Town of Burrillville Rhode Island
Hazard Mitigation Plan
2021 Update
July 1, 2021

Contents

Executive Summary

The Town of Burrillville has undertaken this update to its Hazard Mitigation Plan in an attempt to better understand and reduce disaster risk within the Town. Since the 2014 plan update, the Town has self-funded significant achievements to reduce disaster risk. Luckily, the Town has only experienced one presidentially declared disaster, a Severe Winter Storm (DR-4212), resulting in $63,124 of costs. Other than these improvements and one disaster, the Town of Burrillville has only experienced insignificant changes that would not impact hazard mitigation planning.

This plan is designed to document the significant planning process undertaken by Town leaders and residents to create a reasoned plan for hazard mitigation. The major sections of the plan include the following:

- Introduction- Describes the purpose of the plan
- Community Profile- Provides demographic and geographic information about Burrillville
- Planning Process- Describes steps taken to revise the plan
- Hazard Identification and Risk Assessment- Discusses hazard identification and risk assessment that includes descriptions and potential impacts and capabilities
- Mitigation Actions- Steps taken to address the hazard identified in the plan
- Implementation- Identifies the actionable steps, responsible parties, and timetable

What is Hazard Mitigation?

As defined in 44 CFR 201.2, hazard mitigation means any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards.[1] As the direct and indirect costs of disasters continue to rise, it becomes particularly critical that preparing for the onslaught of damage from these events must be done to reduce the amount of damage and destruction. This strategy is commonly known as mitigation. The purpose of multi-hazard mitigation is twofold: 1) to protect people and structures from harm and destruction, and 2) to minimize the costs of disaster response and recovery.

Hazards

The Local Hazard Mitigation Committee (LHMC) also reviewed the hazards presented in the 2014 plan and updated them based on new concerns expressed, additional research, and the State of Rhode Island's 2019 State Hazard Mitigation Plan Update[2]. The chart below details the hazards from the 2014 Plan compared to the 2021 Plan:

2014 Hazards	2021 Hazards
Dam Failures	Aquifer Contamination

[1] 44 CFR 201. Accessed via: https://www.law.cornell.edu/cfr/text/44/201.2 18 January 2020
[2] http://www.riema.ri.gov/RIHMP_FullPlan_Reduced.pdf

Droughts	Critical Incidents
Earthquakes	Dam Failure
Floods	Droughts
Hazardous Materials Events	Earthquakes
Hurricane & Tropical Storms	Flood
Nor'easters	Hazardous Materials Events
Severe Winter Storms	Hurricanes & Tropical Storms
Temperature Extremes	Infectious Disease
Tornados	Lightning
Wildfires/Conflagration	Severe Winter Storms
	Temperature Extremes
	Tornado
	Wildfire

Each hazard was rated by the individual committee members using available data and their area of expertise. The committee members scored the frequency, area impact, and potential damage magnitude of the hazard. The scores were reviewed amongst the group to ensure consistency. The final hazard score was used by averaging each committee members score and putting it through this formula:

- Total Score = (Frequency + Area Impact) x Potential Damage Magnitude

Ultimately, the top three hazards from the Town of Burrillville were Severe Winter Storms, Hurricane & Tropical Storms, and Aquifer Contamination.

Mitigation Actions

The Town of Burrillville made a significant investment in mitigation during this planning cycle. Focusing on reducing flooding within Town and was able to complete 10 mitigation projects identified in the 2014 Plan. Due to changing situations within Town and on the State level, three prior mitigation actions were deemed not feasible. Six new mitigation projects have been added to the update of this plan. They include:

- Identifying potential threats to the water supply
- Developing a new wellhead/potable water source
- Installing a new supply pipe for the Cherry Farm Road Tank
- Installing 3 communication towers to address communications issues
- Upgrading the Town's Dispatch Center
- Conducting a lightning protection survey

Overall, the Town of Burrillville is committed to reducing disaster risk to its residents and businesses.

1.0- Introduction

Disasters are becoming more costly. Since the last update of the Town's Hazard Mitigation Plan, ten or more billion-dollar weather and climate disaster events have impacted the United States[3] each year. The National Oceanic and Atmospheric Administration's National Centers for Environmental Information has cataloged the information and the chart below summarizes these findings:

DISASTER TYPE	NUMBER OF EVENTS	PERCENT FREQUENCY	CPI-ADJUSTED LOSSES *(BILLIONS OF DOLLARS)*	PERCENT OF TOTAL LOSSES	AVERAGE EVENT COST *(BILLIONS OF DOLLARS)*	DEATHS
Drought	26	10.1%	$249.7 CI	14.2%	$9.6	2,993†
Flooding	32	12.4%	$146.5§ CI	8.3%§	$4.6§	555
Freeze	9	3.5%	$30.5 CI	1.7%	$3.4	162
Severe Storm	113	43.8%	$247.8 CI	14.1%	$2.2	1,642
Tropical Cyclone	44	17.1%	$945.9 CI	53.9%	$21.5	6,502
Wildfire	17	6.6%	$84.9 CI	4.8%	$5.0	347
Winter Storm	17	6.6%	$49.3 CI	2.8%	$2.9	1,048
All Disasters	**258**	**100.0%**	**$1,754.6** CI	**100.0%**	**$6.8**	**13,249**

4

This alarming trend has been identified by the Town of Burrillville which has chosen to be proactive by keeping updated the Town's Hazard Mitigation Plan.

The purpose of this Hazard Mitigation Plan is to set in motion short-term and long-term actions, which will reduce the actual or potential loss of life or property from hazardous events such as winter storms, flooding, severe storms, droughts, hurricanes, and earthquakes. This plan is a directive of the Federal Emergency Management Agency and conforms specifically to 44 CFR Parts 201 and 206 Hazard Mitigation Planning and Hazard Mitigation Grant Program: Interim Final Rule. The Town of Burrillville, upon adoption of this plan, will become an eligible applicant for various mitigation grant funding opportunities including the Hazard Mitigation Grant Program (HMGP). These grant resources may be used to mitigate the effects of natural hazards on both public and private property.

[3] https://www.ncdc.noaa.gov/billions/
[4] https://www.ncdc.noaa.gov/billions/summary-stats

What is Hazard Mitigation?

As defined in 44 CFR 201.2, hazard mitigation means any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards.[5] As the direct and indirect costs of disasters continue to rise, it becomes particularly critical that preparing for the onslaught of damage from these events must be done to reduce the amount of damage and destruction. This strategy is commonly known as mitigation. The purpose of multi-hazard mitigation is twofold: 1) to protect people and structures from harm and destruction, and 2) to minimize the costs of disaster response and recovery.

To ensure the national focus on mitigation, the Federal Emergency Management Agency (FEMA) introduced a National Mitigation Strategy in 1995. The strategy promotes the partnership of government and the private sector to "build" safer communities. Hazard mitigation encourages all Americans to identify hazards that may affect them or their communities and to take action to reduce risks.

Mitigation Benefits

Mitigation actions help safeguard personal and public safety. Retrofitting bridges, for example, can help keep them from being washed out, which means they will be available to fire trucks and ambulances in the event of a storm. Installing hurricane clips and fasteners can reduce personal and real property losses for individuals. It can also reduce the need for public assistance in the event of a hurricane. Increasing coastal setbacks reduces the risk of deaths and property losses from tsunamis and storm surge. Increased setbacks also reduce the risk of property losses from coastal erosion.
Another important benefit of hazard mitigation is that money spent today on preventative measures can significantly reduce the impact of disasters in the future, including the cost of post-disaster cleanup. The following is stated under Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended by Section 104 of the Disaster Mitigation Act of 2000:

> *"To obtain Federal assistance, new planning provisions require that each state, local and tribal government prepare a hazard mitigation plan to include sections that describe the planning process, an assessment of the risks, a mitigation strategy, and identification of the plan maintenance and updating process."*

The adoption of this multi-hazard mitigation strategy will enhance Burrillville's eligibility for federal grants, which include FEMA's pre-disaster Flood Mitigation Assistance (FMA) program and its post-disaster Hazard Mitigation Grant Program (HMGP). Pre-disaster planning will also help post-disaster operations become more efficient. For instance, procedures and necessary permits can be identified before the disaster, and therefore, permit streamlining procedures can be put into place. Priorities for mitigation during reconstruction can also be identified, helping to reduce the high costs of recovery after a disaster. The State emergency response effort will run more smoothly because of the guidance provided in this strategy.

[5] 44 CFR 201. Accessed via: http://www.gpo.gov/fdsys/pkg/CFR-2011-title44-vol1/pdf/CFR-2011-title44-vol1-sec201-2.pdf 17 September 2012

Sustainable Communities

"A resilient community is one that lives in harmony with nature's varying cycles and processes."

David Godschalk, Timothy Beatley, et. al.

"Disaster resilient" communities employ a long-range, community-based approach to mitigation. Mitigation advocates for communities to proactively address potential damage that could occur from hurricanes, coastal erosion, earthquakes, flooding, and other natural hazards. When natural hazard mitigation is combined with the standards of creating sustainable communities, the long-term beneficial result is smarter and safer development that reduces the vulnerability of populations to natural disasters while reducing poverty, providing jobs, promoting economic activity, and most importantly, improving people's living conditions.[6] In addition to a community's sustainability criteria for social, environmental, and economic protection, there is also the criterion that development must be disaster-resistant.[7]

Resilient communities may bend to the impact of natural disaster events, but they do not break. They are constructed so that their lifeline systems of roads, utilities, infrastructure, and other support facilities are designed to continue operating during high winds, rising water, and shaking ground. Hospitals, schools, neighborhoods, businesses, and public safety centers are located in safe areas, rather than areas prone to high hazards. Resilient and sustainable communities' structures are built or retrofitted to meet the safest building code standards available. It also means that their natural environmental habitats such as wetlands and dunes are conserved to provide the natural benefits of hazard mitigation.

The Burrillville Hazard Mitigation Plan advocates the concepts of disaster-resilient and sustainable communities. Burrillville is committed to building a disaster-resistant community and achieving sustainable development through the commitment of state and local government and its policymakers to mitigate hazard impacts before disaster strikes. Additionally, Burrillville will achieve a disaster-resilient, and therefore, safer community, through the process of completing its Hazard Risk and Vulnerability Assessment (RVA), and Multi-Hazard Mitigation Strategy (HMS) and through the implementation of mitigation programs and policies. The Town will have the capability to implement and institutionalize hazard mitigation through its human, legal, and fiscal resources, the effectiveness of intergovernmental coordination and communication, and with the knowledge and tools at hand to analyze and cope with hazard risks and the outcomes of mitigation planning.

Mission and Goals

The missions of the Town of Burrillville multi-hazard mitigation strategy are to:

[6] Munasinghe and Clarke, 1995.
[7] Institute for Business and Home Safety, 1997; FEMA, 1997.

1. Provide coordinated, consistent goals for reducing or minimizing human and property losses, major economic disruption, degradation of ecosystems and environmentally critical habitats, and destruction of cultural and historical resources from natural disasters.

2. Provide transparency to the risks faced within the Town as well as the proactive steps being taken by town and community leaders to address current and future challenges.

3. Provide a basis for intergovernmental coordination in natural hazard mitigation programs at the state and local levels.

4. Develop partnerships between the Town, private sector, local districts, and non-profit organizations to coordinate natural hazard mitigation programs.

5. Identify and establish close coordination with local government departments and agencies responsible for implementing the sound practices of hazard mitigation through building standards and local land use development decisions and practices.

6. Provide for continuing public education and awareness about the risks and losses from natural disasters, and natural hazard mitigation programs, policies, and projects.

The goals of the multi-hazard Burrillville Mitigation Strategy are to:

1. Protect public health, safety, and welfare.

2. Reduce property damages caused by natural disasters.

3. Minimize dislocation and social distress.

4. Reduce economic losses and minimize disruption to local businesses.

5. Protect the ongoing operations of critical facilities.

6. Reduce the dependence and need for disaster assistance funding after natural disasters.

7. Expedite disaster mitigation efforts during the recovery phase of a disaster.

8. Promote non-structural flood measures to reduce the risk of damage to the surrounding properties and environmental habitats.

9. Continue to enhance and maintain the LHMC to support, implement and revise the Burrillville multi-hazard mitigation strategy and to provide the support necessary for an ongoing forum for the education and awareness of multi-hazard mitigation issues, program, policies, and projects.

10. Provide for adequate financial and staffing resources to implement the Burrillville Hazard Mitigation Strategy.

11. Incorporate the best available information and practices into the development of Town mitigation actions.

12. Educate the public about the benefits of hazard mitigation.

The National Flood Insurance Program (NFIP)

In 1968, Congress created the National Flood Insurance Program (NFIP) in response to the rising cost of taxpayer-funded disaster relief for flood victims and the increasing amount of damage caused by floods. The Federal Insurance and Mitigation Administration (FIMA) a component of the Federal Emergency Management Agency (FEMA) manages the NFIP and oversees the floodplain management and mapping components of the program.

Communities participate in the NFIP by adopting and enforcing floodplain management ordinances to reduce future flood damage. In exchange, the NFIP makes federally subsidized flood insurance available to homeowners, renters, and business owners in these communities. Flood insurance, Federal grants and loans, Federal disaster assistance, and Federal mortgage insurance is unavailable for the acquisition or construction of structures located in the floodplain shown on the NFIP maps for those communities that do not participate in the program.

To get secured financing to buy, build, or improve structures in Special Flood Hazard Areas (SFHA), it is legally required by federal law to purchase flood insurance. Lending institutions that are federally regulated or federally insured must determine if the structure is in a SFHA and must provide written notice requiring flood insurance. Flood insurance is available to any property owner located in a community participating in the NFIP.

Flood damage is reduced by nearly $1 billion a year through partnerships with communities, the insurance industry, and the lending industry. Further, buildings constructed in compliance with NFIP building standards suffer approximately 80 percent less damage annually than those not built compliant. Additionally, every $3 paid in flood insurance claims saves $1 in disaster assistance payments.

The NFIP is self-supporting for the average historical loss year, which means that operating expenses and flood insurance claims are not paid for by the taxpayer, but through premiums collected for flood insurance policies. The program has borrowing authority from the U.S. Treasury for times when losses are heavy; however, these loans are paid back with interest.

The Town of Burrillville had a Community Assistance Visit during the update to the mitigation plan on December 19, 2019. The purpose of the meeting was to discuss the Town's participation in, and obligations to, the National Flood Insurance Program (NFIP). The intent of the meeting was also to assist, if necessary, in strengthening the review and enforcement of NFIP standards. The result of the meeting

was positive and revealed little new development in the floodplain and the State Floodplain Coordinator concluded the local officials had a comprehensive understanding of NFIP and floodplain management.

Floodplain Management Goals / Reducing Flood Risks

A major objective for floodplain management is to continue participation in the National Flood Insurance Program. Communities that agree to manage Special Flood Hazard Areas shown on the NFIP maps participate in the NFIP by adopting minimum standards. The minimum requirements are the adoption of the Floodplain Ordinance and Subdivision/Site Plan Review requirements for land designated as Special Flood Hazard Areas.

Federally subsidized flood insurance is available to any property owner located in a community participating in the NFIP. Communities that fail to comply with NFIP will be put on probation and/or suspended. Probation is a first warning where all policyholders receive a letter notifying them of a $50 increase in their insurance. In the event of a suspension, the policyholders lose their NFIP insurance and are left to purchase insurance in the private sector, which is of significantly higher cost. If a community is having difficulty complying with NFIP policies, FEMA is available to meet with staff and volunteers to work through the difficulties and clear up any confusion before placing the community on probation or suspension.

According to NFIP policies, when an applicant files a request for a building permit in the floodplain, the applicant must include an elevation certificate to comply. If an applicant intends to fill onsite, a Letter of Map Revision (LOMR) must be submitted along with the application. According to NFIP requirements in the Floodplain Ordinance, building permits should be reviewed to assure sites are reasonably safe from flooding, and requirements for anchoring to prevent flotation, collapse, or lateral movement as well as construction using flood-resistant materials is being followed.

To reduce flood risks, the Code Enforcement Officer/Building Inspector should be familiar with the Floodplain Ordinance and the NFIP. Additionally, the Planning Board should be familiar with NFIP policies, especially those regulations that are required to be incorporated into the Subdivision/Site Plan Review regulations. A workshop sponsored by the Rhode Island Emergency Management Agency would be appropriate to educate current staff and volunteers.

An essential step in mitigating flood damage is participation in the NFIP. The Town of Burrillville works to consistently enforce NFIP compliant policies to continue its participation in this program.

Repetitive Losses

Repetitive losses are those structures that are covered under an NFIP flood insurance policy and:

> (a) That has at least four NFIP claim payments (including building and contents) over $5,000 each, and the cumulative amount of such claims payments exceeds $20,000; or
> (b) For which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building.

For both (a) and (b) above, at least two of the referenced claims must have occurred within any ten years and must be greater than 10 days apart.8

FEMA mitigation funds are available to States so that the riskiest repetitive flood loss properties can be targeted offering the owners financial help to get their buildings high and dry--either moved to a safer location or elevated well above flood elevations. The National Flood Insurance Agency (FIA) is considering a change in their regulations so that policyholders under the flood insurance program who decline an offer of FEMA's mitigation funds to move or elevate their property would pay full-risk premiums for flood coverage. Currently, consistent with the grandfather provisions of the flood insurance program's authorizing legislation, the FIA charges the owners of properties built before we developed detailed flood risk information less than full-risk premiums. These older structures have been eligible for the reduced premiums account for nearly all of the repetitive loss properties insured under the flood insurance program.

Community Rating System (CRS)

When communities go beyond the minimum standards for floodplain management, the Federal Emergency Management Agency's (FEMA) National Flood Insurance Program (NFIP) Community Rating System (CRS) provides discounts up to 45 percent off flood insurance premiums for policyholders in that community. Formal adoption and implementation of this strategy will help Burrillville gain credit points under the CRS. For example, points are given to municipalities that form a Local Hazard Mitigation Committee (LHMC). Communities also receive points if they involve the public in the planning process, coordinate with other agencies, assess the hazard and their vulnerability, set goals, draft an action plan (local hazard mitigation strategy), and adopt, implement, and revise the plan.

There are many categories to gain credit for public education and awareness activities regarding floodplain management and mitigation. The maintenance of non-federally owned open space land in floodplains can also help a municipality gain credit points under the CRS program. Also, vegetated open-space land enhances the natural beauty and the beneficial functions that floodplains serve while helping to prevent flood damage.

Benefits of the Community Rating System

Not only do CRS activities save money, but they also protect the environment and improve the quality of life — even when there is no flood. For example, when the Town of Burrillville preserves open space in the floodplain, the residents will get to enjoy the natural beauty of the land. If there is a flood, here are some of the many benefits CRS activities bring:

[8] http://www.fema.gov/severe-repetitive-loss-program

- CRS activities prevent property damage.
- Avoid lost jobs and economic devastation caused by flooding in offices, factories, farms, stores, and other businesses.
- Prevent damage and disruption to roads, schools, public buildings, and other facilities you rely on every day.
- May reduce casualties if setbacks decrease the impact of physical structures.

The State Floodplain Coordinator encouraged local officials to participate in the Community Rating System, however, the Town has elected not to participate due to the low number of properties, premiums, and claims.

2.0 Town of Burrillville Profile

When preparing a mitigation strategy, it is imperative to assure that the plan encompasses all aspects of the Town. To assure that this was the case, the LHMC first studied the current situation of the Town of Burrillville, namely the climate, geography, and demographics. We also performed a historical review to assure that the Town of Burrillville Mitigation Strategy brings together every aspect of the Town. This section will serve as a foundational summary for the Burrillville Mitigation Strategy.

General Information

Burrillville is a rural/suburban town located in the northwest corner of Rhode Island, bordered on the north by Massachusetts and on the west by Connecticut. Burrillville is approximately twenty miles from Providence, Rhode Island, 45 miles from Boston, and 190 miles from New York City. Burrillville has a land area of 57.3 square miles with many lakes and streams.

The Town of Burrillville was separated from the Town of Glocester, RI, and incorporated in 1806. It was named for James Burrill Jr., then State Attorney General, in recognition of his services in establishing the new town. One of the main reasons for the creation of the new town was the people living in what was to become Burrillville disliked having to travel to the village of Chepachet to conduct official business and attend town meetings.

Burrillville grew quickly, its economy fed by a textile industry which continued to be of major importance until the 1950s when the textile industry in the Northeast began to move to the South. It was Burrillville's mills that led to the development of the town's many small villages.

The Town of Burrillville is a municipal corporation operating under the General Laws of Rhode Island and utilizes a Town Council/Town Manager form of government with seven elected members headed by a Council President. The Burrillville School District is directed by a seven-member School Committee. The town has three elementary schools, a middle school (grades 6-8) and one high school (grades 9-12).

Burrillville, Rhode Island is located in the Northwest corner of Rhode Island. It contains 57.1 square miles and has a population of 16,740 people according to the 2018 Census Estimate.

Geography and Climate

A generally rural community, that is dotted throughout by many lakes and ponds. Summer temperatures tend to be in the 53-76 F/12-24 C range. There are some 90+F/ 32+ C days, mostly in July, but the afternoon sea breeze keeps most summer highs in the low 80s F/27 C. September and October are generally clear, with highs in the mid 60s to mid 70s F/17-23 C. Winter is wet, sometimes snowy, sometimes icy and chilly (18 to 37 F/-8 to -3 C).

General Demographic Characteristics

- **Population**: The population count for The Town of Burrillville as of the 2018 Census Estimate, was 16,740. This represented a +4.9% increase from the 2010 population of 15,953[9].
- **Age Distribution**: In 2018 it was estimated that 5.2% were under 5 years old, 20.4% are under 18 years old and 14.5% is 65 or older.
- **Population Density**: The 2018 population density estimate for Burrillville is 290 persons per square mile of land area. Burrillville contains 55.56 square miles of land area (143,908,049 sq. meters) (35,560.73 acres) and 1.58 square miles of water area (4,097,389 square meters) (1,011.2 acres).
- **Housing Units**: The total number of housing units in the Town of Burrillville as of April 1, 2010, was 6,419. This represented an increase of 598 units from the 5,821 housing units in 2000. Of the 6,419 housing units, 550 were vacant. 230 of the vacant units were for seasonal or recreational use.
- **Households**: In 2018, there are 6,053 households in Burrillville with an average size of 2.64 persons. 75.2% of these units are recorded as owner-occupied.
- **Race and Hispanic Origin:** The Town sees the following percentages of races and origins within their population:
    - White: 94.7%
    - Black or African American: 0.9%
    - Asian: 1.4%
    - Two or More Races: 2.4%
    - Hispanic or Latino: 2.3%

Town Infrastructure

The analysis, assessment, and identification of assets within a community are integral to determining what may be at risk for loss from a natural disaster. This section examines the assets in four separate categories: Critical Facilities, Vulnerable Populations, Economic Assets, and Special Considerations.

Each category lists the facility's address and which hazard(s) it is vulnerable to. The hazards listed are primarily natural disasters but can also include secondary disasters such as sewer/water line rupture, or human-made disasters/emergencies such as automobile accidents.

In Burrillville, each asset can be damaged by all the hazards in Section 4.0. The Critical Facilities have been plotted on the large map which can be found at the end of this section. When the asset was not specifically vulnerable to one or more hazards, the term "All" was used to signify the asset's vulnerability to all possible hazards.

[9] https://www.census.gov/quickfacts/burrillvilletownprovidencecountyrhodeisland

Critical Facilities

Critical Facilities are categorized as those Town or State buildings or services that are the first responders in a disaster. Fire departments, police departments, highway departments, and City/State offices play a pivotal role in coordinating and implementing emergency services in the event of a disaster. Other critical facilities include hospitals, airports, and schools that are used as shelters. The office of the Department of Public Works is also included, as road maintenance plays a key role in disaster response.

Key Facilities

Facility	Address	Lat/Long	Hazard
Burrillville Town Hall	105 Harrisville Main Street, Harrisville, RI 02830	41°57'59.27" N, 71°40'39.42" W	Snow, Wind
Town Hall Annex, Carlton Brown Bldg.	144 Harrisville Main Street, Harrisville, RI 02830	41°57'55.63" N, 71°40'35.40" W	Snow, Wind
Burrillville Police Station	1477 Victory Highway PO Box 231Burrillville, RI 02830	41°57'51.96" N, 71°38'35.75" W	Snow, Wind
Burrillville Public Works	200 Clear River Drive Oakland, RI 02859	41°58'1.14" N, 71°41'40.97" W	Snow, Wind
Harrisville Fire District	201 Callahan School Street, Harrisville, RI 02830	41°58'7.13" N, 71°40'44.36" W	Snow, Wind
Nasonville Fire District	2577 Victory Highway, Harrisville, RI 02830	41°58'48.18" N, 71°36'45.68" W	Snow, Wind
Oakland/Mapleville Fire District	46 Oakland School Street, Oakland, RI 02858	41°57'36.03" N, 71°38'46.09" W	Snow, Wind
Pascoag Fire District	105 Pascoag Main Street, Pascoag, RI 02859	41°57'25.60" N, 71°42'4.02" W	Snow, Wind
Wallum Lake Fire Department	2090 Wallum Lake Road, Pascoag, RI 02859	41°59'50.03" N, 71°45'45.02" W	Snow, Wind
Burrillville School Department	2300 Broncos Highway, Harrisville, RI 02830	41°58'52.85" N, 71°37'15.79" W	Snow, Wind
Jesse M. Smith Library	100 Tinkham Lane, Harrisville, RI 02830	41.965204 N, 71.674586 W	Snow, Wind

Schools

School	Address	Lat/Long	Hazard
Steere Farm Elementary	915 Steere Farm Road, Harrisville, RI 02830	41°57'12.15" N, 71°40'22.27" W	Snow
Burrillville Middle School	2220 Broncos Highway, Harrisville, RI 02830	41°58'53.50" N, 71°37'21.49" W	Snow
Burrillville High School	425 East Avenue, Harrisville, RI 02830	41°58'5.80" N, 71°39'44.20" W	Snow
W.L. Callahan School	75 Callahan School Street, Harrisville, RI 02830	41°58'8.28" N, 71°40'57.66" W	Flooding, Snow
AT Levy Elementary School	135 Harrisville Main St., Harrisville, RI 02830	41°57'56.27" N, 71°40'36.90" W	Snow

Community Christian School	111 Church Street Pascoag, RI 02859	41°57'31.28" N, 71°42'21.34" W	Wind, Snow

Utilities

Department	Address	Lat/Long	Hazard
Pascoag Utility District (water, electric)	253 Pascoag Main Street, Pascoag, RI 02859	41°57'36.48" N, 71°41'57.16" W	Wind, Snow
Pascoag Utility District water department	44 Silver Lake Avenue, Pascoag, RI 02859	41°57'51.51" N, 71°41'56.10" W	Earthquake
Pascoag Utility District water tower	Rock Avenue, Pascoag, RI 02859	41°57'7.55" N, 71°42'21.90" W	Wind, Earthquake
Pascoag Utility District water tower	South Main Street, RI 02859	41.946131 N 71.691067 W	Wind, Earthquake
Harrisville Fire District (water) office & wells	115 Central Street, Harrisville, RI 20380	41°57'42.92" N, 71°40'11.89" W	Wind, Snow, Flooding, Earthquake
Harrisville Fire District Eccleston Field wells	Callahan School Street, Harrisville, RI 02830	41°58'10.12" N, 71°40'58.30" W	Flooding, Earthquake
Harrisville Fire District water tower #1	Cherry Farm Road, Harrisville, RI 02830	41°59'3.21" N, 71°40'32.48" W	Wind, Earthquake
Harrisville Fire District water tower #2	Steere Farm Road, Harrisville, RI 02830	41°57'12.15" N, 71°40'22.27" W	Wind, Earthquake
Nasonville Water District	95 Gig Road, Harrisville, RI 02830	41.972857 N -71.604461	Wind, Snow
Burrillville Wastewater Treatment Facility	141 Clear River Drive, Oakland, RI 02858	41°57'41.30" N, 71°39'18.37" W	Flooding. Earthquake
Verizon	33 Park Place, Pascoag, RI 02859	41.955986 N -71.70121 W	Wind, Snow

Medical Facilities

Name	Address	Lat/Long	Hazard
WellOne Health Center	36 Bridge Way, Pascoag, RI 02859	41°57'24.41" N, 71°42'8.62" W	Flood, Wind, Snow
Zambarano Hospital	2090 Wallum Lake Road, Pascoag, RI 02859	41°59'50.03" N, 71°45'45.02" W	Wind, Snow

Vulnerable Populations

Areas or neighborhoods that are densely populated, buildings that house people who may not be self-sufficient in a disaster, or areas that include homes that are not very resistant to natural disasters are considered vulnerable. Vulnerable populations include manufactured home parks and elderly housing developments or care facilities.

Vulnerable Populations

Name	Address	Lat/Long	Hazard

Bradford Court	45 North Main Street, Pascoag, RI 02859	41°57'37.24"N, 71°42'2.04"W	Snow, Wind
Ashton Court	424 Chapel Street, Harrisville, RI 02830	41°57'59.37"N, 71°40'46.54"W	Snow, Wind
Stillwater Heights	30 Central Street, Harrisville, RI 02830	41°57'43.93"N, 71°40'6.86" W	Snow, Wind
Overlook Nursing & Rehabilitation Center	14 Rock Avenue Pascoag, RI 02859	41°57'18.41"N, 71°42'20.77"W	Snow, Wind
Bayberry Commons Health Care Facility	181 Davis Drive Pascoag, RI 02859	41°56'10.16"N, 71°41'0.09"W	Snow, Wind
Crystal Lake Rehabilitation Center	999 South Main Street, Pascoag, RI 02859	41°56'10.87"N, 71°40'54.87"W	Snow, Wind
Brothers of the Sacred Heart Provincial Home	915 Steere Farm Road, Harrisville, RI 02830	41°57'12.15"N, 71°40'22.27"W	Snow, Wind
Maplehill Mobile Home Park	61 Hillside Drive, Mapleville, RI 02839	41°56'55.24"N, 71°38'4.40" W	Snow, Wind

Economic Assets

Although the Town of Burrillville contains many small businesses, several businesses stand out prominently in a community. These businesses employ Burrillville residents and are prominent gathering places that could pose logistical problems in cases of evacuations during a disaster. However, some of the large businesses are equipped to provide critical services/products to residents or sustenance to their employees for an extended period.

Economic Assets

Name	Address	Lat/Long	Hazard
Burrillville Industrial Park	115 Davis Drive Pascoag, RI 02859	41°57'59.27" N, 71°40'39.42" W	Wind, Snow
Burrillville Commerce Park	Danielle Drive, off Bronco Highway, Harrisville, RI 02830	41°56'13.91" N, 71°41'9.29" W	Wind, Snow
Clear River Industrial Park	Aspen Way off of Clear River Drive, Oakland 02858	41°57'37.67" N, 71°39'13.86" W	Wind, Snow
Downtown Pascoag Business District	Pascoag Main Street Pascoag, RI 02859	41°57'38.16" N, 71°41'59.80" W	Wind, Snow
DPI	Danielle Drive, Mapleville, RI 02839	41° 56'49.38" N, 71°38'18.312" W	Wind, Snow
Atlas Pallet	50 Old Mill St, Harrisville, RI 02830	41° 59'7.116" N, 71°37'23.34" W	Wind, Snow
Bruin Plastics	61 Joslin Road Glendale, RI 02826	41° 58'35.328" N, 71°37'55.74" W	Wind, Snow
Doering Equipment Company	135 Douglas Pike Burrillville, RI 02830	41° 58'7.83" N, 71°35'56.34" W	Wind, Snow

Special Considerations

Churches are special considerations for their unique contributions to society. Churches are often natural gathering places for people in disasters and can temporarily provide shelter and accommodation. Businesses that potentially store or use hazardous materials are listed as special considerations due to the potential for leaking or combustion in the event of a disaster.

Churches

Name	Address	Lat/Long	Hazard
Berean Baptist Church	474 Chapel Street Harrisville, RI 02830	41°57'59.62" N, 71°40'41.14" W	Wind, Snow
Community Christian Church	111 Church Street Pascoag, RI 02859	41°57'31.28" N, 71°42'21.34" W	Wind, Snow
Our Lady of Good Help Church	1035 Victory Highway Mapleville, RI 02839	41°57'16.80" N, 71°39'0.19" W	Wind, Snow
New Hope Baptist Church	66 South Main Street Pascoag, RI 02859	41°57'15.41" N, 71°42'6.17" W	Wind, Snow
St. Joseph Church	183 Sayles Avenue Pascoag, RI 02859	41°57'37.49" N, 71°42'14.18" W	Wind, Snow
St. Patrick's Church	31 Harrisville Main Street Harrisville, RI 02830	41°58'5.61" N, 71°40'42.07" W	Wind, Snow
St. Theresa of the Child Jesus	42 Dion Drive Harrisville, RI 02830	41°59'3.00" N, 71°36'58.27" W	Wind, Snow
First Universalist Church of Burrillville	134 Harrisville Main Street Harrisville, RI 02830	41°57'56.40" N, 71°40'36.06" W	Wind, Snow
Seventh-Day Adventist	854 Victory Highway, Mapleville, RI 02839	41.949975 N -71.648969 W	Wind, Snow
Burrillville Apostolic Church	764 South Main Street Pascoag, RI 02830	41.941923 N -71.684935 W	Wind, Snow

Hazardous Materials Facilities

Name	Address	Lat/Long	Hazard
Western Sand and Gravel	135 Douglas Pike	41°57'47.75" N, 71°35'12.17" W	Flood
Algonquin Gas compressor station	54 Algonquin Lane	41°58'4.31"N,71°45'20.05"W	Earthquake
Dattco	400 Pascoag Main St	41°57'47.77"N,71°41'46.99"W	Flood, Hurricane
OSP Nasonville Substation	Douglas Pike	41° 55' 22.87'' N 71° 31' 44.71'' W	Flood
Ocean State Power	1575 Sherman Farm Rd	42° 0'36.68"N, 71°40'14.69"W	Earthquake Flood

Verizon substation	33 Park Place	41°52'31.27"N, 41°52'31.27"W	Earthquake Flood
Western Hill Sunoco	605 Douglas Pike	41°54'7.47"N, 71°30'16.39"W	Flood
Sunoco Gas Station	Route 107, Chapel Street	41° 58' 7.32'' N 71° 41' 18.312'' W	Flood
Mobil Station (Former)	24 N Main Street, Pascoag	41° 57' 35.712'' N 71° 42' 5.652'' W	Flood

Local Bridges

Bridge Number	Location	Village	Posted Weight
353	Gazza Road	Mapleville	15-ton x 2 axle 22-ton x 3 axle 35-ton x 5 axle
337	Main Street	Mapleville	
035501	Warner Lane	Pascoag	
354	Railroad Ave	Harrisville	
356	Tarklin Road	Nasonville	7 tons
512	Sayles Ave	Pascoag	
315	Frank Potter Mem	Pascoag	

State Bridges

Bridge Number	Location	Village	Posted Weight
105	Oakland Bridge	Oakland	No limit
111	Route 7	Nasonville	15 tons
112	Glendale Bridge	Glendale	
198	Pascoag Main St Bridge	Pascoag	15 tons
306	E Ave Falls	Harrisville	19 tons
307	Shippee Bridge	Harrisville	5 tons
308	Chapel Street	Pascoag	10 tons
310	Chapel St Memorial	Pascoag	
354	Railroad Ave Bridge	Harrisville	
355	Warner Lane	Pascoag	
356	Tarklin Bridge	Pascoag	
378	Round Top Bridge	Pascoag	5 tons
412	North Road	Pascoag	
512	Sayles Ave	Pascoag	

Critical Facilities

Each jurisdiction classifies “critical facilities” based on the relative importance of that facility’s assets for the delivery of vital services, the protection of special populations, and other important functions. If damaged, the loss of that critical facility would present an immediate threat to life, public health, and

safety. Protection of critical facilities is also important for rapid response and recovery of a community, its neighborhoods, and its businesses. In the Town of Burrillville, critical facilities are classified under the following subsections:

- **Public Infrastructure**: Fire stations, Police Stations, Schools, Town Hall, Hospitals, and Bridges with Utilities
- **Utilities**: Sewer treatment plants, Sewer lift stations, Water pump stations, and Water towers
- **Preparedness**: Red Cross approved shelters, Evacuation routes, and Traffic control points

Section 3.0 Planning Process

Local Hazard Mitigation Committee

The development of this mitigation plan update has been a result of significant hours of work by all parties involved over six months. To assure the plan fully encompassed all the aspects of the Town of Burrillville, a working group was reconvened in December 2019 consisting of members of the Town Government, affiliates of major institutions located in the Town, and the Town Residents. This allowed for the demographics of the group to be in line with the overall demographics of the Town. Planning in this fashion creates a mitigation strategy that fully encompasses all aspects of disaster impact, from concerns of the residency, business continuity, and local disaster response and recovery activities. The following is a list of all parties involved in the update of the Burrillville Hazard Mitigation Plan.

Town of Burrillville Hazard Mitigation Committee

- Mr. Michael C. Wood, Town Manager, and Town Resident
- Mr. Glenn Biddiscombe, Director, Burrillville Emergency Management Agency, and Town Resident
- Major Dennis Leahey, Burrillville Police Department
- Mr. Jeffrey McCormick, P.E., Town Engineer & Director, Department of Public Works, and Town Resident
- Mr. Ray Goff, Planning Director
- Mr. Joseph Raymond, Building & Zoning Official and Town Resident
- Mr. William J. Guertin, Assistant Manager, Pascoag Utility District (Electric) and Town Resident
- Mr. Michal Kirkwood, Pascoag Utility District (Water)
- Mr. Richard Peck, Interim Chief, Pascoag Fire Department, and Town Resident
- Mr. Michael E Gingell, Chief, Harrisville Fire Department, and Town Resident
- Mr. Joseph Bertholic, Chief, Oakland Mapleville Fire Department, and Town Resident
- Mr. Paul Bisson, Harrisville Water Department, and Town Resident

The committee met monthly and discussed any issues encountered in the development of the strategy. Tasks were assigned to appropriate group members and meetings were scheduled to discuss developments as they were made.

Burrillville is a small community and the LHMC included both individuals who were members of town offices, town businessmen (such as Mr. Bertholic, who has a working farm in town), and private utility providers. All of the members of the Town Council were also invited to participate. The general public was invited to join the planning process by way of a significant outreach strategy that included e-mails, posting on the Town's website, advertisements in local newspapers, social media outreach, and placing draft plans in key locations such and Fire Stations, Town Hall, and the libraries.

The plan was also sent to the Town's neighbors, Glocester and North Smithfield in Rhode Island, Douglas, and Uxbridge in Massachusetts, and Thompson in Connecticut. The goal of this outreach is to ensure alignment with regional goals and encourage support for mitigation efforts across borders.

Methodology

The first step in updating a multi-hazard Mitigation Strategy is to identify all of the hazards that have the potential to impact the Town of Burrillville. The second step is to perform a risk assessment. The risk assessment is a systematic way to quantify the effects of the identified hazards and provides a way to recognize and compare risks. After quantifying the risk, data about population, property, economic and environmental resources were gathered to determine how and where Burrillville is vulnerable to the impact of various hazards. Information on the existing protection systems currently in place within Burrillville (both physical and regulatory) was gathered to better understand the community's vulnerability more accurately.

During this 2021 update, the Town sought to build upon the previously completed work of LHMC while also being reflective of changing science, trends, and hazard within the Town. The Town again engaged CDR Maguire to support the update of the plan after a successful 2014 update.
At the Committee's first meeting of the update cycle on December 4, 2019, they reviewed the overall planning process and items that needed to be accomplished to ensure a successful update. The Town recognized that they were slightly behind their update cycle and wanted to engage in a complete, but compressed review timeline. This required additional work by all committee members in between each meeting.

The Committee also decided to realign the plan to best practices within the State of Rhode Island. After a discussion with the State Hazard Mitigation Officer, it was decided that the format of the plan should align similarly to what North Kingstown had presented to FEMA Region 1 earlier that year. This model was held up as a best practice and the Town wanted to align with that.

During this first meeting, the Committee revised the plan's Mission and Goals; an additional mission and goal were added as well as cleaning up the language presented. Adjustments were made to add Mission Statement 2 while shifting the remaining mission items down. Additionally, goals 7 and 9 were cleaned up to update their language including adding "Continue to enhance and maintain" instead of "Establish" the LHMC.

Next, the team reviewed the hazards from the previous plan. There was a robust discussion regarding the hazards based on a review of past incidents within the Town, development trends, and the latest State Hazard Mitigation Plan Update, adopted in early 2019. The Committee also reviewed the one disaster declaration since the last update, DR-4212 Rhode Island Severe Winter Storm and Snowstorm. The Town had fared well during the disaster only having $63,124 in Category B- Emergency Protective Measures.

Based on this review and robust discussion, the hazards were refined and expanded. Each member of the committee was then given homework to complete the hazard scoring based on a risk assessment and vulnerability scoring as well as review the past mitigation actions of the town. This allowed time to reflect on the items discussed at the meeting and the opportunity to score hazards based on the best available data. Once the results from the risk assessment and vulnerability analysis were known and an understanding was gained of how and where Burrillville is vulnerable to the impacts of these hazards in

terms of damage to public infrastructure, critical facilities, as well as environmental, societal, and economic components, a clearer picture of the areas at risk was depicted using Geographic Information System (GIS) maps.

At the second meeting on January 9, 2020, the Committee reconvened to review the results of the risk assessment and vulnerability analysis and discussed previous and new mitigation items. The Town was largely successful in mitigating hazards associated with flooding but noted increased concern regarding one of the newly identified hazards, aquifer contamination. Overall, 10 mitigation actions were completed by the Town since the last plan update. The committee however did not want to rest on their laurels and identified an additional 6 mitigation actions to be undertaken in this update cycle. Significant research and work were undertaken between the second meeting and the first draft review of the updated Hazard Mitigation Plan on March 10, 2020.

During the Committee's plan review period, the 2020 COVID-19 pandemic struck in earnest. Many of the committee members were forced to focus on the response and recovery efforts instead of hazard mitigation planning. When the committee began to conduct business by e-mail in early May, it was decided that infectious disease events should be added to the plan and included. Another draft review cycle occurred on June 22, 2020. The plan was presented externally for review on July 6, 2020, for public comment.

The Committee endeavored to have a robust public engagement. To that end, the Town leveraged its website, social media, local newspapers, and local community gathering places to provide for a review of the plan. The Town also reached out to its surrounding jurisdictions that border Burrillville to ensure their review and comment. The plan was sent to the following communities:

- North Smithfield, RI
- Smithfield, RI
- Glocester, RI
- Putnam, CT
- Thompson, CT
- Douglas, MA
- Uxbridge, MA

No changes were provided by those communities for the plan.

Most significantly, a special town meeting was held on August 12, 2020, via Zoom[10] in which the plan was presented to the Town Council and the general public. An explanation of the purpose of hazard mitigation planning changes, during this update, and a discussion on the hazard mitigation items occurred. During the meeting, the Town Council voted to submit the plan to RIEMA and FEMA upon the approval of the majority of the LHMC. The slides from that presentation and the vote can be found below:

[10] Due to COVID-19 Restrictions

iParametrics | CDR|MAGUIRE

Town of BURRILLVILLE RHODE ISLAND

Burrillville Hazard Mitigation Plan Update

August 12, 2020

1

MEETING OBJECTIVES

- Discuss Hazard Mitigation
- Goals of the Local Hazard Mitigation Plan
- Hazards Addressed
- Successes of the Town
- Mitigation Actions Proposed
- Public Comment and Questions

2

WHAT IS HAZARD MITIGATION?

- As defined by 44 CFR 201.2, Hazard Mitigation means any sustained action taken to reduce or eliminate the long-term risk to human life and property
- In simple terms, lessening or eliminating threats to the community

3

FEDERAL GUIDANCE

- Disaster Mitigation Act (DMA) of 2000
  - Guide mitigation activities in a coordinated and economic manner
  - Incorporate into other existing planning mechanisms
  - Reduce losses; make community more resistant
- Flood Mitigation Act (FMA)
  - Reduce or eliminate claims under the National Flood Insurance Program (NFIP)
  - Outlines a comprehensive strategy for implementing technical feasible flood mitigation activities
- Building Resilient Infrastructure and Community Grant (BRIC)

7

FEMA'S PLANNING PHASES

- Phase 1- Organize Resources
- Phase 2- Assess Risks
- Phase 3- Develop the mitigation plan
- Phase 4- Implement the plan/monitor progress

7

SO WHAT'S NEW?

- New Plan Format
- Update of Plan Goals
- Hazards re-evaluated and adjusted
- New Mitigation Actions
  - 10 Mitigation Projects Completed
  - 6 New Ones Identified
- Update of Assets

7

CRITERIA FOR SELECTING MITIGATION MEASURES

- Will it work?
- Is it cost-beneficial?
- Is it affordable?
- Is it legal?
- Is it fair?
- Do people want it?
- Are there administrative burdens?
- Is it politically acceptable to community leaders?
- Is it environmentally sound?

7

10

EXAMPLE ACTIONS

- Identifying potential threats to the water supply
- Developing a new well head/potable water source
- Installing a new supply pipe for the Cherry Farm Road Tank
- Installing 3 communication towers to address communications issues
- Upgrading the Town's Dispatch Center
- Conducting a lightning protection survey

7

11

PUBLIC OUTREACH

- Creation of a Hazard Mitigation Committee involving several Town residents
- Website
- Distribution of Plans in Open Buildings
- Tonight's Meeting

7

12

NEXT STEPS

- Public Comment Closes; Adjustments Made
- Submit the Plan to RIEMA for a State Review
- Address State Review Comments. Resubmit (if needed)
- RIEMA Submits the Plan to FEMA Region I
- Address Region I Comments. Resubmit (if needed)
- Upon Region I approval, the Town Council formally adopts the plan
- Review annually or after a disaster

7

CDR|MAGUIRE iParametrics

QUESTIONS?

25

PUBLIC HEARING of the Burrillville Town Council held Wednesday, August 12, 2020 at 6:00 P.M. in the Wallace F. Lees Public Safety Complex, 1477 Victory Highway, Oakland, RI for and within the town of Burrillville, Rhode Island.

This meeting was held in accordance with the provisions of the Governor's Executive Orders 20-46 and 20-53. All members of the Town Council participated in person. Members of the public were invited to listen and/or participate in the meeting, as required, by the means listed on the posted agenda.

MEMBERS PRESENT: Councilors Stephen N. Rawson, Dennis M. Anderson, Jeremy P. Bailey and Donald A. Fox.

MEMBERS ABSENT: Council President John F. Pacheco III and Councilors Amanda K. Gingell and Raymond J. Trinque were excused

Relative to considering and acting upon the update of the town's Hazard Mitigation Plan.

Note: Notice of public hearing was advertised as a display ad in The Woonsocket Call on August 5, 2020.

1. Comments/Input/Recommendations by the Administration and Consultants

Michael C. Wood, Town Manager, explained that it is a Federal requirement to have a plan up to date in order to qualify for any Federal funds if a disaster does happen.

Jeffrey Stevens, of iParametrics, gave a presentation; a copy of which is on file with the record of the meeting.

2. Public Comment:

Discussion: It was noted that there has been no input from the public so far, and there is none at the meeting tonight. Mr. Stevens will check back by August 14 to see if we receive any.

3. VOTED to close the public hearing.

Motion by Councilor Donald F. Fox. The motion carried unanimously by the four members present.

4. Town Council Members Comments/Input

Discussion: There was discussion about some typos and clarifications needed in the document.

5. VOTED to adopt the proposed updates to the town's Hazard Mitigation Plan and send to the Rhode Island Emergency Management Agency for approval when all of the public comments have been incorporated.

6. Adjournment

Motion by Councilor Donald A. Fox. The motion carried unanimously by the four members present.

APPROVED
AUG 26 2020

Vicki T. Martin, Town Clerk

At the end of the Public Comment period, the plan was updated to reflect the input of the community. This final plan was again reviewed and approved by the LHMC to send to RIEMA for State review. After the State's review was addressed, the plan was submitted to FEMA Region 1 for review and approval. Upon state and federal approval, the Burrillville Town Council voted to formally adopt the 2021 Hazard Mitigation Plan Update on XXX.[11]

Incorporation of Mitigation into Planning Mechanisms

In writing this plan, the Town Comprehensive Community Plan was read, in addition to existing policies and on-going programs. Details of these plans were incorporated into this Multi-hazard Mitigation Plan along with all other pertinent planning and implementation tools available such as local zoning, building, and subdivision ordinances. This Mitigation Plan will allow Burrillville to focus on strengthening existing plans, programs, policies, and procedures by incorporating mitigation as part of the on-going process of Community Development.

The updated hazard mitigation plan will be utilized where appropriate into other existing planning mechanisms. These plans include but are not limited to the Town of Burrillville Comprehensive Plan, Emergency Operations Plan (EOP), Zoning Ordinance, redevelopment plans, and capital improvement plans. The HMP will be referenced when these plans are updated if it applies to the plan. The HMP may also be incorporated into mutual aid agreements, evacuation plans, stormwater management plans, and/or zoning ordinances. The above-mentioned plans are available for incorporating the mitigation requirements of the HMP.

The consistent relationship between this mitigation strategy and the Town of Burrillville Comprehensive Plan is demonstrated by referencing several elements already discussed in the Comprehensive Plan with which this Mitigation Plan is consistent. For example, the following are some of the areas of the Community Comprehensive Plan where policy crossover (consistency) between this Mitigation Plan and the Comprehensive Plan is apparent.

Incorporation of Mitigation into Emergency Management

The Emergency Management Program in the Town of Burrillville consists of one part-time emergency management director. The role of the director is to coordinate the Town's emergency management program. The position is funded through the Town with financial assistance from FEMA's Emergency Management Performance Grant Program (EMPG). Most recently, the Town's Emergency Operation Plan was rewritten in 2011 to include mitigation as a principal means for protecting the Town from the impact of natural hazards. This will allow the Town to develop response priorities based upon expected damage that is derived from solid research and not just educated guesses.

Once approved, the Mitigation Plan will be incorporated into the Town's emergency management program. This will strengthen the comprehensive nature of the Town's Emergency Management Program. Implementation of mitigation actions will allow for a more effective program by protecting the

[11] To be addressed as Plan progresses in review

critical infrastructure of the Town and increasing the likelihood that this infrastructure will remain functional throughout a hazard event. Further, the actions identified in the plan will reduce the possibility of responders becoming victims themselves. Essentially, this plan will allow mitigation to move into the foreground as the best means to reduce disaster impact on the community and to ensure an effective response to unavoidable damages.

Section 4.0 Hazard Identification, Vulnerability and Risk Assessment

The purpose of this section is to provide an overview of how various hazards can and have impacted Burrillville. A natural hazard is defined as "an event or physical condition that has the potential to cause fatalities, injuries, property and infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm or loss." A natural hazard can also be exacerbated by societal behavior and practice, such as building in a floodplain or an earthquake fault. Natural disasters are inevitable, but the impacts of natural hazards can, at a minimum, be mitigated or, in some instances, prevented entirely.

To support this planning, the LHMC first reviewed the previous Hazard Mitigation Plan Update (2014), the Rhode Island State Hazard Mitigation Plan (2019), plans from neighboring communities, and the latest research on emerging threats from sources such as National Oceanic and Atmospheric Administration (NOAA) and the National Centers for Environmental Information (NCEI). The Committee also reviewed previous disaster declarations within the State as well as national disaster trends.

Overall, the Committee agreed that the existing hazards list needed to be refined and better defined as well as additional hazards added for consideration. The chart below outlines the changes in the hazard list:

2014 Hazards	2021 Hazards
Dam Failures	Aquifer Contamination
Droughts	Critical Incidents
Earthquakes	Dam Failure
Floods	Droughts
Hazardous Materials Events	Earthquakes
Hurricane & Tropical Storms	Flood
Nor'easters	Hazardous Materials Events
Severe Winter Storms	Hurricanes & Tropical Storms
Temperature Extremes	Infectious Disease
Tornados	Lightning
Wildfires/Conflagration	Severe Winter Storms
	Temperature Extremes
	Tornado
	Wildfire

The Committee reviewed the impacts of severe storms such as Nor'easters and felt that the concerns generated from them were largely similar to Severe Winter Storms, and thusly combined them. The Committee also reviewed Thunderstorms and Severe Storms and felt that the largest unaccounted-for hazard was Lightning. Therefore, Lightning was created as a separate Category. Finally, Aquifer Contamination, Critical Incidents, and Infectious Disease were added.

This list represents those hazards that impact Burrillville most frequently and have the "potential to cause fatalities, injuries, property and infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm or loss[12]", as described in the RIHMP. The following hazards will not be addressed in this plan:

- Avalanche
- Cybersecurity Incident
- Expansive soils
- Infrastructure Failure
- Land subsidence
- Landslide
- Sea Level Rise
- Volcanoes
- Tsunamis

The town determined these hazards would not be considered for the following reasons:

- Lack of frequency in which they occur;
- The minimal probability of their occurrence; and/or
- The lack of resources to devote any amount of time to further research the likelihood or potential occurrence or impact.

Risk Assessment

Risk assessment is the determination of the likelihood of adverse impacts associated with specific natural hazards to the built, natural, business, and social environments[13]. To assess the risk of the Town of Burrillville to the hazards previously identified, the NOAA Community Risk Assessment Tool was used to determine the frequency, area of impact, and potential damage magnitude of each hazard. Each hazard was rated by the individual committee members using available data and their expertise. The committee members scored the frequency, area impact, and potential damage magnitude of the hazard according to the Tool. The scores were reviewed amongst the group to ensure consistency. The final hazard score was used by averaging each committee member's score. The description of each element is below.

[12] 2019 RI State Hazard Mitigation Plan Update, Page 3-1
[13] Heinz Coastal Hazards Panel Report, 1999, p.110

Frequency

Evaluating the number of times that the natural hazard has impacted the Town of Burrillville or a region within Rhode Island in the past provides a measure of the likelihood of the event occurring again in the future. This rating is derived from an investigation of trends in the long-term (30 years at least) data. Examination of past events helps to determine the likelihood of similar events occurring in the future.

Approx. Recurrence (years)	Approx. Annual Probability	Subjective Description	Frequency Score
1	100.0%	Frequently recurring hazards, recurrences annually	5
10	10.0%	Typically occurs at least once every decade	4
50	2%	Typically occurs at least once in a lifetime	3
100	1%	It may occur once in a lifetime	2
500	0.2%	Highly infrequent events, like a maximum, considered earthquake	1
2500	0.04%	Unlikely event	0

Area of Impact

A second criterion used in evaluating the risk of Burrillville to natural hazards is to determine the area of impact. Some hazard events impact only a small region, while others can affect the entire community. The area of impact determination indicates how much of the immediate area is impounded by a single event. Again, historical data is used to investigate damage and loss records of previous hazard events to develop an estimate of where expected impacts or the amount of property damage may occur from future events.

Mean Affected Area (sq. miles)/event	Subjective Description	Area Impact Score
0	No affected area	0
1	Highly localized (city block scale)	1
10	Single zip code impact	2
50	City scale impact	3
100	County scale impact	4
500	Regional impact (e.g., statewide)	5

Magnitude

An intensity or magnitude criterion is used to determine the range of the severity of damage (from minor to devastating) expected from a single event. Previous damage reports and other historical data (e.g., newspaper articles, personal accountings, video clips, etc.,) are used.

Magnitude Score	Earthquake MMI	Hurricane SSI	Average Flood Elevation
0	3	0	0
1	4	1	1
2	5	2	8
3	7	3	12
4	9	4	14
5	12	5	24

Total Score

Based on the results of the cumulative scores, the following formula is used to prioritize the potential threat each hazard poses on the Town of Burrillville:

- Total Score= (Frequency + Area Impact) x Potential Damage Magnitude

The 2021 ranking of the hazards based on this formula is as follows:

2021 Risk Assessment		
Priority	**Hazard**	**Total Score**
1	Severe Winter Storms	28.86
2	Hurricanes & Tropical Storms	25.08
3	Aquifer Contamination	21.45
4	Flood	20.74
5	Infectious Disease	20.71
6	Dam Failure	18.13
7	Hazardous Materials Events	14.52
8	Droughts	13
9	Lightning	12.98
10	Temperature Extremes	11.66
11	Earthquake	10.12
12	Wildfire	7.92
13	Tornado	6.96
14	Critical Incidents	5.2

The following table is provided to show the change in priorities since the last plan approval:

2014 Risk Assessment	
Priority	**Hazards**
1	Flood
2	Severe Winter Storms
3	Hurricanes & Tropical Storms
4	Nor'easters
5	Droughts
6	Tornado
7	Hazardous Materials Events
8	Wildfire
9	Dam Failure
10	Earthquake
11	Temperature Extremes

Hazard Description and Vulnerability Assessment

The following section describes each hazard and a vulnerability assessment for its potential impact on the Town of Burrillville. The hazards are presented in alphabetical order.

Aquifer Contamination- Risk Score 21.45

"An aquifer is a body of rock and/or sediment that holds groundwater. Groundwater is the word used to describe precipitation that has infiltrated the soil beyond the surface and collected in empty spaces underground.

There are two general types of aquifers: confined and unconfined. Confined aquifers have a layer of impenetrable rock or clay above them, while unconfined aquifers lie below a permeable layer of soil. A common misconception about aquifers is that they are underground rivers or lakes. While groundwater can seep into or out of aquifers due to their porous nature, it cannot move fast enough to flow like a river. The rate at which groundwater moves through an aquifer varies depending on the rock's permeability.

Much of the water we use for domestic, industrial, or agricultural purposes is groundwater. Most groundwater, including a significant amount of our drinking water, comes from aquifers. To access this water, a well must be created by drilling a hole that reaches the aquifer. While wells are manmade points of discharge for aquifers, they also discharge naturally at springs and in wetlands."[14]

[14] https://www.nationalgeographic.org/encyclopedia/aquifers/

The Town of Burrillville has numerous, significant aquifers that are used to supply drinking water to the residents. These aquifers, wells, and associated infrastructure are run by several private utilities within the Town run through the Town's Fire Districts. The map to the left outlines the aquifers that the Town relies on.

Since 2000, there have been two major incidents of aquifer contamination that have impacted the Town. First, the gasoline additive methyl tertiary-butyl ether (MTBE) was discovered in the public drinking water well PW-3A of the Pascoag Water District. The source of the contamination was determined to be the property located at 24 North Main Street in Pascoag (North Main Street Mobil). The extent of the release was exacerbated as public well PW-3A drew contaminants approximately 1,500 feet in a northerly direction from the source across an area covering approximately 20 acres. Other contaminants of concern are all gasoline-related constituents and include benzene, ethylbenzene, toluene, xylenes, naphthalene, and various oxygenates.[15]

From 2001 through 2014, RIDEM operated and maintained many groundwater remediation systems throughout the area. These systems treated over 12.5 million gallons of groundwater with activated carbon filters removing an estimated equivalent of over 3,100 gallons of gasoline.[16]
Second, the Oakland section of Burrillville has over 30 homes impacted by per- and polyfluoroalkyl substances (PFAS) contamination.[17] The contamination was traced back to firefighting foam that leached into the group from the Oakland-Mapleville Fire District, but the actual date of contamination is unknown.[18] The removal of this contamination is on-going, but the residents have been hooked into the Harrisville Water District until the contamination can be addressed.

Geographic Area Affected: The entire Town of Burrillville has the potential to be impacted by aquifer contamination.

Severity: Aquifer contamination in Burrillville is likely to have a moderate or severe impact on the Town. These events are often high impact and long-duration events. Further, the provision of safe drinking water is crucial to the delivery of service to residents and faith in government.
Probability of Future Events: Given the unknown nature of some of these contaminations, predicting the probability of future events is murky. The Town has deemed it crucial to prepare for these incidents.

Critical Incidents- Risk Score 5.2

[15] http://www.dem.ri.gov/programs/wastemanagement/pascoag.php
[16] http://www.dem.ri.gov/programs/wastemanagement/pascoag.php
[17] https://www.ri.gov/press/view/31565
[18] https://www.providencejournal.com/news/20190517/lurking-danger-for-ris-drinking-water

Critical Incidents include a wide range of incidents or hazards that can disrupt the fabric of a community and/or overwhelm law enforcement resources. Typical critical incidents include:

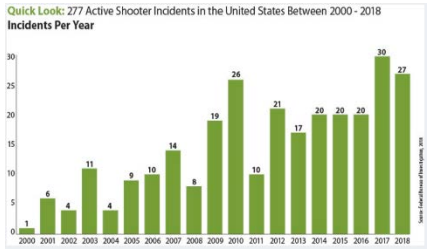
- International Terrorism- violent, criminal acts committed by individuals and/or groups who are inspired by, or associated with, designated foreign terrorist organizations or nations (state-sponsored)[19]
- Domestic Terrorism- violent, criminal acts committed by individuals and/or groups to further ideological goals stemming from domestic influences, such as those of a political, religious, social, racial, or environmental nature.[20]
- Active Threat/Active Shooter- an event in which one or more persons are actively engaged in killing or attempting to kill people in a populated area.[21]
- Riot: a tumultuous disturbance of the public peace by three or more persons assembled and acting with a common intent.[22]
- Civil Disobedience or Protest- refusal to obey the demands or commands of a government or occupying power, without resorting to violence or active measures of opposition; its usual purpose is to force concessions from the government or occupying power.[23]

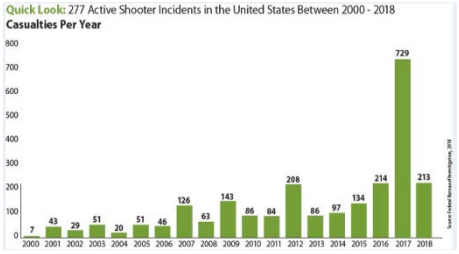
At their core, critical incidents are demanding situations that tax local resources and significantly impact the community. While the Town has luckily not experienced a critical incident the State of Rhode Island has been impacted by several in recent years. Recently, in December 2019, a 66-year old man living in an apartment complex in Westerly, RI shot two employees and another resident before killing himself.[24] Additionally, the State Hazard Mitigation Plan identifies other previous occurrences where significant protests and demonstrations led to the shutdown of I-95 outside Provide in late 2014.[25]

Geographic Area Affected: The entire Town of Burrillville has the potential to be impacted by a critical incident. However, some areas of highest concern include schools and other public facilities.

Severity: The severity of these incidents is often localized, though extremely high impact.

Probability of Future Events: The probability of critical incidents impacting the Town of Burrillville in the future is growing. As demonstrated from the chart to the right, the FBI is seeing an increase in both the frequency and severity of active threat/shooter incidents. These critical incidents will continue to increase and the Town must identify solutions to mitigate these challenges.





[19] https://www.fbi.gov/investigate/terrorism
[20] https://www.fbi.gov/investigate/terrorism
[21] https://www.publicsafety.upenn.edu/pennready/procedures/active-shooter/
[22] https://www.merriam-webster.com/dictionary/riot
[23] https://www.britannica.com/topic/civil-disobedience
[24] https://www.cnn.com/2019/12/19/us/westerly-rhode-island-shooting/index.html
[25] RI State Hazard Mitigation Plan 2019 Update Page 3-33

Dam Failure- Risk Score 18.13

Disastrous floods caused by dam failures may cause great loss of life and property damage, primarily due to their unexpected nature and release of a high-velocity wall of debris-laden water rushing downstream destroying everything in its path. FEMA's Multi-Hazard Identification and Risk Assessment[26] reports that dam failures can result from any one or a combination of factors:

- Prolonged periods of rainfall and flooding;
- Inadequate spillway capacity;
- Internal erosion resulting in structural failure
- Improper maintenance
- Improper design;
- Negligent operation;
- Failure of upstream dams on the same waterway;
- Landslides into reservoirs which may cause surges resulting in overtopping;
- High winds which can cause significant wave action resulting in substantial erosion; and
- Earthquakes, which cause longitudinal cracks and weaken the entire structure.

Category	Loss of Life	Property Damage
Low	None expected	Minimal (undeveloped to occasional structures or agriculture)
Significant	Few	Appreciable (notable developments and/or a small number of inhabitable structures, agriculture, or industry)
High	More than five	Excessive (extensive community, industry, or agriculture)

Within the Town of Burrillville are several dams that were constructed during the Industrial Revolution for the benefit of local industrial concerns. These dams are inspected regularly by the RI Department of Environmental Management (DEM). According to DEM inspections and town staff investigations, eleven dams in Burrillville pose a potential loss downstream (if a dam were to fail) and are classified as a high or significant hazard, per the 2018 RIDEM Dam Safety Annual Report[27]. Listed in alphabetical order below are the high hazard dams, then the significant hazard dams, respectively:

High Hazard Dams

Harrisville Mill Pond Dam

RIDEM ID#	008	**Hazard classification**	High
National Inventory of Dams ID#	RI00303	**Drainage basin (square miles)**	43
Latitude	41.9657402423N	**Dam owner**	Town of Burrillville
Longitude	-71.6748657084W	**Dam operator**	Town of Burrillville
Height (in feet)	20	**Year completed**	1854, rebuilt 2009
Max storage volume	100 acre-feet	**River**	Pascoag River

Pascoag Upper Reservoir Dam

RIDEM ID#	016	**Hazard classification**	High

[26] https://www.fema.gov/media-library/assets/documents/7251
[27] http://www.dem.ri.gov/programs/benviron/compinsp/pdf/damlist.pdf

National Inventory of Dams ID#	RI00304	**Drainage basin (square miles)**	21
Latitude	41.9506148949N	**Dam owner**	Patrick Conley
Longitude	-71.7050628555W	**Dam operator**	Pascoag Upper Dam Assoc
Height (in feet)	10	**Year completed**	1860
Max storage volume	9000 acre-feet	**River**	Brandy Brook

Wilbur Pond Dam

RIDEM ID#	572	**Hazard classification**	High
National Inventory of Dams ID#	RI00313	**Drainage basin (square miles)**	1
Latitude	41.9302215611N	**Dam owner**	Tillinghast Holding Co., LLC
Longitude	-71.7644271673W	**Dam operator**	Tillinghast Holding Co., LLC
Height (in feet)	7	**Year completed**	1854
Max storage volume	100 acre-feet	**River**	Mary Brown Brook

Wilson's Reservoir Dam

RIDEM ID#	003	**Hazard classification**	High
National Inventory of Dams ID#	RI00302	**Drainage basin (square miles)**	13
Latitude	41.9661521782N	**Dam owner**	Wilson's Reservoir Property Owners Assoc.
Longitude	-71.7223281955W	**Dam operator**	Wilson's Reservoir Property Owners Assoc.
Height (in feet)	21	**Year completed**	1866
Max storage volume	840 acre-feet	**River**	Clear River

Significant Hazard Dams

Nichols Pond Dam

RIDEM ID#	051	**Hazard classification**	Significant
National Inventory of Dams ID#	RI00309	**Drainage basin (square miles)**	7
Latitude	41.9555321083N	**Dam owner**	Nichols Pond Development Corporation
Longitude	-71.5996779959W	**Dam operator**	Nichols Pond Development Corporation
Height (in feet)	9	**Year completed**	1885
Max storage volume	130 acre-feet	**River**	Tarkiln Brook

Ross Pond Dam

RIDEM ID#	565	**Hazard classification**	Significant

National Inventory of Dams ID#	RI04026	**Drainage basin (square miles)**	0.25
Latitude	41.9637489466N	**Dam owner**	Nancy Binns
Longitude	-71.7185439501W	**Dam operator**	Nancy Binns
Height (in feet)	8	**Year completed**	Unknown
Max storage volume	12 acre-feet	**River**	Clear River tributary

Spring Lake Dam

RIDEM ID#	039	**Hazard classification**	Significant
National Inventory of Dams ID#	RI00306	**Drainage basin (square miles)**	0.8
Latitude	41.9782447917N	**Dam owner**	Harrisville Spring Lake Campers Assoc.
Longitude	-71.6661071546W	**Dam operator**	Harrisville Spring Lake Campers Assoc.
Height (in feet)	13	**Year completed**	1885
Max storage volume	840 acre-feet	**River**	Herring Brook

Sucker Pond Dam

RIDEM ID#	027	**Hazard classification**	Significant
National Inventory of Dams ID#	RI00305	**Drainage basin (square miles)**	<1
Latitude	41.9358978416N	**Dam owner**	Bliss Golf Investors
Longitude	-71.6707992794W	**Dam operator**	Bliss Golf Investors
Height (in feet)	13	**Year completed**	1883
Max storage volume	330 acre-feet	**River**	Sucker Brook

Union Mill Dam

RIDEM ID#	015	**Hazard classification**	Significant
National Inventory of Dams ID#	RI04011	**Drainage basin (square miles)**	9
Latitude	41.9661521782N	**Dam owner**	KRA (Pascoag) Acquisition
Longitude	-71.7223281955W	**Dam operator**	KRA (Pascoag) Acquisition
Height (in feet)	7.3	**Year completed**	1883
Max storage volume	70 acre-feet	**River**	Pascoag River

Wallum Lake Dam

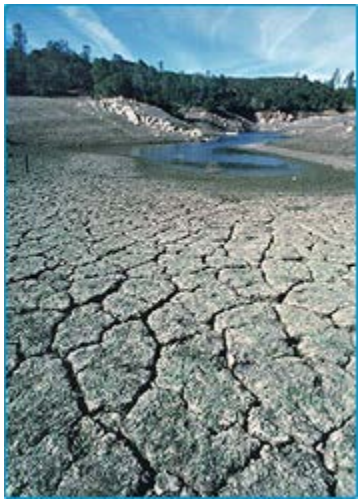
RIDEM ID#	001	**Hazard classification**	Significant
National Inventory of Dams ID#	RI00301	**Drainage basin (square miles)**	2.2
Latitude	42.00071N	**Dam owner**	Town of Burrillville Conservation Commission
Longitude	-71.76204W	**Dam operator**	Town of Burrillville Conservation Commission.
Height (in feet)	7	**Year completed**	1866
Max storage volume	10,000 acre-feet	**River**	Clear River

Geographic Area Affected: The areas downstream of the listed dams are the locations that could be impacted by a dam failure in the Town of Burrillville. Most likely, are the significant and high-hazard dams.

Severity: The severity of dam failure in the Town of Burrillville is moderate to high. The Town has several high-hazard and significant hazard dams that could have serious implications downstream if the dams were to fail. The inundation from this flooding would impact residential homeowners and could cause evacuations.

Probability of Future Events: It is not possible to predict the probability of dam failure. The Town can only work with dam owners to maintain the structures to reduce the probability.

Drought- Risk Score 13.00



A drought is defined as "a period of abnormally dry weather sufficiently prolonged for the lack of water to cause serious hydrologic imbalance in the affected area."[28] It is a normal part of virtually all climatic regimes, including areas with high and low average rainfall.
A drought is a period of unusually persistent dry weather that persists long enough to cause serious problems such as crop damage and/or water supply shortages. The severity of the drought depends upon the degree of moisture deficiency, the duration, and the size of the affected area.

There are four different ways that drought can be defined:

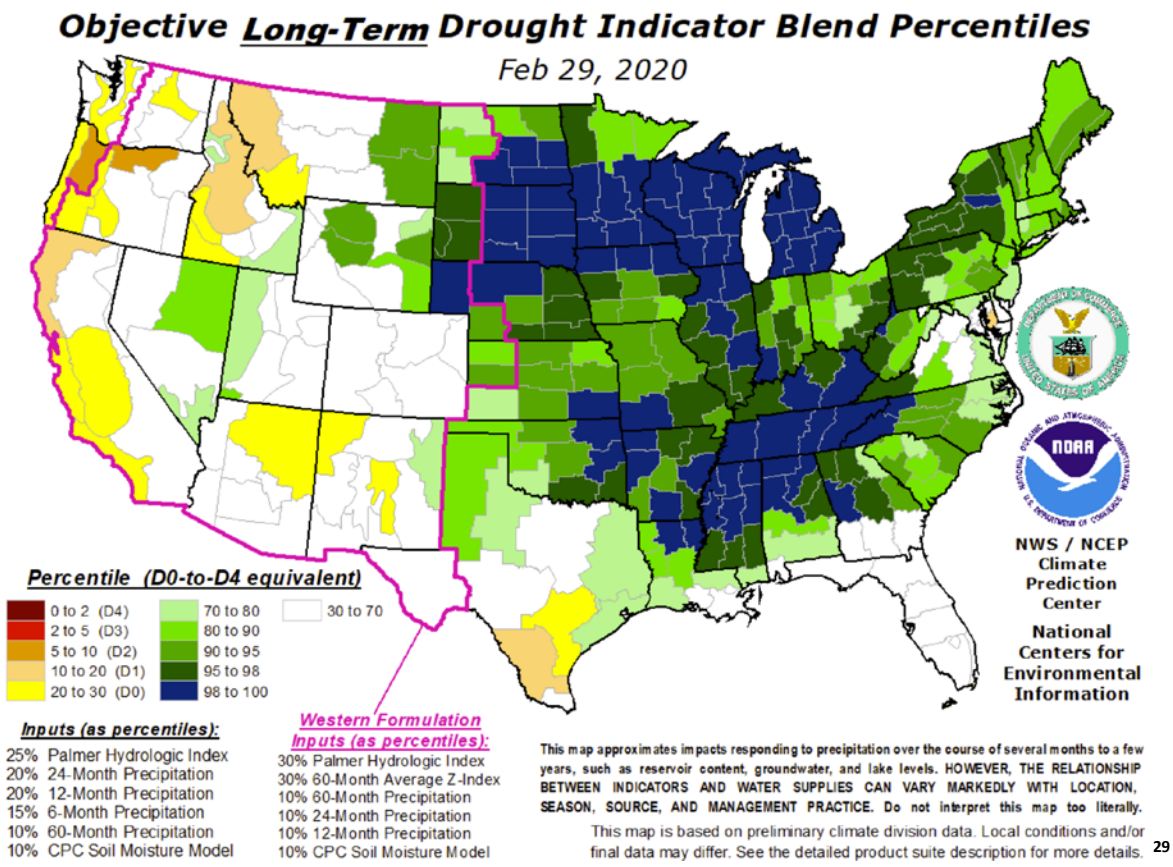
1. Meteorological- a measure of the departure of precipitation from normal. Due to climatic differences, what might be considered a drought in one location of the country may not be a drought in another location.
2. Agricultural- refers to a situation where the amount of moisture in the soil no longer meets the needs of a particular crop.
3. Hydrological- occurs when surface and subsurface water supplies are below normal.
4. Socioeconomic- refers to the situation that occurs when physical water shortages begin to affect people.

The potential for drought is best projected by the Palmer Index. The Palmer Index was developed by Wayne Palmer in the 1960s and uses temperature and rainfall information in a formula to determine dryness. It has become the semi-official drought index.

The Palmer Index is most effective in determining long-term drought—a matter of several months—and is not as good with short-term forecasts (a matter of weeks). It uses a 0 as normal, and drought is shown in terms of minus numbers; for example, minus 2 is moderate drought, minus 3 is severe drought, and

[28] Glossary of Meteorology, 1959.

minus 4 is extreme drought. The Palmer Index can also reflect excess rain using a corresponding level reflected by plus figures (i.e., 0 is normal, plus 2 is moderate rainfall, etc.)

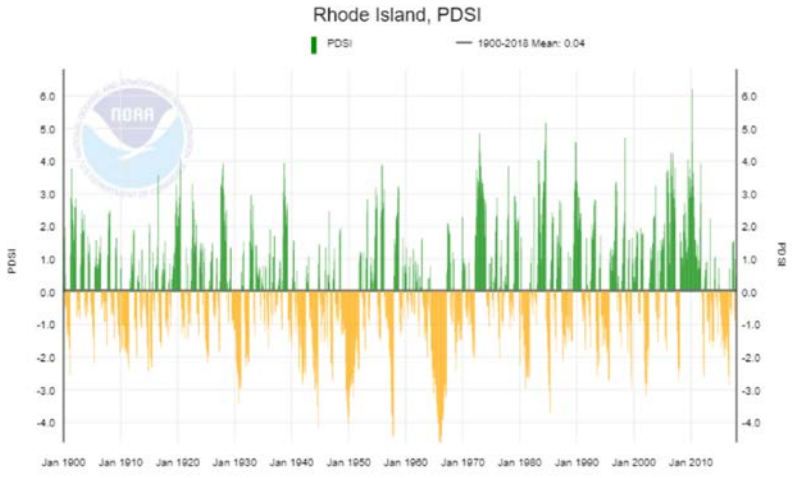


[29]

As you can see Rhode Island is in the 90-95% range and well out of the potential drought range at present. The following graph shows the Palmer Hydrological Drought Index for the Northeast Region over the past 100 years. As you can see, there have been historical periods of drought in this region.

[29] https://droughtmonitor.unl.edu/ConditionsOutlooks/CurrentConditions.aspx

Figure 3-2 Palmer Drought Severity Index for Rhode Island (1900 – July 2018).[44]



[30]

For the major historical drought events, the National Weather Service noted that the precipitation during the preceding fall and winter months was below-normal too much below- normal which is typically defined as ninety and seventy-five percent less than normal precipitation. Precipitation continued at below normal to much-below-normal levels through the spring and led to the most severe drought episodes, including the 1965-67 long-term drought. The 1965-67 drought episode lasted for three summers and included long periods of below-normal precipitation through the winter, spring, and summer months. This drought period serves as the classic model of a long-term drought in Rhode Island. Though short-term droughts, such as 1999, may not pose a significant impact on the state's public water systems, no water system will be immune to periods of long-term drought.

Rhode Island Historical Droughts and Location of Impacts		
Date	**Area Affected**	**Remarks**
1930-31	Statewide	Estimated streamflow about 70% of normal
1941-45	Statewide. Particularly severe in the Pawtuxet and Blackstone Rivers	Estimated streamflow about 70% of normal
1949-50	Statewide	Estimated streamflow about 70% of normal
1963-67	Statewide	Water restriction and well replacements common
1980-81	Statewide. Groundwater deficient in the eastern part of State	Considerable crop damage in 1980
1987-88	Southern part of State	Crop damage, $25 million

Geographic Area Affected: The entire Town of Burrillville has the potential to be impacted by drought.

Severity: Droughts in the Northeast are likely to: reduce potable water supplies, provide inadequate streamflow volumes to support fish, increase the threat of wildfires, and pose a threat to vegetation

[30] RI State Hazard Mitigation Plan 2019, Page 3-63

that relies on natural precipitation. The severity of a drought can be reduced by water conservation technology and practices. The length of the recovery period is determined by the intensity of the drought, duration, and quantity of precipitation received as the drought recedes.

Probability of Future Events: Droughts are hard to predict, however, according to the Rhode Island State Hazard Mitigation Plan, a review of limited data suggests a drought will occur about every 10 years in Rhode Island.[31] The frequency, duration, and depth may increase with climate change.

While Burrillville is not on Rhode Island's list of jurisdictions most vulnerable to drought, nor is it a critical area for drought according to the National Drought Mitigation Center; the historical records demonstrate that it is important to consider drought conditions as a potential impact on the region. Climate change will change the patterns of precipitation and the expanse of arid regions. Even without changes in the overall quantity of precipitation, rain replacing snow will cause shortages in the summer water supply.

Earthquake- Risk Score 10.12

One of the most frightening and destructive phenomena of nature is a severe earthquake and its terrible aftereffects. An earthquake is a sudden movement of the Earth, caused by the abrupt release of strain that has accumulated over a long time. For hundreds of millions of years, the forces of plate tectonics have shaped the Earth as the huge plates that form the Earth's surface slowly move over, under, and past each other. Sometimes the movement is gradual. At other times, the plates are locked together, unable to release the accumulating energy. When the accumulated energy grows strong enough, the plates break free. If the earthquake occurs in a populated area, it may cause many deaths and injuries, and extensive property damage.

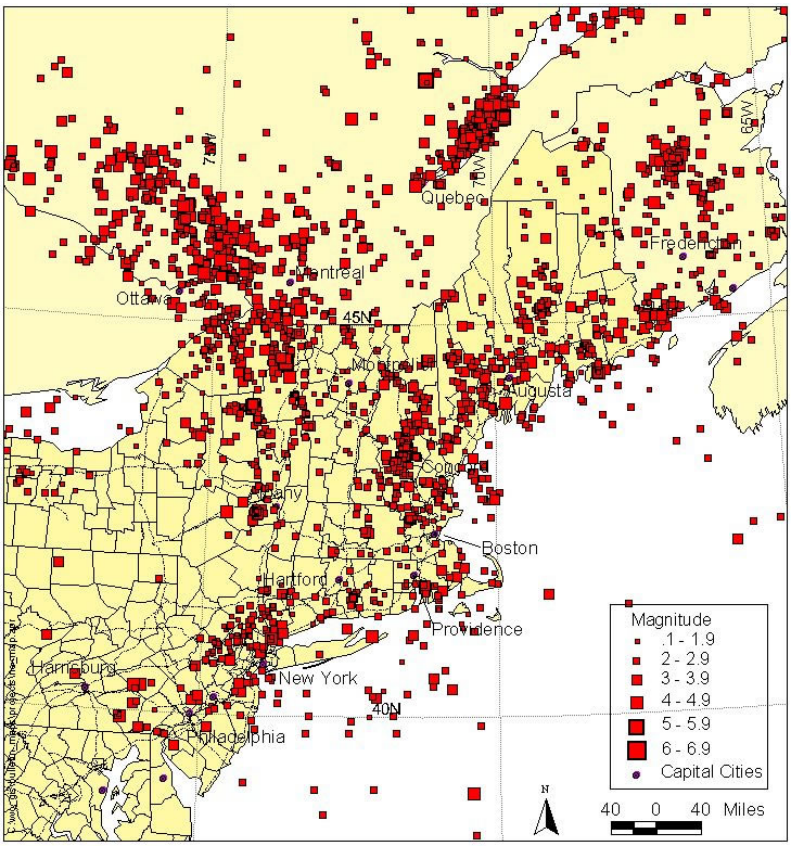
Introduced in 1967, the theory of plate tectonics holds that the Earth's crust is broken into several major plates. These rigid 50 to 60 mile-thick plates move slowly and continuously over the interior of the earth, meeting in some areas and separating in others. As the tectonic plates move together, they bump, slide, catch, and hold. Eventually, faults along or near plate boundaries slip abruptly when the stress exceeds the elastic limit of the rock, and an earthquake occurs. Surface faulting, ground failure, and tsunamis are dangerous secondary hazards that can occur after an earthquake.

[31] RI State Hazard Mitigation Plan 2019, Page 3-65

Although earthquakes have caused much less economic loss annually in the United States than other hazards such as floods, they have the potential for causing great and sudden loss. Within 1-2 minutes, an earthquake can devastate part of an area through ground-shaking, surface fault ruptures, and ground failures.

Earthquake frequency, impact, and intensity ratings were derived by examining both historical seismicity and probabilistic seismic hazard maps. In general, the region around Burrillville does not suffer from frequent earthquakes; however historical events in New England have been of moderate to high intensity and impact area.

A map was created to show historic earthquake epicenters, since 1700, concerning the Town of Burrillville and surrounding areas. The map shows that several minor earthquakes and a moderate earthquake have occurred in and around the Town of Burrillville and the state of Rhode Island. The entire state of Rhode Island lies within the same earthquake hazard zone.



[32]

The National Earthquake Hazard Reduction Program (NEHRP) maps were examined to determine the frequency and intensity of earthquake ground motions affecting the southeastern New England region. The table below summarizes peak ground acceleration for the Burrillville region based on the 1997 NEHRP maps. In this table, peak ground acceleration measures the maximum acceleration on the

[32] http://www.nesec.org/hazards/earthquakes.cfm.html

bedrock in any direction due to an earthquake. Note that higher accelerations would be expected on soils and are required for consideration during building design.

Peak ground acceleration for Burrillville **Source: USGS**

Frequency (P% exceedance in t years)	Return Period (years)	Peak Ground Acceleration on Bedrock (g)
10% exceedance in 50 years	475	.035
5% exceedance in 50 years	975	.065
2% exceedance in 50 years	2475	.13

In the risk and vulnerability assessment, expected damage caused by earthquakes and the areas in which the community is vulnerable need to be identified. Much of the risk from earthquakes is related to life safety; therefore, the occupancy of buildings is an important factor in determining risk.

Other factors to consider when evaluating Burrillville's vulnerability to earthquakes are:

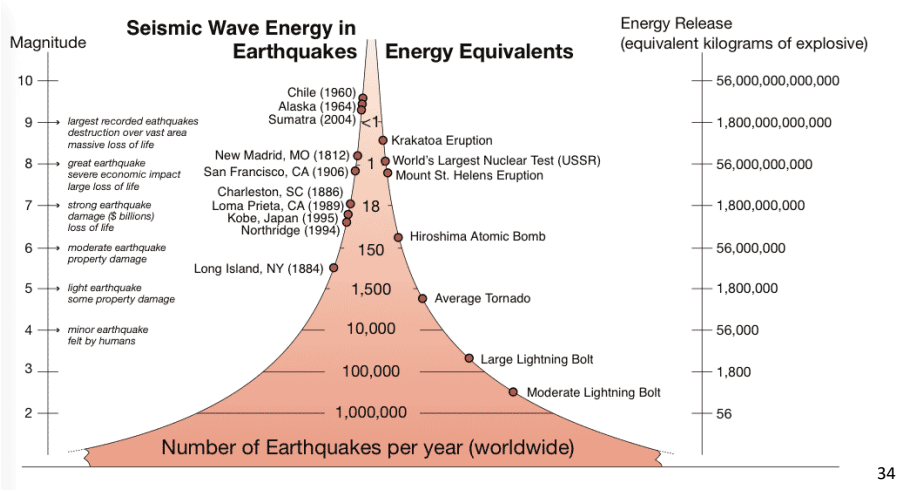
- Type of structures in the community.
- Contents of the structures.
- Structure use and occupancy.

When earthquakes occur, much of the damage is a result of structures falling under the stress created by the earth's movement. Building failure can cause damage to the building, deaths, injuries, and loss of function. Local topography and soil type also affect earthquake severity. Steep slopes composed of loose material may produce large landslides during an earthquake. The type of construction also affects the risks of damages to property. For these reasons, earthquake hazards are highly localized, and difficult to assign regional earthquake boundaries that share the same relative degree of hazard. Earthquakes are classified by their magnitude and intensity. The United States Geological Survey (USGS) discusses these categories by saying:

> Magnitude and Intensity measure different characteristics of earthquakes. Magnitude measures the energy released at the source of the earthquake. Magnitude is determined from measurements on seismographs. Intensity measures the strength of shaking produced by the earthquake at a certain location. Intensity is determined by effects on people, human structures, and the natural environment.[33]

The graphic below describes the magnitude, number of annual earthquakes worldwide of that magnitude, and energy equivalent:

[33] http://earthquake.usgs.gov/learn/topics/mag_vs_int.php



[34]

Geographic Area Affected: The entire Town of Burrillville has the potential to be impacted by earthquakes.

Severity: The severity of earthquakes in the Town of Burrillville is low. Of the three types of earthquakes (subduction zone, Benioff, and crustal), crustal earthquakes are currently thought to present the greatest risk to Rhode Island. While they tend not to last as long as the other types of earthquakes, the short shock waves associated with them cause more violent ground shaking for the entire region than the other types of earthquakes.

Probability of Future Events: The recurrence intervals of earthquakes are unknown. Due to the infrequency of earthquakes in Rhode Island, they are difficult to predict.

Flood- Risk Score 20.74

Flooding is the accumulation of water within a body of water and the overflow of excess water onto adjacent floodplain lands. The flood plain is the land adjoining the channel of a river, stream, ocean, lake, or other watercourse or water body that is susceptible to flooding (FEMA, Multi-Hazard Identification and Risk Assessment, 1997). Flooding is the result of large-scale weather systems generating prolonged rainfall or onshore winds. Other causes of flooding include locally intense thunderstorms and dam failures.

Overbank flooding of rivers and streams known as riverine flooding is the most common type of flooding event. Riverine

[34] https://www.forbes.com/sites/marshallshepherd/2019/07/06/hurricane-and-earthquake-scales-often-confuse-people-why-thats-dangerous/#3534fc2d39ff

floodplains range from narrow, confined channels in the steep valleys of hilly areas, and wide, flat areas in low-lying coastal regions. Annual spring floods result from snowmelt, and the extent of this flooding depends on the depth of winter snowpack and spring weather patterns.

Some other types of floods include flash floods, ice-jam floods, and dam-break floods that occur due to structural failures or overtopping of embankments during flood events.

Flooding most frequently occurs in the six months from October through March. In the winter and early spring, there is less vegetation to soak up the precipitation and there is typically more rainfall. The duration of a flooding event may be limited to a few hours or may extend for several days or even weeks. Dam failure can happen over several years or it can happen in a matter of moments. With proper inspection and maintenance, a dam will be less likely to fail. The severity of a dam failure is based upon the amount of water that the dam is holding back. A dam failure may not cause any problems downstream, or it could cause catastrophic issues.

Flash floods are characterized by a rapid rise in water level, high velocity, and large amounts of debris. Flash floods are capable of tearing out trees, undermining buildings and bridges, and scouring new channels. Burrillville is more prone to flash flood events in areas where there is a predominance of clay soils that do not have high enough infiltration capacities to absorb water fast enough from heavy precipitation events.

Flash floods may also result from dam failure, causing the sudden release of a large volume of water in a short period. In urban areas flash flooding is an increasingly serious problem due to the removal of vegetation, and replacement of ground cover with impermeable surfaces such as roads, driveways, and parking lots. In these areas and drainage systems, flash flooding is particularly serious because the runoff is dramatically increased.

The greatest risk involved in flash floods is that there is little to no warning to people who may be located in the path of high-velocity waters, debris, and/or mudflow[35]. The major factors in predicting potential damage are the intensity and duration of the rainfall and the steepness of watershed and stream gradients. Additionally, the amount of watershed vegetation, the natural and artificial flood storage areas, and the configuration of the streambed and floodplain are also important.
There is often no sharp distinction between these separate types of floods; however, they are widely recognized and helpful in considering not only the range of flood risk but also appropriate responses. Stormwater runoff and debris flows also negatively impact public infrastructure such as roads and bridges as water collects typically the result of inadequate drainage systems in the immediate area, creating ponding conditions oftentimes making roads impassable. Standing surface water develops after intense rainfall events where poor soil permeability and urbanization prevent adequate water drainage. This may interrupt road transportation and damage low elevation buildings.

[35] Please note that mudflows are not typically seen in Rhode Island flash floods

Flooding Events in Burrillville

Minor flooding is bound to occur each year, but it is the unusually excessive rainfall events over short periods that cause catastrophic damage. The common denominator of all floods is that an amount of water is encountered that damages, or destroys, the land and structures and may cause multiple fatal casualties. Historically, torrential rainfall and snowmelt are the primary causes of floods experienced in Burrillville.

In 2005 the Burrillville area received over 8 inches of rain in 24 hours exceeding a 100-year rainfall intensity. Several areas were severely flooded namely Wilson's Reservoir, Centennial Street, and several other roads some required temporary closing. Houses around Wilson's had water above floor elevations requiring evacuation. The same occurred on Centennial Street which is along the Clear River downstream from Wilsons Reservoir. Several other roads had severe erosion along edges that required several weeks to fix. The floods initiated a watershed study of the clear river watershed, including Wilsons Reservoir and Eccleston field which now has public drinking water wellheads in the field adjacent to the river.

In March of 2010, there was another 100-year storm event that appeared worse than the 2005 flood however, Wilsons was less affected as the lake had already been lowered to winter levels and was drained even further. The flooding at Centennial Street was about the same. Several other roads had severe erosion along edges that required several weeks to fix. One dam was compromised in Oakland in which a soil berm was breached, and the backside started to erode. DPW, Oakland Mapleville Fire Department, and the Police Department sandbagged the dam enough to stop the erosion and the Dam has since been repaired.

The Town has invested heavily in addressing past flooding concerns and as a result of these significant mitigation actions, the impact of flooding has been reduced within the Town. Since the last update of the hazard mitigation plan, there have been limited flooding events and they have all be minor in severity.

Geographic Area Affected: The entire Town of Burrillville has the potential to be impacted by Floods especially groundwater flooding, however, there is increased risk near the rivers and streams especially the Centennial Street and Wilson Reservoir area.

Severity: The severity of flooding in the Town of Burrillville has the potential to be medium to high. Areas that routinely see flooding can have a severe impact such as the Centennial Street and Wilson Reservoir areas.

Probability of Future Events: With climate change, increased stormwater runoff, and the introduction of more impermeable surfaces, the frequency of localized flooding events is likely to increase. Climate change research suggests an increase in extreme weather patterns with wetter winters characterized by increased precipitation and intensity. The projected changes will increase the occurrence and severity of flooding events in Burrillville.

NFIP Participation

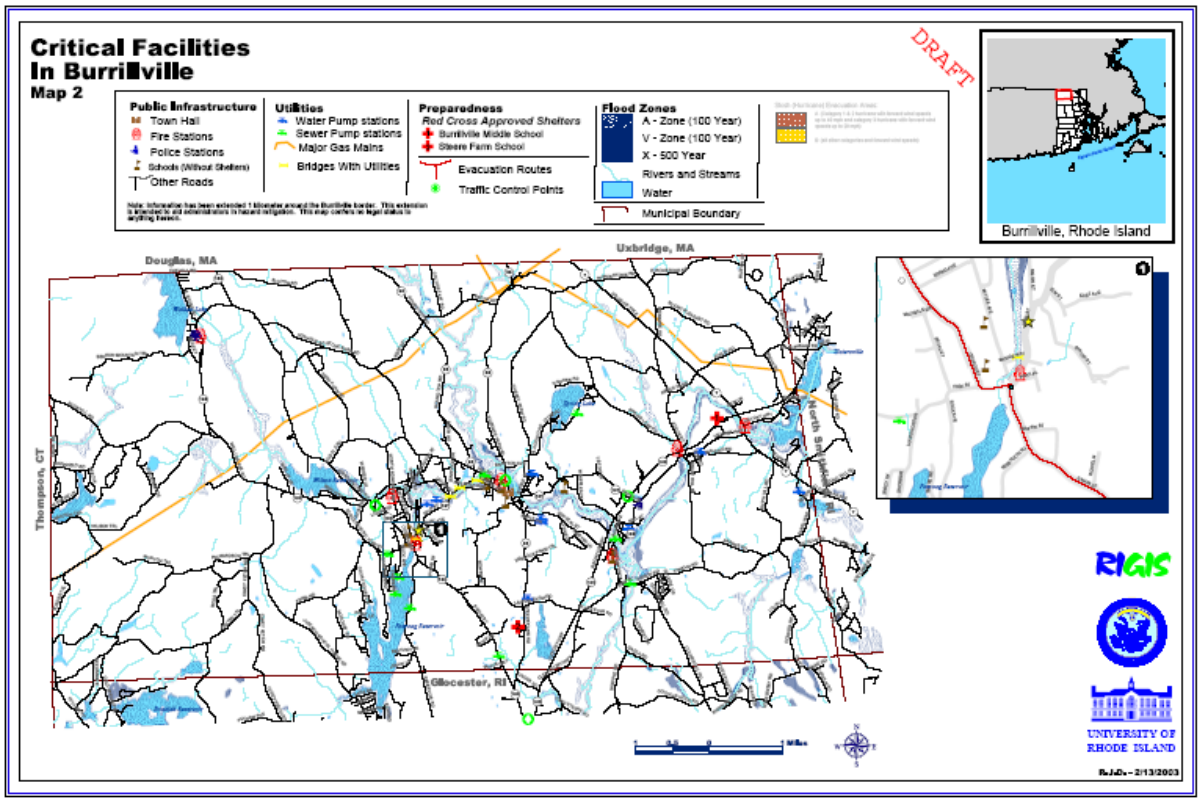
Burrillville has been a participant in the National Flood Insurance Program since 1979. There are currently 51 policies in force and 17 losses have been paid since 1978. The Town Building Official is the NFIP Coordinator.

NFIP Information	
NFIP Policies in Effect	51
Total Premium	$38,732
Number of Policies in A* Zone	19
Total Coverage	$13,259,700.00
Number of Paid Losses	11
Total Claims Paid	$117,975.40
Number of Repetitive Loss Residential Properties	2
Number of Repetitive Loss Non-Residential Properties	1
Repetitive Loss Incidents	6
Total Repetitive Loss Payments	$81,420.18

NFIP Breakdown by Zone	Policies in Force	Number of Closed Paid Losses
A01-30 & AE	16	3
A Zones	3	1
AO Zones	0	0
AH Zones	0	0
AR Zones	0	0
A99 Zones	0	0
V01-30 & VE Zones	0	0
V Zones	0	0
D Zones	0	0
B, C & X Zones		
Standard	9	0
Preferred	23	5
Total	**51**	**9**

Historical Flood Vulnerability

There are very few critical structures located within the floodplain in the Town of Burrillville. There is however one critical utility within the Town that has suffered from repetitive flooding.



Located within the Eccleston Field are three Harrisville Fire District well sites and a pump house that have suffered repeated flooding. These well sites contribute significantly to the water supply for approximately 2,000 customers in the Harrisville and Pascoag villages. The wellfield is exposed to contamination when the field floods due to the runoff of chemicals and fertilizers used to treat the fields in the recreational park. The Army Corps of Engineers is looking into the problem to find a solution to the repetitive flooding. This may include dredging of the river and changes to the structures used to control the river volume (i.e., dams, spillways, etc.).

Eccleston Field

Risk by Zone

The following breaks down each area and zone based on risk:

Moderate to Low-Risk Areas

In communities that participate in the NFIP, flood insurance is available to all property owners and renters in these zones:

- **Zone B and X (shaded)-** Area of moderate flood hazard, usually the area between the limits of the 100-year and 500-year floods. B Zones are also used to designate base floodplains of lesser hazards, such as areas protected by levees from a 100-year flood, or shallow flooding areas with average depths of less than one foot or drainage areas less than 1 square mile.
- **Zone C and X (unshaded)-** Area of minimal flood hazard, usually depicted on FIRMs as above the 500-year flood level. Zone C may have ponding and local drainage problems that do not warrant a detailed study or designation as a base floodplain. Zone X is the area determined to be outside the 500-year flood and protected by levee from a 100-year flood.

High-Risk Areas

In communities that participate in the NFIP, mandatory flood insurance purchase requirements apply to all the following zones:

- **Zone A-** Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.
- **Zone AE-** The base floodplain where base flood elevations are provided. AE Zones are now used on new format FIRMs instead of A1-A30 Zones.
- **Zone A1-30-** These are known as numbered A Zones (e.g., A7 or A14). This is the base floodplain where the FIRM shows a BFE (old format).

- **Zone AH-** Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
- **Zone AO-** River or stream flood hazard areas and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.
- **Zone AR-** Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements will apply, but rates will not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.
- **Zone A99-** Areas with a 1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones.

High Risk - Coastal Areas[36]

In communities that participate in the NFIP, mandatory flood insurance purchase requirements apply to all these zones:

- **Zone V-** Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. No base flood elevations are shown within these zones.
- **Zone VE, V1 – 30-** Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.

Undetermined Risk Areas

- **Zone D-** Areas with possible but undetermined flood hazards. No flood hazard analysis has been conducted. Flood insurance rates are commensurate with the uncertainty of the flood risk.

[36] Note to Reader: Burrillville is not affected by coastal areas. However, a description of these hazards was included for descriptive purposes.

Hazardous Materials Events- Risk Score 14.52

Hazardous materials (HAZMAT) are chemical substances, which if released or misused can pose a threat to the environment or health. These chemicals are used in industry, agriculture, medicine, research, and consumer goods. Hazardous materials come in the form of explosives, flammable and combustible substances, poisons, and radioactive materials.

Hazardous materials in various forms can cause death, serious injury, long-lasting health effects, and damage to buildings, homes, and other property. Many products containing hazardous chemicals are used and stored in homes routinely. These products are also shipped daily on the nation's highways, railroads, waterways, and pipelines.

Varying quantities of hazardous materials are manufactured, used, or stored at an estimated 4.5 million facilities in the United States--from major industrial plants to local dry-cleaning establishments or gardening supply stores.

Under the Emergency Planning and Right to Know Act of 1986, the United States Department of Transportation (DOT) identified 308 specific chemicals from 20 chemical categories as hazardous. In small doses, these chemicals may have minimal or no effects on humans. During transportation, DOT classifies HAZMAT in one or more of the following categories: explosive; blasting agent; flammable liquid; flammable solid; oxidizer; organic peroxide; corrosive material; compressed gas; flammable compressed gas; poison (A and B); irritating materials; inhalation hazard; etiological agent; radioactive materials; and other regulated material (FEMA and DOT, 1989).

There are many sources of hazardous materials in and around Burrillville. Table 6.14 below depicts the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) sites. These sites have been identified as hazardous sites that have been investigated or are in the process of investigation for contamination risk.

CERCLIS Sites in Burrillville

EPA ID	Site Name	Address	Non-NPL Status	Non-NPL Status Date	NPL Status
RID049101041	BOLIDEN METECH INC	1 Mapleville Main St	AC	04/25/2005	Not NPL
RID009764929	WESTERN SAND & GRAVEL	135 Douglas Pike	[Blank Code]	[Blank Date]	Final NPL

Note: NPL is an acronym for the National Priority List
Source: U.S. Environmental Protection Agency

The table below lists the facilities within the Town of Burrillville required to submit an Emergency and Hazardous Chemical Inventory Form to the Local Emergency Planning Committee (LEPC), the State Emergency Response Commission (SERC), and the local fire department annually, under the Emergency Planning and Community Right-to-Know Act (EPCRA). Burrillville is included in Rhode Island LEPC-1. Any

facility required under Occupational Safety and Health Administration (OSHA) regulations to maintain material safety data sheets (MSDSs) for hazardous chemicals stored or used in the workplace. Facilities with chemicals in quantities that equal or exceed the following thresholds must report:

- For Extremely Hazardous Substances (EHSs), either 500 pounds or the Threshold Planning Quantity (TPQ), whichever is lower.
- For gasoline (all grades combined) at a retail gas station, the threshold level is 75,000 gallons (or approximately 283,900 liters), if the tank(s) was stored entirely underground and was in compliance at all times during the preceding calendar year with all applicable Underground Storage Tank (UST) requirements at 40 CFR part 280 or requirements of the State UST program approved by the Agency under 40 CFR part 281.
- For diesel fuel (all grades combined) at a retail gas station, the threshold level is 100,000 gallons (or approximately 378,500 liters), if the tank(s) was stored entirely underground and the tank(s) was in compliance at all times during the preceding calendar year with all applicable Underground Storage Tank (UST) requirements at 40 CFR part 280 or requirements of the State UST program approved by the Agency under 40 CFR part 281.
- For all other hazardous chemicals, 10,000 pounds.

EPCRA Sites in Burrillville

SIC Code	Site Name	Address	Chemical 1	Chemical 2	Chemical 3	Chemical 4	Chemical 5	Chemical 6
4922	Algonquin Gas compressor station	54 Algonquin Lane	Ethylene glycol	Oil, petroleum				
4151	Dattco	400 Pascoag Main St	Low sulfur diesel fuel	Lead-acid batteries				
3442	Lockheed Window Corporation	925 South Main St	Aluminum	Polyvinyl chloride				
4911	OSP Nasonville substation	Douglas Pike	Mineral oil dielectric fluid					
4911	Ocean State Power	1575 Sherman Farm Rd	**Sulfuric acid**	Fuel oil, No.2	Sodium hydroxide	Sodium hypochlorite	Ammonium hydroxide	Transformer oil
4813	Verizon substation	33 Park Place	**Sulfuric acid**					
5541	Western Hill Sunoco	605 Douglas Pike	**Kerosene**					

Note: red boldface indicates an Extremely Hazardous Substance (EHS) chemical

Source: Rhode Island LEPC-1

Geographic Area Affected: The entire Town of Burrillville has the potential to be impacted by hazardous materials.

Severity: According to the U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA), hazardous materials are most dangerous when they are first released from containment, and the severity of an event depends on the chemical and biological components of the material released.[37] The Town of Burrillville has three listed facilities that have Tier II chemicals; however, an extensive web of federal, state, and local regulations effectively limits the probable impacts and severity of a point source hazardous materials incident.

Probability of Future Events: An increase in hazardous material facilities will increase the potential for both point source and non-point source events.

Hurricane and Tropical Storms- Risk Score 25.08

Hurricanes, tropical storms, and typhoons, collectively known as tropical cyclones, are among the most devastating naturally occurring hazards in the United States and its territories. Almost 100 million people live in the States along the Gulf of Mexico and Atlantic Ocean coast[38]; they are of the conterminous United States most susceptible to tropical cyclones. These are also the regions with the highest growth rates and rising property values. The trend of increasing development in coastal zones magnifies the exposure of those areas to catastrophic losses from tropical cyclones.

A tropical cyclone is defined as a low-pressure area of closed circulation winds that originates over tropical waters. Winds rotate counterclockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere. A tropical cyclone begins as a tropical depression with wind speeds below 39 mph. It may develop into a tropical storm as it intensifies, with further development producing a hurricane or typhoon. Tropical cyclones with wind speeds between 39 mph and 74 mph are commonly known as tropical storms. When wind speed exceeds 74 mph they are commonly known as hurricanes. The eye, the storm's core, is an area of low barometric pressure that is generally 10 to 30 nautical miles in diameter. The surrounding storm may span 100 to 500 nautical miles in diameter, with intense wind fields in the eastern and northern quadrants.

Hurricanes are classified as Categories 1 through 5 using the Saffir-Simpson Hurricane Scale (Table 5.1). The analysis is based on central pressure, wind speed, storm surge height, and damage potential. These storms involve both atmospheric and hydrologic characteristics. Those commonly associated with tropical cyclones include severe winds, storm surge flooding, high waves, coastal erosion, extreme rainfall, thunderstorms, lightning, and, in some cases, tornados.

[37] U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration. "Incident Reporting." http://phmsa.dot.gov/hazmat/incident-report

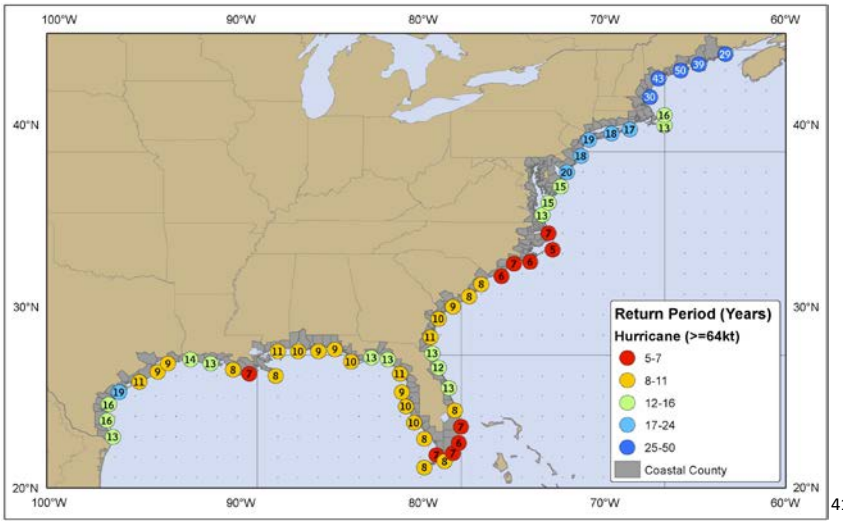
[38] http://stateofthecoast.noaa.gov/features/coastal-population-report.pdf

Saffir-Simpson Hurricane Scale[39]

Category	Sustained Winds	Types of Damage Due to Hurricane Winds
1	74-95 mph 64-82 kt 119-153 km/h	**Very dangerous winds will produce some damage:** Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110 mph 83-95 kt 154-177 km/h	**Extremely dangerous winds will cause extensive damage:** Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3 (major)	111-129 mph 96-112 kt 178-208 km/h	**Devastating damage will occur:** Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (major)	130-156 mph 113-136 kt 209-251 km/h	**Catastrophic damage will occur:** Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5 (major)	157 mph or higher 137 kt or higher 252 km/h or higher	**Catastrophic damage will occur:** A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

The approximate damage potential of a hurricane increases as the square of the integer value for the Saffir-Simpson category. The wind speed of a hurricane decreases as it moves inland for two reasons. First, the major source of storm energy (warm water) is no longer available to fuel the storm. Second, the land, vegetation, and structures offer frictional resistance to the storm winds. The peak wind speed distribution of a hurricane is a direct function of its rotational wind speed and forward speed. Storms that have a higher traveling speed do not stay in one place for long, minimizing the possibility of damaging buildings and other stationary structures. However, faster-moving storms tend to be more destructive further inland. Because they travel further inland causing higher storm surge and stronger winds.

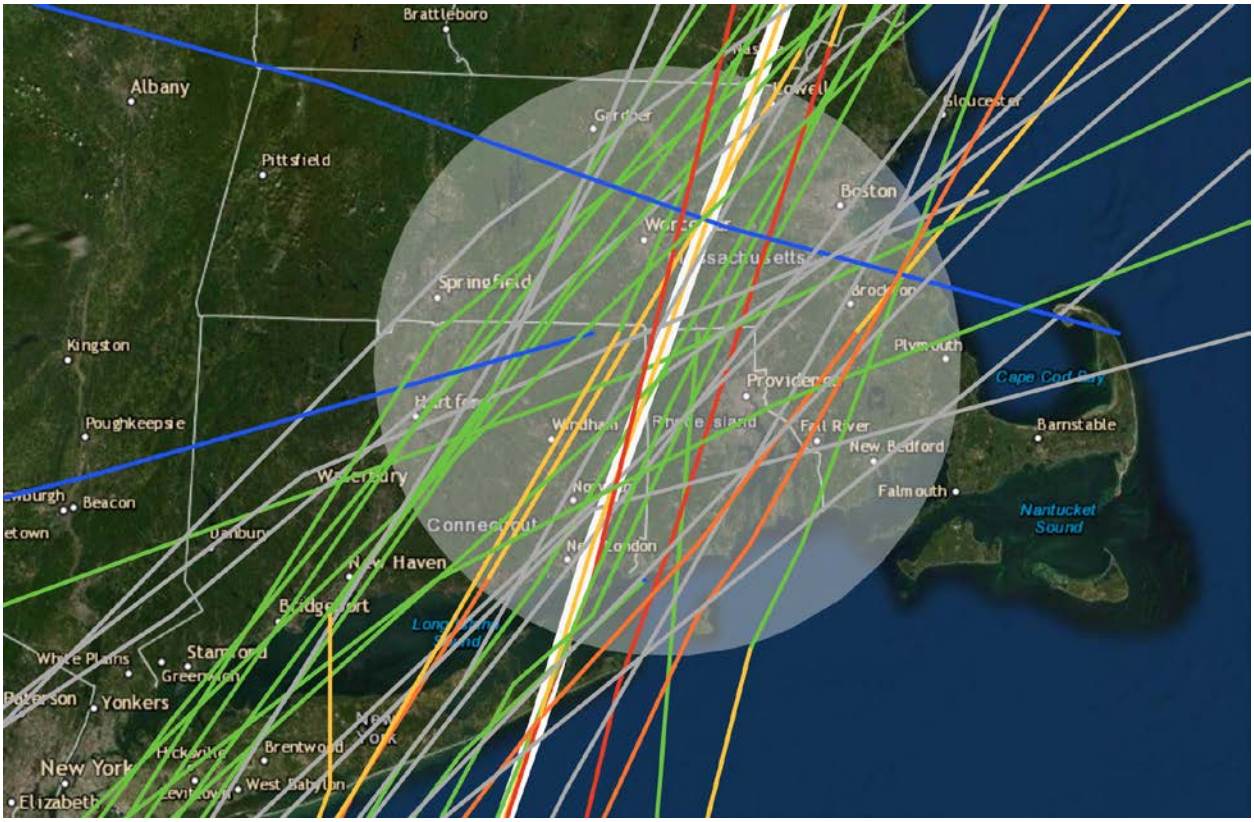
While Hurricane Season runs from June 1st through November 30th, Tropical cyclones, including hurricanes and tropical storms, typically impact Rhode Island from the south and southwest during the late summer and fall. Although an average of 10 storms[40] forms each hurricane season in the Atlantic, most do not impact the Northeast. The National Hurricane Center estimates that a Hurricane will impact Rhode Island once every 17 years:



[41]

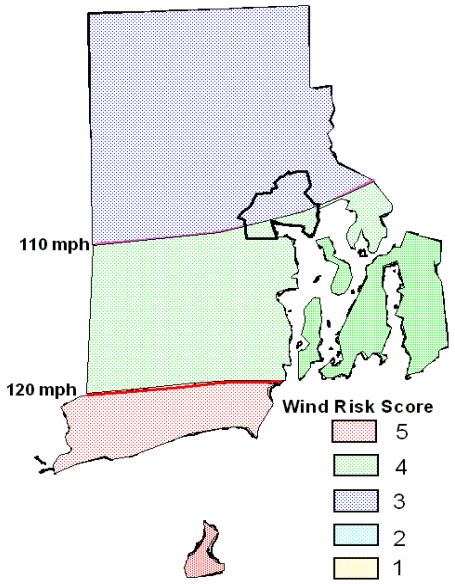
[39] http://www.nhc.noaa.gov/aboutsshws.php
[40] http://www.cpc.ncep.noaa.gov/products/outlooks/background_information.shtml#NOAADEF
[41] https://www.nhc.noaa.gov/climo/images/return_hurr.jpg

Although most Hurricanes or Tropical Storms tracking through the Atlantic Ocean have not made a direct hit on Rhode Island, the "near misses" generate moderately high winds causing varying degrees of damage. Since 1851, 36 Hurricanes or Tropical Storms have tracked within 50 nautical miles of the Town of Burrillville. The graphic below displays their tracks and windspeeds according to the best available data from NOAA:



42

[42] https://coast.noaa.gov/hurricanes/



The hurricane events that represent much of the wind hazard for Burrillville are eastward systems. The eye of an eastward hurricane passes east of the state, staying offshore, to the south and east of Cape Cod, Massachusetts. It is common for Rhode Island to experience rainfall from eastward hurricanes several days before the actual arrival of the hurricane.

The graphic to the left shows the relative wind hazard ranking for Burrillville and all of Rhode Island. These rankings are based on the American Society of Civil Engineers (ASCE) *Minimum Design Loads for Buildings and Other Structures, ASCE 7-98.* The Town of Burrillville is in the risk category 3.

While these storms occur infrequently, they have the potential to cause large amounts of damage over a widespread area. Eight notable storms have caused damage in Rhode Island since 1900. The table below highlights those storms:

DATE	NAME	TYPE	WINDS (MPH)	PROPERTY DAMAGE ($ MILLION)	DEATHS
September 21, 1938	N/A	Westward	95	100	262
September 14, 1944	N/A	Rhode Island	82	2	0
August 31, 1954	Carol	Westward	110	90	19
September 11, 1954	Edna	Eastward	40	0.1	0
August 19, 1955	Diane	Eastward	45	170	0
September 12, 1960	Donna	Westward	58	2.4	0
September 27, 1985	Gloria	Westward	81	19.8	1
August 19, 1991	Bob	Rhode Island	63	115	0

Source: NWS Boston Notable New England Hurricanes: http://www.erh.noaa.gov/box/hurricane/NewEnglandNotableStorms.shtml

43

[43] Note to Reviewer: This list is complete because Irene and Sandy did not strike Rhode Island or Burrillville with Hurricane force effects. The citations have been updated to reflect this review.

Geographic Area Affected: The entire Town of Burrillville has the potential to be impacted by hurricanes and tropical storms.

Severity: Hurricanes and tropical storms in Burrillville are likely to have a severity of low to moderate. This would depend on the location of the eye of the hurricane or tropical storm. The rain and winds could cause severe damage depending on the severity of the winds and the amount of rain. Debris would most likely be the biggest issue if the Town were impacted by a hurricane. Downed trees and power lines could isolate people within the Town from emergency response personnel.

Probability of Future Events: According to forecasters at the National Weather Service, there is less than a 10-15% chance of a hurricane impacting the Town of Burrillville in any given year. Hurricanes and tropical storms are frequent in the Atlantic, however, if they begin a northerly track up the east coast, they tend to curve eastward back out to sea.

Infectious Disease- Risk Score 20.71

The World Health Organization describes infectious diseases as those diseases that are caused by pathogenic microorganisms, such as bacteria, viruses, parasites, or fungi; the diseases can be spread, directly or indirectly, from one person to another.[44] The Rhode Island State Hazard Mitigation Plan identifies diseases such as influenza, pertussis, tuberculosis, and meningitis are examples of infectious diseases that can pose a threat to a community's population.[45] Additionally, coronaviruses are also potential pandemic diseases that could cause a significant impact on the community. The 2020 COVID-19 pandemic caused significant impacts globally and within the State of Rhode Island. As of June 22, 2020, the State of Rhode Island has 16,459 confirmed cases and 903 deaths with 102 positive cases in Burrillville[46].

Geographic Area Affected: The entire Town of Burrillville has the potential to be impacted by infectious disease.

Severity: Depending on the virality of the disease will depend on the severity. Viruses like the H1N1 Swine Flu created an epidemic proportion of disease while COVID-19 caused significant impacts.

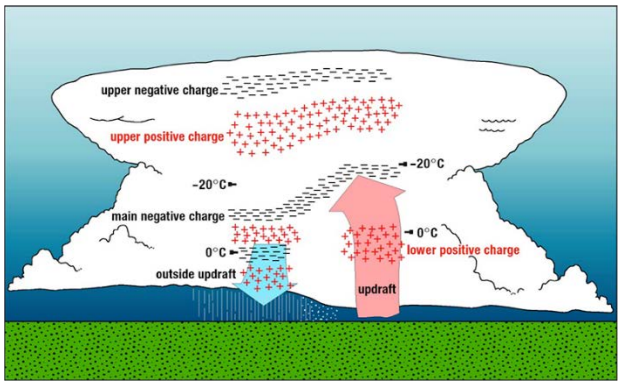
Probability of Future Events: According to the State Hazard Mitigation Plan, "The probability of incidents that result from infectious disease occurring in Rhode Island over the next 12 to 60 months is likely (between 50% and 89.9% probability). Indeed, such incidents occur every year; the probability of an infectious disease incident over the next 12 to 60 months has a significant probability. The probability of an infectious disease progressing to the epidemic stage within the same timeframe is less clear, as is the probability of a pandemic. Generally speaking, pandemics are predicted to occur once every 100 years; the most recent pandemic was in 2009, which suggests that the probability of a pandemic within the next

[44] https://www.who.int/topics/infectious_diseases/en/
45 http://www.riema.ri.gov/forms-additional-resources/documents/Rhode%20Island%202019%20State%20Hazard%20Mitigation%20Plan-COMBINED_DRAFT.pdf Page 3-154
46 https://ri-department-of-health-covid-19-data-rihealth.hub.arcgis.com/

12 to 60 months is relatively low. However, the incidence of infectious disease outbreaks is increasing. In 2007, the WHO reported that over 40 infectious diseases had been discovered since 1970; nearly one new infectious disease has emerged each year over the last 50 years."[47]

Lightning- Risk Score 12.98

Lightning is a giant spark of electricity in the atmosphere between clouds, the air, or the ground. In the early stages of development, air acts as an insulator between the positive and negative charges in the cloud and between the cloud and the ground. When the opposite charges build up enough, this insulating capacity of the air breaks down and there is a rapid discharge of electricity that we know as lightning. The flash of lightning temporarily equalizes the charged regions in the atmosphere until the opposite charges build up again.



Lightning can occur between opposite charges within the thunderstorm cloud (intra-cloud lightning) or between opposite charges in the cloud and on the ground (cloud-to-ground lightning).

Lightning is one of the oldest observed natural phenomena on earth. It can be seen in volcanic eruptions, extremely intense forest fires, surface nuclear detonations, heavy snowstorms, large hurricanes, and thunderstorms.[48]

The Town of Burrillville is regularly affected by lighting during the spring and summer months. In the past two years, significant lighting strikes have caused damage to homes[49] and knocked out power to 41 percent of the Town[50]. It can impact any buildings within the Town and could significantly impact Town operations. Tall objects such as trees and buildings tend to be the most often struck target because they are closer to the base of a storm cloud.

Geographic Area Affected: The entire Town of Burrillville has the potential to be impacted by lightning.

Severity: Lightning strikes can cause significant damage in a localized area depending on what they strike. The impact could range from a single structure to a larger area from a lighting-caused fire.

---

[47] http://www.riema.ri.gov/forms-additional-resources/documents/Rhode%20Island%202019%20State%20Hazard%20Mitigation%20Plan-COMBINED_DRAFT.pdf Page 3-157

[48] https://www.nssl.noaa.gov/education/svrwx101/lightning/

[49] https://www.wpri.com/news/local-news/northwest/lightning-strikes-blows-up-chimney-of-burrillville-home/1308276671/

[50] https://www.providencejournal.com/news/20190717/storm-knocks-out-power-to-41-percent-of-burrillville-lightning-hits-houses-in-smithfield-warwick

Probability of Future Events: Lightning will continue to occur within the Town most often occurring during the last Spring through early Fall timeframe. Summer thunderstorms will continue to cause the most frequent impacts.

Severe Winter Storms- Risk Score 28.86

Winter storms and blizzards originate as mid-latitude depressions or cyclonic weather systems, sometimes following the path of the jet stream. A blizzard combines heavy snowfall, high winds, extreme cold, and ice storms. The origins of such weather patterns are primarily from four sources in the continental United States.

In the Northwestern States, cyclonic weather systems from the North Pacific Ocean or the Aleutian Island region sweep in as massive low-pressure systems with heavy snow and blizzards. In the northeast, lake effect snowstorms develop from the passage of cold air over the relatively warm surfaces of the Great Lakes, causing heavy snowfall and blizzard conditions.

In the Midwestern and Upper Plains States, Canadian and Arctic cold fronts push ice and snow deep into the interior region and, in some instances, all the way down to Florida. The Eastern and Northeastern States are affected by extra-tropical cyclonic weather systems in the Atlantic Ocean and the Gulf of Mexico that produce snow, ice storms, and occasional blizzards.

Another form of a severe winter storm is an ice storm. An ice storm is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Significant accumulations of ice pull down trees and utility lines resulting in loss of power and communication. These accumulations of ice make walking and driving extremely dangerous and can create extreme hazards to motorists and pedestrians (NWS, 2005).

Ice storms deposit layers of ice upon roadways, sidewalks, trees, power, and telephone lines generally causing major damage, and often some deaths. All severe winter storms can cause collapsing roofs due to the weight of the ice and snow. Luckily, ice storms occur far less frequently than storms that deposit significant quantities of snow and/or sleet. Also, they generally do not last for more than one or two days.

Lastly, Nor'easters are another type of Severe Winter Storm under the Town of Burrillville's broad definition. Nor'easters are defined as a large weather system traveling from South to North, passing along or near the seacoast. As the storm approaches, and its intensity becomes increasingly apparent, the resulting counterclockwise cyclonic winds impact the coast and inland areas from a northeasterly direction. In the winter months, oftentimes blizzard conditions accompany these events. The added impact of the masses of snow and/or ice upon infrastructures often affects transportation and the delivery of goods and services for an extended period.

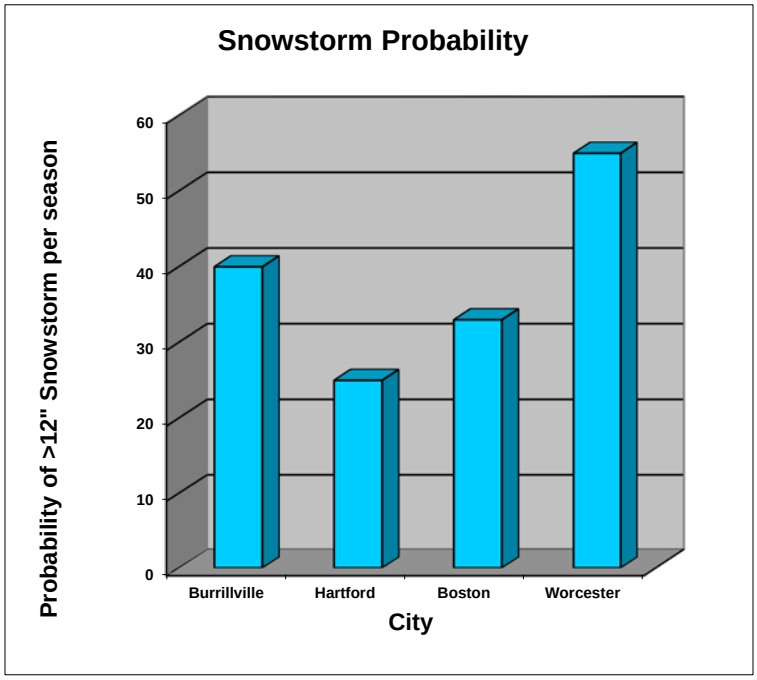
New Bedford's Fisherman's Wharf after a Nor'Easter

Nor'easters, named for the strong northeasterly winds blowing in ahead of the storm, are also referred to as a type of extra-tropical cyclones (mid-latitude storms, or Great Lake storms. A Nor'easter is a macro-scale extra-tropical storm whose winds come from the northeast, especially in the coastal areas of the Northeastern U.S. and Atlantic Canada. More specifically, it describes a low-pressure area whose center of rotation is just off the coast and whose leading winds in the left forward quadrant rotate onto land from the northeast. Wind gusts associated with these storms can exceed hurricane forces in intensity. Unlike tropical cyclones that form in the tropics and have warm cores (including tropical depressions, tropical storms, and hurricanes); Nor'easters contain a cold core of low barometric pressure that forms in the mid-latitudes. Their strongest winds are close to the earth's surface and they often measure several hundred miles across. Nor'easters may occur at any time of the year but are most common during the fall and winter months (September through April).

Burrillville, Rhode Island lies within the heavy snow regions of the state. Located in the Northwest corner of Rhode Island, Burrillville does not receive the warmer climate associated with the coastal regions of the State. Severe winter storms are spatially expansive.

The two major threats, in Burrillville, from severe winter storms, are snow loading on rooftops, and loss of power due to ice on power lines. The impact of major storms can be quite extreme causing power outages potentially lasting several days.

Heavy Snowstorm Probability of Occurrence.



Source: NOAA

Geographic Area Affected: The entire Town of Burrillville has the potential to be impacted by Winter Storms.

Severity: Winter Storms in Burrillville are likely to have a severity of low to moderate. Historically, these storms have been relatively short-lived and have had mostly localized impacts. The main concerns about a severe storm in Burrillville are the potential to isolate citizens and businesses if roads are blocked by snow or ice and the potential for power outages. This may cause some financial hardships for the Town, but it is unlikely to cause widespread, permanent damage or loss of life.

Probability of Future Events: Reports from the International Panel on Climate Change confirmed that the region's climate is changing and that the impacts will be far-reaching. The Town of Burrillville can expect an increase in severe storm events in the future.

Temperature Extremes- Risk Score 11.66

Extreme summer weather is characterized by a sometimes dangerous combination of very high temperatures and exceptionally humid conditions. When such a pattern persists over an extended period, it is known as a heatwave.

The National Weather Service uses a heat index that includes the combined effects of high temperature and humidity when measuring the severity of a heatwave. They also gather and compile the information used to estimate the index and then distribute the determined value to the public and the weather broadcasting industry.

The estimation of the heat index is a relationship between dry bulb temperatures (at different humidities) and the skin's resistance to heat and moisture transfer. Because skin resistance is directly related to skin temperature, a relation between ambient temperature and relative humidity versus skin temperature can be determined. If the relative humidity is higher or lower than the base value, then the apparent temperature is higher or lower than the ambient temperature.[51]

Extreme winter weather is characterized by very low temperatures and low humidity. When such a pattern persists over an extended period, it is known as a cold snap. The average number of deaths attributed to cold is 770 yearly, substantially higher than the number attributed to heat.[52]

When extreme cold temperatures are combined with high winds an effect called wind chill can increase the severity of the temperature extreme. The term "wind chill" goes back to the Antarctic explorer Paul Siple, who coined it a 1939 dissertation, "Adaptation of the Explorer to the Climate of Antarctica." During the 1940s, Siple and Charles Passel conducted experiments on the time needed to freeze water in a plastic cylinder that was exposed to the elements. They found that the time depended on how warm the water was, the outside temperature, and the wind speed. The formulas used to calculate wind chill were based on those experiments.

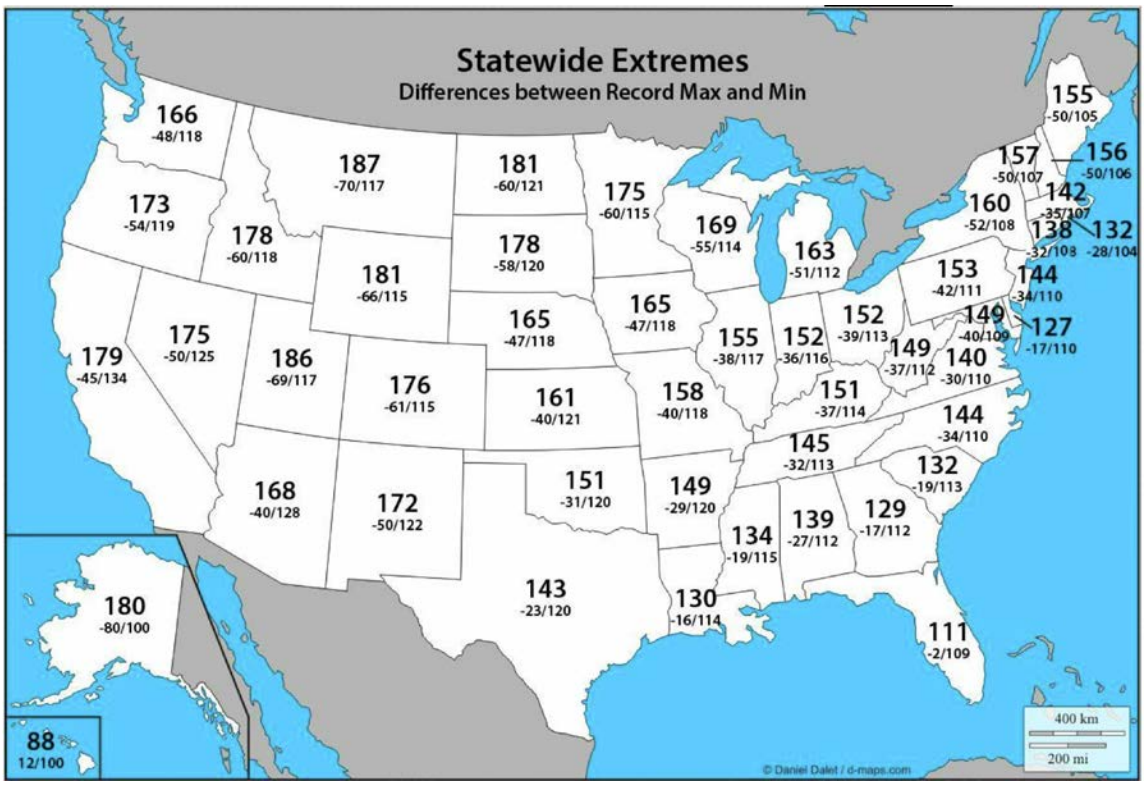
In the fall of 2001, the U.S. National Weather Service and the Canadian Weather Service replaced the formulas with new ones (one for Fahrenheit temperatures and one for Celsius readings). The formulas are based on greater scientific knowledge and on experiments that tested how fast the faces of volunteers cooled in a wind tunnel with various combinations of wind and temperature.
The formula for winds in mph and Fahrenheit temperatures is:

- Wind chill temperature = 35.74 + 0.6215T - 35.75V (**0.16) + 0.4275TV (**0.16)

In the formula, V is in the wind speed in statute miles per hour, and T is the temperature in degrees Fahrenheit.

An examination of historical temperature records reveals that Rhode Island lies in an area of varying temperatures. Summers can have brief periods of extreme heat, while winters are often quite cold. The potential impact of such extremes is primarily economic, though threats to life are quite real. In the past, the Town has opened both heating and cooling shelters to support residents. The chart below details the extremes between high and low by state:

[51] National Weather Service, 1997
[52] Kilbourne, 1997.



[53]

Geographic Area Affected: The entire Town of Burrillville has the potential to be impacted by Extreme Temperatures.

Severity: Temperatures that hover 10 degrees or more above the average high temperature for a region, and last for several weeks, constitute an extreme heat event and temperatures that remain below freezing for a prolonged period constitute an extreme cold event. The severity is low in the Town of Burrillville. The residents are used to cold weather in the winter and hot weather in the summer. The main impact would be if there was a power outage and the residents could not heat or cool themselves, however, the Town has heating and cooling centers in place to address this.

Probability of Future Events: At this time, it is impossible to stop an Extreme Temperature event. Therefore, mitigation activities should be tailored towards protecting lives and preventing injury from an Extreme Heat event.

Tornado- Risk Score 6.96

Tornados are violently rotating columns of air extending from within a thundercloud down to ground level. The strongest tornadoes may sweep houses from their foundations, destroy brick buildings, toss cars, and school buses through the air, and even lift railroad cars from their tracks. Tornadoes vary in diameter from tens of meters to nearly 2 km (1 mi), with an average diameter of about 50 m (160 ft). Most tornadoes in the northern hemisphere create winds that blow counterclockwise around a center of extremely low atmospheric pressure. In the southern hemisphere, the winds generally blow

[53] https://ggweather.com/climate/extremes_us.htm

clockwise. Peak wind speeds can range from near 120 km/h (75 mph) to almost 500 km/h (300 mph). The forward motion of a tornado can range from a near standstill to almost 110 km/h (70 mph).

A tornado becomes visible when a condensation funnel made of water vapor (a funnel cloud) forms in extremely low pressures, or when the tornado lofts dust, dirt, and debris upward from the ground. A mature tornado may be columnar or tilted, narrow or broad—sometimes so broad that it appears as if the parent thundercloud itself had descended to ground level. Others, especially very violent ones, may break into several intense suction vortices—intense swirling masses of air—each of which rotates near the parent tornado. A suction vortex may be only a few meters in diameter, and thus can destroy one house while leaving a neighboring house relatively unscathed.[54]

Many tornadoes, including the strongest ones, develop from a special type of thunderstorm known as a supercell. A supercell is a long-lived, rotating thunderstorm 10 to 16 km (6 to 10 mi) in diameter that may last several hours, travel hundreds of miles, and produce several tornadoes. Supercell tornadoes are often produced in sequence so that what appears to be a very long damage path from one tornado may be the result of a new tornado that forms in the area where the previous tornado died. Sometimes, tornado outbreaks occur, and swarms of supercell storms may occur. Each supercell may spawn a tornado or a sequence of tornadoes.

Direct measurements of tornado wind speeds are difficult (and dangerous) to obtain. In 1971 Theodore Fujita, a meteorology professor at the University of Chicago, devised a classification system based on damage to manmade structures. His Fujita-scale classification system (F-scale) ranks tornado damage as weak (F0 and F1), strong (F2 and F3), or violent (F4 and F5). The weakest tornadoes (F0) may damage chimneys and signs, whereas the most violent tornadoes (F5) can blow houses completely off their foundations. Scientists correlate F-scale values roughly using only wind speeds. For instance, a wind speed of 145 km/h (90 mph) might do minor F0 damage to a well-constructed building but significant F2 damage to a poorly constructed building. Scientists estimate that F0 tornadoes may have wind speeds up to 110 km/h (70 mph), while F5 tornadoes may have wind speeds somewhere in the range of 420 to 480 km/h (260 to 300 mph). Despite its drawbacks, the F-scale system is a convenient means for scientists to classify and discuss the intensity of tornadoes.

Due to many problems that arose with the use of the original Fujita scale a new scale was needed. The main problems were that we needed a better estimation of real-life wind speeds based on damage to certain structures. For instance, damage to a weak building or mobile home is not the same as a brick well-built home being leveled. We also needed consistency with rating tornadoes. Too often what constituted an F-3 tornado in one part of the country ended up being an F-5 in other parts. We needed a scale that meant an EF-5 in Rhode Island was the same as an EF-5 in Oklahoma.

[54] "Tornado," Microsoft, Encarta Online Encyclopedia, 2004

Therefore, not only meteorologists but structural engineers help develop a new scale. This scale used more of the real-world nature of construction in the U.S. and also what we know about wind speeds in tornadoes. In 2007, the National Weather Service updated the Fujita scale to the Enhanced Fujita Scale.[55] The chart below helps explain the EF scale:

Scale	Wind speed		Relative frequency	Potential damage	
	mph	km/h			
EF0	65–85	105–137	53.5%	Minor damage. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage (i.e., those that remain in open fields) are always rated EF0.	
EF1	86–110	138–178	31.6%	Moderate damage. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.	
EF2	111–135	179–218	10.7%	Considerable damage. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.	
EF3	136–165	219–266	3.4%	Severe damage. Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.	
EF4	166–200	267–322	0.7%	Extreme damage to near-total destruction. Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.	
EF5	>200	>322	<0.1%	Massive Damage. Strong frame houses leveled off foundations and swept away; steel-reinforced concrete structures critically damaged; high-rise buildings have severe structural deformation. Incredible phenomena will occur.	

Another damaging effect of tornados is hail. A hailstorm is an outgrowth of a severe thunderstorm in which balls or irregularly shaped lumps of ice greater than 0.75 inches in diameter fall with rain.[56] In the earliest developmental stages of a hailstorm, ice crystals form within a low-pressure front due to the rapid rising of warm air into the upper atmosphere, which then causes a subsequent cooling of the air mass. Frozen droplets gradually accumulate on the ice crystals until, having developed sufficient weight, they fall as precipitation.

The size of hailstorms is a direct function of determining the size and severity of the storm. High-velocity updraft winds are required to keep hail in suspension in thunderclouds. The strength of the updraft is a function of the intensity of heating at the earth's surface. Higher temperature gradients relative to the elevation above the surface result in increased suspension time and hailstone.

[55] http://wxbrad.com/the-ef-scale-explained/
[56] Gokhale, 1975

Tornadoes do not occur frequently across New England, and the Burrillville area is no exception. In 62 years (1950 – 2019), 7 tornadoes were reported around Northern Rhode Island, as reported by the National Climatic Data Center. A tornado is reported in southern New England once every two to three years.

Tornadoes are among the most destructive forces of nature. Even minor tornadoes can destroy property and cause injuries or death. While tornadoes can occur in and around the Burrillville area, the events are typically small in size.

Recent Tornado Activity in Rhode Island[57]

7 TORNADOS were reported in **Providence County, Rhode Island** between **01/01/1950** and **11/30/2019**.

Mag: Magnitude
Dth: Deaths
Inj: Injuries
PrD: Property Damage
CrD: Crop Damage

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								0	23	4.250M	0.00K
PROVIDENCE CO.	PROVIDENCE CO.	RI	08/26/1985	13:00	CST	Tornado	F1	0	0	0.00K	0.00K
PROVIDENCE CO.	PROVIDENCE CO.	RI	08/07/1986	14:30	EST	Tornado	F1	0	0	250.00K	0.00K
PROVIDENCE CO.	PROVIDENCE CO.	RI	08/07/1986	15:15	EST	Tornado	F2	0	20	2.500M	0.00K
PROVIDENCE CO.	PROVIDENCE CO.	RI	08/08/1986	09:15	EST	Tornado	F1	0	0	250.00K	0.00K
PROVIDENCE CO.	PROVIDENCE CO.	RI	09/23/1989	14:30	EST	Tornado	F0	0	3	250.00K	0.00K
FOSTER	PROVIDENCE CO.	RI	08/16/2000	14:00	EST	Tornado	F0	0	0	0.00K	0.00K
NORTH PROVIDENCE	PROVIDENCE CO.	RI	10/23/2018	14:31	EST-5	Tornado	EF1	0	0	1.000M	0.00K
Totals:								0	23	4.250M	0.00K

Geographic Area Affected: The entire Town of Burrillville has the potential to be impacted by tornadoes.

Severity: The severity of a tornado in the Town of Burrillville is low to moderate depending on the track of the tornado. If a tornado strikes a wooded area it would cause a lot of debris, however, if a tornado struck in a more residential area it does have a potential for loss of life.

[57] http://www.ncdc.noaa.gov/stormevents/

Probability of Future Events: The Town of Burrillville does not anticipate an increase in the probability of future events for tornadoes, however with the recent tornado that impacted Springfield, Massachusetts, it is a reality that the Town must plan for and remain vigilant.

Wildfires- Risk Score 7.92

Wildfires occur in virtually all of the states in the United States. They are fueled by naturally occurring or non-native species of trees, brush, and grass. There are four categories of wildfires that are experienced in the United States.

These are:

1. Wildland fires- fires fueled almost exclusively by natural vegetation. They typically occur in national forests and parks, where Federal agencies are responsible for fire management and suppression.
2. Interface or intermix fires- urban/wildland fires in which vegetation and the built-environment provide fuel.
3. Firestorms- events of such extreme intensity that effective suppression is virtually impossible. Firestorms occur during extreme weather and generally burn until conditions change, or the available fuel is exhausted.
4. Prescribed fires and prescribed natural fires- fires that are intentionally set or selected natural fires that are allowed to burn for beneficial purposes.

Conflagration is a large destructive fire. Triggers that cause fire can be natural, such as lightning, or human-induced. Downed power lines during any storm can cause fires. Fire is a secondary hazard following an earthquake. Fires are influenced by the amount and condition of available fuel, slopes, wind, and ambient temperature. Fires tend to be more prevalent from mid-May to October; however, they can occur at any time.

Conflagration can happen anywhere within the Town of Burrillville. Fires cannot be predicted, and their duration is dependent on the size and severity of the fire.

In the past five years, Rhode Island has experienced 100 to 215 small wildfires a year. These wildfires are also known as brush fires. On average the fires consumed between one to two acres of land per fire. The probability of a major fire is considered to be low; however, Rhode Island has experienced some major fires in the past. The most devastating wildfire was the Coventry fire of 1941 which consumed 18,000 acres of forest. A wildfire in Exeter in 1951 consumed 5,000 acres.

There are four types of woodland fires that are characterized by their behavior and location within the biomass: Ground fire, Surface fire, Canopy fire, and Firestorm. Ground fire is primarily restricted to thick layers of organic materials, such as old roots and peaty deposits. Surface fires consist of rapidly moving fires that consume dry grass, low shrubs, and litter on forest floors. Surface fires are relatively easy to control because of their low fuel load. A canopy fire consists of a forest fire that involves the crowns of trees, such as tall stands of White Pines. Burrillville contains many stands of such trees but has been fortunate to elude such fires due to its temperate climate.

A firestorm is a violent and nearly stationary mass fire that develops an inflowing wind system, mostly in the absence of preexisting ground wind. As stated above, Burrillville has not experienced any of these large woodland fires occur within the town. However, all these fire types have the potential of occurring in Burrillville, and historic structures and or other significant man-made features adjacent to these types of forests should be recognized.

Conflagration is a large destructive fire caused either by natural (lighting) or man-made (thrown cigarette) triggers. Fires are influenced by the amount and condition of available fuel, slopes, wind, and ambient temperature. Fires tend to be more prevalent from mid-May to October; however, they can occur at any time.

Geographic Area Affected: The entire Town of Burrillville has the potential to be impacted by wildfire hazards.

Severity: Potential losses from wildfire include human life; structures and other improvements; natural and cultural resources; the quality and quantity of the water supply; range and croplands, and economic losses. Smoke and air pollution from wildfires can pose a severe health hazard. Other secondary impacts include future flooding and erosion during heavy rains.

The severity of both wildfires and urban/woodland interface fires is influenced by topography, vegetation, development patterns, weather conditions, and the use of flammable landscaping and construction materials. The severity of fires in Burrillville varies depending on the type of fire. A wildfire, primarily fueled by natural vegetation, can have a major impact in areas with dense canopy coverage, specifically in areas of more undeveloped land. The severity of an interface fire will increase as urban development encroaches into areas previously undeveloped. Development may decrease the risk of wildfire, but the risk of interface fires will increase. As development continues, the man-made structures will provide fuel for a fire and increase the severity of urban/woodland fires.

Probability of Future Events: Climate change will make Northern Rhode Island summers drier, thus increasing the risk of fire. New development in previously wooded or undeveloped areas, specifically in areas of high risk for wildfires, will increase the risk of urban/woodland interface fires.

Section 5.0 Mitigation Actions

The Town of Burrillville has made mitigation a cornerstone of development within the community. The town has made significant investments in mitigation since the last plan update. The result has been significant in reducing flooding risk within the Town and increased public education. The Town has integrative approach to mitigation thinking. The Town has rated its capabilities related to hazard mitigation as follows:

Planning	Regulatory	Fiscal	Political	Overall
High	Moderate	Moderate	Moderate	Moderate

Plans and Programs	
HMP: Hazard Mitigation Plan	CIP: Capital Improvements Plan
DRP: Disaster Recovery Plan	HPP: Historical Preservation Plan
CLUP: Comprehensive Land Use Plan	ZO: Zoning Ordinance
FMP: Floodplain Management Plan	SO: Subdivision Ordinance
SMP: Stormwater Management Plan	FDPO: Flood Damage Prevention Ordinance
EOP: Emergency Ops Plan	NFIP: National Flood Insurance Program
COOP: Continuity of Ops Plan	CRS: Community Rating System
TRANS: Transportation Plan	BCL Building Codes

HMP	DRP	CLUP	FMP	SMP	EOP	COOP	TRANS	CIP	HPP	ZO	SO	FDPO	NFIP	CRS	BC
✓			✓	✓	✓			✓		✓	✓	✓	✓		✓

The chart below details the actions that were taken since the last plan update. Please note that completed actions are shaded in gray, while new actions are highlighted in light green:

Hazard	Potential Program or Activity	Description of Potential Strategy(ies)	Current Status	Point of Contact	Current Status	Potential Funding Sources
All	Emergency Operations Plan Update and Training	Annually review and update the Emergency Operations Plan. Hold drills and mock emergency exercises with Burrillville's departments. Make a list of contacts that can assist (Red Cross etc.)	This action is complete.	Emergency Management	The EOP is annually updated, and regular drills take place, including shelter drills. The Town has created MOUs with the appropriate NGOs and those are reviewed annually as well. Finally, the Town's Emergency Management Leadership Group meets each year at the beginning of Hurricane Season to review its preparedness. Given that this strategy has been ingrained in the culture of the Town, it is being marked as complete.	Emergency Preparedness Grants, FEMA, RIEMA
All, Extreme Temperatures	Promotion of Shelters – Red Cross	Make the public aware of shelter availability and rules through direct mail, e-mail, and website updates. Demarcate evacuation routes based on disaster type also identify heating and cooling centers since their addition to the EOP in 2009.	This action is complete.	Emergency Management	Warming and coiling shelters have been updated and are publicized via multiple modalities (Town website, RIEMA website, Burrillville Bugle, Social Media, and CodeRed). Additionally, the Police Department's Administrative Aide calls to check on the Elderly to see if they need sheltering assistance during any time of extreme temperature or snowstorms.	Emergency Preparedness Grants, FEMA, RIEMA
All	Identify potential threats to Water Supply	Continue to evaluate the potential for water contamination within sensitive areas to protect the drinking water supply.	The LHMC will continue this action in this plan update. Annually, water departments hold training and also assess their vulnerabilities for contamination. Time Frame- once a year	Water Department, Public Works	Currently updating vulnerabilities and Emergency Response Plans Threats to the water supply were identified, including Perfluorooctanoic Acid (PFOA) and other Perfluoronated items contamination identified in the Oakland/Mapleville Aquifer. The wells were deactivated and connected to Harrisville Water Department. Groundwater remediation action pending Implemented annual active monitoring for the two closed/capped landfills in town to ensure they do not cause groundwater contamination. Town has completed a study for a new sewer line (1500') between river street and union avenue on Route 107 to eliminate substandard septic systems and cesspools. Has begun preliminary design as of January 2020.	Emergency Preparedness Grants, FEMA, RIEMA

Aquifer Protection	Identify potential threats to Water Supply	Study the drinking water system in the town to include aquifers, supply, and infrastructure	New Action Timeframe- 0-3 Years			ARP, BRIC, FEMA, RIDEM
Aquifer Protection	New Well Head/Potable Water Source	Create a new wellhead/potable water source along with the associated infrastructure to improve service and enhance redundancy	New Action Timeframe- 0-5 Years			ARP, BRIC, FEMA, RIDEM
Aquifer Protection	New Supply Pipe	Need new above-ground 12" supply pipe for Cherry Farm Road Tank as the current pope goes through Clear River and is impossible to maintain.	New Action Timeframe- 0-5 Years			ARP, BRIC, FEMA, RIDEM
Flood	Repetitive Loss Structures	May include dredging of the river and changes to the structures used to control the river volume (i.e., dams, spillways, etc.).	New Action Timeframe- 0-5 Years	Army Corps of Engineers	The Army Corps of Engineers is looking into the problem to find a solution to the repetitive flooding.	
Flood	Wetland Buffering	Continue to regulate development according to local wetland setback regulations	This action is complete.	Building Department	The Town regularly educates builders on the ordnance when applying for permits, further regular community assistance visits are held with RIEMA to ensure that the Town is staying up to date on the latest floodplain management techniques and regulations. This action is being marked complete.	
All	Provide disaster preparedness public outreach.	Perform public outreach program to inform the public of loss prevention measures.	This action is complete.	Emergency Management	The public is advised to obtain information regarding loss prevention and mitigation by utilizing a government web-site, www.ready.gov.org. Burrillville EMA also promotes this activity via their website, the Burrillville Bugle, and Code Red. Overall, the town views this as a completed action as a culture of preparedness has been created within the Town.	
All	Train Officers on Hazardous Materials Suits and Protocol	Have received equipment through Homeland Security Grant	This action is no longer viable.	Police Department	Due to changes in the State protocols and process, the Town is no longer providing Hazardous Materials Suits to officers and instead maintains capability through the RI Statewide Mutual Aid Plan and the RI Statewide WMD Tactical Team. Overall the Fire and Police Departments maintain vigilance on hazardous materials through annual refresher training. Action Marked Complete as there is no further action.	DHS, FEMA, RIEMA
All	Develop a COOP Plan	Finalize the draft COOP for the Town to include all departments. Once finalized disseminate to all necessary personnel.	No action was taken. Time Frame- 0-5 Years	Emergency Management	Due to other planning priorities, this action was delayed and will be completed during this update cycle.	FEMA, RIEMA, EMS Grants

All	Enhance the MEDS/PODS plan and train and exercise the plan	Continue to meet the annual MEDS contract deliverables, as defined by HEALTH.	Continued Action Needed. Time Frame- once a year	Emergency Management	Burrillville continues to participate in the MEDS/PODS program with the Rhode Island Department of Health. RIDOH evaluates and approved the POD program via a full-scale drill conducted on an annual basis. Continued participation is required to continue to enhance the Town's capabilities.	RIDOH, RIEMA, FEMA
Flood, Severe Winter Storms, Hurricanes & Tropical Storms	Implementation of capital improvement projects	Implement the recommended capital improvement projects from the Clear River Watershed Study	This action is complete.	Planning Department, Public Works	In 2017, the Town implemented the necessary recommendations identified within the plan including installing a new spillway on a critical point of Wilson Reservoir and addressing other drainage issues through installation of new pipe and rerouting of infrastructure. The Town self-funded the entire project because it recognized the benefits of completing this mitigation action.	NRCS, RIEMA, FEMA
Flood	Drainage Study	Conduct a study to develop a strategy for the Centennial Street flooding.	Waiting on Additional Data. Time Frame- 0-5 years depending on funding	Planning Department	The area from Wilsons Reservoir into this area along with Slaterville Reservoir are being remapped by FEMA, according to RIEMA. The Town decided to hold action on this until those maps are complete and will develop a plan of action afterward.	NRCS, RIEMA, FEMA
Flood	Strategy Study	Conduct a study to develop a strategy for the Mowry Street/Harrisville Main Street culvert area. Video footage may assist in determining the problem.	Continued Monitoring Needed. Time Frame- 0-5 years depending on funding	Planning Department	Completed the study 2016 and full design between 2016/2017. Installed Trash Rack and the State cleaned two pipes. Private Property ownership issues preventing the implementation of the design. The town will continue to monitor conditions, which have improved since the installation Trach Rack and pipe cleaning.	NRCS, RIEMA, FEMA
Flood, Hurricanes & Tropical Storms	Evacuation Routes	Work with RIEMA and RISP to identify evacuation routes.	This action is complete.	Emergency Management, Police	Recently reviewed and approved by the Burrillville Town Council and implemented in the town EOP. This action is complete.	RIEMA, RISP, FEMA
Aquifer Protection, Dam Failure, Flood	Repair Mill Pond Dam	Dredge and clean the basin of silt and debris to increase the capacity of the Town-owned dam.	This action was reworded based on review and changed from dredging the basis to repairing the dam. Time Frame- 0-5 years depending on funding	Public Works	In coordination with RIDEM, the Town conducted a study to identify issues with the dam and if dredging and cleaning would be needed. Based on the state study, the dam needed remediation, not cleaning, and subsequent investigations identified issues with the low-level orifice that will necessitate larger design remediation. Wing-wall replacement, riprap re-armoring, and re-piping of discharges will all need to be done. Currently, the project is in preliminary design. Also investigating including a 12" water main replacement as part of the project. During the discussion, this was emphasized as the most critical mitigation action for the Town due to the multi-system impact of a potential failure.	

Flood	Implementation of Flood Control Projects	Implement strategy with assistance from Army Corps of Engineers (USACE) to reduce flooding of Eccleston Field well site	The plan is complete and the Town is ready to move forward with implementation but is dependent on USACE Time Frame-0-5 years depending on funding	Water Department	The Town needs assistance from the Army Corps of Engineers to proceed with this project. At this time, assistance is not able to be provided. The Town will continue to monitor this project.	ARMY CORPS, RIEMA, FEMA, NRCS
Dam Failure, Flood, Tropical Storms & Hurricanes,	Update Dam Emergency Action Plans (EAPs)	Update the Dam EAPs continually	Continued work is needed. Time Frame- Review once a year	Emergency Management, Public Works	Burrillville EMA receives reports of dam EOP's from RIDEM and/or engineering agencies. Additionally, RIEMA also notified and reviews the plan for compliance. The Town is currently working with the State to identify needs for review and update.	ARMY CORPS, NRCS, RIEMA, FEMA
All	Communication Tower Generator Project	Install generators at all communication towers	This action is complete.	Police Department	All three towers now have generators.	Emergency Preparedness Grants, RIEMA, FEMA
Critical Incidents, Wildfire	Install 3 Communication Towers	Install three communications towers to address communication issues amongst Police, Fire and Emergency Management	This is a new mitigation action. Time Frame- 0-5 years depending on funding		The Town has conducted significant radio testing over two years beginning in 2017 and identified the need for additional towers due to lack of signal. One tower at Burrillville Middle School has been procured and scheduled to be installed in Spring 2020. Two additional towers are still needed. One tower will be installed at West Rd. The Tower at Buck Hill needs to be replaced with a higher tower.	DHS
Critical Incident, Dam Failure	Upgrade Town Dispatch Center	Update and upgrade Burrillville's Town-wide Dispatch Center to address antiquated technology ensuring effective communication	This is a new mitigation action. Time Frame-0-5 years			DHS
Flood, Winter Storms, Hurricanes & Tropical Storms	Glendale Water Association Project	Install generator at Glendale Water Association	Action is not feasible.	Planning Department	Identified that due to funding restrictions, the Town was unable to invest in this privately owned water system. Further, no assistance was requested. This action will be eliminated.	Emergency Preparedness Grants, RIEMA, FEMA
Flood, Nor'easters, Tropical Storms & Hurricanes	Community Rating System (CRS)	Gain entrance into the Community Rating System	Action is not feasible.	Emergency Management, Planning	After investigation, the costs to the Town's residents outweighed the benefits of joining the Community Rating System. There were too few policies with too low of premiums. This action is being marked as not feasible.	FEMA, RIEMA
Wildfire	Wildfire Safety Zones	Create wildfire safety zones around critical facilities by managing and altering landscaping and vegetation	This action is complete.	Emergency Management, Fire Departments, Planning	The Fire Districts work with RI Forestry each mark and have incorporated these items into their pre-plans. This action is complete.	USFA, RIEMA, FEMA

Flood	Construction	Renovate the Wilson Reservoir Spillway to allow for more rapid discharge of water	This action is complete.	Public Works	This was completed in 2017 with Town Funds.	FEMA, RIEMA, Town Operating Budget
Earthquakes, Tornados	Safety Campaign	Create a public education and safety campaign to educate residents on individual mitigation actions they can take to prevent damage.	On-going	Emergency Management	Burrillville EMA website has been updated to include this information, but additional work is still needed. This action will remain a part of the plan.	FEMA, RIEMA
Drought	Drought Public Information	Create a drought public information campaign.	This action is complete.	Emergency Management, Planning Dept.	Processes are in place for the communication of water restriction and cessation of burn permits and have been communicated to residents.	FEMA, RIEMA, Town operating budget
All	Develop a debris management plan	Develop a debris management plan to minimize cleanup costs and minimize storm damage	This is not complete. The Town has not identified funding or staffing to complete the project. Time Frame- 0-5 years depending on funding	Public Works	The Town has not identified funding or staffing to complete the project. It was discussed that this will be prioritized in this update cycle.	
Lightning	Conduct a lightning protection survey	Survey all town infrastructure to identify needed lightning protection; address lightning protection	This is a new mitigation action. Time Frame-0-3 years	Public Works		ARP, BRIC, FEMA
Infectious Disease	Planning Updates	Update Town Plans, Policies, and Procedures to lessen the impact of an infectious disease outbreak	This is a new mitigation action. Time Frame-0-3 years	Town Manager; Emergency Management		ARP, Town funds
Infectious Disease	Identify Regulatory and Legal Changes	Conduct a review of the regulatory and legal changes necessary to effectively respond to a pandemic	This is a new mitigation action. Time Frame-0-3 years	Town Manager		ARP, Town funds

Section 6.0 Implementation

The completion of a planning document is merely the first step in its life as an evolving tool. The Hazard Mitigation Plan is a dynamic document that should be reviewed regularly as to its relevancy and usefulness and to add new tasks as old tasks are completed. This section discusses the methods by with the Town of Burrillville will review, monitor, and update its Hazard Mitigation Plan.

Monitoring of the Plan

This LHMC will meet throughout the year to review the plan, all mitigation actions, any achievements as well as new developments. The Town of Burrillville Emergency Management Director and Department of Public Works Director will be jointly responsible for maintaining a permanent LHMC. The Emergency Management Director and the Public Works Director will serve as the co-Chairs of the Committee.

Evaluating the Plan

Should a disaster occur, within 90 days the Committee will host an ad hoc meeting to evaluate the responsiveness of the mitigation strategy to the disaster. The review criteria will test each implemented action to determine the degree to which the action has reduced the vulnerability to the structures or populations it was meant to protect. This review is critical after an event as the degree of protection offered by the strategy is especially apparent. The committee will consider if changes are needed to the risk assessment or mitigation strategy based on response costs, damages, economic impacts, type/location/extent of damage, or other lessons learned.

The LHMC, under the direction of the Co-Chairs, will oversee an annual evaluation of progress towards implementation of the Hazard Mitigation Strategy and will review all proposed and already implemented strategies to determine their effectiveness. Meeting minutes should be documented for justification of plan updates. The evaluation should consider the following questions at a minimum in determining the need for a change to the mitigation strategy:

- Are there new hazards not present in the existing plan?
- Are there mitigation ideas missing?
- What is the status of current mitigation projects?
- Was there a change in capability to complete a mitigation goal?
- Is mitigation funding adequate?

The evaluation and implementation of actions will be evaluated using the STAPLEE Criteria. STAPLEE is an acronym for a general set of criteria common to public administration officials and planners. It stands for the Social, Technical, Administrative, Political Legal, and Economic/Environmental criteria for making planning decisions. The LHMC decided that the STAPLEE criteria are the best way to prioritize mitigation actions. The LHMC has chosen not to rank the mitigation actions during this review cycle but will instead rank each action using the STAPLEE Criteria when going after competitive grant funding. A cost benefit analysis will be performed for the mitigation actions. Potential grant funding sources for mitigation implementation may include the Building Resilient Infrastructure and Communities (BRIC) grant and/or the Hazard Mitigation Grant Program (HMGP). The Town Manager's Office is responsible for administering the mitigation actions and coordinating with town departments.

Updating the Plan

This Hazard Mitigation Plan will be updated as needed based on changes in federal requirements for hazard mitigations plans, significant natural or man-made hazards, or at least every five years (whichever occurs first). Funds will be placed into the annual budget for the administrative costs associated with updating the plan such as word processing and map generation, and for printing costs. The Town Manager of the Town of Burrillville will invite all department members to participate in these Hazard Mitigation Plan update meetings. Public notice of the meetings will be posted in local newspapers, libraries, as well as the Town of Burrillville website. This will allow for public involvement in the planning process.

The initials steps for the five-year update to this plan will be started at least a year in advance of the current FEMA approval expiration to ensure the Town always has an approved plan. Additional time may be required to be added to the start date for planning grants. The update will incorporate a formalized process for prioritizing actions and weighing the cost/benefit of such actions. Once the LHMC has been organized to oversee the update, the following schedule will take place to facilitate the process:

1. Review recent FEMA hazard mitigation planning requirements and/or guidance.
2. Evaluate the existing planning process and make improvements as needed.
3. Consider revision(s) to the Risk Assessment, including hazard description, frequency, area of impact, magnitude, and vulnerabilities.
4. Update of mitigation strategies, goals, and action items, in large part based on the annual plan implementation evaluation input.
5. Evaluate if existing plan maintenance procedures are adequate and revise if needed.
6. Comply with all applicable Federal regulations and directives.

All updates or revisions to the plan will be submitted to the RIEMA upon local approval to ensure the State Hazard Mitigation Strategy also remains current.

Continued Public Involvement

The LHMC is incorporates involvement of its residents (e.g., feedback and comments on the plan) throughout the five-year implementation cycle and interim reviews. The Town Manager of the Town of Burrillville, under the direction of the Town Council, will be responsible for assuring that all Town departments and the public have adequate opportunity to participate in the planning process. Other administrative staff may be utilized to assist with the public involvement process.

Hazard Mitigation Planning meetings will be open to the public-to-public involvement in the Plan will increase and will be reflected in future revisions.
For the annual update process, techniques that will be utilized for public involvement include:

- Provide personal invitations to Budget Committee members
- Provide personal invitations to Town Department heads
- Post notice of meetings at the Town Hall, Fire Departments, Police Departments, and Library
- Submit newspaper articles for publication
- The LHMC will update the Town website with the Hazard Mitigation meeting notices.

Appendix A: STAPLEE Criteria

STAPLEE CRITERIA FOR SELECTING MITIGATION MEASURES

Social: Is the proposed action socially acceptable to the Community? Are there equity issues involved that would mean that one segment of the Community is treated unfairly? Will the action cause social disruption?

Technical: Will the proposed action work? Will it create more problems than it solves? Does it solve a problem or only a symptom? Is it the most useful action in light of other Community goals?

Administrative: Can the Community implement the action? Is there someone to coordinate and lead the effort? Is there sufficient funding, staff, and technical support available? Are there ongoing administrative requirements that need to be met?

Political: Is the action politically acceptable? Is there public support both to implement and to maintain the project? Will the Mayor, his Cabinet, County Council, and other decision-making political bodies support the mitigation measure?

Legal: Is the Community authorized to implement the proposed action? Is there a clear legal basis or precedent for this activity? Is enabling legislation necessary? Are there any legal side effects? (e.g., could the activity be construed as a taking?) Will the Community be liable for action or lack of action? Will the activity be challenged?

Economic: What are the costs and benefits of this action? Does the cost seem reasonable for the size of the problem and the likely benefits? Are maintenance and administrative costs taken into account as well as initial costs? How will this action affect the fiscal capability of the Community? What burden will this action place on the tax base or the local economy? What are the budget and revenue effects of this activity? Does the action contribute to other community goals, such as capital improvements or economic development? What benefits will the action provide?

Environmental: Sustainable mitigation actions that do not have an adverse effect on the environment, that comply with Federal, State, and local environmental regulations and that are consistent with the community's environmental goals have mitigation benefits while being environmentally sound.