

Town of Brookfield, Vermont
2022 Local Hazard Mitigation Plan

***Prepared by the Two Rivers-Ottawaquechee Regional Commission and
the Town of Brookfield***

Date of Town Adoption: 1/10/2022

Date of Final Approval by FEMA: 1/12/2022



FEMA

January 14, 2022

Stephanie A. Smith, State Hazard Mitigation Officer
Vermont Emergency Management
45 State Drive
Waterbury, Vermont 05671-1300

Dear Ms. Smith:

As outlined in the FEMA-State Agreement for FEMA-DR-4474, your office has been delegated the authority to review and approve local mitigation plans under the Program Administration by States Pilot Program. Our Agency has been notified that your office completed its review of the Town of Brookfield, Vermont 2021 Local Hazard Mitigation Plan and approved it effective **January 12, 2022** through **January 11, 2027** in accordance with the planning requirements of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), as amended, the National Flood Insurance Act of 1968, as amended, and Title 44 Code of Federal Regulations (CFR) Part 201.

With this plan approval, the jurisdiction is eligible to apply to Vermont Emergency Management for mitigation grants administered by FEMA. Requests for funding will be evaluated according to the eligibility requirements identified for each of these programs. A specific mitigation activity or project identified in this community's plan may not meet the eligibility requirements for FEMA funding; even eligible mitigation activities or projects are not automatically approved.

The plan must be updated and resubmitted to the FEMA Region I Mitigation Division for approval every five years to remain eligible for FEMA mitigation grant funding.

Thank you for your continued commitment and dedication to risk reduction demonstrated by preparing and adopting a strategy for reducing future disaster losses. Should you have any questions, please contact Jay Neiderbach at (617) 832-4926 or Josiah.Neiderbach@fema.dhs.gov.

Sincerely,

Paul F. Ford
Acting Regional Administrator
DHS, FEMA Region I

PFF:jn

cc: Ben Rose, Recovery and Mitigation Section Chief, VEM

CERTIFICATE OF ADOPTION
January 10, 2022
TOWN OF Brookfield, Vermont Selectboard
A RESOLUTION ADOPTING THE Brookfield, Vermont 2021 Local Hazard Mitigation Plan

WHEREAS, the Town of Brookfield has historically experienced severe damage from natural hazards and it continues to be vulnerable to the effects of the hazards profiled in the **Brookfield, Vermont 2021 Local Hazard Mitigation Plan**, which result in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the Town of **Brookfield** has developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for its **Brookfield, Vermont 2021 Local Hazard Mitigation Plan (Plan)** under the requirements of 44 CFR 201.6; and

WHEREAS, the **Plan** specifically addresses hazard mitigation strategies, and Plan maintenance procedures for the Town of **Brookfield**; and

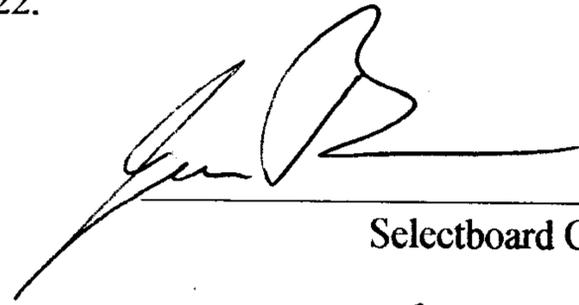
WHEREAS, the **Plan** recommends several hazard mitigation actions (projects) that will provide mitigation for specific natural hazards that impact the Town of **Brookfield** with the effect of protecting people and property from loss associated with those hazards; and

WHEREAS, adoption of this **Plan** will make the Town of **Brookfield** eligible for funding to alleviate the impacts of future hazards; now therefore be it

RESOLVED by Town of **Brookfield** Selectboard:

1. The **Brookfield, Vermont 2021 Local Hazard Mitigation Plan** is hereby adopted as an official plan of the Town of **Brookfield**;
2. The respective officials identified in the mitigation action plan of the **Plan** are hereby directed to pursue implementation of the recommended actions assigned to them;
3. Future revisions and **Plan** maintenance required by 44 CFR 201.6 and FEMA are hereby adopted as part of this resolution for a period of five (5) years from the date of this resolution; and
4. An annual report on the process of the implementation elements of the Plan will be presented to the Selectboard by the Emergency Management Director or Coordinator.

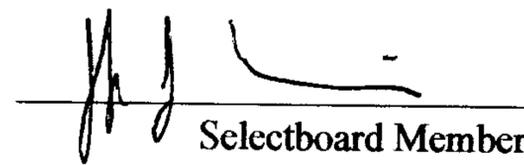
IN WITNESS WHEREOF, the undersigned have affixed their signature and the corporate seal of the Town of **Brookfield** this 10th day of JANUARY, 2022.



Selectboard Chair

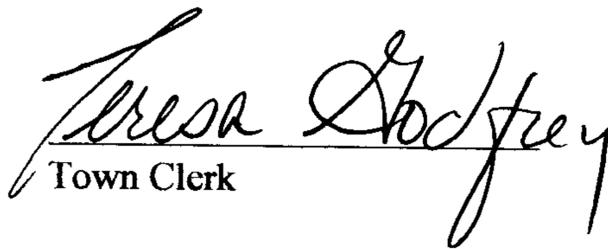


Selectboard Member



Selectboard Member

Attest



Town Clerk

Table of Contents

I. Introduction	3
II. Purpose of Mitigation Planning.....	4
IV. The Planning Process.....	7
• A. Plan Developers	7
• B. Plan Development Process	7
• C. Status Update on Mitigation Actions Identified in 2016.....	11
• D. Changes in Town Priorities and Vulnerabilities Since the 2016 Plan.....	17
• E. Status of Development in Brookfield	17
• F. Town Capabilities for Implementing Mitigation Strategy.....	18
• G. Plan Maintenance.....	22
V. Community Vulnerability by Hazard.....	25
• A. Hazard Identification.....	25
• B. Hazard Profiles.....	28
Fire Hazards (Structure, Brushfires, and Wildfires)	28
Invasive Species/ Infestation.....	29
Severe Weather	35
VI. Mitigation	40
• A. Mitigation Goals	40
• B. Excerpted Town Plan Goals & Objectives Supporting Local Hazard Mitigation.....	40
• C. Hazard Mitigation Strategies: Programs, Projects & Activities.....	40
Implementing the plan.....	47
Attachments.....	48
• Attachment A: Map of the Town of Brookfield	48

I. Introduction

Natural and human-caused hazards may affect a community at any time. They are not usually avoidable; however, their impact on human life and property can be reduced through community planning. Accordingly, this Local Hazard Mitigation Plan (hereafter referred to simply as the Plan) seeks to provide an all-hazards mitigation strategy that will make the community of Brookfield more disaster resistant.

Mitigation planning is only one of four phases of emergency management. Preparedness, response, and recovery are the other pieces of the cycle. At any one time, a community may be in more than one phase of emergency management. It is important to distinguish between these four phases, especially between mitigation and preparedness. Mitigation is often confused with preparedness, and vice versa. Below are descriptions of each of the four phases of emergency management:

- **Mitigation:** preventing future emergencies or minimizing their effects
 - Includes any activities that prevent an emergency, reduce the chance of an emergency happening, or reduce the damaging effects of unavoidable emergencies.
 - Buying flood and fire insurance for your home is a mitigation activity.
 - Mitigation activities take place before and after emergencies.
- **Preparedness:** preparing to handle an emergency
 - Includes plans or preparations made to save lives and to help response and rescue operations. Training and proper equipment are preparation
 - Evacuation plans and stocking food and water are both examples of preparedness.
 - Preparedness activities take place before an emergency occurs.
- **Response:** responding safely to an emergency
 - Includes actions taken to save lives and prevent further property damage in an emergency situation. Response is putting your preparedness plans into action.
 - Rescuing people from flooding or putting out a fire are both response activities.
 - Response activities take place during an emergency.
- **Recovery:** recovering from an emergency
 - Includes actions taken to return to a normal, preferably incorporating mitigation actions to create an even safer situation following an emergency.
 - Recovery includes getting financial assistance to help pay for the repairs.
 - Rebuilding damaged roads or providing loans to businesses are both recovery activities.
 - Recovery activities take place after an emergency.

II. Purpose of Mitigation Planning

The purpose of this Plan is to assist Brookfield in identifying all hazards facing the town, ranking them, and identifying strategies reduce risks from known priority hazards.

The Town of Brookfield seeks to be in accordance with the strategies, goals, and objectives of the State Hazard Mitigation Plan.

The 2015 Brookfield Local Hazard Mitigation Plan was the first stand-alone mitigation plan drafted for the Town. Previously, the Town had a town-specific 2011 Annex in the Regional Pre-Disaster Mitigation Plan. This Plan has been reorganized and new sections were added:

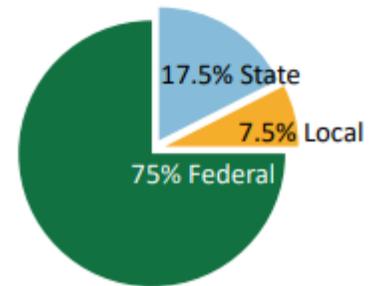
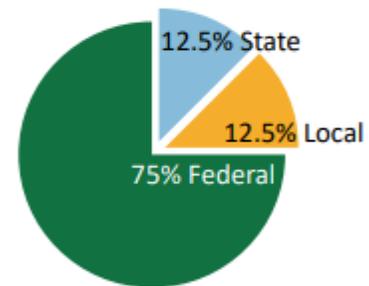
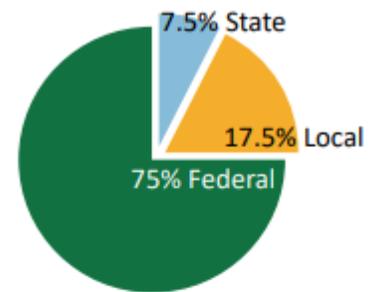
- Program eligibility subsequent to plan approval
- Authority for plan development
- Participating jurisdictions
- Funding for plan development
- Brief information about the community

Old assumptions have been challenged throughout and new information has been added to make the plan stronger and more useful for the Brookfield town officials and residents who will implement the hazard mitigation strategies in the future.

This 2021 Plan expands upon the 2015 plan by analyzing new hazards, adding new and relevant data, and creates new mitigation actions for the Town to follow over the next five years.

In addition, for identifying hazards and ways to mitigate them in Brookfield, the Plan also serves as an important financial incentive during federally declared disasters. In October 2014, the state enacted new Emergency Relief and Assistance Fund (ERAF) rules that provide additional state matching funds for federal disaster relief under FEMA’s Public Assistance Program (FEMA typically requires a 25% match). To qualify, municipalities must have taken four actions: adopt updated road standards, participate in the National Flood Insurance Program (NFIP) by adopting flood hazard area regulations, annually adopt a local emergency management plan, and have a local Hazard Mitigation Plan approved by FEMA. Under ERAF, there is a financial incentive that allows the town to lessen their financial burden during federally declared disasters. By having taken these four basic actions, the state will contribute half (12.5%) of the 25% match on federal disasters.

A fifth incentive that not many communities in Vermont take advantage of is to adopt either a River Corridor bylaw or participate in the Community Rating System (CRS). River Corridor bylaws regulate



lands mapped by the State of Vermont that are usually beyond the FEMA-mapped flood zone, with the concern being erosion that can undermine structures. CRS is a complicated administrative process with a simple premise – that taking additional flood prevention steps will lessen flood damages. Communities in the CRS enjoy lower flood insurance rates.

Having either of the fifth actions will lower the financial burden under the ERAF rule to only a 7.5% match for the town. At the time of this writing, the town is financially responsible for 17.5% on the dollar in federally declared disasters due to the expiration of the local hazard mitigation plan. Every percent saved in a million-dollar disaster is \$10,000.

Separately, in 2014, state planning law (24 V.S.A. Chapter 117) required that all updated municipal comprehensive plans must include a “flood resilience” element, addressing both flooding and fluvial erosion hazards. This requirement was met with the adoption of Brookfield’s Town Plan on May 15, 2017. The flood resilience section references and incorporates material from the 2016 adopted and FEMA-approved hazard mitigation plan. III. Community Profile

Brookfield is a predominantly rural and agricultural community of 24,472 acres centrally located in Orange County. The Town's topography is typical of the area east of the Green Mountains. It ranges from hills up to about 1,800 feet elevation on the easterly border of the Town through valleys slightly below 700 feet elevation, to Bear Hill, the Town's highest point, on the west at just over 2,100 feet. Ayers Brook and its tributaries and upper Sunny Brook are the major streams in the western part of the Town.

The Second Branch of the White River drains the eastern valley. Four ponds are designated as state waters because they are over 25 acres in size: Sunset Lake, Baker Pond, North Pond, and Rood Ponds. Lamson Pond was historically a large pond that was under this designation, but is viewed as more of a wetland than a pond in recent years. In addition to approximately 6 miles of I-89, Brookfield has over 20 miles of State highway (Routes 12, 14, and 65) and nearly 75 miles of Town roads: Class II - 15.85 miles, Class III - 37.80 miles, and Class IV - 22.27 miles. A portion of Pond Village is designated a State Historic District with smaller historic districts located around the churches in East and West Brookfield.

Brookfield’s Floating Bridge spans Sunset Lake, formerly Colt’s Pond, in Pond Village. The bridge is supported by floating pontoons because the lake is too deep for traditional pilings. The seasonal bridge was completely replaced and reopened in 2015. Sunset Lake Dam, an earthen dam, impounds Sunset Lake. The dam was rebuilt in 2000 to provide a safe, low-maintenance structure. The dam now has rehabilitated primary and auxiliary masonry spillways to improve hydraulic performance, a concrete cutoff wall along the upstream face of the dam to inhibit seepage, and a concrete slab over the dam to provide overtopping protection.

Sunset Lake Dam is inspected routinely by the Vermont Department of Environmental Conservation, and during the 2008 inspection, the dam was found to be in good condition. An Emergency Action Plan (EAP) was written in 2001 for the dam and it is filed with the Town and the Dam Safety Section of the Vermont Agency of Natural Resources. The EAP contains an emergency notification chart. The LHMP discussed dam failure and determined not to address it in this plan because dam failure is considered improbable.

Between 1970 and 1980 the Town's population grew from 606 to 969, and by 1990 the population had risen to 1,089. As of the U.S. Census in 2010, the population had risen further still to 1,292, the highest level seen in well over a century. The 2020 U.S. Census stated that Brookfield has a population of 1,244. This is slightly lower than the 2010 Census, but it indicates that the population in Brookfield has remained relatively the same over the past decade. Orange County data from the U.S. Census aligns with the trends in Brookfield with a large increase in population from 1990 to 2010, with a stable population from 2010 to 2020.

The population consists of many families whose wage-earners are employed out of town, chiefly in the Randolph-Bethel corridor, but also as far south as White River Junction and to the north in Barre, Montpelier and Waterbury. There are also numerous retired people who reside full-time or part-time in the Town and many second home owners who reside in Brookfield only a few months a year. There are still a number of families that earn their livelihood in the Town, in part due to the rural agricultural nature of the Town and the wider region.

As of the 2007 USDA Census of Agriculture, there were 20-30 farms concentrating on dairy, beef, sheep, horse, deer, small fruits and vegetables. The latest USDA Census of Agriculture only quantifies data by state and county. Between 2012 and 2017 in Orange County, there was a decrease of the number of farms from 7,338 in 2012 to 6,808 in 2017. This trend is on par with much of Vermont. It is expected for the 2022 Agricultural Census that this decline will continue. Apart from what the USDA Census calculates, there are also several known tree farms producing Christmas trees, hardwoods and conifers for timber, pulp and fuel wood, and a number of sugarbushes with sugarhouses producing syrup for owners and surplus for sale in Brookfield. The local farmer's markets in nearby towns, such as Randolph, Royalton, and Bethel, provide outlets for raw agricultural and value-added products.

Electric power and telephone services are primarily provided by Green Mountain Power, Washington Electric Cooperative, Consolidated Communication, along with other competitive telecommunications carriers. In the past couple of years, a local telecommunications company, EC Fiber, set up on all roads in Brookfield reliable fiber optic internet and phone services. All water and sewage facilities are privately owned. In 1992 Brookfield joined Braintree and Randolph in establishing a separate solid waste district. Trash is now collected in Randolph and trucked by a contractor to a landfill outside the district. In July 2015, the Towns of Randolph, Braintree, Brookfield, Northfield joined together to form the Mountain Solid Waste District.

Primary fire protection is provided by the voluntary fire company based in East Brookfield and, for West Brookfield, by the Randolph Fire Department. Volunteer membership for the fire department fluctuates, but stays around twenty active members that meet monthly for trainings. Law enforcement services are provided by the Town Constable, the Orange County Sheriff, and the State Police.

Medical emergencies are handled by the private, non-profit White River Valley Ambulance (WRVA), Inc. located in Bethel. They have three ambulances. The Randolph Center Fire Department has extraction equipment. The closest hospital is Gifford Medical Center, located in Randolph. Medivac services are available by the DHART helicopter. In 2015, Brookfield split the town in two in terms of EMS coverage, and coverage will be split between Barre Town EMS and WRVA, though there is no plan to reduce the area in town that WRVA serves.

IV. The Planning Process

A. Plan Developers

The Town of Brookfield procured the Two Rivers-Ottawaquechee Regional Commission (TRORC) to assist with updating the 2015 Hazard Mitigation Plan. Tory Littlefield, Regional Planner, was the main staff person from TRORC that assisted the town. In conjunction with Rich Doolen, the Emergency Management Director, the following community members were enlisted to be the steering committee for this Plan update:

- Gwynn Zakov – Planning Commission Chair, TRORC Board Representative
- Jeff Kimmel – Selectboard Member
- Kevin Wheatley – Volunteer Fire Department Chief

B. Plan Development Process

The 2010 Brookfield Annex was originally part of the 2008 multi-jurisdictional Regional Hazard Mitigation Plan, drafted by Two Rivers-Ottawaquechee Regional Commission, and approved by FEMA on September 30, 2008 with its first local annex. The Brookfield Annex received subsequent FEMA approval, but, since it was part of a larger plan, FEMA treats its start date as September 30, 2008, meaning the Brookfield Annex expired on September 30, 2013.

This Plan was reconstructed in 2016 (FEMA Approved June 24, 2016) as a single jurisdiction, standalone Brookfield Local Hazard Mitigation Plan. As such, several sections were added or updated to include all necessary information.

The 2016 Plan provided a good base for the 2021 Plan update. Below, you can find the summary of changes and of the planning process for the 2016 Plan, and a thorough description of the changes and planning process for the 2021 Plan.

Summary of 2016 Planning Process, Changes, and Additions

New sections were added to discuss the plan development process, mitigation strategies, existing hazard mitigation programs, projects and activities, and plan maintenance. Data updates were made to relevant sections, and hazards were reevaluated with a hazard ranking system used by Vermont Emergency Management (then the Vermont Division of Emergency Management and Homeland Security).

The top hazards that were identified by the Town, and was analyzed in great detail in the Plan, were; Structure Fire, Flash Flood/Flood/Fluvial Erosion, Extreme Cold/Snow/Ice Storm, and Severe Weather. A previous top hazard from the 2010 Annex and was removed from this 2016 Plan was Hazardous Materials Spills. For each new hazard, a location/vulnerability/extent/impact/likelihood table was added to summarize the hazard description. Additionally, maps were added to the 2016 Plan depicting critical facilities, town infrastructure, and the NFIP designated floodway and 100-year floodplain.

Several meetings were held in 2014 through 2016 for this iteration of the mitigation plan. The planning process began in October 2014 with TRORC and members of the Town of Brookfield to explain the purpose of a hazard mitigation plan and the benefits it provides to the towns. Subsequent meetings were held in January, February, April, and June 2015. All were publicly warned and open to the public.

2021 Plan Changes and Planning Process

While the 2016 Brookfield Plan provided a good basis for the 2021 Plan, there were several sections that needed to be updated based on public meetings. Below is a list of significant changes made to this Plan:

- **General**
 - Data updates: new hazard incidents, new federal emergency declarations, and census data,
 - Reevaluation of hazards using a hazard ranking system.
 - Maps were updated to reflect new state data layers.
- **Hazard Analysis**
 - Based on the hazard ranking exercise conducted on a public meeting held on July 20, 2021, the following hazards were identified as being the top hazards in Brookfield: Fire Hazards (Structure, Wildfires, and Brushfires), Invasive Species, and Severe Weather. Each hazard is thoroughly analyzed for the Town of Brookfield to include location, vulnerability, extent, impact, and likelihood.
 - No top hazards were explicitly removed from the 2016 Plan for the 2021 Plan. The committee felt that Severe Weather is an all-encompassing term, so they decided to place extreme cold, flood/flash flood/fluvial erosion under that. They also decided to combine Structure Fires with Brushfires/Wildfires.
- **Mitigation Strategies**
 - A public meeting was held on August 24, 2021 with the committee to develop mitigation strategies for the 2021 Plan.
 - Mitigation strategies related to Severe Weather, Fire Hazards (Structure, Brushfire, and Wildfires) and Invasive Species. Hazards that were completed or no longer relevant to the new Plan were deleted in the new mitigation strategy table.
 - Mitigation strategies that were completed since the 2016 plan were removed and added into a new table that shows what was accomplished since the last plan was adopted.
- **“Review of existing plans, studies, reports, and technical information (44 CFR 201.6(b)(3))**
 - State of Vermont Hazard Mitigation Plan, 2018
 - Brookfield Hazard Mitigation Plan (Adopted June 13, 2016)
 - This plan was referenced extensively during the update / development process, especially in regard to the worst threats and mitigation action strategies identified in 2016.
 - Brookfield Town Plan (Adopted September 12, 2016)
 - This plan provided TRORC’s staff with background information on the community, as well as more detail on their emergency services.
 - Brookfield’s Local Emergency Management Plan (LEMP) (Last Adopted March 22, 2021)
 - This Plan was referenced for general information about Royalton’s emergency operations.
 - Additional data sources are listed below for each hazard:
 - Fire Hazards (Structure, Brushfire, and Wildfires)
 - Data was provided by the Brookfield Fire Chief on calls the Fire Department responded to in the last five years.

- Invasive Species
 - Data was acquired from the Vermont Invasives website on invasive species that affect Brookfield.
- Severe Weather
 - Data was acquired from the NOAA Storms Database over the past 20 years of major storms that affected Brookfield and Orange County, Vermont.

The 2016 planning process was an immersive process taken on by the committee and TRORC, since it acted as a standalone plan for the first time. For the 2021 Plan, a similar process was conducted with the committee to gather as much public feedback as possible. Below are descriptions of each meeting that was held when drafting this new plan.

- July 20, 2021
 - Summary: a public meeting was notified and held at the Randolph CO-Working Space. There was a total of four participants. This meeting acted as a kick-off meeting to explain what a hazard mitigation plan is, as well as to conduct the hazard ranking exercise.
 - Major outcomes: Three major hazards were selected as the focus of this Plan based on the hazard ranking exercise.
 - Notifications: A notice was created and posted to the TRORC website, in physical locations around town, and in the Randolph Herald. No members of the public were present.
- August 24, 2021
 - Summary: a public meeting was notified and held at the Randolph Co-Working Space. There was a total of four participants. A summary of mitigation planning was had as a brief recap for the attendees, and then the group went through the 2016 mitigation actions and created new mitigation actions.
 - Major outcomes: The group went through the 2016 mitigation actions and determined which ones were completed, which ones were not, and which actions should be rolled over to the 2021 Plan. New mitigation actions were then created to account for new top hazards.
 - Notifications: a public notice was posted to the TRORC website, posted around town, and placed in the Randolph Herald. No members of the public were present.
- October 5, 2021
 - Summary: this meeting was not posted publicly, and its purpose was for the planning committee to review the changes to the draft mitigation plan before the final public meeting.
 - Major outcomes: the committee went through the entire plan prepared by TRORC based on the outcomes of the other public meetings. More suggested edits were made throughout the Plan. Overall the committee was impressed on how the Plan came together.
- October 25, 2021
 - Summary: A public meeting was notified and held at the regularly scheduled Brookfield Selectboard meeting at the Brookfield Town Office. TRORC walked the selectboard

through the plan, explaining the major changes, and discussing next steps. There were two members of the public present at this meeting.

- Major outcomes: The Selectboard had a lively discussion on historical storms that occurred in Brookfield. They felt this plan was a good reminder of the hazards that affect the Town.
- Notifications: This was a regularly scheduled Selectboard meeting, the agenda was posted on the town website and in three physical locations around town.

A draft of the Brookfield Mitigation Plan was sent to surrounding communities Selectboard Chair or Town Manager via email on October 22, 2021 to ask for feedback. The community's that the draft plan was sent to included Roxbury, Northfield, Williamstown, Chelsea, Randolph, and Braintree. Feedback was due via email to TRORC by November 5, 2021. No comments on the draft plan were received. Below is the email message that was sent to these communities:

Dear town official,

*On behalf of the Town of Brookfield, per 44 CFR 201.6 Local Mitigation Plans Requirement §201.6(b)(2), jurisdictions that are updating or creating a Local Hazard Mitigation Plan are required to send a draft of the plan to all neighboring communities for comment. The Brookfield Mitigation Plan is attached for your review. **Any comments on this plan must be emailed back to me by Friday, November 5, 2021 for consideration.** Additionally, a public meeting on the Brookfield Hazard Mitigation Plan will be held at the Brookfield Town Office at 6:30 p.m. on Monday, October 25, 2021. Comments are welcome at this meeting.*

C. Status Update on Mitigation Actions Identified in 2016

The following table outlines the mitigation actions that were proposed in Brookfield’s 2016 Hazard Mitigation Plan for the Town of Brookfield.

Participants in the new Plan update process reviewed these actions and reported on the status of each (in order of 2011 priority). Actions related to long-term mitigation of natural hazards are so noted.

Mitigation Action	Local Leadership	Prioritization (Mitigation Plan Status)	Possible Resources	Time Frame	Completed?
Structure Fire					
<p><i>Install new dry hydrants in the following locations to protect town infrastructures from structural fires (Mitigation):</i></p> <ul style="list-style-type: none"> • <i>Brown Dr. at crossing of the Second Branch of White River</i> • <i>Bear Hill Rd. at Order 2 Stream crossing</i> 	Brookfield Fire Department	Medium (4 th in priority of 5 natural hazard mitigation actions in 2011 plan)	Local resources; Vermont Rural Fire Protection Task Force grants	Summer 2019- Summer 2020	No. The Brown Drive location was not completed, and the Bear Hill Road location was determined to be unsuitable for a dry hydrant because the stream is too intermittent. Not incorporated as an action in the 2021 LHMP.
<p><i>Upgrade dry hydrants in the following locations to protect town infrastructure from structural fires (Mitigation):</i></p> <ul style="list-style-type: none"> • <i>East St. near the intersection of Birch Meadow Rd.</i> • <i>Bear Hill Rd. near Brassard Pond</i> 	Brookfield Fire Department	Medium	Local resources; Vermont Rural Fire Protection Task Force grants	Summer 2019- Summer 2020	The East Street location was not completed and is identified as an action in this 2021 plan, the Bear Hill Road location was upgraded to suit the Fire Department’s needs.
Extreme Cold/Snow/ Ice Storm					
<p><i>Develop a program to budget for and maintain roads for safe winter travel, which will reduce the threat to the health of residents. (Mitigation)</i></p>	Selectboard/ Road Foreman	High (new)	Local resources; State of Vermont	Spring 2018	Yes, this is done annually in the town budget.

Mitigation Action	Local Leadership	Prioritization (Mitigation Plan Status)	Possible Resources	Time Frame	Completed?
<i>Create a plan to assist individuals that are vulnerable to extreme cold, which will reduce the risk to the health of these vulnerable residents. (Mitigation)</i>	Town Services Officer	Low (new)	Local resources; Vermont Economic Services Division	Fall 2022	This was not completed. Incorporated as an action in the 2021 LHMP.
<i>Develop a plan to assist VTrans in maintaining Vermont Route 65, including winter maintenance, within the Town of Brookfield. Proper maintenance of this road will ensure the longevity of the infrastructure and will reduce the risk to the health of Brookfield residents who use the road. (Mitigation)</i>	Selectboard/ Road Foreman	High (new)	Local resources; VTrans	Spring 2018	Yes, an agreement between the Town and Vermont Agency of Transportation has been executed.
Extreme Cold/Snow/ Ice Storm/Severe Weather (High Wind)					
<i>Work cooperatively with local utilities to encourage them to clear and maintain utility corridors, as needed. This will help protect utility infrastructure and will reduce power outages. (Mitigation)</i>	Selectboard	Low (1 st and 5 th in priority of 5 natural hazard mitigation actions in 2011 plan)	Local resources; Green Mountain Power; Washington Electric Company	Winter 2021	Yes.
<i>Develop a program to clear and maintain town road rights-of-way to prevent damage to town infrastructure. (Mitigation)</i>	Selectboard/ Road Foreman	High (new)	Local resources (road crew); contractors	Fall 2018	Yes, this has been completed and is conducted annually.
Flash Flood/ Flood/ Fluvial Erosion/Severe Weather					

Mitigation Action	Local Leadership	Prioritization (Mitigation Plan Status)	Possible Resources	Time Frame	Completed?
<i>Develop a schedule and program to replace undersized culverts. Properly sized culverts effectively handle large volumes of water and therefore protect town infrastructure. (Mitigation)</i>	Selectboard/ Road Foreman	Medium (2 nd in priority of 5 natural hazard mitigation actions in 2011 plan)	Local resources; VTrans	Spring 2020	Yes, this is done annually and as needed.
<i>Complete an up-to-date geo-referenced culvert inventory, which will identify priority upgrade projects. Defining which culverts require replacement identifies areas that will be improved. Upgraded culverts will allow for greater volumes of water to be cleared in flooding and storm events, therefore protecting town infrastructure. (Mitigation)</i>	Road Foreman	Medium	Local resources; TRORC; VTrans Better Backroad grant	Summer 2019- Summer 2020	Yes, this was completed in 2020.
<i>Update the Brookfield Flood Hazard Area Bylaw, which will properly identify what actions are impermissible in flood hazard areas. Disallowing these actions in floodplains protects infrastructure from future damage. (Mitigation)</i>	Planning Commission	Medium (new)	Local resources; TRORC; Municipal Planning Grant	2 years from date of Plan Approval	This was not completed, but is rolled over as a 2021 mitigation action.

Mitigation Action	Local Leadership	Prioritization (Mitigation Plan Status)	Possible Resources	Time Frame	Completed?
<i>Adopt river corridor regulations that will incorporate VT ANR's river corridor maps. Identifying areas on a map that are prone to flooding allows residents and town officials to pinpoint areas that are vulnerable to damage and future areas where development should be avoided in case of future damage. (Mitigation)</i>	Planning Commission	Medium (3 rd in priority of 5 natural hazard mitigation actions in 2011 plan)	Local resources; TRORC; Municipal Planning Grant; Vermont Agency of Natural Resources	Winter 2019	This was not completed. The Town has added this as an action item for this 2021 Plan.
<i>Request new flood map from FEMA. Updated flood maps will more accurately portray areas and properties that are vulnerable to flooding, which will allow Brookfield to define strategies to mitigate damage to newly identified hazard areas. (Mitigation)</i>	Town Zoning Administrator	Medium (new)	Local resources; FEMA	Fall 2019	The committee was unsure if this was done. At the time of the 2021 Plan update, FEMA was doing some re-mapping work on the main stem of the White River. The Town still wishes to complete this action.
<i>Encourage projects to protect or restore strategic areas of floodplain to provide areas for flood storage, which will help alleviate peak flood flows and protect other infrastructure in town from flooding. (Mitigation)</i>	Selectboard/ Planning Commission	Low (new)	Local resources; Vermont Department of Environmental Conservation's Ecosystem Restoration Program grants	Fall 2022	Yes, this is evident in Brookfield's bylaw.

Mitigation Action	Local Leadership	Prioritization (Mitigation Plan Status)	Possible Resources	Time Frame	Completed?
<i>Provide public outreach on flood hazard and river corridor zoning bylaw proposals and implications for federal flood insurance. Citizen comprehension of these topics will help prevent risk to public health during hazards and will spread knowledge about vulnerable hazard areas in Brookfield. (Mitigation)</i>	Planning Commission/ Selectboard	Medium (new)	Local resources; TRORC; Municipal Planning Grant; Vermont Agency of Natural Resources	Spring 2019	This was not completed, but the Town will look at doing this over the next five years as it updates their regulations.
<i>Provide technical assistance to homeowners who qualify for federal elevation or acquisition of their property, and wish to proceed with fulfilling these actions. Elevation and acquisition of structure will reduce the risk to property in frequently flooded areas and the health of those who live in these structures. (Mitigation)</i>	Selectboard	Low (new)	Local resources; FEMA HMGP	Fall 2022	This was not completed, and the committee is unsure if this is a service the town should provide. Not incorporated as an action in the 2021 LHMP.
<i>Upgrade culvert on Old Cross Road, which will increase its hydraulic capacity, therefore mitigating against damage to town infrastructure. (Mitigation)</i>	Selectboard/ Road Foreman	High (new)	Local resources; consultant	Summer 2018	Unsure if this has been completed, this is added as an action item in this 2021 Plan.

Mitigation Action	Local Leadership	Prioritization (Mitigation Plan Status)	Possible Resources	Time Frame	Completed?
<i>Upgrade culvert #0326 on Bear Hill Road to a box culvert, which will greatly increase its hydraulic capacity and therefore mitigating against damage to town infrastructure. (Mitigation)</i>	Selectboard/ Road Foreman	<i>High (new)</i>	<i>VTrans Structures grant; local resources</i>	Summer 2018- Summer 2019	This has not been completed, but the Town is currently applying for a grant from VTrans to upgrade the structure. Incorporated as an action in the 2021 LHMP update.
<i>Install catch-basin and 15" culvert on Northfield Road which will connect to catch pond located on the opposite side of road. This will help prevent future road erosion and will protect town infrastructure. (Mitigation)</i>	Selectboard/ Road Foreman	<i>High (new)</i>	<i>VTrans Better Backroads grant; local resources</i>	Summer 2018- Summer 2019	Completed, but the culvert installed was 18" to comply with Vermont stormwater rules.
All Hazards					
<i>Ensure that Brookfield's Local Emergency Operations Plan (LEOP) is kept up-to-date and identifies vulnerable areas and references this Plan. (Preparedness)</i>	Selectboard/ Emergency Management Director	High	Local resources; TRORC; Vermont Department of Emergency Management & Homeland Security (DEMHS)	Spring 2017	Yes, this is done annually
<i>Develop a methodology to document infrastructure damage after weather events. (Preparedness)</i>	Road Foreman	High (new)	Local resources; TRORC; VT DEMHS	Fall 2019	Yes
<i>Disseminate information about VT Alert and encourage residents to sign up. (Preparedness)</i>	Town Administrative Assistant	High (new)	Local resources; VT DEMHS; VT Alert	Fall 2018	No, but the town will still pursue it.
<i>Install a generator at the Brookfield Elementary School. (Preparedness)</i>	Brookfield Elementary School in coordination with the Selectboard	Low	Local resources; Brookfield Elementary School; generator grants	Spring 2022	Yes

Mitigation Action	Local Leadership	Prioritization (Mitigation Plan Status)	Possible Resources	Time Frame	Completed?
			(ex. FEMA HMGP)		
Structure Fire					
<i>Ensure that fire department personnel maintain their firefighter certifications. (Preparedness)</i>	Brookfield Fire Department	High	Local Resources	Spring 2017	Yes

Table 1. Status Update on Mitigation Actions Identified in 2016

D. Changes in Town Priorities and Vulnerabilities Since the 2016 Plan

This 2021 Local Hazard Mitigation Plan reflects the evolution of the Town’s priorities since 2016. Most of the hazards changed in rankings and the top hazards that were selected differ from those of the 2016 Plan. In 2016, the top hazards were structural fire, extreme cold/snow/ice storm, severe weather, and flash flood/flood/fluvial erosion. The 2021 planning committee decided to create a broader Severe Weather category that includes extreme cold/snow/ice storm and flash flood/flood/fluvial erosion. The Structural Fire category was broadened to include wildfires and brushfires. The committee added Invasive Species as a top hazard due to the recent Emerald Ash Borer infestation, among other invasive species that have had detrimental effects on Brookfield’s ecosystem.

E. Status of Development in Brookfield

The Town of Brookfield is rural. It meets the definition of a “bedroom community,” particularly with its close proximity to Interstate 89. Despite sharing a border with one of the most populous and developed towns in the region, Randolph, the building activity in Brookfield has been relatively light in recent years. Since the new zoning administrator started in August 2019, there have been 54 permit applications that include new housing development, add-ons, decks, garages, and sheds. There were 6 subdivision applications that were reviewed and approved by the Town. Overall, the development in Brookfield is minimal and nothing major has been permitted in the town.

There are no plans for commercial development in the Town, and no development of this type is anticipated. Due to the mountainous terrain and steep valleys in the Town of Brookfield, new development may be vulnerable to either flood hazards or fluvial erosion hazards. The vulnerability of any new growth would be dependent on its location near a Special Flood Hazard Area (SFHA), near a small stream, or on a steep hill. The Town’s Flood Hazard Area Bylaws prohibit new development in the SFHA and will be updated, as needed during the upcoming Town Plan and zoning bylaw update. The Town is also interested in adopting river corridors regulations, which help reduce the vulnerability of new development to fluvial erosion hazards. According to Flood Ready Vermont, Brookfield has 19 buildings in the SFHA, 3 of which have current flood insurance policies in place. Repetitive flood damage on these buildings are unknown.

F. Town Capabilities for Implementing Mitigation Strategy

The Town of Brookfield is currently engaged in the following hazard mitigation programs, projects and activities:

This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(3).

	Type of Existing Authority / Policy / Program / Action	Resources: Staffing & Funding	Ability To Expand/Improve On
Community Preparedness Activities	Program—Annual update of Brookfield’s Local Emergency Management Plan (LEMP). Last updated and approved on 03/22/2021.	Volunteer time from the Selectboard//Emergency Management Director/Coordinator; assistance from TRORC. Funding from Vermont Emergency Management and local resources.	This document is reviewed and updated each year to ensure that the contact information of emergency response personnel is up-to-date. This information is then sent to Vermont Emergency Management and TRORC for their records. Potential expansions would be to complete the long-form version of this Plan.
	Red Cross Shelter Designation	Staff time from the Brookfield School, Emergency Management Director/Coordinator. Funding from American Red Cross.	There remains interest in completing this action, but a shelter has not been designated at the school yet. The current town shelter is at the Fire Department. The Town needs to assess and find a better location for a local shelter for Brookfield residents.
	REMC Emergency Management Association	Staff time from the Brookfield EMD. REMC is staffed by TRORC with funding through VEM.	Brookfield has not traditionally attended LEPC meetings, the EMD should attend REMC meetings once this organization is stood up.
	Program—Participation in the Fire Advisory Committee between the Towns of Braintree, Brookfield, and Randolph	Volunteer time from the Brookfield Fire Chief and possibly other members of the Brookfield Fire Department.	Participation in the Fire Advisory Committee is adequate at this time (monthly), so there is no need to expand or improve it.
	Ongoing Action— Ensure that fire department personnel maintain their Firefighter certifications.	Volunteer time from the Brookfield Fire Chief. Funding from fire department, VT Fire Academy, and mutual aid departments.	There is no need to expand or improve on this action.
	Ongoing Action - receive training and practice using brushfire/forestry equipment.	Volunteer time from the Brookfield Fire Chief. Funding from fire department,	There is no need to expand or improve on this action.

	Type of Existing Authority / Policy / Program / Action	Resources: Staffing & Funding	Ability To Expand/Improve On
		VT Fire Academy, and mutual aid departments.	
	Ongoing Action - survey potential dry hydrant sites to determine the need for additional sites and potential location, and install dry hydrants.	Volunteer time from the Brookfield Fire Chief. Funding from fire department, VT Fire Academy, and mutual aid departments.	There is no need to expand or improve on this action.
	Ongoing Action – Notify residents of how they can obtain a burn permit and instruct them on how to safely burn outdoors.	Volunteer time from the Brookfield Fire Chief.	There is no need to expand or improve on this action.
Insurance Programs	<p>Authority/ Program— participation in National Flood Insurance Program (NFIP)</p> <p>The Town of Brookfield participates in and is compliant with the NFIP by enforcing its most currently adopted Flood Hazard Area Bylaws (Adopted in 2007). The Town enforces the Flood Hazard Area Regulations based on the 09/29/1978 FIRMs.</p> <p>[Note: This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(3)(ii).]</p>	Staff time from the Brookfield Administrative Officer and sometimes volunteer time from the Zoning Board of Adjustment. Assistance from TRORC and Vermont ANR. Funding from local resources—annual budget.	<p>The Town’s initial Flood Hazard Boundary Map (FHBM) was dated 12/13/1974. The Town’s initial Flood Insurance Rate Map (FIRM) was dated 09/29/1978. The Town of Brookfield Vermont Flood Insurance Study (FIS) is dated March 1978. The Town’s current Flood Insurance Rate Map (FIRM) has been updated since the Flood Insurance Study (FIS) was issued, and the current effective date for the Town’s FIRMs is 09/29/1978.</p> <p>The Town has not requested that FEMA update its FIRMs.</p> <p>There are no documented NFIP repetitive loss properties in Brookfield as of December 2021.</p>
Land Use Planning	Policy/Program— Brookfield Town Plan (Adopted 9/12/2016).	Volunteer time from Planning Commission, and assistance from TRORC and other state agencies on specific subject matter. Funding from Municipal Planning Grants.	The Town Plan is updated every eight years, as required by statute. The Planning Commission may expand or improve on any section it deems necessary, or that is required by changes in state statute. The next

	Type of Existing Authority / Policy / Program / Action	Resources: Staffing & Funding	Ability To Expand/Improve On
			Town Plan will be expired in 2024, the Planning Commission will shortly begin revisions.
	Authority—Brookfield Development Bylaw (As Amended Effective 04/12/2010)	Volunteer time from Planning Commission, and assistance from TRORC and other state agencies on specific subject matter. Funding from Municipal Planning Grants.	During the Town Plan review/update period, the Brookfield Development Bylaw is also reviewed and updated if needed. At this time, the Planning Commission is currently updating the bylaw.
	Authority—Brookfield Flood Hazard Area Bylaw (Adopted in 2007).	Volunteer time from the Planning Commission, and assistance from TRORC and Vermont ANR. Funding from Municipal Planning Grants.	During the Town Plan review/update period, the Flood Hazard Area Bylaw also is reviewed and updated if needed. The Planning Commission expects to review the Flood Hazard Area Bylaw in conjunction with the current Town Plan review process.
	Authority—Brookfield Subdivision Regulations (As amended 11/14/2005)	Volunteer time from the Planning Commission and assistance from TRORC. Funding from Municipal Planning Grants.	The Subdivision Regulations are reviewed during the Town Plan review/update process, and updated if necessary. At this time, there are no specific plans to update the Town’s Subdivision Regulations.
	Policy— Encourage projects to protect or restore strategic areas of floodplain to provide areas for flood storage, which will help alleviate peak flood flows and protect other infrastructure in town from flooding.	Staff time from Zoning Administrator; Volunteer time from Planning Commission and Selectboard. Funding From FEMA and Town budget.	There is no need to expand or improve on this action.
	Ongoing Action— Maintain the geo-referenced culvert inventory update with TRORC assistance in 2020	Staff time from the Road Foreman; with assistance from TRORC. Funding from VTrans.	The Town is currently using the culvert inventory to further its culvert improvement program, and the inventory was updated in 2020 with assistance from the Road Foreman. The inventory was improved upon by georeferencing culvert locations.

	Type of Existing Authority / Policy / Program / Action	Resources: Staffing & Funding	Ability To Expand/Improve On
Hazard Control & Protection of Critical Infrastructure & Facilities	2020 Road Erosion Inventory This Road Erosion Inventory (REI) will provide the town a list of road segments that are the most vulnerable to fluvial erosion as well as an improvement plan for this road segments to lessen erosion.	Personnel time from Town Road Commissioner/Foreman; assistance from TRORC. Funding from Better Roads grants and local resources.	The Town will use this REI to further its culvert and road improvement program by helping to prioritize culvert and ditching upgrade projects. The Town will keep the REI inventory up-to-date on a five-year basis. This will be the first time Brookfield has a completed REI to comply with the Municipal Roads General Permit (MRGP).
	Authority— Town Road and Bridge Standards (Adopted 07/22/2019)	Adopted by the Selectboard, implemented by the Road Foreman, assistance from TRORC. Funding from VTrans and the local budget to implement.	Specifies minimum construction standards for roadway, ditches, culverts and bridges and guardrails. VTrans updates the Town Road and Bridge Standards on a fairly regular basis. The Town has the authority to require above-and-beyond what is written in the policy.
	Ongoing Action— Maintain the program to regularly inspect culvert and bridges, as well as keeping to the culvert replacement schedule as recommended in the culvert inventory.	Staff time from the Road Foreman; with assistance from TRORC. Funding from local budget.	There is no need to expand or improve on this action.
	Policy/Program— Brookfield Hazard Mitigation Plan (Adopted on 07/26/2010)	Volunteer time from Town officials; assistance from TRORC and Vermont DEMHS. Funding from FEMA; Vermont DEMHS; TRORC.	The 2015 Brookfield Local Hazard Mitigation Plan will replace the expired 2010 Plan. The 2015 LHMP has evolved from the 2010 Plan and has greatly expanded and improved upon it. Future iterations of the Town’s LHMP will be updated by the Town at least every five years.
	Ongoing Action— Plan for, budget and maintain roads for safe winter travel.	Staff time from Road Foreman and Volunteer time from Selectboard. Funding from local budget.	There is no need to expand or improve on this action.
	Ongoing Action— Clear and maintain town road rights-of-way, and work with local	Staff time from the Road Foreman; with assistance from utility companies.	There is no need to expand or improve on this action.

	Type of Existing Authority / Policy / Program / Action	Resources: Staffing & Funding	Ability To Expand/Improve On
	utilities to request that utility corridors are cleared and maintained, as needed.		
	Ongoing Action— Education/Communication to community regarding structure fire prevention or important information.	Time from the Volunteer Fire Department and funding from Fire Department budget.	This is an ongoing action. The Brookfield Volunteer Fire Department circulates fire prevention information and participates in Fire Prevention Week. Every two to three years, the Fire Department runs a fire prevention program and completes a fire drill activity every five years or so.
Education/ Public Outreach	Ongoing Action—The Town of Brookfield regularly posts to Front Porch Forum.	Time from the Volunteer Fire Department and funding from Fire Department budget.	There is no need to expand or improve on this action.
	Ongoing Action—Brookfield Town website Important and pertinent town information and a town-events calendar (including meeting information for the Selectboard and Planning Commission) can be found on the Town’s website.	Staff time from the Town Office	The Town recently upgraded its website, and the current website works well.
	Ongoing Action – Conservation Commission outreach on climate change affects to Brookfield	Time from the volunteer Conservation Commission, funding from local sources.	There is no need to expand or improve on this action.

Table 2. Existing Hazard Mitigation Programs, Projects & Activities in Brookfield

G. Plan Maintenance

This Plan will be updated and evaluated annually, by discussing its effectiveness and making note to incorporate any necessary revisions in the update process, at a March or April Selectboard meeting, along with the review of their Local Emergency Management Plan (LEMP). At this meeting, the Selectboard and Emergency Management Director will monitor the implementation of the hazard mitigation strategies outlined in this Plan, by noting those that have been completed, are in the process of completion, or any issues with initiating the activity. Any comments from local officials and the public will be incorporated when relevant. This meeting will constitute an opportunity for the public and other town officials to hear about the town’s progress in implementing mitigation strategies and to give input on future activities and Plan revisions. The public will be given the opportunity to comment at this meeting, and the comments will be incorporated when relevant.

The local Emergency Coordinator/Director will lead in monitoring and updating this plan. Updates and evaluation of this Plan by the Selectboard and the local Emergency Coordinator/Director will also occur within three months after every federal disaster declaration directly impacting the Town of Brookfield. The Town will monitor, evaluate and update this Local Hazard Mitigation Plan at a March or April Selectboard meeting and after every federally declared disaster directly impacting the Town. The Town shall reference the Local Hazard Mitigation Plan when working on Town Plan amendments or changes to the Town's bylaws.

At least one year before the Plan expires, the update process will begin (through annual updates, monitoring of progress and evaluation that will occur at the April Selectboard meeting). The town may seek outside consultation to assist in the next plan update by sending out a request for proposals that meets federal procurement standards. Two Rivers-Ottawaquechee Regional Commission (TRORC) may be an available source to help with Plan updates if assistance is requested by the Town of Brookfield and if funding is available. If an outside consultant is unable to assist the Town, then Brookfield's Town Clerk, Administrative Assistant, or Selectboard will update the Plan, or the Selectboard may appoint a committee of interested citizens (including the current local Emergency Director) to draft changes. Ultimately, it will be the Town's responsibility to update their Local Hazard Mitigation Plan.

The process of evaluating and updating the plan will include continued public participation through public notices posted on the municipal website, notice within the municipal building, and notice in The Valley News and the TRORC newsletter/website, inviting the public to the scheduled Selectboard (or specially scheduled) meeting. The public will be given the opportunity to comment during this process. Additional stakeholders should be invited to the meeting; these include: UV Mutual Aid, the Army Corps of Engineers, and the Vermont Agency of Natural Resources (VT ANR). VT ANR will be invited because they can provide assistance with NFIP outreach activities in the community, models for stricter floodplain zoning regulations, delineation of fluvial erosion hazard areas, and other applicable initiatives. These efforts will be coordinated by the Selectboard.

Updates may include changes in community mitigation strategies; new town bylaws, zoning and planning strategies; progress on the implementation of initiatives and projects; effectiveness of implemented projects or initiatives; and evaluation of challenges and opportunities including overall effectiveness of plan goals and actions in reducing vulnerabilities. If new actions are identified in the interim period, the plan can be amended without formal re-adoption during regularly scheduled Selectboard meetings.

Brookfield shall also incorporate mitigation planning into their long-term land use and development planning documents. The 2015 Brookfield Town Plan makes reference to the 2015 Brookfield LHMP. The 2013 Vermont Legislature passed a law requiring all towns to incorporate flood resiliency elements into their town plans as of July 2014. To do so, flood hazard and fluvial erosion hazards will be identified, and strategies and recommendations will be provided to mitigate risks to public safety, critical infrastructure, historic structures and public investments. This Local Hazard Mitigation Plan assisted the Town when the Town Plan was updated and adopted in 2017 when a new flood resilience element was added.

It is also recommended that the process work both ways and the Town review and incorporate elements of the Local Hazard Mitigation Plan into updates for the municipal plan, zoning regulations, and flood

hazard/ fluvial erosion hazards (FEH) bylaws. The incorporation of the goals and strategies listed in the Local Hazard Mitigation Plan into the municipal plan, zoning regulations and flood hazard/FEH bylaws will also be considered after declared or local disasters. The Town shall also consider reviewing any future TRORC planning documents for ideas on future mitigation projects and hazard areas.

Town compliance with the NFIP is enforced by the Floodplain Administrator and the Flood Hazard Review Board, as outlined in Brookfield's Flood Hazard Area Regulations. A permit is required for all construction and development in special flood hazard areas. Certain activities within the flood hazard area, such as parking of recreational vehicles, may be approved administratively by the Administrative Officer. Conditional uses in the flood hazard area require approval from the Flood Hazard Review Board, such as fills or excavations, creation of a lot, and utilities.

V. Community Vulnerability by Hazard

A. Hazard Identification

Mitigation efforts must be grounded in the rational evaluation of hazards to the area and the risks these hazards pose. This is done through a process that in essence asks and answers three basic questions:

- What bad things can happen, given the Town’s vulnerabilities?
- How likely are they to occur?
- How bad could they be?

This process, which is laid out in the table below, is an attempt to inventory the known hazards, establish the likelihood of them occurring in the future, and then assess the community’s potential vulnerability to each. In performing this analysis, we are then able to prioritize actions that are designed to mitigate the effects of each of these disaster types and ultimately make Brookfield a safer place.

It is important that we learn from the past in order to avoid the same disasters and their outcomes. Disasters that have occurred within the Town of Brookfield, the larger region, and the State of Vermont can give us good information about what types of disasters we can expect in the future and what kinds of damage they might cause. However, while this historical data can inform our perspective of what might happen in the future, it is by no means a prophecy. While Brookfield might not have been impacted by a specific hazard in the past, this does not necessarily mean it will never be affected in the future. Indeed, the advance of climate change means that old weather patterns may not hold. For instance, in recent years, Vermonters have seen an increase in the number and severity of storms, especially high intensity rainfall events. Armed with historical data and a healthy respect for climate change and the unknown, we have tried our best to identify hazards and prepare for the future.

The following table reflects the hazards that we believe can be expected, or are at least possible, in the central Vermont area. In the 2021 Plan, it was decided to model the hazard ranking off of the 2018 Vermont State Hazard Mitigation Plan to simplify the process. The table below shows the ranking criteria that was used.

Hazard Assessment Ranking Criteria		
	Frequency of Occurrence: Probability of a plausibly significant event.	Potential Impact: Severity and extent of damage and disruption to population, property, environment and the economy.
1	Unlikely: >1% probability of occurrence per year	Negligible: isolated occurrences of minor property and environmental damage, potential for minor injuries, minor economic disruption.
2	Occasionally: 1-10% probability of occurrence per year, or at least one chance in next 100 years	Minor: isolated occurrences of moderate to severe property and environmental damage, potential for injuries, minor economic disruption

3	Likely: >10% by <75% probability per year, at least 1 chance in next 10 years.	Moderate: severe property and environmental damage on a community scale, injuries or fatalities, short-term economic impact
4	Highly Likely: 75% or greater probability in a year	Major: severe property and environmental damage on a community or regional scale, multiple injuries or fatalities, significant economic impact

Table 3. Hazard Assessment Ranking Criteria

Using this ranking criteria, the table on the next page shows a list of hazards that may affect Brookfield in the future, along with their ranking on which hazards are most likely to be severe. Out of this table, three hazards that are believed to be the worst threats are then followed-up with discussion and mitigation strategies throughout the rest of this Plan.¹ In this iteration of the Plan, several new hazards were added to the table, these included: pandemic, invasive species, sinkholes, gaps in emergency management response, communication gaps, and cyber security. While Severe Weather is one of the top hazards, it is an all-encompassing hazard. On this hazard assessment table, all of the sub-hazards are pieced out for individual analysis. It should be noted that hazards assigned with the same “Hazard Score” are not in order and their placement in the table should not be assumed to reflect their potential to create hazards for the town.

Brookfield Hazard Assessment							
Hazards	Probability	Potential Impact					Score
		Infrastructure	Life	Economy	Environment	Average	
Top Hazards							
Invasive Species	4	3	1	3	4	2.75	11
Severe Weather (averages)	3.2	3.1	1.8	2.1	2.7	2.4	7.5
Hurricane/ Tropical Storms	3	4	2	4	4	3.5	10.5
Ice Jams	3	4	2	3	3	3	9
Lightning	4	2	2	2	2	2	8
Extreme Heat	4	2	2	1	2	1.75	7
Extreme Cold/ Snow/ Ice	4	2	1	1	3	1.75	7
Landslides / Mudslides / Rockslides	2	4	3	3	4	3.5	7
Flash Flood/Floods/Fluvial Erosion	3	3	2	2	2	2.25	6.75
Hail Storms	3	4	1	1	2	2	6
Severe Wind	3	3	1	2	2	2	6

¹ It’s important to note that those hazards which were not found to pose the greatest threats may still occur in Brookfield’s future; however, they are not the focus of this Plan.

Brookfield Hazard Assessment							
Hazards	Probability	Potential Impact					Score
		Infrastructure	Life	Economy	Environment	Average	
Fire Hazards (Structure and Wildlife/Brushfire)	4	3	2	1	2	2	8
<i>Other Hazards Assessed</i>							
Communication Gaps	4	1	2	1	1	1.25	5
Epidemic / Pandemic	2	1	4	4	1	2.5	5
Tornado	1	4	3	2	3	3	3
Cyber Security	1	4	1	3	1	2.25	2.25
Sinkholes	2	4	4	3	4	3.75	7.5
Dam Failure	2	4	4	4	4	4	8
Hazardous Materials Spill	3	2	1	1	3	1.75	5.25
Gaps in EM Response	3	2	3	2	1	2	6
Water Supply Contamination (Private and Public Sources)	2	4	3	3	4	3.5	7
Earthquake	2	1	1	1	1	1	2
Tsunami (Vermont is landlocked)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Volcano (Vermont has no active volcanoes)	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 4. Brookfield Hazard Assessment

The Brookfield LHMP committee discussed the results of the hazard ranking activity and decided to focus on hazards that had the potential to impact the Town on a town-wide scale and had the potential to occur frequently.

After engaging in discussions using their best available knowledge, the Town of Brookfield identified the following ‘top hazards’ (based on frequency of occurrence and potential impact and the need for future analysis) which they believe their community is most vulnerable to:

- Invasive Species
- Severe Weather (Hurricanes, Tropical Storms, Ice Jams, Lightning, Extreme Heat, Extreme Cold / Snow / Ice, Landslides / Mudslides / Rockslides, Flash Flood / Floods / Fluvial Erosion, Hail Storms, and Severe Wind)
- Fire Hazards (Structure, Brushfires, and Wildfires)

Each of these “top hazards” will be discussed in the proceeding sections. Data for these hazards were gathered from several federal resources and are often only available at the county level. As such, information specific to Orange County was used to identify and evaluate the type, frequency and relative

impact of past events within the larger Brookfield region, which could therefore be expected to affect the community in the future.

The Brookfield LHMP committee identified fluvial erosion, snow and ice storms, landslides, earthquakes, infectious disease, and hail as low probability and low impact. Accordingly, and due to a lack of resources and capacity at the town, these hazards will not be discussed in detail in this plan. For a detailed description of these hazards, the reader should review the [Vermont State Hazard Mitigation Plan](#).

Data for these hazards was obtained from several resources within the State of Vermont, FEMA, and the National Oceanic and Atmospheric Administration (NOAA). NOAA compiles storm events data, dating from 1950 to present. For the purposes of this HMP, storm events from 2000 and onward were analyzed. These cover “regional” weather events for the larger Windsor County area (National Weather Service Forecast Zone) for periods of cold/wind chill, extreme cold/ wind chill, flash flood, flood, frost/freeze, hail, heat, heavy snow, high wind, strong wind, thunderstorm wind, winter storm, and winter weather.

B. Hazard Profiles

Fire Hazards (Structure, Brushfires, and Wildfires)

In the 2016 Plan, structure fires and wildfires (brushfires) were separately analyzed and discussed. For the 2021 Plan, the committee felt that an all-encompassing approach to these hazards was more appropriate. Fire hazards, to include structure fires, wildfires, and brushfires, are a regular occurrence in Brookfield, and the state as a whole.

Vermont has one of the highest per capita death rates from fire in the nation. This is in fact the deadliest form of disaster throughout the state. According to the U.S. Fire Administration, Vermont had 4.8 deaths per 1,000 fires in 2018. Nationally, there are 2.5 deaths per 1,000 fires. Although there have been requirements for smoke detectors in rental housing for over 20 years, and requirements for smoke detectors in single-family dwellings since 1994, the majority of residential fires do not have working smoke detectors.

Structure fires may occur at any point and are typically initiated within a single fuel object. Smoke produced by the burning object forms a smoke plume and rises, creating a layer of smoke while also transporting heat to the smoke layer. Fire then spreads quickly by radiation from the flames, or from the smoke layer. Once other objects are engulfed, more smoke plumes are formed, and heat radiates to other objects. Fire burns and moves across different materials depending on the material’s composition, orientation, surface to mass ratio and air supply in the structure/room.

Generally speaking, a wildfire is an outdoor fire that is not controlled, supervised or arranged. Wildfire/brushfires may be sparked by natural or human activities. Lightning is one of two main natural causes of wildfire/brushfires. However, across the United States, approximately 90 percent of wildfire/brushfires are started by humans. According to FEMA, there are three types of wildfire/brushfires that can consume natural landscapes and man-made structures and features: surface fire, ground fire and crown fire. Surface fires are slow moving across the forest floor, and, as a result, kill and damage trees. Ground fires are usually caused by lightning strikes, and burn on or below the forest floor. Crown fires, so called for their location in the crown of trees, effortlessly spread through tree tops, often aided by wind. Wildfire/brushfires probability depends on local weather conditions; outdoor

activities, debris burning and construction; and the degree of public cooperation with fire prevention measures.

The Vermont landscape is especially vulnerable to wildfire/brushfires during the period of time in early spring when all the snow has melted, vegetation has not begun to develop leaves, and the land and vegetation are very dry and/or dead. It is important to note that the scale of wildfire/brushfires that burn in the state of Vermont tend to be smaller and are therefore able to be extinguished more quickly than many of the wildfire/brushfires that rage in the western United States. Most of the Town of Brookfield is forested land. This fact alone makes Brookfield vulnerable to the impacts of wildfires and brushfires.

Over the past five years, the Brookfield Volunteer Fire Department responds to 30 calls a year on average. The table below details the types of calls that they respond to. Data on the number of acres affected for wildfire and brushfires since 2017 is not available.

Brookfield Fire Department Response Activities 2017-2020			
Year	# of Structure Fires	# of Wildfires / Brush Fires	Other Incidents (calls that included car accidents, downed power lines, and false alarms)
2017	9 (chimney fires)	1	29
2018	2 (chimney fires)	0	16
2019	0	0	30
2020	4 structure fires, 1 chimney fire	3	25

Table 5: Fire Hazards Vulnerability Table

Hazard	Location	Vulnerability	Extent	Observed Impact	Likelihood/Probability
Fire Hazards (Structure, Wildfire, and Brushfires)	Town-wide	All housing, municipal buildings, forests, and fields.	Depends on the location and extent of the fire.	Varies depending on the location and extent of the fire. In the past four years, only 2020 saw a significant increase in structure fires to private residences. One fire in February 2020 completely destroyed a home as the effort of 40 firefighters were unable to save it due to location and freezing temperatures. No data on monetary losses was available.	Highly likely

Invasive Species/ Infestation

Infestations by insects can ruin crops or forests. While most of Vermont does not have to deal with these occurrences, a historical invasion of “worms” occurred in 1770 in the Connecticut River valley. It seems that an untold number of “worms” originated near Lancaster, New Hampshire, beginning in late July of 1770, and streamed down the valley all through August. These “worms” were most likely the army worms (actually a type of caterpillar) that caused over \$8 million dollars in damage to the 2001 hay crop,

again largely along this valley. Forests are also threatened by such insects as the wooly adelgid (hemlock) and spotted beetle (maple and ash).

The State of Vermont divides invasive species into two camps: Class A and Class B. Class A species are those that are listed on the Federal Noxious Weed List but are not currently known to be present within the confines of Vermont (see 7 C.F.R. 360.200). Class B species, in contrast, are known to occur within state boundaries and are deemed a treat to residents and the environment.²

Up to date information on all Vermont invasive species can be found on VTINVASIVES.ORG.

Invasive species do not, by their nature, have boundaries. This concept was clearly demonstrated during Tropical Storm Irene, when floodwaters uprooted Japanese knotweed plants along Vermont’s waterways. Years later, the fight to eradicate the knotweed has become even more protracted as it spreads along streambanks and areas beyond, choking out native plant communities and destabilizing banks.

What is known is that invasive species are already present in Brookfield, although the precise location and extent of proliferation and/or damage is not always easily defined, given not all pockets of infestation are necessarily mapped or otherwise accounted for. For the purposes of this Plan, the LHM Planning Team has agreed to focus on the invasive species and infestation hazards that are terrestrial plants or insect pests that the Brookfield is most concerned with. Below is a table of species that currently do— or are anticipated to—adversely impact the community’s natural environment, and, by extension, public health, economy, infrastructure, and private property:

Species	Present in Town and/or Village?*	Extent of Impact	Removal/Prevention Method
Wild Chervil (<i>Anthriscus sylvestris</i>)	✓	Wild chervil is most commonly found along roads, but will spread into fields and their shaded fringes. Seeds are easily spread by mowers and wind over great distances. The plant’s sap can burn skin. The plant’s white flowers bloom in May and June.	Treatment of this plant is easiest before it establishes a root system. Mowing the plants early prior to the plants going to seed can reduce their spread. Do not mow after June when the plant has seeded, and clean equipment after using to prevent spread. Eradication is difficult, and would likely require grazing, pulling, tilling, or native replanting. Successful herbicide treatments have not yet been determined.
Garlic mustard (<i>Alliaria petiolate</i>)	✓	Garlic mustard is an edible weed that tends to grow along roadsides, particularly in the shade. It spreads when either seeds or plant pieces are sown into the ground.	Because of its methods of spreading, it is not advisable that garlic mustard be mowed. Rather, pulling the plant by hand is best practice. Glyphosate herbicide can also be used (although this may risk watershed contamination).

² See http://agriculture.vermont.gov/plant_pest/plant_weed/invasive_noxious_weeds/noxious_weeds_list

Species	Present in Town and/or Village?*	Extent of Impact	Removal/Prevention Method
Wild parsnip (<i>Pastinaca sativa</i>)	✓	Wild parsnip is a heavily toxic plant specimen that has photoreactive sap that causes severe burns to exposed skin. It does not tend to grow well in shaded areas, and also does not tend to grow in dense stands. The plant flowers in late spring to early summer.	Because of the plant's noxious properties, eradication can be a delicate process. Manual pulling should be done with thick gloves and long sleeves. Early mowing before the plant seeds in early July can reduce the spread. Mowing should be repeated once per year for three to five years. Gloyphosate chemical foliar low volume spraying can be used as a control in late summer (mid-July).
Giant Hogweed (<i>Heracleum mantegazziam</i>)		Giant hogweed is a noxious weed that has cropped up in some places in the region. Similar to wild parsnip in appearance, it is also a phototoxic plant, causing painful, scarring blisters. The plant flowers in late spring to early summer.	Removal of giant hogweed plants is the same as wild parsnip (see above). Extreme care must be taken with this plant, too, to avoid any contact with skin or risk injury.
Japanese Knotweed (<i>Polygonum cuspidatum</i>)	✓	Japanese knotweed is one of the most widely spread invasive species in the region, most commonly cropping up along river edges in direct sunlight. The plant rhizomes root and spread easily, and are hard to eradicate once established. Ditch maintenance and traveling down waterways are two main ways the plant spreads. Its lacy white flowers bloom in August.	Repeated mowing or cutting, using loppers or a lawn mower once per month over the plant's growing season (spring through fall) may be the best way to eradicate knotweed plants. Eradication must continue every year for about five years. A drip technique chemical control, using glyphosate concentrate application on plant stems in August, can be combined with mechanical cutting. Pulled stems should be contained in bags to rot for one year. If bagging is not possible, then plants should be stockpiled and covered with a tarp for decomposition. Do not replant native plant species until knotweed has been fully eradicated.
Goutweed (<i>Aegopodium podagraria</i>)		Goutweed invades fields, river edges, and floodplains. It proliferates quickly by means of underground rhizomes, and has established itself in villages throughout Windsor County. The plant's white flowers bloom in July.	New infestations should be treated quickly either before root systems become established or after leaf-out (late summer). Entire plants, including stems, roots, and rhizomes, should be removed and bagged at least a week before disposing in a landfill. Do not compost plant material because it will reseed. For large infestations, cover with a large plastic tarp and secure edges with sandbags. Glyphosate chemical control can also be used in foliar spraying after plants have leafed out.

Species	Present in Town and/or Village?*	Extent of Impact	Removal/Prevention Method
Glossy and Common Buckthorn (<i>Frangula alnus</i>) (<i>Rhamnus cathartica</i>)	✓	Buckthorn grows in two similar varieties, and can drastically change the composition of forested areas. Buckthorn has red berries, which are easily visible in fall and act as an innutritious laxative to animals. Buckthorn increases the nitrogen content in soil and has a longer growing season than native plants, which changes habitat suitability for native plant species.	Mechanical buckthorn control can consist of hand pulling small plants (including roots) or cutting stumps of larger, woodier plants at any time of the year. Glyphosate can also be applied to stumps within one hour. Larger plants may require a weed wrench. Plants may be burned after uprooting.
Purple Loosestrife (<i>Lythrum salicaria</i>)	✓	Purple loosestrife proliferates in damp areas, like wet roadsides and swamp/wetland areas. It is a growing concern in fields and roadsides. Once established, it quickly spreads and squeezes out native plants, impacting wildlife habitat in the process.	Smaller infestations of purple loosestrife can be mowed or pulled by hand and burned or disposed of in a landfill. Removing flower heads prior to seeding can help prevent spread. Biocontrol (the use of natural enemies to control an infestation, such as beetles that do not pose harm to agriculture or other key species) has proven a success in many Vermont towns.
Hemlock Woolly Adelgid (HWA) (<i>Adelges tsugae</i>)		HWAs prey on deciduous eastern hemlock trees, and originate from southern Japan. Hemlocks desiccate, lose needles, and fail to generate new growth, severely weakening, if not outright killing, trees. Hemlocks are the 7th most prevalent tree in Vermont, and are critical for stream bank armoring and serving as a shelter and food source for wildlife.	HWAs have been confirmed in Windham, Bennington, and Windsor Counties (as of Feb. 2021, per the USDA). ³ The HWA egg sacs are found on branches and hatch in the spring, feeding on tree sap. Vigilance is needed to keep an eye on HWA spread, and insecticide treatments may help contain it.

³ See <http://na.fs.fed.us/fhp/hwa/maps/2012.pdf>

Species	Present in Town and/or Village?*	Extent of Impact	Removal/Prevention Method
Asian Longhorned Beetle (ALB) (<i>Anoplophora glabripennis</i>)		Large stands of deciduous trees are target species of the beetle. These trees are especially critical to the health of our forests, slopes, carbon sequestration, and the local economy (e.g., sugar maples). According to the Forest Service, if ALBs became established across the U.S., they could kill a third of all urban trees at a compensatory cost of \$669 billion and decimate the maple sugaring industry. ⁴	The beetle has been identified in nearby states, namely Massachusetts (a large outbreak occurred in central Massachusetts in 2008) It has not yet been detected in Vermont at the time of this report. Vigilance for signs of presence around hardwood trees (sawdust at base of tree, oozing from bark) can alert their presence in the tree, and can prompt containment efforts. Uninfected host tree species may be treated with insecticide after the winter thaw in a quarantine area to prevent spread.
Emerald Ash Borer (EAB) (<i>Agilus planipennis</i>)	✓	Seven-percent of trees (around 150 million trees) in Vermont are ash, making virtually every community vulnerable to ash stand decline. Damaged trees can pose a hazard, particularly in close proximity to sidewalks, roadways, and private property. EABs generally infiltrate new host areas when they are transported in firewood and other wood products.	EAB colony establishment can take years to be visible on trees, but makes trees brittle and weak. Bare bark exposed by woodpeckers reveals intricate pathways created by the EAB. Infestations are located in all surrounding states and Quebec. Preventing the importation of firewood from outside of Vermont is one key tactic to stop the spread. Quarantine efforts have been met with mixed success, and biological and microbial control agents may prove effective containment methods.

Table 6. Invasive Species Present in Brookfield

The Emerald Ash Borer (EAB) is a recent invasive species infestation of concern for the Town of Brookfield. Orange County was the first location that EAB was found in the State of Vermont. The Town of Brookfield is in the cone of concern on the [EAB map](#) hosted by the Agency of Natural Resources. The State’s recommended plan of action for communities like Brookfield would be to either cut down all ash trees that pose a risk to the public (such as in the public road right-of-way) or treat them with pesticides. Treatment with pesticides can prove costly, so removing all high-risk ash trees is the plan of action.

Table 7: Invasive Species Vulnerability Table

Hazard	Location	Vulnerability	Extent	Observed Impact	Likelihood / Probability
Invasive Species/ Infestation	Town-wide, although dependent on host plant for	The entire Town is susceptible to invasive species proliferation, depending on the species and place-	At present, none of the species identified in the Town have had more than a negligible impact on health of residents or property. If left	Insect pests can ravage local silvicultural operations, value-added market product production (e.g., maple syrup industry), and tourism	Highly Likely

⁴ See <http://www.nrs.fs.fed.us/pubs/1983>

	insect pests, or soils/available sunlight for plant infestation.	dependent characteristics that allow for growth and spread of problem species.	unchecked, invasives may crowd out native plant and wildlife species dramatically and, in some case, can pose physical harm to residents.	(seasonal leaf peepers). Invasive plants and insects may destroy/ crowd out key native species and habitat, and some cause physical harm.	
--	--	--	---	---	--

Severe Weather

Severe Weather is an all-encompassing term. For the purposes of this mitigation plan, severe weather will include at the minimum heavy rain, high winds, snow, climate change, sleet, hail, thunderstorms, drought, tropical storms, hurricanes, extreme heat, and flooding.

According to FEMA, there have been 27 federally-declared major disasters for Orange County between 1963 and 2021 – averaging about one every three years – though not all impacted Brookfield directly. As indicated in Federal Disasters Declaration table, the majority of declared disasters was due to flooding or other types of severe storms. Most recently, and one that has never before been declared for, was the pandemic COVID-19 (or coronavirus).

From the NOAA Storms Database for Orange County, Vermont, there were a total of 382 regional storm incidents over the past 21 years (since 2000). This is an average of 18 regional storm events each year. Of these, 15 events were specific to Brookfield. In some cases, several events are reported for the same storm system. Database entries also include more general estimates of related property and crop damage – totaling \$46.7 million over this twenty-one-year period for all storms in Orange County.

As expected, the majority of recorded regional events relate

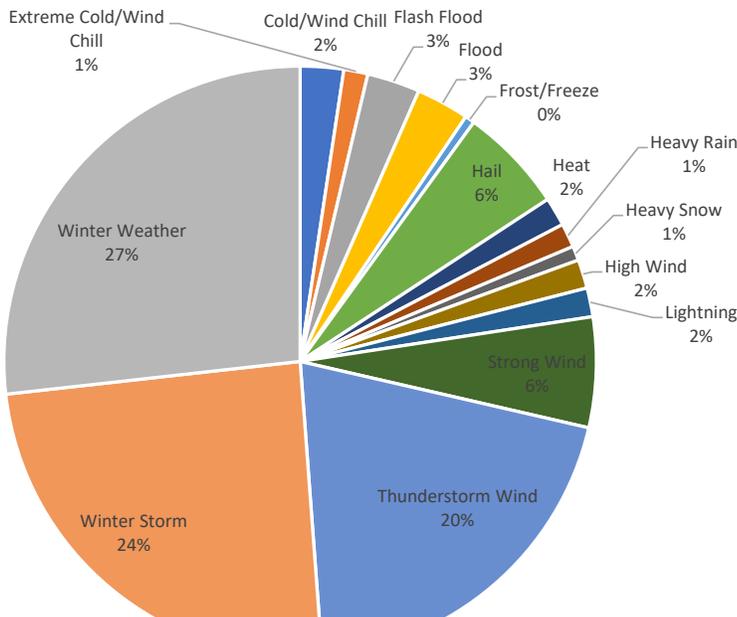


Figure 3. Breakdown of Severe Weather Events in Orange County (2000-2021)

Federal Disaster Declarations: Orange County (1969-2021)

Disaster Number	Date	Description
160	11/27/1963	DROUGHT & IMPENDING FREEZE
164	3/17/1964	FLOODING
397	7/6/1973	SEVERE STORMS, FLOODING & LANDSLIDES
518	8/5/1976	SEVERE STORMS, HIGH WINDS & FLOODING
712	6/18/1984	SEVERE STORMS & FLOODING
840	9/11/1989	SEVERE STORMS & FLOODING
938	3/11/1992	HEAVY RAINS, ICE JAMS & FLOODING
1101	2/13/1996	ICE JAMES AND FLOODING
1201	1/15/1998	SEVERE ICE STORMS, RAIN, HIGH WINDS AND FLOODING
1228	6/30/1998	SEVERE STORMS AND FLOODING
1307	11/10/1999	TROPICAL STORM FLOYD
1336	7/27/2000	SEVERE STORMS AND FLOODING
1488	9/12/2002	SEVERE STORMS AND FLOODING
1698	6/4/2007	SEVERE STORMS AND FLOODING
1715	8/24/2007	SEVERE STORMS AND FLOODING
1790	9/12/2008	SEVERE STORMS AND FLOODING
4001	7/25/2011	SEVERE STORMS AND FLOODING
4022	9/1/2011	TROPICAL STORM IRENE
4140	8/2/2013	SEVERE STORMS AND FLOODING
4178	6/11/2014	SEVERE STORMS AND FLOODING
4207	2/4/2015	SEVERE WINTER STORM
4330	8/16/2017	SEVERE STORMS AND FLOODING
4356	1/2/2018	SEVERE STORMS AND FLOODING
4380	7/30/2018	SEVERE STORM AND FLOODING
4445	6/14/2019	SEVERE STORMS AND FLOODING
4474	1/17/2020	SEVERE STORM AND FLOODING
4532	4/8/2020	PANDEMIC

Source: FEMA.

Figure 2: Windsor County Storm Events | Source: NOAA Storms Database

to winter storms and winter weather, while the majority of more localized events are associated with severe thunderstorms (to include wind, heavy rain, and hail). In addition to flooding and flash flooding, storm-related hazards include high winds, with estimated gusts ranging from 35 to 50 knots (40 to 60 miles per hour) and hail up to 1.75 inches. Hazards related to cold temperatures – including unseasonal frosts, and periods of extreme cold during winter months – are more common than heat spells; however, six heat-related events have been reported since 2006, including dry spells in 2011 and 2012 that resulted in some crop damage.

The next table details the 15 Brookfield specific events from the NOAA storms database, and their monetary damages.

Location	Date	Storm Type	Estimated Total Damage	Extent
EAST BROOKFIELD	7/21/2010	Thunderstorm Wind	\$ 450,000.00	75 mph winds that snapped or uprooted large trees.
EAST BROOKFIELD	7/21/2010	Thunderstorm Wind	\$ 175,000.00	60 mph winds that uprooted trees and destroyed a sugar house.
BROOKFIELD	8/25/2007	Thunderstorm Wind	\$ 100,000.00	55 mph winds that caused power outages and downed trees.
BROOKFIELD	7/23/2016	Thunderstorm Wind	\$ 50,000.00	60 mph wind that knocked down trees.
BROOKFIELD	5/4/2018	Thunderstorm Wind	\$ 50,000.00	60 mph wind that knocked down trees.
EAST BROOKFIELD	7/21/2010	Hail	\$ 25,000.00	Golf ball sized hail, winds knocked down trees and caused power outages.
BROOKFIELD	9/5/2017	Thunderstorm Wind	\$ 15,000.00	55 mph winds that caused power outages and downed trees.
BROOKFIELD	7/4/2002	Thunderstorm Wind	\$ 5,000.00	50 mph winds that caused power outages.
BROOKFIELD	5/26/2011	Thunderstorm Wind	\$ 5,000.00	50 mph winds that caused power outages.
BROOKFIELD	8/21/2011	Thunderstorm Wind	\$ 5,000.00	50 mph winds that caused power outages.
EAST BROOKFIELD	5/29/2012	Thunderstorm Wind	\$ 5,000.00	50 mph winds that caused power outages.
WEST BROOKFIELD	7/21/2010	Hail	\$ 20,000.00	Nickel to quarter size hail caused damage to corn and other crops nearing harvest.
BROOKFIELD	7/4/2002	Hail	Unknown	Quarter sized hail.
BROOKFIELD	7/16/2009	Hail	Unknown	Light accumulation of nickel sized hail.

BROOKFIELD	7/21/2010	Hail	Unknown	Nickel to quarter sized hail.
------------	-----------	------	---------	-------------------------------

Table 8. Severe Weather Events in Brookfield

As seen in Table 8 above, thunderstorm related high winds have caused the most damage in Brookfield. Damage caused by high winds has included downed trees and power lines, and, as a result, power outages. Power outages can be particularly serious for “power critical customers” that do not have the luxury of having a generator. However, in general, high winds cause relatively minor damage on a town-wide scale.

Severe weather events are highly likely to occur in the future in Brookfield. Precipitation trend analysis suggests that intense, local storms are occurring more frequently and will continue to do so in the future. More localized severe weather storms in Chelsea will likely result in increased flooding in the Town.

The Town of Brookfield completed a geo-referenced culvert inventory and road erosion inventory map update with assistance from TRORC in 2020. With the culvert inventory complete, the Town plans to maintain it in-house. The Town of Brookfield’s work to upgrade culverts remains in process, and the culvert inventory has helped the Town plan and prioritize culvert upgrade/improvement projects. Specifically, the Halfway Brook Road culvert #14 is a high priority of the town. The Town of Brookfield suffered significant damages during the July 1, 2017 rain event (DR 4330). The site of culvert 14 on Halfway Brook Road was overtopped and washed out the roadway. This site has repeatedly washed out during T.S. Irene (DR 4022), July 1, 2017 (DR 4330) FEMA event and the April 15, 2019 FEMA event (DR 4445) and often during non-Federally declared disaster rain events. FEMA has repeatedly reimbursed the town on road repairs, but this funding has historically not been to upsize the culvert to mitigate against these damages. The proposed project is to upsize culvert 14 which is an existing 72” x 50ft round metal pipe on Halfway Brook Road that runs parallel to Halfway Brook with a concrete box minimum of 8ft H x 21ft L, with bed retention sills, concrete headwalls and flared wingwalls. An additionally priority culvert identified in the culvert inventory is culvert #326 on Bear Hill Road that needs to be replaced and upsized through grant funding.

Table 9: Severe Weather Vulnerability Table

Hazard	Location	Vulnerability	Extent	Impact	Likelihood/Probability
Severe Weather	Town wide for Hurricanes / Tropical Storms, Ice Jams, Lightning, Extreme Heat, Extreme Cold / Snow / Ice, Landslides / Mudslides / Rockslides, Flash Flood / Floods / Fluvial Erosion, Hail Storms, and Severe Wind impacts.	Town and private buildings and utilities; culverts, bridges, road infrastructure.	High wind events such as those caused by thunderstorms, hurricanes, and tropical storms cause large monetary damages through debris and downed power lines. The storm on 7/21/2010 was the costliest for Brookfield.	Varied depending on the severity of the event. The greatest impact is to existing power lines and trees in the town right-of-way.	Highly Likely

Hazard	Location	Vulnerability	Extent	Impact	Likelihood/Probability
<i>Hurricanes / Tropical Storms</i>	Town Wide	Town and private buildings and utilities; culverts, bridges, road infrastructure.	Tropical Storm Irene dumped 5-7" in Orange County, with about 3-5" in Brookfield alone.	Varied depending on the severity of the event.	Likely
<i>Ice Jams</i>	Town Wide	Town and private buildings and utilities; culverts, bridges, road infrastructure.	While there have been no Ice Jams in Brookfield, one in Chelsea damaged 10 residences and 3 commercial buildings. Full extent of ice jam unknown.	Varied depending on the severity of the event.	Likely
<i>Lightning</i>	Town Wide	Town and private buildings and utilities; culverts, bridges, road infrastructure.	On 6/10/2005 a lightning storm killed 17 cows in Orange County. Other smaller storms started tree fires.	Varied depending on the severity of the event.	Highly Likely
<i>Extreme Heat</i>	Town Wide	Town and private buildings and utilities; culverts, bridges, road infrastructure.	A six-day heat wave in June 2020 saw a high temperature record of 96 degrees for two of those days.	No heat related deaths have been reported in Orange County. Impact is to electrical infrastructure and to life for any future events.	High Likely
<i>Extreme Cold / Snow / Ice</i>	Town Wide	Town and private buildings and utilities; culverts, bridges, road infrastructure.	The winter storm of 2/23/2010 dumped 26 inches of snow in the Brookfield area causing extensive power outages. The coldest temperature recorded was -27 degrees F in Brookfield on January 15, 2004.	Varied depending on the severity of the event. Impacts are generally geared towards power outages, downed trees / roofs, and loss of heat.	Highly Likely
<i>Landslides / Mudslides / Rockslides</i>	Town Wide	Town and private buildings and utilities; culverts, bridges, road infrastructure.	A landslide that is 24 meters high with an unknown width was recorded on Route 65	Varied depending on the severity of the event.	Occasionally

Hazard	Location	Vulnerability	Extent	Impact	Likelihood/ Probability
			in Brookfield in 2019, it is currently still there and impacting Sunset Brook.		
<i>Flash Flood /Floods /Fluvial Erosion</i>	Town Wide	Town and private buildings and utilities; culverts, bridges, road infrastructure.	Tropical Storm Irene dumped 5-7" in Orange County, with about 3-5" in Brookfield alone. Storm caused extensive public infrastructure damage.	Varied depending on the severity of the event.	Likely
<i>Hail Storms</i>	Town Wide	Town and private buildings and utilities; culverts, bridges, road infrastructure.	2" hail was recorded in East Brookfield on 7/21/2010.	Varied depending on the severity of the event.	Likely
<i>Severe Wind</i>	Town Wide	Town and private buildings and utilities; culverts, bridges, road infrastructure.	75 mph winds were recorded in East Brookfield on 7/21/2010.	Varied depending on the severity of the event.	Likely

VI. Mitigation

A. Mitigation Goals

- *To reduce long-term impacts and losses of the natural hazard of flash flooding, flooding and fluvial erosion.*
- *To reduce long-term impacts and losses of the natural hazard of severe weather.*
- *To reduce long-term impacts and losses of the hazard of structural fire.*
- *To reduce long-term impacts and losses of the natural hazard of extreme cold, snow storms and ice storms.*

B. Excerpted Town Plan Goals & Objectives Supporting Local Hazard Mitigation

NOTE: The language listed below was excerpted from the 2016 Brookfield Town Plan.

- Floodplains and Fluvial Erosion Hazard Areas are unsuitable for development because of the high loss potential for life and property as well as the limited ability of septic systems to perform adequately during periods of high water. (p. 68)
- Encourage the maintenance and improvement of public and private lands in the town for recreational use and make sure that all Class 4 roads remain accessible to the public. (p. 62)
- The Selectboard, should consider the development of a capital budget and program for building maintenance, highways, equipment and fire protection. (p. 19) This plan supports the continued restoration of natural riparian vegetation along stream banks and lakeshores. (p. 46)

The Brookfield Town Plan was adopted on September 12, 2016 and has an eight-year lifespan. The Town Plan will expire on September 12, 2024. The Planning Commission will begin revisions after the adoption of this mitigation plan.

C. Hazard Mitigation Strategies: Programs, Projects & Activities

Vermont Emergency Management encourages a collaborative approach to achieving mitigation at the local level through partnerships with Vermont Agency of Natural Resources, VTrans, Vermont Agency of Commerce and Community Development, Regional Planning Commissions, FEMA Region 1 and others. That said, these agencies and organizations can work together to provide assistance and resources to towns interested in pursuing hazard mitigation projects.

With each mitigation strategy, general details about the following are provided: local leadership, possible resources, implementation tools, and prioritization. The prioritization category is based upon the economic impact of the action, Brookfield's need to address the issue, the cost of implementing the strategy, and the availability of potential funding. The cost of the strategy was evaluated in relation to its benefit as outlined in the STAPLEE guidelines (includes economic, political, environmental, technical, social, administrative, and legal criteria). A range of mitigation strategies was vetted by the committee, and those that were determined to be feasible are included in the table below.

Strategies given a "High" prioritization indicate they are either critical or potential funding is readily available, and should have a timeframe of implementation of less than two years. A "Medium" prioritization indicates that a strategy is less critical or the potential funding is not readily available, and has a timeframe for implementation of more than two years but less than four. A "Low" prioritization

indicates that the timeframe for implementation of the action, given the action’s cost, availability of funding, and the community’s need to address the issue, is more than four years.

The Town of Brookfield understands that, in order to apply for FEMA funding for mitigation projects, a project must meet more formal FEMA benefit cost criteria, and a project seeking FEMA funds will undergo a full benefit-cost assessment in the FEMA-approved format. The Town must have a FEMA-approved Local Hazard Mitigation Plan as well.

The following strategies will be incorporated into the Town of Brookfield’s long-term land use and development planning documents. In addition, the Town will review and incorporate elements of this Local Hazard Mitigation Plan into updates for the municipal plan and flood hazard/fluvial erosion hazards (FEH) bylaws. The incorporation of the goals and strategies listed in the Local Hazard Mitigation Plan into the municipal plan and flood hazard/FEH bylaws will also be considered after declared or local disasters. The Town shall also consider reviewing any future TRORC planning documents for ideas on future mitigation projects and hazard areas. Individuals and organizations bolded in the following are primarily responsible for each corresponding action, followed by other individuals and organizations with supporting roles.

Mitigation Actions	Local Leadership	Prioritization	Possible Resources	Time Frame
All Hazards				
<i>Ensure that Brookfield's Local Emergency Management Plan (LEMP) is kept up-to-date.</i>	Selectboard, EMD	High	Local resources; TRORC; VEM	Next update by May 1, 2022
<i>Develop a policy on effective communication of hazards to town departments and residents of Brookfield.</i>	Selectboard, EMD	Medium	Local Resources	May 1, 2022
<i>Develop a methodology the Town can use for consistently documenting infrastructure damage after weather events.</i>	Road Foreman	High	Local resources; TRORC	2022-2023
<i>Meet with VEM regarding setting up VT Alert in Brookfield.</i>	Selectboard, EMD	Low	Local resources; VEM	2022-2023

Mitigation Actions	Local Leadership	Prioritization	Possible Resources	Time Frame
<i>Develop an educational program for Brookfield residents regarding mitigation actions homeowners and renters can undertake to lessen risks to their lives and properties.</i>	Selectboard, EMD	Low	Local resources; TRORC	2023-2024
<i>The Town, EMD, and the Fire Department should work closely together to address safety issues related to hazards.</i>	Selectboard, EMD , Fire Department	Low - Medium	Local resources	2023-2025
<i>Fund a dedicated staff position for hazard mitigation and risk assessment at the town or regional level that can provide services to the Town and Village.</i>	Selectboard	Low	Local resources	2025
Fire Hazards (Structure and Wildfire / Brushfires)				
<i>Develop a pre-plan program for significant structures in the Town of Brookfield. For each significant structure, develop a pre-fire plan and tour the structure to familiarize FD members with the layout of the structure.</i>	Brookfield Fire Chief	Medium	Local resources (FD)	2022-2024
<i>Seek funding to draft a Community Wildfire Protection Plan (assesses and maps the community wildfire risk, discusses the ability to respond and recommends actions to reduce wildfire risk).</i>	Brookfield Fire Chief	Low	Local resources; Vermont Rural Protection Task Fore	2025-2026

Mitigation Actions	Local Leadership	Prioritization	Possible Resources	Time Frame
<i>Develop a public education program to educate residents about wildfire/brushfire risks and how to minimize the occurrence of wildfire/brushfire.</i>	Brookfield Fire Chief	Medium	Local resources (FD)	2022-2024
Severe Weather (Heavy rain, High winds, Snow, Climate Change, Sleet, Hail, Thunderstorms, Drought, Tropical Storms, Hurricanes, Extreme Heat, and Flooding)				
<i>Upgrade culvert #0326 on Bear Hill Road to a box culvert, which will greatly increase its hydraulic capacity and therefore mitigating against damage to town infrastructure. (Mitigation)</i>	Selectboard/ Road Foreman	High	<i>VTrans Structures grant; local resources</i>	2023-2024
<i>Apply for FEMA funding to replace and upgrade the Halfway Brook Road Culvert #14.</i>	Selectboard/ Road Foreman	High	<i>Local resources, FEMA BRIC or HMGP</i>	2021-2022
<i>Update the Brookfield Road Erosion Inventory in order to properly identify and mitigate high erosion areas in town.</i>	Road Foreman	High	Local resources; Vtrans	2024-2025
<i>Identify frequently flooded roads and bridges.</i>	Road Foreman, Selectboard	Medium	Local resources, TRORC	2022-2023
<i>Develop a plan for communicating shelter information to residents and especially to populations that are vulnerable to extreme temperatures.</i>	EMD; American Red Cross	High	Local resources; VEM	2022-2024
<i>Identify hazard trees in town rights-of-way (and</i>	Road Foreman	High	Local resources	2023-2025

Mitigation Actions	Local Leadership	Prioritization	Possible Resources	Time Frame
<i>those at risk at damaging other public infrastructure) and remove them to mitigate damage from severe wind storms.</i>				
<i>Adopt fluvial erosion hazard (FEH)/river corridor regulations where feasible to incorporate VT ANR's river corridor maps.</i>	Planning Commission, Selectboard	Low	Local resources; TRORC	2023-2025
<i>Develop a program to budget for and maintain roads for safe winter travel, which will reduce the threat to the health of residents. (Mitigation)</i>	Selectboard, Road Foreman	Medium	Local resources	2021-2022
<i>Provide public outreach on flood hazard and river corridor zoning bylaw proposals and implications for federal flood insurance. Citizen comprehension of these topics will help prevent risk to public health during hazards and will spread knowledge about vulnerable hazard areas in Brookfield. (Mitigation)</i>	Zoning Administrator, Selectboard, Planning Commission	Low	Local resources	2023-2024
<i>Provide technical assistance to homeowners who qualify for federal elevation or acquisition of their property, and wish to proceed with fulfilling these actions. Elevation and acquisition of structure will reduce the risk to property in frequently flooded areas and the health of those</i>	Selectboard, Zoning Administrator	Low	Local resources	2024-2026

Mitigation Actions	Local Leadership	Prioritization	Possible Resources	Time Frame
<i>who live in these structures. (Mitigation)</i>				
<i>Install a generator at the Brookfield Elementary School.</i>	Selectboard	Medium	FEMA, local resources, Brookfield Elementary School	2025-2026
Invasive Species				
<i>Conduct educational outreach to residents about how they can take measures to control for invasive species.</i>	Conservation Commission	Low	Local resources	2022-2025
<i>Geolocate all Ash Trees in the Town ROW and develop a schedule for removal to mitigate against the Emerald Ash Borer (EAB)</i>	Conservation Commission	Medium - High	VT Forest & Parks, TRORC, Local resources	2024-2026
<i>Develop and implement a mowing schedule for town owned land and roadside mowing to prevent the spread of invasive species.</i>	Conservation Commission	Low	Local resources	2023-2024
<i>Organize a community clean up day (such as Green Up Day) to clear invasive species from town owned property.</i>	Conservation Commission	Low	Local resources	2025-2026

Mitigation Actions	Local Leadership	Prioritization	Possible Resources	Time Frame
<i>Install signage at all public waterways to educate residents on invasive aquatic species that can be transferred by personal watercraft.</i>	Conservation Commission	Low	Local resources	2022-2024

Table 10. Proposed Hazard Mitigation Strategies: Programs, Projects & Activities in Brookfield

Implementing the plan

Hazard Mitigation Plans have a life of five years once formally approved by FEMA. During those five years, it is up to the town to conduct an annual review of the mitigation actions laid out in this Plan to see what is accomplished and what is to be accomplished. Figure 14 lays out the complete process of implementing and maintaining the Hazard Mitigation Plan.

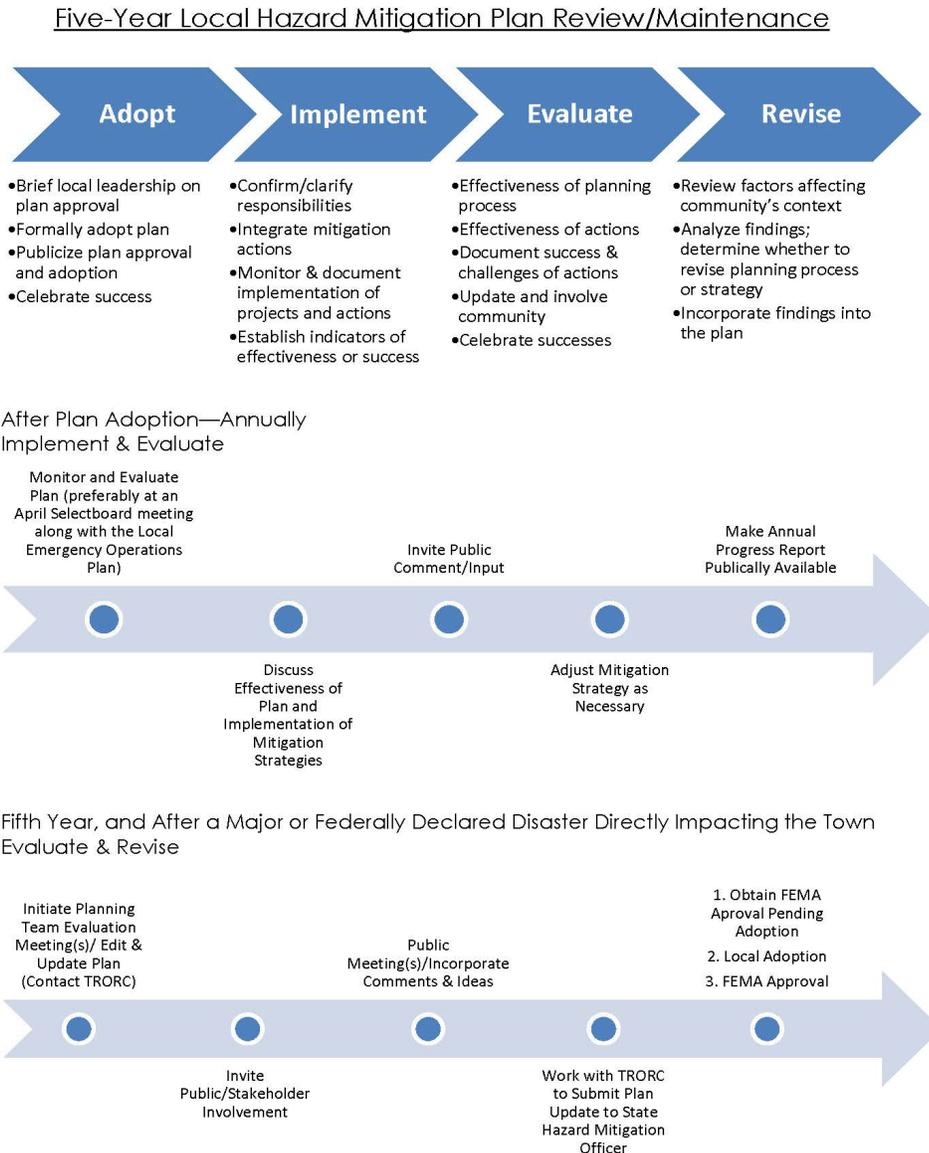


Figure 4: Five-Year Local Hazard Mitigation Plan Review/Maintenance

Attachments

Attachment A: Map of the Town of Brookfield