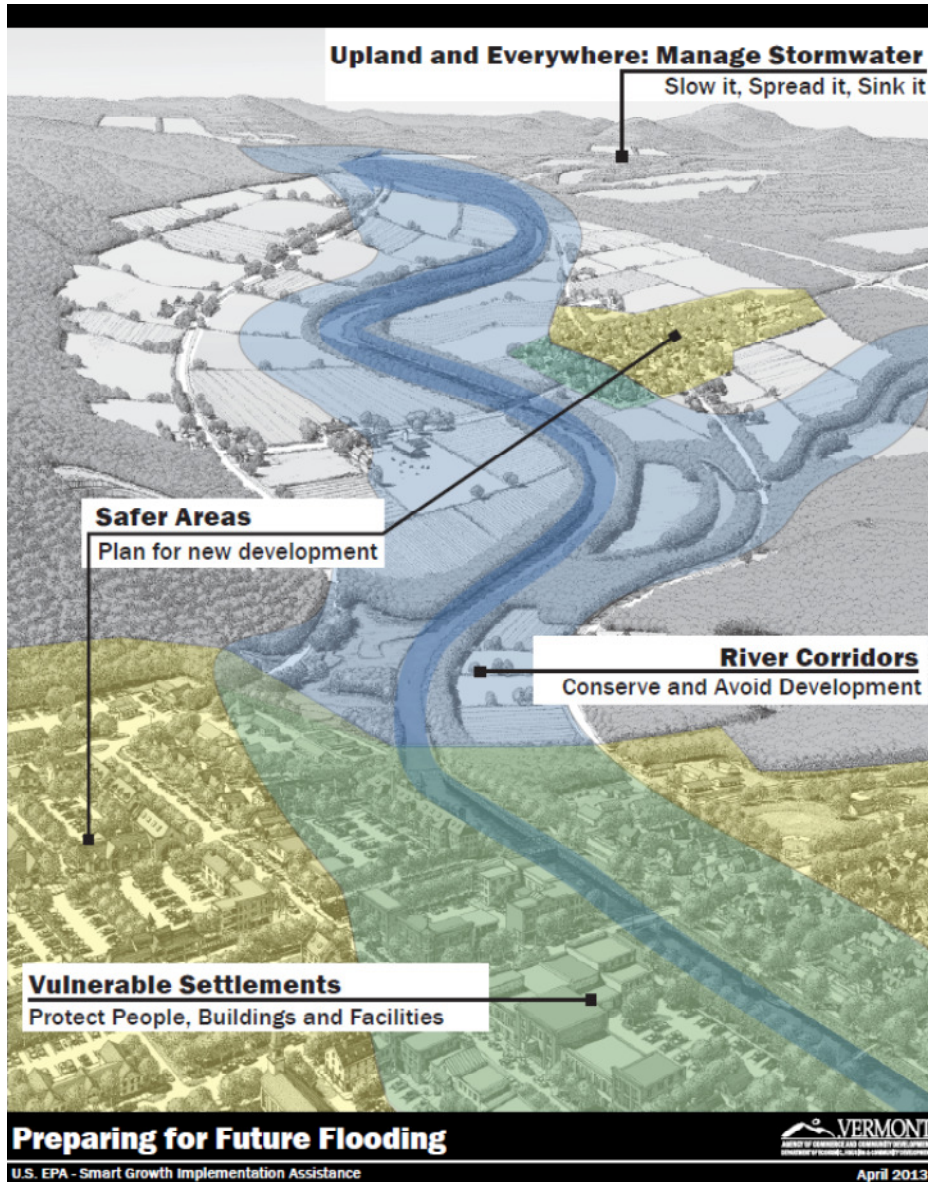
There was widespread recognition at the community stakeholder meeting that towns in the valley could partner together to take steps to address stormwater runoff, particularly from upslope development of less than one acre of impervious surface, which is largely unregulated. Based on anecdotal evidence and comments from interviewees, the lack of stormwater management for smaller developments (which comprise most of the growth in the valley) is contributing significantly to increased erosion and flood damage, although more study and documentation is clearly needed. Several stakeholders who participated in the community meeting commented that MRV communities could jointly explore formation of a stormwater utility that could oversee stormwater management regulation and help prioritize, coordinate, and finance critical pre-disaster mitigation efforts. As a first step towards formation of a utility, a valley-wide Stormwater Management Task Force could be established. The MRVDP might serve as the organization to lead and staff this exploratory effort, given its established expertise and extensive hands-on experience in the MRV, although additional staff and/or financial capacity might be needed. The two communities that are not served by the MRVDP (Duxbury and Moretown) could be brought into the discussion. A recent EPA publication, *Funding Stormwater Programs*,<sup>6</sup> provides information on stormwater utilities and other ways to finance stormwater management programs. The report includes case studies from South Burlington, Vermont, and Newton, Massachusetts. As was mentioned by several stakeholders at the community meeting, sound river science and watershed modeling is needed to develop a stormwater master plan for the MRV in order to understand more clearly what actions need to be taken to absorb or slow down the stormwater that feeds runoff into the Mad River.

**5. Pursue cooperation with the agricultural community regarding pre-disaster mitigation measures.**

Keeping floodplains in agricultural use helps to reduce flood losses due to the capacity of farm land to absorb runoff and store flood waters, as compared to areas of residential and other development. As is true in many states, agriculture-related development and land management practices are largely exempt from local regulation. In the Mad River Valley, some farmers have maintained vegetative buffers and undertaken flood-damage preventive measures (such as storing large hay bales out of the floodplain since they caused extensive damage during Irene). Efforts are already underway by the FOMR, the Winooski Conservation District, and the MRVDP to work with the agricultural community to reduce flood damage. The towns could support these efforts, and if a valley-wide stormwater utility is pursued, consider providing funding for purchase of conservation easements and provision of other incentives to local farmers.

**Land Use Policy Options to Improve Flood Resilience in Waitsfield and Moretown**

The section below outlines several policy options that Waitsfield and Moretown can consider implementing to increase flood resilience in the future. They can choose which options fit their community context and can tailor the policies to fit their needs. The policy options within these categories offer multiple and interrelated benefits. For example, directing development out of floodplains not only keeps people and property safe, it also protects the ability of floodplains to hold and slow down floodwaters before they reach downstream settlements.



Credit: State of Vermont.

Caption: This graphic illustrates the four categories of policy options to enhance resilience to future flooding events: River Corridors, Safer Areas, Vulnerable Settlements, and Upland and Everywhere.

**A. River Corridors:** Conserve land and avoid development in particularly vulnerable areas such as floodplains and river corridors.

Conserving land and avoiding development in particularly vulnerable areas, including floodplains and river corridors, could help Waitsfield and Moretown become more resilient by enabling that land to accommodate water during flooding events. Avoiding development in these areas can reduce the risk that homes, businesses, and critical infrastructure will be damaged in such flooding events. Several policies can help conserve land and avoid development in particularly flood-prone locations.

**1. Acquire or protect land in flood-prone locations and remove vulnerable structures.**

To accommodate water during flooding events and reduce the risk that critical infrastructure will be damaged, communities can acquire or protect land in flood-prone locations. The Vermont Planning Information Center has information on open space and resource protection programs that may be helpful.<sup>7</sup>

Locally, this approach is identified in the Upper Mad River Corridor Plan. Strategies can include buyouts of structures that are repeatedly flooded and purchase of conservation easements on undeveloped flood-prone lands to prevent future growth there. For example, the town of Warren purchased two properties that were flooded several times, demolished the structures, and turned the area into Riverside Park. During Irene, this land again flooded, but with no structural damage to buildings. Similarly, the Vermont Land Trust and other organizations have reportedly purchased in fee or conservation easements on 345 acres or 15% of the floodplain in the MRV.<sup>8</sup> Waitsfield and Moretown could identify structures and properties that have been repeatedly flooded and damaged as candidates for buy-out when funds are available. Communities are likely to need funding assistance (e.g., from FEMA) for a variety of resilience measures. When flooding occurs again in the future, it will be important for communities to document flood damage so they can demonstrate previous damage and meet

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### **River Corridors or Fluvial Erosion Hazard (FEH) Corridors**

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*Most flood damage in Vermont is the result of erosion rather than inundation. Seventy-five percent of Vermont's rivers have been found to be unstable as a result of land use and practices to try to contain and direct their flow. Most of these reaches of river lack access to floodplains with the expected, natural frequency of rainstorms. River corridors (also called Fluvial Erosion Hazard, or FEH, areas) define the area that rivers need to move within, so that they can regain natural stability over time, and become less prone to severe flooding. Most Vermont municipalities regulate land use in floodplains based on minimum standards necessary to obtain national flood insurance through the National Flood Insurance Program. These standards are designed to protect insured structures from losses from inundation, but don't necessarily address erosion that is so common in Vermont.*

*River corridors include the river channel and adjacent lands needed for the river to adjust laterally over time and still maintain its natural stable form. Buildings and infrastructure constructed within the river corridor can be particularly vulnerable to fluvial erosion hazards, and new encroachments can increase the hazards confronting existing development. Therefore, communities may wish to consider limiting new development in these areas. River corridor maps are being produced in Vermont based on geomorphic studies, following an assessment protocol established by the ANR Rivers Program. Because it is not practical to conduct detailed geomorphic studies on all perennial streams in order to generate river corridor data, the ANR Rivers Program uses watershed size and valley slope as criteria to recommend specific streams for river corridor mapping and others (smaller, steeper streams) for simple development setbacks.*

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requirements for the Hazard Mitigation Grant Program (HMGP).

Additionally, the towns could work with the FOMR and Vermont Land Trust to identify undeveloped parcels that are important for flood storage and might be considered for acquisition. The FOMR, Vermont Land Trust, and other organizations may be able to partner with the towns to set priorities for acquiring or purchasing conservation easements for properties that will provide the greatest flood resilience benefits.

## **2. *Adopt River Corridor/Fluvial Erosion Hazard Zoning.***

While both the Waitsfield and Moretown zoning regulations and other development standards contain flood and FEH area overlay districts and stream and wetland buffer standards, there are a number of additional steps that both towns could take. For example, prohibiting new development in mapped river corridors and special flood hazard areas may help enhance flood resilience. Many Vermont communities, including Moretown, do not yet have River Corridor/FEH maps and therefore do not have a regulatory zone specific to fluvial erosion. Instead, they use the minimum National Flood Insurance Program (NFIP) requirements, which allow new structures, fill, and other uses in the floodplain, as long as the development meets minimum protective standards (e.g., residential structures are elevated).

Because the floodplains defined by FEMA and the NFIP do not adequately address all flood hazards, especially in Vermont's steep terrain, where flooding from fluvial erosion can be as damaging as flooding from inundation, the state recommends that municipalities conduct river corridor assessments and use that data to adopt River Corridor/Fluvial Erosion Hazard zoning. In the Mad River Valley, river corridor data has been collected for portions of the Mad River, as well as some stretches of tributaries in Warren. Waitsfield and Moretown could pursue complete river corridor mapping on all recommended streams and subsequently update/adopt more comprehensive fluvial erosion hazard/river corridor zoning.

Waitsfield has some River Corridor/FEH maps and uses them as an overlay district with limitations on new development within that district. Certain activities are allowed with conditional use review. In the FEMA-mapped inundation floodplain, Waitsfield already prohibits new critical facilities development within the mapped 1% and 0.2% annual chance floodplains (also known by the somewhat misleading names of 100-year and 500-year floodplains). Waitsfield also prohibits new principal residential and nonresidential structures, including new manufactured (mobile) homes (except as allowed in the Village Business and Village Residential Districts) in the 1% annual chance floodplain. Waitsfield prohibits new fill except to elevate existing structures and basements, and new structures are prohibited in the floodway. In other words, standards in Waitsfield are higher than minimum already, except for in the Village districts.

Moretown could consider prohibiting all new development in river corridors and special flood hazard areas, except possibly in cases where already subdivided lots are wholly within the floodplain and may have vested development rights and also are located in compact settlements where river channels are being managed to protect existing development. In such instances, development might be allowed but subject to enhanced elevation requirements (e.g., two feet above the base flood elevation) and additional floodproofing and safety standards. However, it is important to note that enhanced elevation requirements may not reduce flood risk entirely, since elevated structures located in a river corridor can impair floodplain function, thereby exposing the elevated structure to damage and increasing the velocity of floodwaters downstream. Where development is proposed in the river corridor, compensatory flood storage could be required to offset impacts on existing structures and public safety.

### **3. *Adopt agricultural or preserve zoning.***

Much of the new development in the MRV has taken place in upland areas with steep slopes. This development has likely contributed to growing stormwater volumes in the Mad River. In both towns, most of these areas are currently zoned agricultural (1 unit/acre) or preserve (1 unit/5 acres). This density may inadvertently lead to spread-out, large lot development which may fail to protect agricultural lands and open space and prevent effective absorption of stormwater runoff. Both towns could consider changing their agricultural zoning to require a minimum lot size of 20 acres or more, and including new residential development only as a conditional use. Importantly, the recently adopted Waitsfield town plan recommends a maximum residential development density of 1 unit/25 acres in its land use policies, at least for the Forest Reserve District (Chapter 12). This density level could be extended to other districts/areas to ensure that agricultural land or other important open space is conserved. The Meadowland Overlay District from the Town of Warren provides an example of standards for sensitive siting of houses to protect agricultural meadowlands and scenic locations.<sup>9</sup> The Vermont Planning Information Center has information on open space and resource protection regulations that may be helpful.<sup>10</sup>

**B. Vulnerable Settlements:** Where development already exists in vulnerable areas, protect people, buildings and facilities to reduce future flooding risk.

Because both Moretown and Waitsfield have historic downtowns in the Mad River floodplain that largely define their attractive character, it is likely that many damaged structures will be repaired and rebuilt in the future as they were after Irene and other major floods. If the towns choose to rebuild in areas that are susceptible to future flooding, they can take some steps to reduce the damage that may occur in future flooding events, although they cannot eliminate these risks entirely.

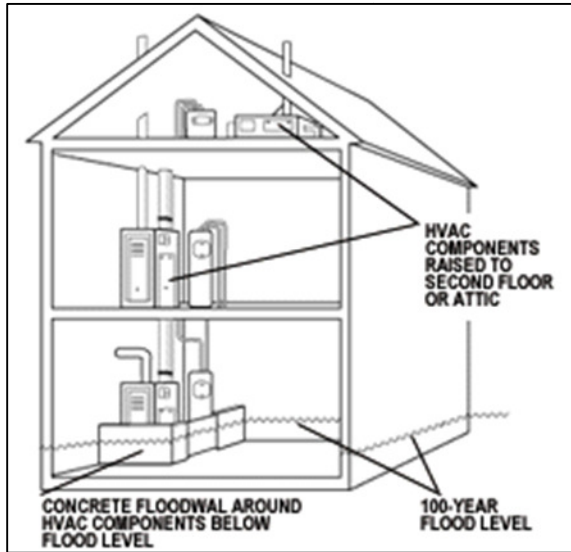
#### **1. *Upgrade zoning regulations to address protection of structures that are rebuilt after flood damage.***

Both Waitsfield and Moretown regulate floodplain development through special flood hazard area overlay districts and associated development standards. In Waitsfield, the basic governing standard requires the lowest floor of any existing structure to be elevated at least one foot above the base flood elevation. Moretown zoning regulations allow construction at the base flood elevation subject to other flood-proofing requirements. The towns could consider increasing this requirement for structures being rebuilt in a floodplain to a minimum of two feet to provide an extra margin of safety as is being done in an increasing number of communities that have experienced repeated flood damage. However, as noted above, towns should be cautious about higher elevation standards, which may still not be safe in dynamic flood hazard areas. Instead, new development in the floodplain could be banned as discussed in the preceding section. Moreover, Waitsfield could consider banning development in the floodway (it is now allowed if a registered professional engineer certifies it as being safe).

#### **2. *Upgrade or adopt building code-like standards in zoning regulations.***

The state of Vermont administers statewide building code standards for commercial development, but not for residential development. Moreover, local governments in the Mad River Valley do not have building codes for residential development. Both towns have NFIP minimum standards in their zoning regulations for new construction or rebuilding in floodplains (e.g., a requirement to use flood-resistant materials and to locate HVAC equipment in less flood-prone areas to avoid future water damage). Both towns could consider adopting more specific building code requirements in their zoning regulations for structures being built or reconstructed in floodplains—for example, the

American Society of Civil Engineers (ASCE) Flood Resistant Design and Construction Standards 24-05.<sup>11,12</sup> As discussed above, the risk of rebuilding some areas may be too great, even if structures were to be elevated. Communities may want to consider adopting cumulative substantial damage regulations that would require damaged structures to be elevated or relocated, once damages exceed 50% of a structure's value. In addition, municipalities are enabled to adopt housing codes under 24 V.S.A. Chapter 123.<sup>13</sup>



Credit: Federal Emergency Management Agency.

Caption: This diagram illustrates how HVAC equipment can be raised or floodproofed in buildings located in areas at high risk of flooding.

### **3. Create new flood storage capacity through redevelopment.**

When redevelopment opportunities arise in vulnerable areas next to rivers, communities can design redevelopment to include additional flood storage capacity. New flood storage capacity could mean creating parks and other open spaces in vulnerable locations, replacing a vertical wall along a riverbank with a more gradual slope to create more room in the river channel for rising water, creating a shallow depression in a lawn that can accommodate inundation, or redesigning buildings to enable the first floor or basement to flood rather than armoring the buildings to repel rising waters. Both Waitsfield and Moretown could consider creating new flood storage capacity in any redevelopment that occurs in vulnerable locations.

### **4. Orient buildings and activities towards the river.**

Development in many historic, riverfront towns and villages often faces away from the river. Except for at bridge crossings, community members may rarely see or consider the river as a part of community life—until a flood arrives. A river can be a social and economic asset if community members can safely access and interact with the riverfront. Opportunities to see and engage with the river could help communities plan for future flooding by increasing community members' consciousness of the river's presence. When redevelopment takes place in vulnerable settlements, communities can consider creating parks, outdoor dining and vending, river-based recreation like fishing and kayaking, and other activities that can withstand flooding and bring people closer to the river during normal flows. Both Waitsfield and Moretown could consider these approaches to reconnect their downtowns to the river in a way that can accommodate periodic flooding.

## **5. Relocate people and assets to less vulnerable areas.**

As certain structures are flooded time and again, some communities may evaluate the option of relocating them to safer areas. While relocating people and assets can be very expensive and politically challenging, there are some advantages to doing so. When considering relocating assets and people, it is particularly important to ensure that critical facilities such as healthcare facilities, town halls, fire and safety facilities, and wastewater facilities are moved to less vulnerable locations if possible. Both Waitsfield and Moretown can consider new locations for critical infrastructure that may be safer in the future. During the site visit, Moretown officials noted that important records in the Town Hall were damaged during Irene. Moretown may wish to investigate alternative locations for storing valuable records in locations that are not as susceptible to future flooding risk.

**C. Safer Areas:** Plan for and encourage new development in areas that are less vulnerable to future flooding events.

With existing flood and erosion data, the towns can begin to identify areas that are expected to be less vulnerable to flood damage (e.g., the Irasville area in Waitsfield). By encouraging development in these areas, the towns can more safely accommodate new growth, such as the housing needs projected by the Central Vermont Regional Planning Commission.<sup>14</sup> Several steps can be taken to foster growth in these areas:

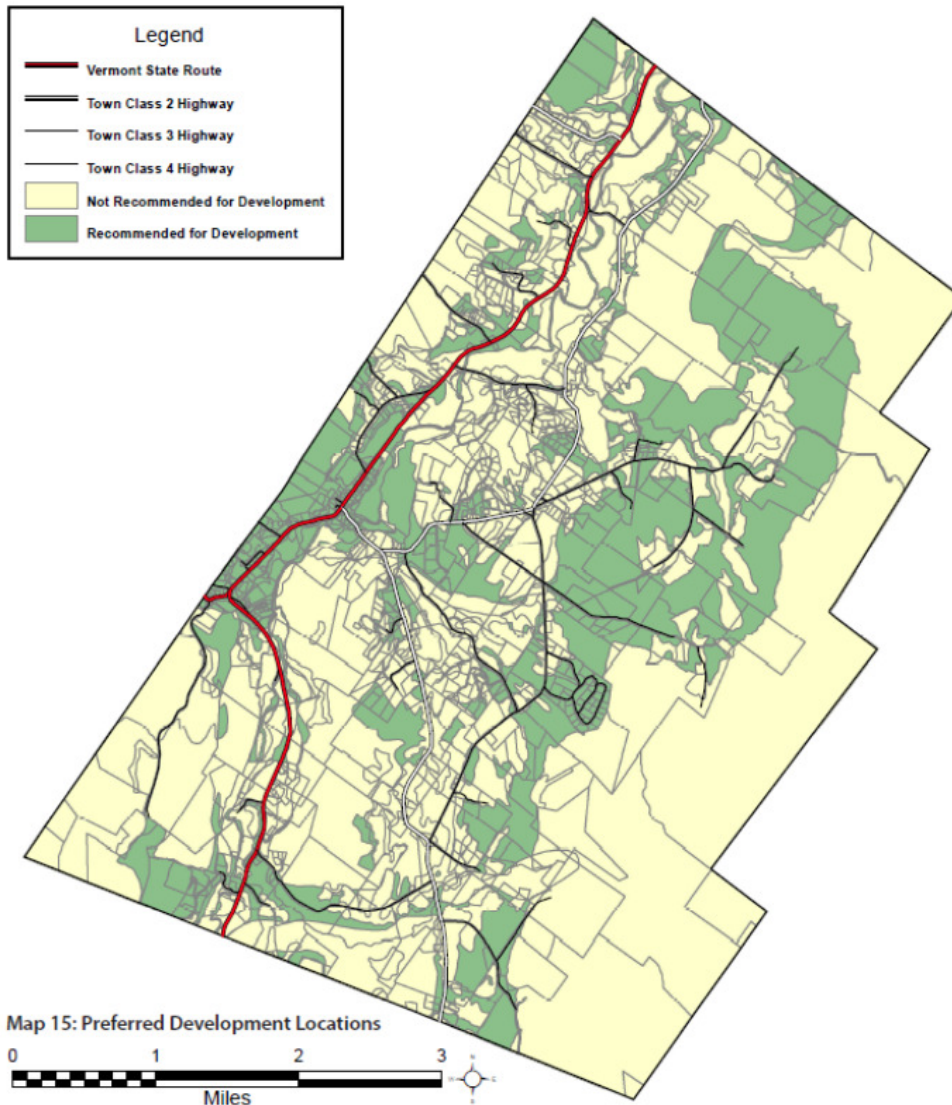
### **1. Identify locations suitable for development and redevelopment that are safer from flooding.**

Recent flood and erosion data and maps of flood hazard areas could help Waitsfield and Moretown begin to specifically identify areas where they can accommodate future growth more safely, and they could indicate these areas as nodes for future growth areas in their plans. Since Moretown does not yet have a mapped River Corridor/Fluvial Erosion Zone, gathering the necessary data and creating a River Corridor/Fluvial Erosion Zone could be an important first step towards identifying safer growth areas.

Both towns could also consider smart growth principles when delineating preferred growth areas, as Waitsfield has largely done in its recently adopted town plan (See Land Use Policies 12.M and Map 15: Preferred Development Locations).<sup>15</sup> Waitsfield officials could evaluate their map of Preferred Development Locations in their plan to determine whether these areas can accommodate growth safely in the future, based on damage experienced during Irene. Moretown has an opportunity to incorporate smart growth principles and identify safe growth areas in a new update of its 2008 town plan.

MRV communities could also consider targeting future nodes of development in safer locations, as was done in the hill farm growth concept. Under this concept, new development would be targeted in new nodes in safer areas outside of the floodplain, in the hills above the communities. For example, the beginnings of such a node of development can be found in East Warren, where a schoolhouse and co-op already exist as a potential focal point for a well-designed planned development. If either Waitsfield or Moretown considers a hillside growth concept, the town might also wish to couple it with appropriate planning for stormwater management in order to ensure that upslope development does not inadvertently exacerbate stormwater runoff.





*Credit: Waitsfield, Vermont, Town Plan.*

*Caption: The Waitsfield, Vermont, Town Plan maps out areas that are recommended and not recommended for development.*

**2. Remove zoning and other land use regulatory barriers to development in safer locations.**

Once preferred safe growth areas are identified as discussed above, the towns could consider revamping their zoning and subdivision regulations to remove unnecessary barriers to preferred development. For example, in Waitsfield the zoning regulations for the Irasville Village District do not allow multi-family developments larger than 7,500 square feet, which in effect prohibits any moderately significant apartment buildings that will be needed to meet the identified housing demand in the town. Additional wastewater and drinking water infrastructure capacity will also be needed in order to reduce lot sizes in these areas. The ongoing effort to extend water and sewer service to this area in Waitsfield will help address this constraint in the town’s growth centers. Similarly, in both communities the setback requirements (40 feet front yard setback in Irasville) and off-street parking standards appear to be excessive, requiring more land and making development

more expensive. Waitsfield and Moretown could reduce off-street parking for commercial and office development from one space for every 200 square feet of development to one space for every 400 square feet of development and could give credit for adjacent on-street spaces.

### **3. Target capital improvements in safer locations.**

Waitsfield and Moretown could target future capital improvements in locations that are designated as safer growth areas by formally coordinating local capital improvement plans with their town plans. By prioritizing capital improvements in safer areas, both towns can provide incentives for development to locate there. At this point, there appears to be only informal coordination of the towns' capital improvement plans and the capital improvement elements of the HMPs. Waitsfield has begun to coordinate these efforts, having provided central water service to the Irasville growth area, and is working to provide wastewater treatment to this same service area.

#### **D. Upland and Everywhere:** Implement stormwater management techniques to slow, spread, and sink floodwater.

Waitsfield and Moretown can also take steps to more effectively manage stormwater. Adopting these policies can help slow stormwater, spread it out over a larger area, and allow it to sink into the ground rather than running off into nearby streams and rivers.

#### **1. Adopt stormwater management regulations that include green infrastructure techniques.**

Currently, neither town has comprehensive, freestanding stormwater management ordinances that require use of best management practices. Waitsfield has basic stormwater management standards in its zoning regulations, but those standards are very general and are not required for every development. The town's subdivision regulations require stormwater management plans for new subdivisions (but not for single-lot developments). Because the state of Vermont regulates stormwater only for developments exceeding one acre of impervious surface, this means that most development in the towns is not subject to any stormwater management requirements.

Feedback received during the on-site visit to the MRV indicated that upland development in the towns caused runoff and drainage problems (e.g., water diverted from driveways, development on steep slopes) and likely contributed to higher flood levels in the Mad River. As noted by a participant in the community meeting, a general theme of "Slow it, Spread it, Sink it" makes sense when it comes to controlling stormwater. Both towns could consider adopting comprehensive stormwater management regulations either as new stand-alone ordinances or as a more detailed section of their zoning regulations. They could consider basing these regulations on the no adverse impact principles recommended by the Association of State Floodplain Managers.<sup>16</sup>

Waitsfield also could consider updating the town's stormwater standards and evaluating the potential of green infrastructure approaches—which use vegetation and soil to manage rainwater where it falls—for new and existing development.<sup>17,18,19</sup> The Vermont Planning Information Center has information on green infrastructure that may be helpful.<sup>20</sup> Both communities could consider requiring all new developments and any expansion or rebuilding of existing structures to prepare stormwater management plans that use best management practices as prescribed by the state of Vermont. In addition to regulating stormwater from new development, both towns could consider regulating stormwater from existing development, including runoff from roads and driveways. Green infrastructure approaches such as rain barrels and rain gardens could be encouraged to retain stormwater runoff on site. There are several examples of green infrastructure techniques being used in Vermont and elsewhere that could serve as models. For example, the Town of Williston, Vermont, has adopted some up-to-date stormwater management regulations.<sup>21</sup>

## 2. *Adopt tree canopy protection measures.*

Waitsfield and Moretown can also slow, spread, and sink stormwater by protecting their existing tree canopy. Large trees can absorb significant amounts of rain and reduce stormwater velocity. To protect tree canopy, the towns could preserve existing forested areas that contribute significantly to reducing stormwater runoff and could also require that larger existing trees, such as those greater than eight inches diameter at breast height (dbh), be preserved on a development site to the maximum extent feasible. Or, if those trees must be removed, a community could require that they be replaced at a minimum 1:1 caliper basis<sup>iii</sup> on-site or mitigated through payment into a municipal tree protection fund.<sup>22</sup>



*Credit: Ben Falk, Whole Systems Design.*

*Caption: Green infrastructure techniques at the Whole Systems Research Farm in the Mad River Valley of Vermont. When Irene ended, this landscape stored about 75% of the entire 6.5" rain event, releasing only about 1.5-2" into the Mad River and Lake Champlain beyond. This flood capacity was created through a network of swales, ponds, terraces and paddies.*

Additional protection standards for trees during construction activities, such as requiring fencing at the tree dripline, can further support tree preservation goals. Communities could also implement requirements to retain a specified percentage of the tree canopy on a development site. For example, for a parcel that has 100% tree canopy cover, regulations might be designed to require that development on the site be placed so that 75% of the canopy is preserved. Currituck County, North Carolina, and Folly Beach, South Carolina, have tree protection codes that illustrate these approaches.<sup>23,24</sup>

According to state officials, Vermont recently completed the first phase of a statewide tree canopy assessment. When finished, this assessment could be a valuable tool for local governments in their tree protection efforts. Williston, Vermont's, watershed buffer standards might serve as a potential model.<sup>25</sup>

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<sup>iii</sup> If a tree that measures six caliper inches is removed, it must be replaced with a total of six caliper inches of new trees.

**3. Adopt stream setback requirements and vegetated buffer requirements.**

Development along streams can contribute to stream instability and fluvial erosion. Development setback requirements and vegetated buffer requirements on high gradient, small streams can help slow, spread, and sink stormwater. Such requirements can limit or prohibit development in the area along a stream that is needed to accommodate physical stream stability and can allow stormwater to infiltrate into the soil and remove pollutants that would otherwise run off into local streams and rivers.

State programs such as the state of Vermont’s Rivers Program<sup>26</sup> may be able to provide additional information on recommended practices for setback requirements. In general, studies show that in more rural areas a setback of 100 feet can significantly reduce stormwater runoff and improve water quality.<sup>27</sup> Smaller setbacks of 25-50 feet may be appropriate in more developed areas.

Local bylaws can include vegetation requirements in defined riparian areas along streams and rivers. However, the benefits of such bylaws may be reduced if the stream’s overall physical stability has been disrupted by development encroachment. Likewise, setback requirements are designed to minimize development near streams but may not require natural vegetation along the streams. For this reason, the state of Vermont’s Rivers Program recommends vegetated buffers and setback requirements as complementary strategies to reduce risk of damage to structures along streams.

At present, Waitsfield’s stream regulations require development to be set back from the top of bank or top of slope of stream banks, wetlands, and ponds. To prevent erosion, protect habitat, and protect water quality within the setback area, the regulations require a buffer to be maintained in a naturally vegetated condition (Section 3.12).<sup>28</sup> The Waitsfield setback/buffer increases from 50 to 150 feet as stream gradient increases, providing more protection to easily incised headwater streams. Along the Mad River, a Fluvial Erosion Hazard Corridor (River Corridor) is established. Waitsfield Village has an identified Fluvial Erosion Hazard Area that has been administratively modified and does not regulate the town’s historic section of development near Bridge Street. While this area is not regulated for fluvial erosion standards, it may be nonetheless subject to powerful and damaging fluvial processes. The Upper Mad River Corridor Plan<sup>29</sup> begins the process of prioritizing river restoration projects in Warren and Waitsfield with the goal of allowing the river to re-establish a physical equilibrium.

Moretown could consider expanding its current 25-foot stream buffer to 100 feet in more rural areas of the town (e.g., on the steep slopes above the downtown) or consult with the ANR Rivers Program staff about where larger setbacks are recommended. Moretown could pursue the assessments and river corridor mapping in coordination with the CVRPC. The ANR Rivers Program may be able to help the community identify opportunities and funding to develop a river corridor map for the area.

**4. Adopt steep slope development regulations.**

Both Waitsfield and Moretown’s zoning ordinances and Waitsfield’s subdivision regulations contain standards addressing development on steep slopes in order to reduce the risk of erosion and increased stormwater runoff. However, the regulations are somewhat vague and are scattered

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*A “vegetated buffer” is an area of land along a river or stream that has undisturbed vegetation. Vegetated buffers have many benefits including enhancing water quality in adjacent rivers and streams and providing natural habitat for animals and plants. Vegetated buffers can increase stormwater infiltration and reduce runoff, stabilize banks, and slow floodwaters.*

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throughout multiple documents, which could reduce their effectiveness. As a first step, Waitsfield and Moretown could locate all steep slope standards in the zoning regulations so that they apply to all development, not merely to subdivisions as is now the case in Waitsfield. Additional amendments could clarify that development on steep slopes in excess of 30% is prohibited in most instances in order to further reduce the risk of erosion and stormwater runoff. Williston, Vermont's steep slope regulations provide one example of such regulations.<sup>30</sup>



*Credit: Vermont Stormwater Program.*

*Caption: Development on steep slopes and poor erosion control methods, as illustrated above, can cause erosion and increase the quantity of stormwater runoff. Steep slope development regulations can help prevent some of these impacts.*

**Appendix A: Community Checklist to Improve Long-Term Flood Resilience for Waitsfield**

This checklist provides a menu of steps that Waitsfield could take to improve its flood resilience. This draft checklist should be considered very preliminary and is intended to help Waitsfield get started on completing a self-assessment.

<u>Overall Strategies to Enhance Resilience</u>		
1. Does the community comprehensive plan have a hazard element that includes flood planning or is addressed in another section of the plan?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
a. Does the community plan cross reference the local hazard mitigation plan (HMP) and any disaster recovery plans?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
b. Does the community plan identify flood-prone areas, including River Corridor/Fluvial Erosion Hazard areas, if applicable?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
c. Did the local government emergency response personnel, floodplain manager, or department of public works participate in the community plan process?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
d. Is the community planner a member of the American Institute of Certified Planners or the Association of State Floodplain Managers?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
2. Does the community have a FEMA and state EMS-approved HMP?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
a. Does the HMP cross-reference the comprehensive plan?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
b. Was the local government planner or zoning administrator involved in the HMP process?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
c. Were other groups such as local businesses, schools, medical communities, farmers, etc. involved in the HMP drafting process? Were other local governments in the watershed involved to coordinate responses and strategies?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
d. Does the HMP focus on non-structural pre-disaster mitigation measures such as bylaw adoption and zoning code amendments?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
e. Does the HMP address improved stormwater management standards that include green infrastructure techniques?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
3. Are structural/engineering flood mitigation approaches (e.g., repairing bridges and levees, armoring river banks, etc.) coordinated with the local capital improvement plans and budget?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
<u>River Corridors: Conserve Land and Avoid Development</u>		
1. Do local land development regulations (zoning, subdivision, etc.) incorporate approaches and standards to protect vulnerable areas such as floodplain areas and wetlands that can help reduce flooding and flood damage? Such as:	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
a. Areas subject to flooding, including mapped river corridors and Special Flood Hazard Areas (except in very compact, already-developed areas where infill development may be encouraged)?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
b. Maintenance of vegetated riparian buffers?	<input type="checkbox"/> Yes	<input type="checkbox"/> No

c. Control of development on steep slopes?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
d. Tree and vegetation protection and erosion control during construction?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
e. Preservation of agricultural land and open space?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
2. Has the community adopted bylaws that go beyond FEMA's minimum standards for Special Flood Hazard areas and also prohibit any new encroachment and fill in Fluvial Erosion Hazard areas (if applicable)?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
3. Does the community participate in the National Flood Insurance Program Community Rating System?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
4. Has the community adopted complements to regulations to promote flood resilience such as:	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
a. Transferable and purchase of development rights programs?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
b. Acquisition of land (or conservation easements on land) that allows for stormwater absorption, river channel adjustment, or other benefits?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
c. Prohibiting investing in capital improvements that may encourage development in vulnerable areas?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<b>Vulnerable Settlements: Protect People, Buildings, and Facilities</b>		
1. Do the local comprehensive plan and HMP identify vulnerable areas that have been or are likely to be subject to flooding?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
a. If so, is development in those areas discouraged or subject to strategies to improve safe rebuilding?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
b. Does the HMP identify critical facilities and infrastructure that could be protected, repaired, or relocated (e.g., bridges, roads, wastewater facilities)?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
c. Does the plan identify projects that could be included in pre-disaster grant applications?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
2. Have land development regulations and building codes been upgraded to promote safer rebuilding in flood-prone areas? Does the community plan for costs associated with follow-up inspection and enforcement?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
a. Has the community adopted International Building Code or ASCE design standards to promote safe flood-resistant design and construction?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
b. Do zoning or floodplain regulations require elevation to two feet or more above base flood elevation?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
c. Is development in floodways prohibited?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
d. Have non-conforming use and structure standards been revised to encourage safer rebuilding in flood prone areas?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No

e. Has the community adopted a cumulative substantial damage ordinance?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
f. Does the community have the ability to establish a temporary post-disaster building moratorium?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
3. Does the comprehensive plan or HMP discuss strategies to relocate people and structures in areas that have been repeatedly flooded, including potential funding sources (e.g., FEMA funds, stormwater utility, special assessment district)?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
<b><u>Safer Areas: Plan for and Encourage New Development</u></b>		
1. Does the local comprehensive plan or HMP clearly identify safer growth areas in the community and adopt policies to encourage development in these areas?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
2. Has the community undertaken detailed development planning that encourages smart growth in safer areas?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
3. Have land development regulations been audited to remove unnecessary impediments to development in safer areas (e.g., excessive off-street parking requirements, limits on residential height and density, large front-yard setback standards)?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
4. Do capital improvement plans and budgets support development in preferred safer growth areas (such as investment in wastewater treatment facilities and roads)?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
5. Have building codes been upgraded to promote safer development in areas that could be subject to future hazards?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
<b><u>Upland and Everywhere: Slow It, Spread It, Sink It</u></b>		
1. Does the community have regulatory and non-regulatory stormwater regulations in place to reduce runoff volumes and velocity that can increase flood damage?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
a. Are green infrastructure techniques allowed or encouraged in the stormwater regulations?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
b. Has the local government explored funding sources for stormwater management such as a stormwater utility?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
c. Has the local government explored regional watershed stormwater management with other area jurisdictions?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
d. Do local stormwater regulations apply to projects that fall below the threshold for state stormwater regulations?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
2. Has the local government undertaken or encouraged riparian area restoration projects in areas subject to erosion and flooding?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No



**Appendix B: Community Checklist to Improve Long-Term Flood Resilience for Moretown**

This checklist provides a menu of steps that Moretown could take to improve its flood resilience. This draft checklist should be considered very preliminary and is intended to help Moretown get started on completing a self-assessment.

<u>Overall Strategies to Enhance Resilience</u>		
1. Does the community comprehensive plan have a hazard element that includes flood planning or is addressed in another section of the plan?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
a. Does the community plan cross reference the local hazard mitigation plan (HMP) and any disaster recovery plans?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
b. Does the community plan identify flood-prone areas, including River Corridor/Fluvial Erosion Hazard areas, if applicable?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
c. Did the local government emergency response personnel, floodplain manager, or department of public works participate in the community plan process?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
d. Is the community planner a member of the American Institute of Certified Planners or the Association of State Floodplain Managers?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
2. Does the community have a FEMA and state EMS-approved HMP?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
a. Does the HMP cross-reference the comprehensive plan?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
b. Was the local government planner or zoning administrator involved in the HMP process?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
c. Were other groups such as local businesses, schools, medical communities, farmers, etc. involved in the HMP drafting process? Were other local governments in the watershed involved to coordinate responses and strategies?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
d. Does the HMP focus on non-structural pre-disaster mitigation measures such as bylaw adoption and zoning code amendments?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
e. Does the HMP address improved stormwater management standards that include green infrastructure techniques?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
3. Are structural/engineering flood mitigation approaches (e.g., repairing bridges and levees, armoring river banks, etc.) coordinated with the local capital improvement plans and budget?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
<u>River Corridors: Conserve Land and Avoid Development</u>		
1. Do local land development regulations (zoning, subdivision, etc.) incorporate approaches and standards to protect vulnerable areas such as floodplain areas and wetlands that can help reduce flooding and flood damage? Such as:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
a. Areas subject to flooding, including mapped river corridors and Special Flood Hazard Areas (except in very compact, already-developed areas where infill development may be encouraged)?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
b. Maintenance of vegetated riparian buffers?	<input type="checkbox"/> Yes	<input type="checkbox"/> No

c. Control of development on steep slopes?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
d. Tree and vegetation protection and erosion control during construction?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
e. Preservation of agricultural land and open space?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
2. Has the community adopted bylaws that go beyond FEMA's minimum standards for Special Flood Hazard areas and also prohibit any new encroachment and fill in Fluvial Erosion Hazard areas (if applicable)?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
3. Does the community participate in the National Flood Insurance Program Community Rating System?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
4. Has the community adopted complements to regulations to promote flood resilience such as:	<input type="checkbox"/> Yes	<input type="checkbox"/> No
a. Transferable and purchase of development rights programs?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
b. Acquisition of land (or conservation easements on land) that allows for stormwater absorption, river channel adjustment, or other benefits?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
c. Prohibiting investing in capital improvements that may encourage development in vulnerable areas?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<b>Vulnerable Settlements: Protect People, Buildings, and Facilities</b>		
1. Do the local comprehensive plan and HMP identify vulnerable areas that have been or are likely to be subject to flooding?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
a. If so, is development in those areas discouraged or subject to strategies to improve safe rebuilding?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
b. Does the HMP identify critical facilities and infrastructure that could be protected, repaired, or relocated (e.g., bridges, roads, wastewater facilities)?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
c. Does the plan identify projects that could be included in pre-disaster grant applications?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
2. Have land development regulations and building codes been upgraded to promote safer rebuilding in flood-prone areas? Does the community plan for costs associated with follow-up inspection and enforcement?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
a. Has the community adopted the International Building Code or ASCE design standards to promote safe flood-resistant design and construction?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
b. Do zoning or floodplain regulations require elevation to two feet or more above base flood elevation?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
c. Is development in floodways prohibited?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
d. Have non-conforming use and structure standards been revised to encourage safer rebuilding in flood prone areas?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No

e. Has the community adopted a cumulative substantial damage ordinance?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
f. Does the community have the ability to establish a temporary post-disaster building moratorium?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
3. Does the comprehensive plan or HMP discuss strategies to relocate people and structures in areas that have been repeatedly flooded, including potential funding sources (e.g., FEMA funds, stormwater utility, special assessment district)?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
<b><u>Safer Areas: Plan for and Encourage New Development</u></b>		
1. Does the local comprehensive plan or HMP clearly identify safer growth areas in the community and adopt policies to encourage development in these areas?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
2. Has the community undertaken detailed development planning that encourages smart growth in safer areas?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
3. Have land development regulations been audited to remove unnecessary impediments to development in safer areas (e.g., excessive off-street parking requirements, limits on residential height and density, large front-yard setback standards)?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
4. Do capital improvement plans and budgets support development in preferred safer growth areas (such as investment in wastewater treatment facilities and roads)?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
5. Have building codes been upgraded to promote safer development in areas that could be subject to future hazards?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
<b><u>Upland and Everywhere: Slow It, Spread It, Sink It</u></b>		
1. Does the community have regulatory and non-regulatory stormwater regulations in place to reduce runoff volumes and velocity that can increase flood damage?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
a. Are green infrastructure techniques allowed or encouraged in the stormwater regulations?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
b. Has the local government explored funding sources for stormwater management such as a stormwater utility?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
c. Has the local government explored regional watershed stormwater management with other area jurisdictions?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
d. Do local stormwater regulations apply to projects that fall below the threshold for state stormwater regulations?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
2. Has the local government undertaken or encouraged riparian area restoration projects in areas subject to erosion and flooding?	<input type="checkbox"/> Yes	<input type="checkbox"/> No

## Appendix C: Endnotes

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