



Statutory Authorization: 24 V.S.A. §§4414, 4424

Type: REGULATORY & NONREGULATORY

Related Topic Areas: Land Use & Development Regulations; Open Space & Resource Protection Programs and Regulations; Subdivision Regulations; Zoning Regulations

Hazards Mitigation

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Overview

In Vermont, natural hazards that endanger people and property include floods, winter storms, windstorms, and landslides. Of these, flooding and the associated catastrophic stream and river channel relocation or adjustment (known as fluvial erosion) is the most frequent, damaging, and costly and is thus the most important hazard to mitigate. Over the last fifty years, flood recovery has cost Vermonters an average of \$14 million a year. Fortunately, municipalities can take action through land use planning and regulation to help mitigate both the economic costs and the public health and safety risks associated with flooding and fluvial erosion hazards.

Floods are inevitable, but there are ways that we can help prevent flood losses. One common approach in the past has been to intensively manage river channels by armoring riverbanks, by dredging rivers, and through the construction of berms, levees, and flood walls. In addition to being very costly, these engineering solutions often fail, leading to even more extensive and costly flood damages. This stopgap approach has been shown to be unsustainable and has led to the situation we are in today, trapped in an escalating cycle of increasing flood damages and costly repairs. Furthermore, this engineering approach has negative impacts on the ecological health of river systems and the wildlife they support.

Another approach is to remove or relocate existing building, roads, and other structures that are threatened by flood hazards. Removal of structures from hazardous areas can be an effective approach when it is feasible. FEMA-funded home buyouts, for instance, were a successful mitigation



Hazard mitigation is all about the actions we can take to prevent or reduce the risk of damage to people and property from hazards like this flood that destroyed a home located too close to a stream. This type of catastrophic stream and river channel adjustment has been the most frequent and costly type of natural hazard in Vermont. Municipalities can help avoid such damage through hazard mitigation planning and by taking measures to prevent building in hazard-prone locations. Photo by Vermont Department of Environmental Conservation, River Management Division.

activity after several of Vermont's destructive floods in the 1990s. While removal or relocation is effective, it is generally far too costly for towns to apply on a broad scale. In addition, it is rarely feasible to remove or relocate large structures, particularly roads and bridges. Retrofitting, another engineering approach (which includes elevating and floodproofing), often works to mitigate inundation hazards but is ineffective for fluvial erosion hazards.

The most cost-effective way for towns to mitigate flood hazards is *avoidance*: limiting building and other investments in river corridors. In addition to preventing future flood losses to structures built in hazardous areas, this approach avoids constraining a river, allowing the stream or river, over time, to become more

stable. Statute 24 V.S.A. §4424 specifically authorizes towns to adopt zoning for shorelines, floodplains, and other hazardous areas, including fluvial erosion zones. Municipalities are uniquely enabled to apply local land use planning and regulations to preventing fluvial hazards and can do so by applying local knowledge and historical perspective to craft approaches that can work for each particular municipality.

Although adopting land use regulations to mitigate flood hazards are likely to be controversial or even unpopular in some communities, municipal officials have a responsibility to consider these measures, as they can have important long-term public health and safety benefits, as well as the economic benefits of reduced flood losses.

Pre-Disaster Mitigation Planning

The federal Disaster Mitigation Act of 2000 requires states and municipalities to undertake hazard mitigation planning in order to maintain eligibility for disaster recovery and mitigation funding. Unlike emergency response plans, pre-disaster mitigation plans identify steps that can be taken before an emergency situation occurs to reduce the damage caused by future disasters.

Hazard mitigation planning takes place at the state, regional, and local level in Vermont. Vermont's State Hazard Mitigation Plan, also known as the 409 Plan (available at the Vermont Emergency Management website: www.dps.state.vt.us/vem or follow links from www.vpic.info), identifies hazards (including floods,

winter storms, windstorms, drought, wildfires, earthquakes, and landslides) and sets mitigation priorities for the state. Regional planning commissions are responsible for preparing Regional Pre-Disaster Mitigation (PDM) plans. The regional plans cover each town within the region and, with the relevant local annex (section in the plan for each town), also serve as the PDM plan for each town. This is an efficient approach, as hazards vary little between towns in a region, and most towns lack the resources and time to develop independent plans. Hazard mitigation goals of the PDM plan should still be integrated into the municipal plan. These goals will provide the basis for any hazard mitigation regulations the municipality may have or is considering adopting.

Flood Hazard Area Regulations

Most communities across Vermont have adopted flood hazard area regulations in order to participate in the National Flood Insurance Program (NFIP). In 1968, the U.S. Congress created the NFIP with the purpose of establishing an insurance program that transfers costs of private property flood losses from the taxpayers to floodplain property owners through flood insurance premiums, reducing flood losses by establishing construction standards for new and substantially improved buildings located in a floodplain and providing financial assistance to floodplain owners and residents who experienced property damage after floods.

Community participation in the NFIP is voluntary. However, because federally sponsored flood insurance is only available to citizens that live in a community that participates in the NFIP and because flood insurance is mandatory for property owners that carry a federally backed mortgage on structures located in a floodplain, most communities in Vermont choose to participate in the NFIP. For a town to participate in the NFIP, it

Flood Map Updates

The National Flood Insurance Program (NFIP) provides participating municipalities with Flood Insurance Rate Maps (FIRMs) that delineate the Special Flood Hazard Area (SFHA), the area that would be inundated by the occurrence of the 100-year flood. Periodically, the NFIP will provide mapping updates to a community's FIRM. While these mapping updates have been limited in the past, the NFIP began a Map Modernization Program in 2003 that will provide updated flood data for many communities in Vermont and digital flood maps to all communities in Vermont.

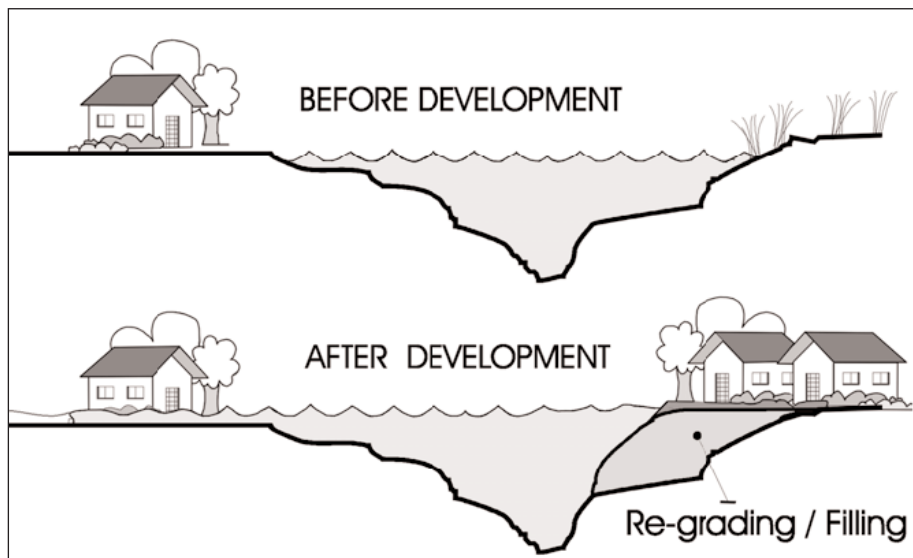
must adopt and enforce flood hazard area regulations that meet at least the minimum NFIP regulations governing development in a floodplain.

Communities that participate in the NFIP are required to issue permits for any development in a 100-year floodplain. Development not only includes the construction of buildings or other structures, but also includes any man-made change to improved or unimproved real estate; mining, dredging, filling, grading, paving, excavation, or drilling operations; and storage of equipment or materials. NFIP minimum standards generally require that all new and substantially improved structures located in a Special Flood Hazard Area (SFHA) be elevated or floodproofed (allowed only for commercial construction) to an elevation at or above the 100-year flood elevation. Before a community issues any permit for new development or substantial improvement in a floodplain, state law (24 V.S.A 4424) requires that the community submit a copy of the application to the Floodplain Management Office at the Agency of Natural Resources (ANR) for a thirty-day review and comment period. The comments that ANR provides are purely advisory. Comments typically address whether the proposal for development meets current NFIP requirements and are intended to ensure that the community is meeting

Local and Regional PDM Plans

Regional Pre-Disaster Mitigation (PDM) Plans, developed by regional planning commissions, identify flood and fluvial erosion hazards as a (and in many cases the most) significant natural hazard and recommend actions communities can take to mitigate these hazards. For example, the Bennington Regional Hazard Mitigation Plan contains the following language:

... local Hazard Mitigation Plans should support the implementation of a landslide and fluvial geomorphic hazard assessment and mapping program conducted on a watershed basis prior to any mitigation activities which may potentially affect that watershed. These assessments provide value in identifying unstable and hazardous rivers, stream banks and related infrastructure. Such assessments should, whenever possible, be conducted according to assessment protocols and mapping methodologies published by the VT Department of Environmental Conservation, River Management Program and the VT Geological Survey.



An important function of floodplains is the storage and conveyance of flood waters. New development and the associated fill placed in a floodplain can obstruct flood flows and reduce the ability of the floodplain to store water, which can subsequently cause floodwaters to rise to higher levels on upstream and adjacent properties. Municipalities should consider the effects of floodplain encroachment on all properties when making land use planning and management decisions. Illustration from FEMA 480, *Floodplain Management Requirements: A Study Guide and Desk Reference for Local Officials*.

its obligations for continued participation in the NFIP.

Unfortunately, most communities in Vermont rely solely on the minimum standards of the NFIP to protect their communities from flood hazards. However, all communities should recognize that floodplain management based solely on NFIP minimum regulations allows for development in floodplains that will reduce the floodplain's ability to convey and store water and will cumulatively result in increases in the 100-year flood elevation. A rise in floodwaters not only can cause properties that were once flood-free to now be flood-prone but can also cause increases in the velocity of floodwaters, thereby increasing the potential for erosion of stream banks during flooding. In addition to not preserving the floodplains' flood storage and conveyance functions, NFIP minimum standards do not preserve other natural and beneficial functions of the floodplain, such as water quality maintenance and protection, groundwater recharge and discharge, and biologic resources and functions, which can

have negative impacts on a community's economic and other resources. Therefore, communities should consider adopting flood hazard area regulations that are more stringent than the minimum requirements of participation in the NFIP. Communities that adopt more stringent regulations are eligible to receive insurance premium

Assistance on Flood Hazard Areas

The Vermont Agency of Natural Resources (ANR), River Management Program, Floodplain Management Office provides general assistance and technical support to communities on all aspects of the National Flood Insurance Program (NFIP). The Floodplain Management Office can be reached at (802) 241-3759.

Model Overlay District Language and other resources can be found in the *Municipal Guide to Fluvial Erosion Hazard Mitigation*, available from the Floodplain Management Office and on the Vermont Agency of Natural Resources Water Quality website: www.anr.state.vt.us/dec or follow links from www.vpic.info.

discounts for their residents through participation in the Community Rating System.

While participation in the NFIP is one important approach to flood hazard mitigation, NFIP maps are based only on inundation hazards and fail to consider the hazards associated with erosion due to physical adjustments of the stream channel during flooding, which is the cause of the majority of all flood damage in Vermont. The following section (Fluvial Erosion Hazard Regulations) explores supplemental approaches towns can take to more effectively mitigate flood and erosion hazards.

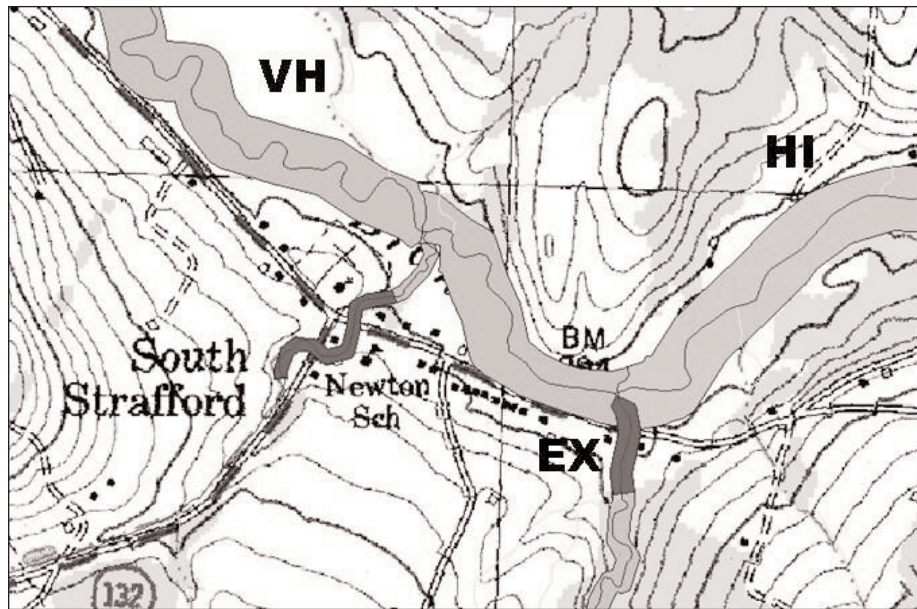
Fluvial Erosion Hazard Regulations

The vast majority of flood damage suffered in Vermont is caused by fluvial erosion, not inundation. Without the expertise and tools to manage fluvial erosion hazards, towns have been helpless to break out of this cycle of repetitive and costly flood damages. In recognition of this problem, the Vermont General Assembly (1997–1998) directed the ANR to identify options for state flood control policy and a state flood control program. The resulting policy is centered on the goal of managing rivers and their corridors to maintain or reestablish a condition of equilibrium. To implement this policy, the River Management Program of the ANR has developed tools and techniques to understand dynamic river systems and identify appropriate management activities. A major component of this effort is the Fluvial Erosion Hazard (FEH) risk assessment and mapping process. FEH maps identify the location and intensity of fluvial erosion hazards, as well as the area needed by a river to maintain equilibrium.

The benefits of understanding and planning for fluvial erosion hazards are numerous and diverse. It is important to remember that fluvial erosion

hazards are just that: hazards that can jeopardize public safety and cause enormous economic losses to individuals and to the public. As a result, local governments have a responsibility to protect citizens and their property by acknowledging and mitigating (reducing or moderating) fluvial erosion hazards. Fluvial erosion hazard mitigation can lead to enhanced public safety and reduce long-term flood damages. Some fluvial erosion hazard mitigation activities can even lead to additional benefits that are harder to put a price tag on, like healthier rivers, enhanced recreational opportunities, improved aesthetics, and better fish and wildlife habitat.

Municipal adoption of a Fluvial Erosion Hazard overlay district is one of the best avoidance strategies for fluvial erosion hazard mitigation. An overlay district is an additional zoning requirement placed on a specific geographic area (in this case the FEH zone) without changing the underlying zoning. (See topic papers Open Space & Resource Protection Programs and Regulations for more information about overlay districts.) The degree of protection afforded by an FEH overlay district depends on the exact wording, but could include limits on structures, land use activities, or even vegetation. Limiting development within an overlay district based on the boundaries of an FEH map has two major functions. First, it will prevent development in hazardous



This Fluvial Erosion Hazard (FEH) map from Strafford shows the stream and river locations that are most subject to erosive channel relocation, as well as the corridor areas needed to accommodate the natural adjustment of the river channel essential for maintaining or restoring equilibrium conditions. The FEH map provides a scientific basis for creating a Fluvial Erosion Hazard overlay district or other types of regulatory and nonregulatory approaches for reducing damages from river channel adjustments. Map from Vermont Department of Environmental Conservation, River Management Division..

areas, reducing costly flood losses. Second, it will prevent river corridor encroachment, which would increase overall fluvial erosion hazards and even impede a river's natural tendency to adjust toward a more stable condition.

The FEH risk assessment and mapping process provides a sound scientific and technical basis for determining the boundaries of an FEH overlay district. Because overlay district boundaries do not shift as a river channel changes position, this ap-

proach can provide a consistent, easy-to-administer tool for mitigating fluvial erosion hazards over a wide geographic area. In the long term, this option will do the best job of minimizing human/river conflicts and limiting losses caused by fluvial erosion.

Setbacks and Buffers

Minimum setbacks and/or buffer requirements are commonly used in regulating development to minimize impacts on water resources. They can

River Corridor Protection: A Nonregulatory Approach

Towns can also work to mitigate fluvial erosion hazards using nonregulatory approaches by sponsoring or participating in river corridor protection projects. These projects generally involve acquiring key sections of river corridor land to prevent development on those sections and ensure the channel moves freely within the corridor. Such land can be acquired through outright purchase, purchase of

development rights, or through protective easements. The same stream-geomorphic assessments that support FEH mapping can also be used to identify the key river corridor areas.

Municipalities that face frequent flooding may want to take the additional step of developing a comprehensive River Corridor Management Plan, which catalogues a variety of strategies and opportunities for corridor protection. These might include identifying river segments where forested buffers need to be established to help secure

a stream bank (along with multiple environmental benefits); or identifying locations where undersized culverts and other road structures constrain streams and develop a capital budget and program for replacing them.

The River Management Program (Vermont Department of Environment Conservation), area land trusts, and other public and nonprofit conservation organizations are committed to supporting river corridor protection projects and can provide municipalities with both technical and financial assistance.

be adopted as general standards applying to all development or as standards specific to an individual zoning district. Setbacks require all development to be separated a specific distance from a designated resource. Buffers require the same type of separation, but also limit disturbance and vegetation management in the setback area (“undisturbed, naturally vegetated” is a common buffer management requirement), which make them much more useful for protecting water quality by filtering pollutants from overland water flow.

While buffers (and to some degree setbacks) serve many important water quality benefits (as well as terrestrial and aquatic wildlife habitat, wildlife migration and travel corridors, and aesthetics), they are generally narrow strips of land with limited usefulness in mitigating flood and erosion hazards. Setbacks and buffers can serve important hazard mitigation functions in small streams, where the setback or buffer width is large enough to accommodate the dynamic adjustments of a stream. In the smallest streams with channels 17 feet wide or less (drainage areas of less than 1.7 square miles), a buffer, 50-foot or greater, will often afford adequate space for the stream to adjust toward or maintain its equilibrium. In these streams, a setback or buffer is often simpler to administer and achieves the same goals without requiring the extensive and time-consuming study

needed to develop a fluvial erosion hazard zone. For maximum effectiveness, setbacks and buffers should be measured from the top of bank or the top of slope (depending upon the geometry of the stream and adjacent slope) and not from the water’s edge.

The ANR has developed several useful documents, including the *ANR Riparian Buffer Guidance* (2005), which outline the functions and values of buffers, as well as technical guidance for their determination. These documents reflect ANR’s approach to buffers in Act 250 proceedings, but provides generally useful information on the topic of buffers for municipalities as well. They are available on the web at www.anr.state.vt.us or follow links from www.vpic.info.

Stormwater Management

Development in a watershed increases the amount of impervious surface (pavement, rooftops, and so on), which in turn affects the magnitude and timing of runoff. In general, an increase in impervious surface leads to “flashier” runoff patterns (more overland runoff in a shorter amount of time). This can worsen flooding, channel instability, and erosion in rivers and streams. While the effect of such hydrologic changes due to stormwater is most dramatic in small, heavily urbanized watersheds, stormwater changes from all types of

development can have an impact on flooding and erosion in many streams. A detailed description of stormwater impacts and solutions is beyond the scope of this guide, and many excellent sources of information on stormwater management are available (see below).

Additional Resources

National Flood Insurance Program (NFIP)

State National Flood Insurance Program Coordinator
Waterbury, VT 05671-0408
(802) 241-3759

Federal Emergency Management Agency (FEMA)

website: www.floodsmart.gov

Pre-Disaster Mitigation Planning

Federal Emergency Management Agency (FEMA) Mitigation Division

website: www.fema.gov/fima/

State Hazard Mitigation Officer

Waterbury, VT 05671
800-347-0488 or (802) 241-5258

Regional Planning Commissions (RPCs)

are involved in predisaster mitigation planning in Vermont. (See topic paper, Introduction: Implementing the Municipal Plan, for RPC contact information.)

Stormwater Management

Stormwater Section, Water Quality

Division, Department of Environmental Conservation
Waterbury, VT 05671
(802) 241-3776

NEMO Vermont (Nonpoint Education for Municipal Officials)

Water Quality Educator
University of Vermont Extension
Lake Champlain Sea Grant Program
Burlington, VT 05405
(802) 656-9110

National NEMO Network, educating local decision makers about the links between land use and natural resource protection.

website: <http://nemonet.uconn.edu>.

Vermont League of Cities and Towns (VLCT), Water Quality Planning:

free on-site training and professional assistance on water quality.improvement planning, bylaws and stormwater compliance.

800-649-7915

website: www.vlct.org

Hazard Mitigation Regulations and the “Takings” Issue

Municipalities and their residents are often concerned that restrictive zoning for hazard mitigation or resource protection infringes on property rights. People often fear that zoning regulations will result in a “regulatory takings,” which occurs when land use regulations remove all viable uses of a person’s property. In fact, successful takings claims are extremely rare, and U.S. courts have been consistently supportive of the right of local govern-

ments to regulate land use to protect public safety and public resources (including water quality, wetlands, historic preservation, and scenic view protection). In fact, takings case law makes it clear that property owners do not have a right to use their land in such a way that may harm public health or welfare or even cause damage to the quality of life of a community. On the contrary, local governments may have the moral (and perhaps even the legal) obligation to do all that they can to mitigate hazards and protect public safety in their communities.