2022 Hazard Mitigation Plan Update

Town of Lincoln, Rhode Island

PREPARED FOR

Town of Lincoln
Town Hall
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Lincoln, RI 02865
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PREPARED BY

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April 1, 2022

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2022-17

A RESOLUTION OF THE TOWN COUNCIL OF THE TOWN OF LINCOLN AUTHORIZING THE ADOPTION OF THE 2022 LINCOLN HAZARD MITIGATION PLAN UPDATE

WHEREAS, the Town of Lincoln recognizes exposure to natural hazards that increase the
risk to life, property, environment, within our community; and

WHEREAS; pro-active mitigation of known hazards before a disaster event can reduce or eliminate
long-term risk to life and property; and

WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements
for pre and post disaster hazard mitigation programs; and

WHEREAS; the 2022 Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in Lincoln from impacts of future hazards and disasters; and

WHEREAS, adoption by the Town Council demonstrates their commitment to hazard mitigation and achieving goals outlined in the 2022 Lincoln Hazard Mitigation Plan Update.

NOW, THEREFORE, BE IT RESOLVED that the Town of Lincoln

1) Adopts in its entirety, the 2022 Lincoln Hazard Mitigation Plan Update (the "Plan") as the
jurisdiction's Natural Hazard Mitigation Plan and resolves to execute the actions identified in the Plan that pertain to this jurisdiction.

2) Will use the adopted and approved portions of the Plan to guide pre- and post-disaster mitigation of the hazards identified.
3) Will coordinate the strategies identified in the Plan with other planning programs and mechanisms under its jurisdictional authority.
4) Will continue its support of the Hazard Mitigation Committee as described within the Plan.

5) Will help to promote and support the mitigation successes of all participants in this Plan.
6) Will incorporate mitigation planning as an integral component of government and partner operations.
7) Will provide an update of the Plan every five years.

PASSED AND ADOPTED on May 17, 2022

ATTEST: Lillian Silva
Lillian Silva, Town Clerk, Town of Lincoln

U.S. Department of Homeland Security
FEMA Region I
99 High Street, Sixth Floor
Boston, MA 02110-2132

FEMA

May 23, 2022

Thomas Guthlein, Acting Director
Rhode Island Emergency Management Agency
645 New London Avenue
Cranston, Rhode Island 02920

Acting Director Guthlein:

The U.S. Department of Homeland Security, Federal Emergency Management Agency (FEMA) Region I Mitigation Division has approved the 2022 Hazard Mitigation Plan Update Town of Lincoln, Rhode Island effective **May 19, 2022** through **May 18, 2027** in accordance with the planning requirements of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), as amended, the National Flood Insurance Act of 1968, as amended, and Title 44 Code of Federal Regulations (CFR) Part 201.

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

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

Thank you for your continued commitment and dedication to risk reduction demonstrated by preparing and adopting a strategy for reducing future disaster losses. Should you have any questions, please contact Alexis Meehan at (617) 832-4923 or Alexis.Meehan@fema.dhs.gov.

Sincerely,

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

PFF:nj

cc: Melinda Hopkins, Mitigation Planning Supervisor/RI State Hazard Mitigation Officer
Samantha Lawton, Planning Branch Chief, RI Emergency Management Agency

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Executive Summary

This Hazard Mitigation Plan (HMP) is a product of the Lincoln Hazard Mitigation Committee (HMC). It has been approved by the Lincoln Town Council, the Rhode Island Emergency Management Agency, and the Federal Emergency Management Agency in accordance with the Disaster Mitigation Act of 2000.

The HMC's overview of past natural hazard occurrences verifies that the Town is vulnerable to diverse events including flooding, hurricanes, Nor'easters, high winds, and winter storms. The discussion puts the likelihood of these events into historical perspective and recognizes that although the probability of thunderstorms and lightning events may be higher; the intensity and potential impacts from less likely events such as hurricanes can be far greater.

The risk assessment portion of the plan confirms that the Town has much to lose from these events. The identified vulnerabilities include flood prone drainage systems, streets and infrastructure, bridges, wastewater systems, dams, critical municipal hazard response facilities, communication equipment, dams, populations, businesses, schools, recreation facilities, historic and natural resources.

To address these risks the 2022 HMP put forth a clear mission, a distinct set of goals and 16 specific mitigation actions. The Town's hazard mitigation mission is to protect public health and safety and create sustainable economic growth by limiting losses to lives, public and private and private property, and natural resources/systems.

To implement the plan, important goals must be met. The Town's mitigation strategy was created to help protect its citizens, visitors, businesses and property from the effects of various natural hazards.

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Introduction

Plan Purpose

The purpose of the Lincoln Hazard Mitigation Plan Update is to set forth guidelines of short-term and long-term actions, which will reduce the actual or potential loss of life or property from natural hazardous events such as hurricanes, Nor'easters, flooding, and high wind. This plan was constructed using input from a variety of municipal and private stakeholders and the general public involved in the planning process. This plan serves as guidance to help the Town reduce their losses and vulnerabilities relating to natural hazards.

Hazard Mitigation and its Benefits

Hazard mitigation planning consists of a series of actions taken to identify specific areas that are vulnerable to natural and human-caused hazards within a town and seek to permanently reduce or eliminate the long-term risk to human life and property. It coordinates available resources and identifies community policies, actions, and tools for implementation that will reduce risk and the potential for future losses town-wide. The process of natural hazard mitigation planning sets clear goals, identifies appropriate actions, and produces an effective mitigation strategy that can be updated and revised to keep the plan current. In short, 'it's where we were, where we are and where we're going' in terms of hazard mitigation.

States and communities across the country are slowly, but increasingly, realizing that simply responding to natural disasters, without addressing ways to minimize their potential effect, is no longer an adequate role for government. Striving to prevent unnecessary damage from natural disasters through proactive planning that characterizes the hazard, assesses the community's vulnerability, and designs appropriate land-use policies and building code requirements is a more effective and fiscally sound approach to achieving public safety goals related to natural hazards.

In the past, Federal legislation has provided funding for disaster relief, recovery, and some hazard mitigation planning. The Disaster Mitigation Act of 2000 (DMA 2000) is the latest federal legislation to improve this planning process. It reinforces the importance of natural hazard mitigation planning and establishes a pre-disaster hazard mitigation program and new requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP) or other annual funding opportunities. Section 322 of the Act specifically addresses mitigation planning at the state and municipal levels of government. It identifies new requirements that allow HMGP funds to be used for planning activities. As a result of this Act, states and communities must now have a FEMA-approved natural hazard mitigation plan in place prior to receiving post-disaster HMGP funds. In the event of a natural disaster, municipalities that do not have an approved natural hazard mitigation plan will not be eligible to receive post-disaster HMGP funding.

A **Natural Hazard** is defined as an extreme natural event. **Natural Disasters** occur when these extreme natural events come into contact with people and property.

Natural hazard mitigation is any sustained action taken to permanently reduce or eliminate long-term risk to people and their property from the effects of natural hazards.

Natural Hazard mitigation planning is a process undertaken by a community to analyze the risk from natural disasters, coordinate available resources, and implement actions to minimize the damage to property, and injury or loss of life of its citizens before disaster occurs.

The purpose of this Plan is to recommend actions and policies for the Town of Lincoln to minimize the social and economic loss of hardships resulting from natural hazards. These hardships include the loss of life, destruction of property, damage to critical infrastructure and critical facilities, loss/interruption of jobs, loss/damage to businesses, and loss/damage to significant historical structures. To protect present and future structures, infrastructure and assets and to minimize the social and economic hardships, the Town of Lincoln implements the following general actions and policies:

- Revisions to the Town's Comprehensive Plan
- Revisions to the Town's Capital Improvement Plan
- Incorporation of hazard mitigation into the permit review process
- Local building code review

The Town of Lincoln also recognizes the important benefits associated with hazard mitigation, its interaction with municipal land use and infrastructure planning, and the need for a comprehensive planning approach, which accommodates these interdependencies. The Town's Comprehensive Plan (2009) addresses natural and cultural resources, land use, housing, economic development, community services and facilities, open space and recreation, a heritage corridor, and circulation around town. While the entire hazard mitigation plan will not be formally incorporated into the revised Comprehensive Plan, certain, applicable mitigation actions will be incorporated during the update process. The Town recognizes coordination between the HMP and the Comprehensive Plan to be of benefit because it will ensure a unified planning approach into the future and ensure that risk reduction remains a critical element of municipal planning. This is also in alignment with current goals of Rhode Island Division of Statewide Planning.

A second benefit of hazard mitigation allows for a careful selection of risk reduction actions through an enhanced collaborative network of stakeholders whose interests might be affected by hazard

losses. Working side by side with this broad range of stakeholders can forge partnerships that pool skills, expertise, and experience to achieve a common goal. Proceeding in this manner will help the Town ensure that the most appropriate and equitable mitigation projects are undertaken.

A third benefit of hazard mitigation is endorsing a proactive planning approach focused on sustainability, whereby the Town of Lincoln could minimize the social and economic hardships that have resulted from the occurrence of previous natural disasters. These social and economic hardships include: the loss of life/injuries, destruction of property, interruption of jobs, damage to businesses, and the loss of historically significant structures and facilities. This proactive planning approach would look for ways to combine policies, programs, and design solutions to bring about multiple objectives and seek to address and integrate social and environmental concerns. Linking sustainability and loss reduction to other goals can provide a framework within the state and local governments that will bring the comprehensive planning process full circle.

Lastly, the participation in a hazard mitigation planning process establishes funding priorities. The formal adoption and implementation of this plan will allow the Town of Lincoln and its residents to become more involved in several programs offered by the Federal Emergency Management Agency (FEMA) including: the Community Rating System Program (CRS); the Pre-Disaster Mitigation Assistance Program (PDM); the Building Resilient Infrastructure in Communities (BRIC); the Flood Mitigation Assistance (FMA) Program; and the Hazard Mitigation Grant Program (HMGP). Money spent today on preventative measures can significantly reduce the cost of post-disaster cleanup tomorrow.

Mission Statement and Goals:

The Town of Lincoln will protect public health and safety and create sustainable economic growth by limiting losses to lives, public and private and private property, and natural resources/systems.

Goals

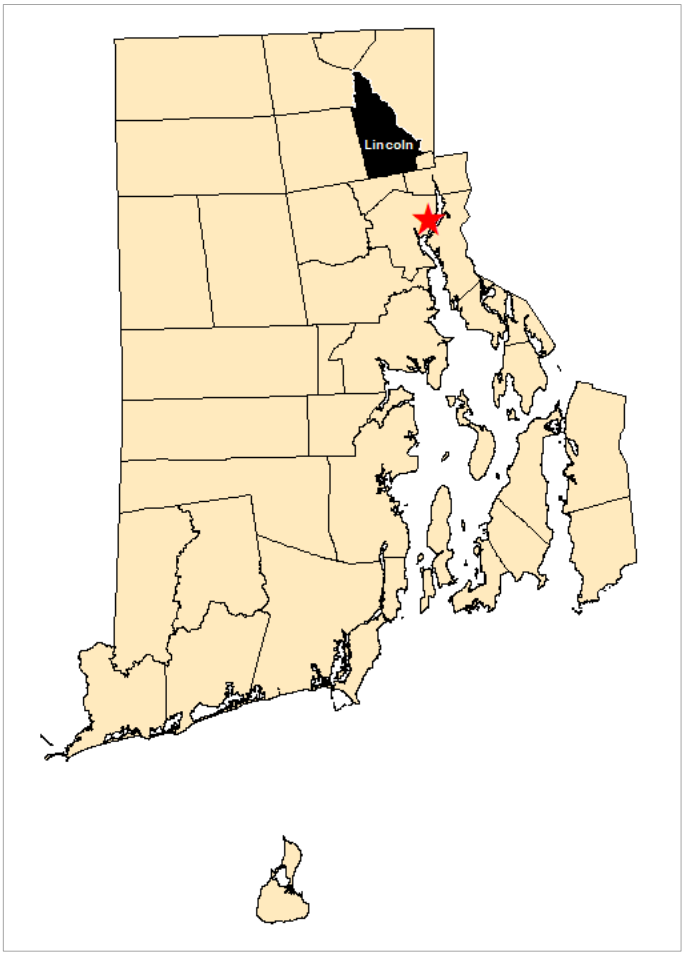
This mitigation strategy is adopted by the Town of Lincoln to present actions which help protect its citizens, visitors, businesses and property from the effects of various natural hazards. It is the intent of the Town of Lincoln to:

1. Develop and implement projects and programs which minimize losses associated with natural hazards
2. Protect critical infrastructure and maintain essential services
3. Preserve cultural, historical, and natural resources
4. Facilitate a rapid recovery process following natural disasters
5. Facilitate actions so that businesses are able to rapidly recover from a disaster.

Background

The Town of Lincoln is located in the northeast section of Rhode Island, bordered by the Towns of Smithfield and North Smithfield to the west, the City of Woonsocket to the north, the Town of Cumberland to the north and east, the City of Central Falls to the east, and the Town of North Providence and City of Pawtucket to the south. Lincoln is approximately 8 miles northwest of the capital city of Providence. The total size of the Town is approximately 12,100 acres (18.9 square miles). The Blackstone River that flows north to south makes up the town's eastern-most border with Cumberland and Central Falls.

Figure 1: Locus Map



Lincoln has an estimated population of 22,529[1] making it one of the more populated communities in Rhode Island. That puts it at #17 of the 39 cities and towns in Rhode Island for overall population count.

Lincoln's overall land use pattern is one that is primarily defined by the transportation system that runs throughout the town. Route 146 runs north to south and divides the eastern and western portions of the town. Interstate 295, a four-lane highway, runs east to west and divides the northern section of the town with the southern section. Route 116 runs parallel to I-295 which creates a corridor of easily accessible land between these two highways. Commercial and industrial development is located primarily along the 295/116 corridors and in the industrial park to the southwest of the Route 116 and Route 146 intersection. The interstates and the excellent highway system not only support modern commercial and industrial development but also have turned much of Lincoln into a suburban commuting town.

Lincoln includes the following villages: Lonsdale, Saylesville, Fairlawn, Quinnville, Lime Rock, Albion, Manville, and the Industrial Corridor.

1 United States Census Bureau, 2020.

History

In 1731, Lincoln was part of Smithfield, Rhode Island. In 1871, Lincoln became a separate town whose boundaries were finally established in 1895. As with neighboring towns in the region, agriculture was the mainstay of the economy in the 18th century with the requisite saw and grist mills to support farming. As early as the 1660s lime mining began in Lincoln at the Lime Rock quarries and evolved into a substantial industry by the late 1700s. Early roads followed presumed Native American trails along the Blackstone and Moshassuck Rivers. Great Road, also following the route of a Native American trail, was laid out in 1683. In 1804 the Louisquisset Turnpike opened connecting Providence with Lime Rock (one of Lincoln's villages) and this toll road was in operation longer than most until 1870.

First to settle in Lincoln were colonists from Providence and Quakers from Massachusetts – many escaping persecution. French-Canadians immigrated in the mid-19th century particularly to Manville and Albion where they worked in the mills. The 20th century population figures for Lincoln had risen to nearly 9,000 in 1900, increased to 11,200 by 1950 and nearly doubled in the second half of the 20th century to nearly 21,000 at the turn of the 21st century. This last growth spurt was in part due to suburbanization of Lincoln in the late 20th century.[2]

Demographics[3]

The Town of Lincoln is a residential inland community with a population of 22,529 (2020). Lincoln's population is on the average, older than the State average of 40. The median age of our residents is 43.

Approximately 19% of the population is over 65. The Town of Lincoln is predominantly white at 91.4%, Hispanic or Latino 4.5%, Asians 3.4%, Black or African Americans make up 1.4%. A language other than English is spoken in 16% of the homes.

The 2019 American Community Survey 5-Year Survey Estimates reported an estimate of 8,863 housing units which is an increase of 0.5% from the 2010 Census count. Approximately 22% of the housing units were built before 1939. Approximately 61% of the housing units are single family detached or attached (condo). The remaining 30% of the housing units are considered multi-family. The greatest concentration of multi-family housing units is located in the village of Manville which is located in the northern section of Town.

Economic Conditions

According to the 2019 American Community Survey 5- Year Estimates, the median household income of Lincoln residents is $81,045.

2 Lincoln Reconnaissance Report, Blackstone Valley Heritage Landscape Inventory. December 2010. Rhode Island Historic Preservation and Heritage Commission and Blackstone River Valley National Heritage Corridor Commission. Microsoft Word - Lincoln Report 12-12-10.doc (blackstoneheritagecorridor.org)

3 For the purpose of this element, the most comprehensive data set is from 2019. United States Census, 2019 ACS 5-Year Estimates https://data.census.gov/cedsci/profile?g=0600000US4400741500

Businesses occupy 23% of Lincoln's taxed land base. Lincoln's economic success is linked to the availability of business land along a regional highway network, small village-based business centers, and a high proportion of day to night population and location of high-tech business corporations.[4]

Annually, about 69% of the 8,066 occupied housing units in Lincoln are owner-occupied (compared to 60% for the state), and median family income ($81,045) is higher than the statewide median family income of $75,655. Over seven percent of the population has income below the poverty level.

Table 1 Demographic Changes

	2010	2019	% Change
Housing Units (total)	8,822	8,863	0.5%
Population	21,120	21,731	2.9%
Owner-occupied housing units	8,360	8,066	-3.5%

Government

The Town of Lincoln is governed by an elected Town Council with five (5) members, elected every two (2) years. The elected Town Administrator is responsible for the execution of laws and the administration of Town government.

Land Use Patterns

Lincoln's overall land use pattern is one that is primarily defined by the transportation system that runs throughout the town. Route 146 runs north to south and divides the eastern and western portions of the town. Interstate 295, a four-lane highway, runs east to west and divides the northern section of the town with the southern section. Route 116 runs parallel to I-295 which creates a corridor of easily accessible land between these two highways. Commercial and industrial development is located primarily along the 295/116 corridors and in the industrial park to the southwest of the Route 116 and Route 146 intersection. The interstates and the excellent highway system not only support modern commercial and industrial development but also have turned much of Lincoln into a suburban commuting town. Functioning, vacant, redeveloped mills, and underutilized mill complexes can be found in the villages of Manville, Albion, Lonsdale and Saylesville.

The villages of Lincoln are very clearly defined and relatively healthy. Their sizes range from fewer than 100 homes in the Quinnville section to thousands of homes in the Sayles and Fairlawn section of town. This variety of density has created a large variety of housing types, and asset rarely found in most suburban communities.

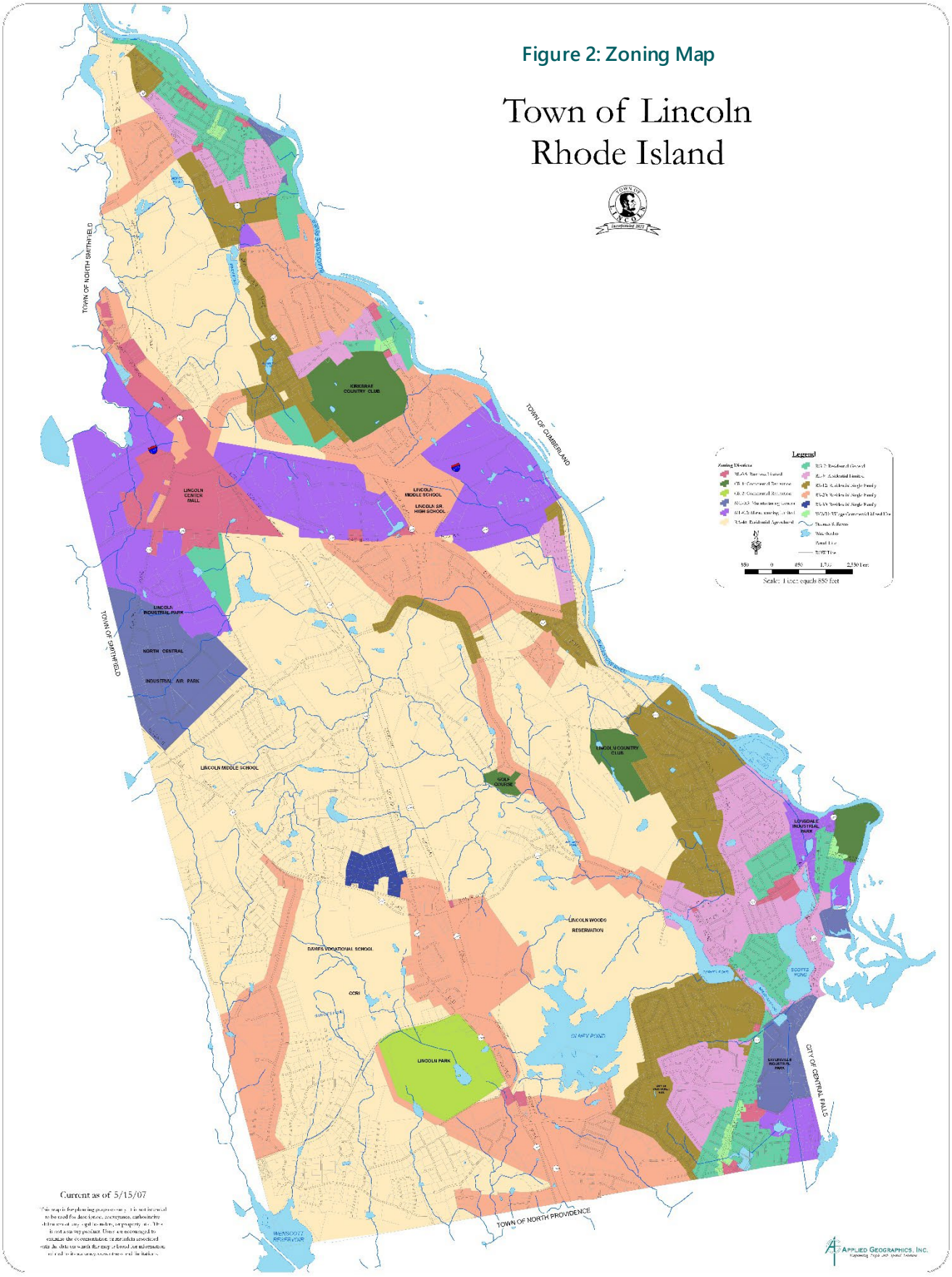
The significant divisions within the town along fire district and school district lines have preserved the village orientation within the Town of Lincoln."[5]

The latest (2011) depiction of land use throughout the town can be seen in Figure 2, Zoning Map.

4 Town of Lincoln Comprehensive Plan Update, 2003.

5 2003 Comprehensive Plan Update, Land Use Element

Figure 2: Zoning Map



Roads and Bridges

There are about 105 miles of municipal-owned roadways in Lincoln. Of those, most are minor arterials and collector roads. Collector roads handle low to moderate volume traffic, providing vehicular access to residential areas. Local roads connect to residential neighborhoods and provide access primarily for single and multi-family family homes to connect to the collector and arterial road system.

Three limited access highways in town (Interstate 295, Route 146, and Route 99) provide major intercity connections north and south of Lincoln.

There are no large suspension bridges in Lincoln however there are numerous roads that span the Blackstone River and Crookfall Brook in the northwest corner of town. Major bridges include the St. John Bridge, Whipple Bridge, Martin Street Bridge, George Washington Highway (Route 116) Bridge, I-295 Overpass Bridge, the Albion Bridge, Route 120 Bridge over the Crookfall Brook, Route 146 over Crookfall Brook, and Reservoir Road over Crookfall Brook.

Dams

In 2018 the Department of Environmental Management (DEM) identified 20 dams in the Town of Lincoln. Nine of the 20 dams are classified as high hazard dams, the remainder are identified as low hazard dams.

High Hazard Dam – where failure or misoperation will result in probable loss of human life

Significant Hazard Dam – where failure or misoperation will result in no probable loss of human life but can cause major economic loss, disruption of lifeline facilities or impact other concerns detrimental to the public's health, safety or welfare.

Low Hazard Dam – where failure or misoperation will result in no probable loss of human life and low economic losses.

Utilities

The Lincoln Water Commission, a quasi-municipal agency, operates the local public water system distribution system. The majority of Lincoln residents and businesses purchase water from the Providence Water Supply Board.[6]

Drinking water from all sources is delivered to the consumers in Lincoln through a distribution system that includes five (5) pumping stations, five (5) storage tanks, and 133 miles of pipes. Water services to each building include a connection to the main pipe, a shut-off valve, and a water meter. Water is available for firefighting through more than one thousand public and private fire hydrants. The Lincoln Water Commission owns a single municipal well in Lonsdale and maintains pipeline connections with the surrounding communities of Woonsocket, Cumberland, and Pawtucket to provide water in case of emergencies or during periods of high demand.

The Town of Lincoln is serviced by public sewer. The town currently has 32 sewer pumping stations, four public water storage tanks, and regional electric, gas, and regional sewer mains throughout the town. The Town of Lincoln is responsible for the local public sanitary sewer (wastewater) system. The

[6] University of Rhode Island Cooperative Extension. 2003. *Cumberland, Lincoln, and Pawtucket Water Assessment.*

Narragansett Bay Commission (NBC), a quasi-state agency, owns and operates several sewage interceptors that connect to the local system and ultimately carry the majority of the town's wastewater to their Bucklin Point facility. Wastewater from the southwestern portion of town goes to the NBC's Field's Point Facility. The NBC also owns and operates three pump stations; two of which are located in town. These pump stations include Saylesville Pump Station and Washington Highway Pump Station.

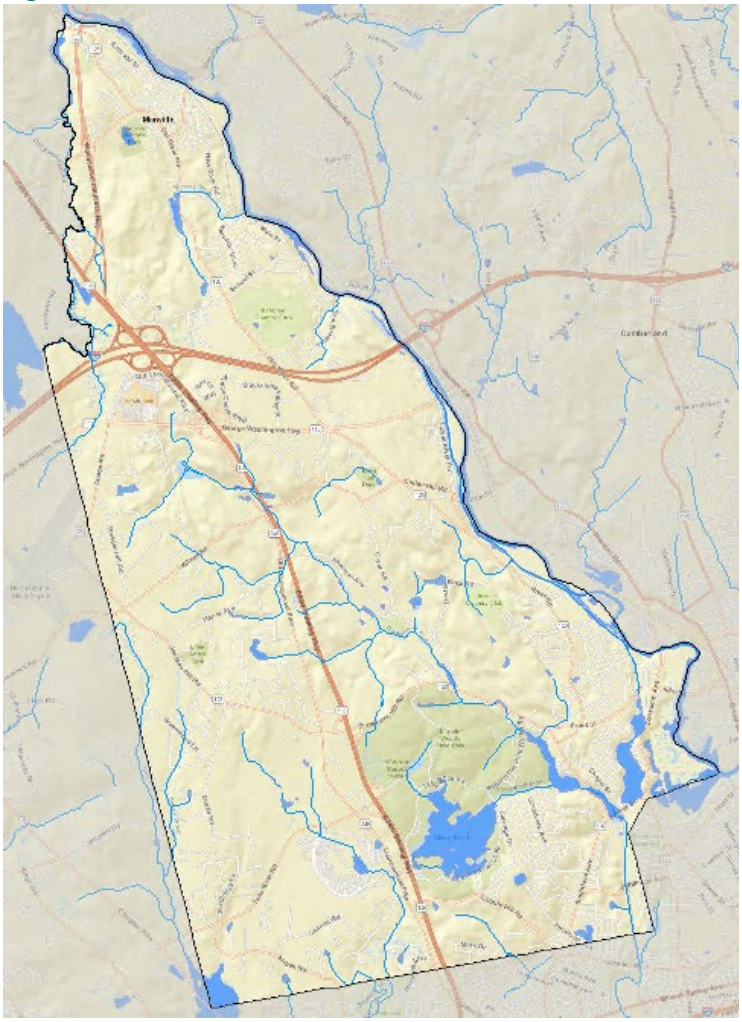
National Grid is responsible for delivering natural gas and electricity throughout town. While regional gas, electric, and sewer utilities are regularly maintained by the entities that own them, the Town's public utility infrastructure is maintained as needed.

The Town of Lincoln's communication equipment is located throughout the town. Private cellular towers are also located throughout the town.

Water Resources

The most significant natural feature in Lincoln is the Blackstone River. It defines the town's land boundaries to the east and was the genesis for development of Lincoln's early industrial economy. The second largest water resource is the Moshassuck River and its tributary the West River. Most of the runoff from the highway system drains into the Moshassuck. Crookfall Brook is another significant water resource which drains the newer industrial and commercial areas along Route 116 in town.

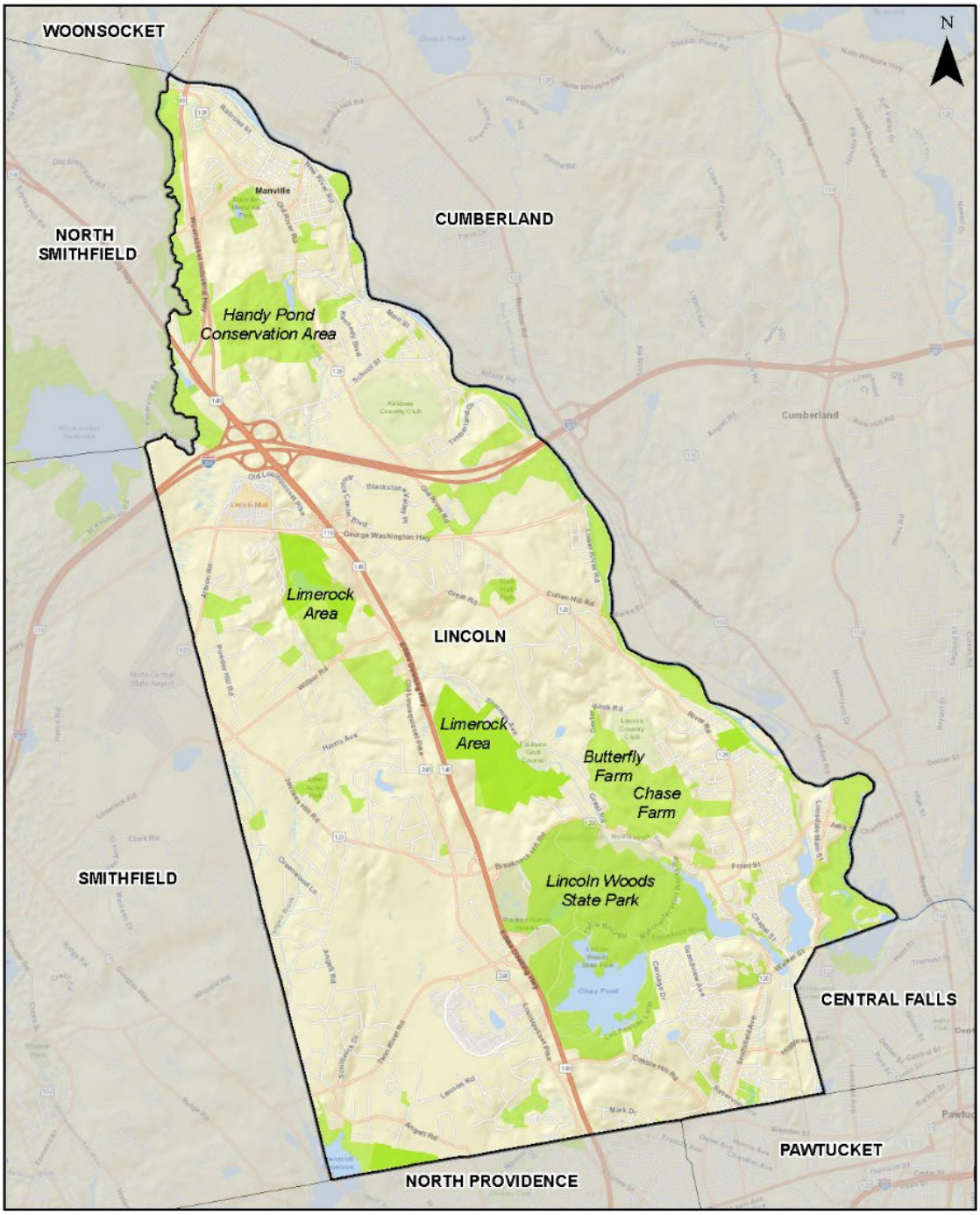
Figure 3: Water Resources



Forest and Open Space

Forested open space is well dispersed throughout the town and includes land of both active and passive recreational value as well as lands of ecological significance. Currently there are an estimated 25,777 acres (21.3%) of land protected as open space. Maintaining the greenbelt around the villages of Lonsdale, Fairlawn and Saylesville, as well as the 150-acre ribbon of land along the Blackstone River have been important natural features which maintain the town's character.

Figure 4: Conservation Land



Cultural and Historic Resources

Lincoln's inventory of historic and natural/environmental resources is quite extensive. The town's goal of protecting at least 30% of the land area (currently 27% open space) has resulted in a significant number of publicly owned open spaces and historic properties. These lands include both active and passive recreation areas, a variety of natural areas, and historical features such as Chase Farm, Hannaway Blacksmith Shop, and the Blackstone River Bike Path. One of the largest natural resource is the State-owned and managed Lincoln Woods.

The Town of Lincoln has seven National Register Historic Districts- Albion, Blackstone Canal, Great Road, Lime Rock, Lonsdale, Old Ashton, and Saylesville.

There are 21 sites listed on the National Register of Historic Places or within Historic Districts, and 7 sites are eligible for listing.

Development Trends Since the 2016 Plan

Lincoln continues to experience high development pressures. The amount of developable land has significantly decreased. Once less desirable areas along steep slopes or ledge outcrops are now being developed. Heavy rain events stress the site-specific soil erosion control methods and can cause them to fail on these steeper slopes. Ledge outcrop reduction and/or complete removal in order to construct home site stress the established surrounding areas. In 2016, the State's Subdivision and Land Development legislation was amended to allow for steep slopes of the land and wetland buffer areas to be included in the calculation of buildable lot area. This change increased the number of buildable lots on land. Before 2016, the Town of Lincoln excluded the area of steep slopes and wetland buffers from being included in the calculation of buildable lot area.

Future development is anticipated to consist of infill development throughout the town as well as the continued development of less desirable areas utilizing more advanced construction methods. Consequently, more advanced engineered controls will be required and inspected more frequently.

2

Planning Process

Overview

The Town of Lincoln initiated the hazard mitigation planning effort in 2021 at the recommendation of the Town EMA Director and Town Planner. This Hazard Mitigation Plan Update is the result of a dedicated group of individuals working for nine months identifying natural hazards and proposing ways to improve Lincoln's resiliency.

Lincoln Hazard Mitigation Committee

This updated Hazard Mitigation Plan (HMP) is a product of the Lincoln Hazard Mitigation Committee (HMC). The 2021/2022 Committee members include:

- Lawrence Filippelli, School Department
- Ron Frasier, Twin River
- Michael Gagnon, Public Works
- Francine Jackson*, Conservation Commission
- William McManus*, Resident
- Roger Pierce, Building Official
- Leslie Quish*, Engineering
- Albert Ranaldi, Planning
- Brian Sullivan*, Police Chief and Acting Town Administrator
- Karen Tarantino, Lincoln Commons (Acadia Realty)
- Sean Thompson, Lincoln EMA Director
- Peggy Weigner*, Planning Assistant
- Nicole Dotzenrod, Valley Breeze (weekly newspaper)

* denotes Lincoln resident.

The Planning Process

This 2022 HMP update is the result of a 7-step process that was initiated in January 2021 with the establishment of the HMC. Membership of the HMC consisted of town staff and positions that participated in the development of the previous Hazard Mitigation Plan completed in 2016, by invitation from the Town Planner. The Town hired a consultant to assist with this planning effort.

Step two started the plan development process and included the first meeting of the HMC on January 28, 2021. The HMC met virtually every month on Zoom.

The Town's previous plan was dated 2016, so the first meeting focused on re-ranking hazards and discussing the process for updating the plan. At this initial meeting, the group reviewed a set of questions to be included in an online public survey. The purpose of the survey was to capture the local residents' perception of natural hazards.

The link to the survey was widely distributed on social media and on the Town's website. Over 20 people responded to the survey. See Appendix A for survey results.

Step three began with the HMC meeting on February 25, 2021. After reviewing the hazards of concerns and survey results, the HMC identified critical infrastructure and community assets within the town. Fourteen areas of vulnerability were identified: flood prone drainage systems/streets, or infrastructure; bridges; wastewater; water supply; electric utilities; public communication equipment; dams; critical municipal hazard response facilities; populations; businesses; schools; natural resources; recreational facilities; and historic resources.

During this early phase, the Town's consultant reviewed the existing Comprehensive Plan, local ordinances, and gathered information on current infrastructure projects going on within the town.

Current town capabilities were discussed at the meeting on February 25, 2021. Many different departments, committees, and programs already engage in activities that help Lincoln become more resilient to a variety of hazards. It is important to highlight these capabilities and show how they support the Town's hazard mitigation efforts.

Step four was creating an updated list of mitigation actions to reduce the impact to the identified vulnerable areas. At the March 25, 2021 meeting, the HMC reviewed goals and mitigation items that were proposed in the 2016 plan. Status updates were given for all the previous actions. The incomplete actions that were still important were rolled into the list of actions for this 2021 plan update. The HMC also began to brainstorm new mitigation actions at this meeting.

Step five was begun at the April 19, 2021 meeting where the group continued to with proposing new actions, establishing action timelines, costs, and identifying responsible parties.

Step six focused on the prioritization of the mitigation actions. This occurred towards the end of the April 29th meeting. After this meeting the consultant finished the draft of the plan for committee review.

Step seven furthered the public input and review process with the Lincoln Town Council, and the general public for review and comment. See *Public Input* below.

Table 2 below provides a summary of the Committee's meeting dates and the activities that they conducted:

Table 2 Committee Meetings

Date	Meeting Summary
01/28/2021	› Kick off meeting with new contractor, VHB. HMC discussed the plan purpose and hazards of concern. Reviewed survey questions.
02/25/2021	› The HMC reviewed the hazards of concern and listed critical infrastructure and community assets.
03/01/2019	› Hazards survey posted online.
03/25/2021	› Review of community assets and discussion of current capabilities. › Review status of 2016 actions.
04/29/2021	› Finalized mitigation actions and discussed prioritization
12/01/2021	› Plan review by the HMC
02/15/2022	› Distributed to Town Council and Town Administrator
02/28/2022	› Posted for public comment and sent neighboring towns
03/14/2022	› Received comments from public and Town Council
04/07/2022	› Sent to RIEMA for review
04/29/2022	› Sent to FEMA for approval
05/17/2022	› Plan adopted by the Town Council

Public Input

This hazard mitigation plan benefits from various distinct types of public input strategies that were utilized by the HMC during the drafting process and prior to its adoption by the Town Council. Public input for the updated Lincoln Hazard Mitigation Plan was primarily collected through a public survey, public meetings and an invitation to comment.

Early in the planning process, the HMC promoted and distributed a "Hazard Perceptions" survey online. The purpose of the anonymous survey was to hear from residents the hazards and neighborhoods they are most concerned about. Over 20 individuals participated in the survey. Not surprisingly, most were concerned about Hurricanes/Tropical Storms/Nor'easters, winter storms, and high winds. The survey also provided the HMC with a list of problematic areas that are susceptible to flooding. The HMC used the input from the survey to focus their mitigation planning efforts.

The 2021/2022 HMC included town residents and local employees. The HMC's roles focused on reviewing the content of the risk assessment matrix to ensure proper classification of problems and estimates of potential impacts; formulation of mitigation actions and

sequencing of primary tasks; and identification of feasible implementation methods and schedules. Their comments were incorporated into the final 2021 hazard mitigation plan.

Prior to public release of the 2022 HMP, the HMC drafted the plan through a series of committee meetings. While these meetings did not rise to the level of public hearings, they were posted on the Secretary of State's website and were open to the public. Local media and businesses did occasionally attend.

Another public input strategy was geared toward the general public as opposed to specific stakeholders. On February 15, 2022, the Town Council received a presentation on the Hazard Mitigation Plan Update. Comments from the Council at this time centered around funding for the various mitigation actions and aligning the Town to be in good standing to receive additional FEMA grants.

Starting on February 28, during the draft review portion of the plan development, an electronic copy of the draft 2022 HMP was available on the Town's website and available at the Town Library for review. The public and neighboring communities were informed of this two-week review period via the Town's website and social media posts. Reviewers were encouraged to read the document and send any questions or suggested edits to the Town Planner. See Appendix B.

During the public review period, a one comment was received suggesting that the plan address black mold which may be found in historical buildings used for low-income housing. As second comment from the City of Woonsocket suggested that the Town of Lincoln consider an action item to conserve land abutting reservoirs #1 and #3 and their tributaries to protect the quality of the water supply.

Review and comments from the Federal Emergency Management Agency and the Rhode Island Emergency Management Agency were also incorporated prior to adoption by the Town Council.

3

Natural Hazards

Hazards of Concern

The Rhode Island 2019 State of Rhode Island State Hazard Mitigation Plan Update Draft and Lincoln 2016 Hazard Mitigation Plan were used as a starting point for identifying hazards that pose the largest threat to the Town. The following table summarizes the hazards identified by the Lincoln Hazard Mitigation Committee.

Table 3 Hazards Identified by the Lincoln Hazard Mitigation Plan Committee

Natural Hazards Identified by the State	Identified by the LHM Committee	Notes
Severe Winter Weather		
Ice Storm	✓	
Snow	✓	
Flood		
Riverine	✓	
Coastal	–	Lincoln is not on the coast.
Flash	✓	
Urban/Street	✓	
High Wind	✓	
Extreme Heat	✓	
Hurricane and Tropical Storms		
Nor'easter	✓	
Storm Surge	–	Lincoln is not on the coast.
Extreme Cold	✓	
Thunderstorm		
Hail	✓	
Lightning	✓	
Dam Failure	✓	

Table 3 Hazards Identified by the Lincoln Hazard Mitigation Plan Committee

Natural Hazards Identified by the State	Identified by the LHM Committee	Notes
Fire		
Urban	–	Focus on natural hazards
Wildfire/Brushfire	✓	
Sea Level Rise	–	Lincoln is not on the coast.
Infectious Disease	–	
Drought	✓	
Earthquake	✓	
Tornado	✓	
Human-Caused Hazards		
Cyber Security	–	Not covered by this natural hazard plan
Chemical Incident	–	Not covered by this natural hazard plan
Terrorism	–	Not covered by this natural hazard plan
Biological Incident	–	Not covered by this natural hazard plan
Radiological Incident	–	Not covered by this natural hazard plan
Civil Unrest	–	Not covered by this natural hazard plan
Technological Hazards		
Infrastructure Failure	–	Not covered by this natural hazard plan

During the beginning phases of the planning process, the Hazard Mitigation Committee participated in an exercise that captured the frequency of various hazards, their potential damage extent, and their impacts (i.e. to populations, infrastructure, natural environment, etc.). The following scales were used during the analysis:

Probability of Future Occurrence	
Highly likely:	Near 100% probability within the next year;
Likely:	Between 10% and 100% probability within the next year or at least one chance in next 10 years;
Possible:	Between 1% and 10% probability within the next year or at least one chance in next 100 years;
Unlikely:	Less than 1% probability in next 100 years.
Damage Extent	
Low:	Some local property damage not town wide, minor injuries/ loss of life
Medium:	50% of property could be damaged and possible injuries/ loss of life
High:	Major town wide property damage, injuries and loss of life.
Level of Concern/Risk Rank	
Developed by the HMC to rank the various hazards based on frequency and damage potential.	
Low:	Not expected to occur with any frequency, damages will be limited.
Medium:	Will occur within the next 10 years but the Town has resources to reduce risks.
High:	Expected to occur within the next 5 years and is a major concern for the town. Town-wide impacts.

Based on a combination of probability of future occurrence, damage extent and impacts, the team assigned each hazard a Level of Concern. The table below summarizes the hazards of concern for the Town of Lincoln, ranked from a high concern to low concern

Table 4 Hazards Ranked

Hazard	Level of Concern/Risk Rank
High Wind/Microburst	High
Flooding (Heavy Rain/Runoff)	High
Hurricane/Nor'easter	High
Winter Weather (Snow, Ice, Cold)	Medium
Lightning	Medium Low
Tornadoes	Medium Low
Brushfires	Low
Dam Failure	Low
Drought	Low
Earthquakes	Low
Heat Wave	Low
Landslides	Low

In this hazard mitigation plan, climate change is treated as an ongoing amplifier to the identified natural hazards, not profiled as an independent hazard. "Extreme weather events have become more frequent during the past half-century, and this trend is projected to continue.[7] For instance, more frequent intense precipitation events may translate into more frequent flooding episodes. The National Climate Assessment and Development Committee has documented that the average temperature across the United States has increased 1.5°F since 1895, with the majority of the increase since 1980. Weather events have and will continue to become more intense and frequent and will result in health and livelihood related impacts such as water supply, agriculture, transportation, and energy. The impact of dynamic storm events includes, but is not limited to, more frequent and intense heat waves, increases in ocean and freshwater temperatures, frost-free-days, heavy downpours, floods, sea level rising, droughts, and wildfires." [8]

Climate change impacts will be mentioned for each hazard.

The following subsections are organized by the level of risk as identified in Table 4, Hazards Ranked.

7 IPCC, 2012 - Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (Eds.) Available from Cambridge University Press, The Edinburgh Building, Shaftesbury Road, Cambridge CB2 8RU ENGLAND, 582 pp.

8 National Climate Assessment and Development Advisory Committee (NCADAC) January 2013 Draft Climate Assessment Report. http://ncadac.globalchange.gov/

High Winds

Description

Wind is the movement of air caused by a difference in pressure from one place to another. Local wind systems are created by the immediate geographic features in a given area such as mountains, valleys, or large bodies of water. National climatic events such as high gale winds, tropical storms, thunderstorms, nor'easters, hurricanes, and low-pressure systems produce wind events in Rhode Island. Wind effects can include blowing debris, interruptions in elevated power and communications utilities, and intensification of the effects of other hazards related to winter weather and severe storms.

Table 5 Beaufort Scale

Beaufort Number	Description	Wind Speed (km/h)	Observations
0	Calm	<1	Smoke rises vertically
1	Light Air	1-5	Smoke drifts slowly
2	Light Breeze	6-11	Leaves rustle, wind vanes move
3	Gentle Breeze	12-19	Leaves and twigs on trees move
4	Moderate Breeze	20-29	Dust picked up from ground
5	Fresh Breeze	30-38	Small trees sway in wind
6	Strong Breeze	39-51	Large branches move
7	Near Gale	51-61	Trees move, hard to walk
8	Gale	62-74	Twigs break off trees
9	Strong Gale	75-86	Branches break off trees
10	Whole Gale	87-101	Trees uprooted
11	Storm	102-120	Buildings damaged
12	Hurricane	>120	Severe building and tree damage

The Beaufort Wind Scale is a 12-level scale used to describe wind speed and observed wind conditions at sea and on land. A wind classification of 0 has wind speeds of less than 1 mile per hour are considered calm. On the other end, a classification of 10 with wind speeds reaching 63 miles an hour will blow down trees and cause considerable damage.

Location

Wind events are expected throughout the year in Lincoln.

Probability of Future Occurrence

Highly Likely.

Extent (Event Magnitude)

The windier part of the year lasts for 6.0 months, from October 28 to April 26, with average wind speeds of more than 5.8 miles per hour.[9]

Impact and Damage Extent

Strong wind gusts of 40 miles an hour (Beaufort Scale of 8) can blow twigs and small branches from trees. Occasional gusts and sustained winds at this speed (and above) are of concern to the Town. Damages from wind events range from power outages, property damage to vehicles and buildings and fallen trees/limbs. Previous wind events in Lincoln have resulted primarily in power outages and downed tree limbs with minimal property damage. It is important that the Town of Lincoln maintain their public tree trimming program that will reduce the likelihood of fallen trees/limbs from disrupting transportation routes, taking down power lines, and/or creating damage to the tree canopy.

Climate Change Impacts

Changes in atmospheric circulation are predicted to occur. See "Hurricanes and Nor'easters."

History[10]

Table 6 Recent History of High Winds in the Lincoln Area

Date	Magnitude (kts)	Comments
10/29/12	50	Hurricane Sandy brought heavy winds
01/31/13	56	High wind event across much of Southern New England.
06/23/15	50	Thunderstorm event, several trees and wires down in neighboring North Providence.
07/23/16	40	Thunderstorm that also produced hail. In neighboring Cumberland, 3" to 5" diameter tree limbs were downed by the high winds.
08/06/16	50	Thunderstorm wind which caused tree damage
10/07/20	53	Widespread tree and power line damage from what was later classified as a "derecho."

9 WeatherSpark https://weatherspark.com/y/26130/Average-Weather-in-Lincoln-Rhode-Island-United-States-Year-Round accessed 02/02/2021

10 NOAA Storm Event Database (2021)

Hurricanes

Description

Tropical cyclones, a general term for tropical storms and hurricanes, are low pressure systems that usually form over the tropics. These storms are referred to as "cyclones" due to their rotation. Tropical cyclones are among the most powerful and destructive meteorological systems on earth. Their destructive phenomena include very high winds, heavy rain, lightning, tornadoes, and storm surge. As tropical storms move inland, they can cause severe flooding, downed trees and power lines, and structural damage (Rhode Island State Hazard Mitigation Plan 2019).

There are three categories of tropical cyclones:

1. Tropical Depression: maximum sustained surface wind speed is less than 39 mph
2. Tropical Storm: maximum sustained surface wind speed from 39-73 mph
3. Hurricane: maximum sustained surface wind speed exceeds 73 mph

Once a tropical cyclone no longer has tropical characteristics it is classified as an extratropical system (Rhode Island State Hazard Mitigation Plan 2019).

Most Atlantic tropical cyclones begin as atmospheric "easterly waves" that propagate off the coast of Africa and cross the tropical North Atlantic and Caribbean Sea. When a storm starts to move toward the north, it begins to leave the area where the easterly trade winds prevail and enters the temperate latitudes where the westerly winds dominate. This situation produces the eastward curving pattern of most tropical storms that pass through the Mid-Atlantic region. When the westerly steering winds are strong, it is easier to predict where a hurricane will go. When the steering winds become weak, the storm follows an erratic path that makes forecasting very difficult (Rhode Island State Hazard Mitigation Plan 2019).

Hurricanes are categorized according to the Saffir/Simpson scale (Table 7) with ratings determined by wind speed and central barometric pressure. Hurricane categories range from one (1) through five (5), with Category 5 being the strongest (winds greater than 155 mph). A hurricane watch is issued when hurricane conditions could occur within the next 36 hours. A hurricane warning indicates that sustained winds of at least 74 mph are expected within 24 hours or sooner (Rhode Island State Hazard Mitigation Plan 2019).

The Saffir-Simpson scale below is based primarily on wind speeds and includes estimates of barometric pressure and storm surge associated with each of the five categories. It is used to give an estimate of the potential property damage and flooding expected along the coast from a hurricane landfall.

Table 7 Saffir/Simpson Hurricane Wind Scale[11]

Wind Speed	Typical Effects
Category 1 – Weak 74-95 MPH (64-82kt)	*Minimal Damage:* Damage is primarily to shrubbery, trees, foliage, and unanchored mobile homes. No real damage occurs in building structures. Some damage is done to poorly constructed signs.
Category 2 – Moderate 96-110 MPH (83-95kt)	*Moderate Damage:* Considerable damage is done to shrubbery and tree foliage; some trees are blown down. Major structural damage occurs to exposed mobile homes. Extensive damage occurs to poorly constructed signs. Some damage is done to roofing materials, windows, and doors; no major damage occurs to the building integrity of structures.
Category 3– Strong 111-130 MPH (96-113kt)	*Extensive Damage:* Foliage torn from trees and shrubbery; slarge trees blown down. Practically all poorly constructed signs are blown down. Some damage to roofing materials of buildings occurs, with some window and door damage. Some structural damage occurs to small buildings, residences and utility buildings. Mobile homes are destroyed. There is a minor amount of failure of curtain walls (in framed buildings).
Category 4 – Very Strong 131-155 MPH (114-135kt)	*Extreme Damage:* Shrubs and trees are blown down; all signs are down. Extensive roofing material and window and door damage occurs. Complete failure of roofs on many small residences occurs, and there is complete destruction of mobile homes. Some curtain walls experience failure.
Category 5 – Devastating Greater than 155 MPH (135kt)	*Catastrophic Damage:* Shrubs and trees are blown down; all signs are down. Considerable damage to roofs of buildings. Very severe and extensive window and door damage occurs. Complete failure of roof structures occurs on many residences and industrial buildings, and extensive shattering of glass in windows and doors occurs. Some complete buildings fail. Small buildings are overturned or blown away. Complete destruction of mobile homes occurs.

Location

Lincoln's close proximity to the Atlantic Ocean renders it particularly susceptible to hurricanes and the resulting loss of human life and property.

Probability of Future Occurrence

Likely.

Extent (Event Magnitude)

Hurricanes that likely make it up to Rhode Island are usually weak (Category 1) or downgraded tropical systems. The wind speeds may be less but the storms can still bring a lot of rain which can cause widespread flooding.

Impact and Damage Extent

Hurricane strength storms can cause riverine and street flooding. Extensive rain and could damage homes, roads, and cripple the town. The high winds could down power lines and trees, and damage older structures. During extremely dangerous conditions, the Town may

11 National Weather Service, National Hurricane Center

elect to open shelters. Damage extent is dependent upon the size and timing of the storm. A slow-moving storm may bring more rain to the area than a fast-moving storm.

Climate Change Impacts

Warming global air and water temperatures may increase the intensity of hurricanes that travel along the Atlantic Coast.

History

In 2011, Hurricane Irene hit Lincoln as a tropical storm. Despite the relatively low wind speeds, sustained winds over a 6 to 12-hour long duration resulted in widespread tree damage and resulted in power outages to roughly half a million customers throughout the state. Numerous trees, poles, and wires were downed throughout the area. Local roads were also flooded. Collective effects throughout Massachusetts and Rhode Island resulted in 1 fatality, no injuries, and $127.3 million in property damage.[12]

In October 2012, Hurricane Sandy severely impacted coastal Rhode Island as it came ashore with Tropical Storm strength winds. Lincoln was mainly impacted by high winds. Tree damage was widespread.

Tropical Storm Isaias (downgraded from a hurricane) knocked out power to tens of thousands of Rhode Island residents on the evening of August 4, 2020. Heavy rain and strong winds led to tree damage throughout town.

Tree damage on private property on August 4, 2020.

Nor'easters

Description

A strong low-pressure system along the Mid-Atlantic and New England can form over land or over coastal waters. The storm radius is often as large as 1,000 miles, and the horizontal storm speed is about 25 miles per hour, traveling up the eastern United States coast. Sustained wind speeds of 10-40 MPH are common during a nor'easter, with short term wind speeds gusting up to 70 MPH. Typically a winter weather event, Nor'easters are known to produce heavy snow, rain and heavy waves along the coast. Unlike hurricanes and tropical storms, Nor'easters can sit offshore, wreaking damage for days.

12 NOAA Storm Event Database (accessed May 2021).

Also called East Coast Winter Storms, Nor'easters are characterized by:

- A closed circulation.
- Located within the quadrilateral bounded at 45N by 65W and 70W, and at 30N by 85W and 75W.
- Show a general movement from the south-southwest to the north-northeast.
- Contain winds greater than 23 mph.
- The above conditions must persist for at least a 12-hour period[13].

The magnitude or severity of a severe winter storm or Nor'easter depends on several factors including a region's climatological susceptibility to snowstorms, snowfall amounts, snowfall rates, wind speeds, temperatures, visibility, storm duration, topography, and time of occurrence during the day (e.g., weekday versus weekend), and season.

The extent of a severe winter storm (including Nor'easters that produce snow) can be classified by meteorological measurements and by evaluating its combined impacts. For measuring wind effects, the Beaufort Wind Scale is a system that relates wind speed to observed conditions at sea or on land (See Figure 5). The snow impact of a Nor'easter can be measured using NOAA's Regional Snowfall Index (See the section *Winter Storms*).

Location

Lincoln's close proximity to the Atlantic Ocean renders it particularly susceptible to Nor'easters and the resulting damages and loss of human life and property.

Probability of Future Occurrence

Likely.

Extent (Event Magnitude)

On average, Lincoln experiences or is threatened by a Nor'easter every year or two.

Impact and Damage Extent

Most damage in Lincoln would be to utilities, roads, stormwater infrastructure, personal property, trees, and snow loads on roofs. Expected damages are similar to those from a hurricane. The Blizzard of 1978 was the largest Nor'easter on record. Many people in Rhode Island were without heat and electricity for over a week.

Climate Change Impacts

Similar to hurricanes, changes in air and water temperatures may lead to stronger Nor'easters along the Atlantic Ocean. Lincoln should expect stronger and more frequent severe storms.

13 Hersher, et al. An East Coast Winter Storm Climatology. Northeast Regional Climate Center, Cornell University, Ithaca, NY, 2001.

History

Table 8 Nor'easter History[14]

Date	Comments
02/10/1969	Up to 20 inches of snow in parts of Rhode Island.
02/06/1978	Catastrophic snowstorm in Southern New England. 3' of snow reported in nearby Providence.
02/11/1994	Major Nor'easter in the region. School closed by noon, business and highway travel disrupted.
02/18/1998	Heavy rainfall, isolated flash floods, and thunderstorms to mainly central and southern Rhode Island. 2.16 inches of rain at T.F. Green Airport in nearby Warwick during a 12-hour period.
02/23/1998	Second Nor'easter to affect region in less than one week brought heavy rainfall and strong winds. 2" of rain fell in nearby Coventry.
03/21/1998	Spring nor'easter brought a mixture of snow, sleet, and rain to Rhode Island. Over the northern half of the state, snow accumulation was from 2 to 4.5 inches.
05/25/2005	Late season Nor'easter brought strong winds and heavy rains, some gusts as high as 60 mph.
02/12/2006	A strong Nor'easter produced heavy snow and windy conditions across Rhode Island. Snowfall ranged from 9 to 14 inches.
03/2018	Three (3) Nor'easters in the month of March brough high winds, rain, and eventually snow throughout the area.
12/05/2020	Nor'easter with winds gusting at 40-45mph.
01/31/2021	Up to 12 inches of heavy wet snow and gusty winds in Lincoln.

14 NOAA Storm Event Database, Providence County. https://www.ncdc.noaa.gov/stormevents/

Flooding (Riverine)

Description

Riverine flooding occurs when heavy rainfall or snow melt causes the water in rivers and streams to flow over their banks. The severity of the flood depends on the saturation of the surrounding ground, the amount of precipitation, and duration of the event. Riverine flooding is most likely to occur in the late summer and early spring due to snow melt and spring rainfalls.

Swollen Blackstone River at the Cumberland/Lincoln Town Line, March 2010.

Location

During the March 2010 flood event, the Blackstone River reached record heights. Overtopped riverbanks combined with heavy rain and a high-water table can easily flood parts of town. Low-lying areas around the Blackstone River are the most vulnerable.

Probability of Future Occurrence

Riverine flooding is likely. More likely conditions include the addition of locally heavy rainfall or snowmelt on land.

Extent (Event Magnitude)

Localized flooding can be expected to occur on an annual basis. The flood event which occurred in March 2010 was a 250 year +/- event with about 5 ½ inches of rain in a short period of time.

Impact and Damage Extent

Damages are localized but can be serious. In addition to inconveniencing populations, severe flooding can impact the wastewater infrastructure and local businesses.

Bridges along the flooded rivers can be compromised as waters rise and scour away at the foundations.

Climate Change Impacts

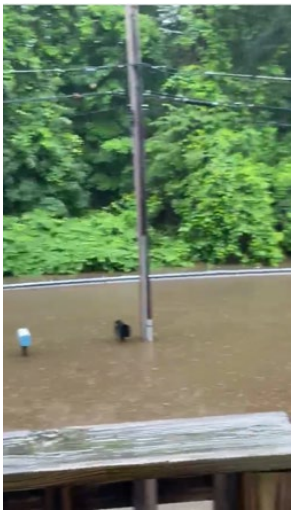
Changing climate conditions are likely to bring more rainfall events to Lincoln and fewer snowstorms. More intense storms will stress the rivers and natural floodplains designed to carry floodwaters.

History

The most significant riverine flood in Lincoln was in March 2010 when the Blackstone crested its banks. Fortunately, no lives were lost in the flood but the Blackstone River in nearby Woonsocket exceeded it's 9-foot flood stage by 5.5 feet. Also see Table 10.

Flooding (Street/Urban)

Ballou Avenue (note the placement of the mailboxes)



July 2020 Flooding

Description

According to the Rhode Island 2019 Hazard Mitigation Plan Update, "Flooding is a localized hazard that is generally the result of excessive precipitation. Flooding is the most commonly occurring natural hazard, due to the widespread geographical distribution of river valleys and coastal areas, and the attraction of human settlements to these areas. Floods are among the most frequent and costly natural disasters in terms of human hardship and economic loss."

"A flood, which can be slow or fast rising but generally develops over a period of days, is defined by the National Flood Insurance Program (NFIP) as:

- A general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties from: overflow of inland or tidal waters; unusual and rapid accumulation or runoff of surface waters from any source; or a mudflow; or
- The collapse or subsidence of land along the shore of a lake or similar body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood as defined above."

Flooding due to runoff occurs when water runs over the land's surface impervious surfaces (paved areas, building subdivisions, and highways). Two major environmental modifications are primarily responsible for drastically altering the rain fall-runoff relationship.

1. Making the land surface impervious by covering it with pavement and construction work.

2. Installing storm sewer systems that collect urban runoff rapidly discharging large volumes of water into stream networks and/or freshwater wetland system.

FEMA maintains regulatory flood maps called Flood Insurance Rate Maps (FIRM). Insurance companies refer to these when providing coverage to homeowners. These maps are available for viewing at Town Hall and online at The FEMA Map Service Center https://msc.fema.gov. Please note that there is a process for the public to request a change in the flood zone designation for their property.

Table 9 Flood Zone Descriptions

Flood Zone	Description
A	1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. No recorded Base Flood Elevation
AE	1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Base Flood Elevation is provided.
AO	1% or greater chance of shallow riverine 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

Location

During heavy or extensive rain events, flooding around town is generally caused by undersized catchbasins and poor natural drainage. These areas include but are not limited to:

- Heath Street to Hazel Street
- Areas of Route 146
- Rockridge Road
- Summer Street at Old River Road
- Smithfield Street at Grandview
- Stonybridge Drive and Route 123
- Jencks Hill Road
- Spruce Street
- Ballou Avenue
- Allen Drive and Front Street
- Old River Road and Route 116

Probability of Future Occurrence

Street/urban and coastal flooding is highly likely.

Extent (Event Magnitude)

Localized flooding can be expected to occur on an annual basis.

Impact and Damage Extent

Heavy rains, quick thaws with precipitation, and hurricanes accompanied by heavy winds and rain make the Town vulnerable to personal, property and environmental damage associated with flooding.

Vulnerable structures include stormwater infrastructure, dams, residential homes, water supply lines, wastewater infrastructure, and roads. Structures without proper ventilation may be susceptible to mold caused by standing water.

Climate Change Impacts

Changing weather patterns may lead to more severe rain events.

History

The Town of Lincoln regularly experiences street/urban flooding on the nuisance level. The larger events in the county are outlined in the following table.

Table 10 Recent History of Flooding

Date	Comments
3/28/2010	Heavy rains, Blackstone River rose to moderate flood levels, several small streams rose above flood level. Numerous streets and basements were flooded across the region with several being undermined and eroding away. The entire state was impacted by this event and a Presidential Disaster Declaration was made. It is estimated that there were over $26 million in damages.
09/26/2018	3-5 inches of rain. Higginson Ave. near the Wood and Wire Fence Company was flooded and impassable.
07/01/2020	Slow moving thunderstorms caused local street flooding. Water quickly receded.
12/01/2020	Street flooding from heavy rains.
07/09/2021	Tropical Storm Elsa dropped approximately 4 inches of rain in 8-10 hours in Lincoln. The intense rain fell faster than the street drainage systems could drain the water.
09/01/2021	Tropical Storm Ida brought up to 4 inches of rain to Lincoln, causing localized street flooding.

Snow Storm

Description

The majority of Rhode Island lies outside the heavy snow and ice regions of the northeast. Due to its maritime climate, Rhode Island generally experiences cooler summers and warmer winters than inland areas. However, snow and ice do occur and can be more than an inconvenience and cause extensive damage. The two major threats from these hazards are loss of power due to ice on electrical lines and snow loading on rooftops. Additionally, loss of power could mean loss of heat for many residents.

Winter storms vary in size and strength and can be accompanied by strong winds that create blizzard conditions and dangerous wind chill. There are three categories of winter storms. A blizzard is the most dangerous of the winter storms. It consists of low temperatures, heavy snowfall, and winds of at least 35 miles per hour. A heavy snow storm is one which drops

four or more inches of snow in a twelve-hour period. An ice storm occurs when moisture falls and freezes immediately upon impact.

Location

A severe winter storm could have a serious impact on private and public structures, as well as the general population throughout Lincoln.

Probability of Future Occurrence

Highly Likely.

Extent (Event Magnitude)

On average, Lincoln receives 36 inches of snow during the winter months. The average winter temperature (December-February) in Lincoln is 39 degrees Fahrenheit.[15]

Impact and Damage Extent

The combination of wind, ice, and snow can have a crippling effect on the town. Heavy and/or excessive snowfall amounts can stress roofs and slow plowing efforts, as well as cause power outages. The local economy slows when businesses are closed due to winter weather.

Climate Change Impacts

Lincoln may likely see less snowfall over the winter season but may see more intense blizzards when they do occur.

History

Lincoln has been subjected to annual snowstorms and Nor'easters. The Great Blizzard of 1978 blanketed Lincoln with 55 inches of snow and closed businesses for several days. More than 9,000 people in Rhode Island sought refuge in makeshift shelters, hotels, and movie theaters. In February 2013, Winter Storm Nemo temporarily crippled the region. Power lines were downed, and heavy snow hampered driving conditions.

Table 11 History of Recent Significant Snow Events in Providence County[16]

Date	Inches	Comments
02/08/2013	24-30	Fierce winter storm brought blizzard conditions and hurricane force winds resulting with widespread power outages and transportation problems throughout the region.
01/26/2015	18+	The Blizzard of January 2015 produced very strong winds late Monday into Tuesday near the Massachusetts and Rhode Island coasts where gusts of 50 to 65 mph were common. The Governor of Rhode Island declared a state-wide travel ban beginning at midnight on January 27th and continuing through 8 pm. Town of Lincoln had near record snowfall and peak wind gusts at 53 mph, accompanied by icing conditions, which made for hazardous roads.

15 U.S. Climate Data https://www.usclimatedata.com/

16 Snow events impact the entire region but vary across the state. The NOAA history of events in Providence County is the most comprehensive resource. NOAA Storm Event Database www.ncdc.noaa.gov

Table 11 History of Recent Significant Snow Events in Providence County[16]

Date	Inches	Comments
02/02/2015	3 -13	Low pressure passed south of New England bringing snow and gusty winds to much of Southern New England.
02/08/2015	7-13	A clipper low moved across southern Quebec on February 7. This was followed by low pressure moving east from the Great Lakes on February 8. On February 9 and 10, low pressure moved off the mid-Atlantic coast, becoming a Nor'easter as it approached southern New England. This all resulted in a long duration snowstorm that dumped up to a foot and a half of snow across southern New England.
02/14/2015	7-12	Heavy snow to all of southern New England.
01/23/2016	4-8	Low pressure intensified as it moved off the coast of North Carolina and tracked northeastward, passing south of southern New England. This brought accumulating snow to areas south of Interstate 90 in Massachusetts, including Connecticut and Rhode Island. In addition, strong, damaging winds accompanied the snow. With bare trees, there was remarkably little damage associated with winds that gusted near hurricane force at times.
02/5/2016	6-8	Extraordinarily wet and heavy snow, bringing down trees and wires across portions of southern New England.
02/8/2016	4-8	Heavy snow and gusty winds.
04/4/2016	5-8	Early April snow across much of southern New England.
03/14/2017	5-6	Mix of snow, sleet and rain. Strong/damaging winds gusted to 45 to 60 mph
11/15/2018	4-7	Moderate to heavy snow.
01/29/2022	15-18	Blizzard conditions across the state.

Ice Storm

Description

Ice Storm. Source: NOAA.

An ice storm occurs when moisture falls and freezes immediately upon impact. The term ice storm is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Freezing rain most commonly occurs in a narrow band within a winter storm that is also producing heavy amounts of snow and sleet in other locations. If extreme cold conditions are combined with low or no snow cover, the cold can better penetrate downward through the ground and potentially create problems for underground infrastructure, as well. When utilities are affected, and heating systems are compromised or do not work, water and sewer pipes can freeze and even rupture.

Location

All of Lincoln is susceptible to ice storms.

Probability of Future Occurrence

Highly Likely.

Extent (Event Magnitude)

Ice storms can be the most devastating winter weather phenomena and are often the cause of automobile accidents, power and communication system outages, personal injury, and death. Moreover, they can hinder the delivery of emergency services needed in response to these catastrophes and endanger the responders. Ice storms accompanied by wind gusts cause the most damage.

The Sperry–Piltz Ice Accumulation (SPIA) Index is a scale for rating ice storm intensity, based on the expected storm size, ice accumulation, and damages on structures, especially exposed overhead utility systems. The SPIA Index uses forecast information to rate an upcoming ice storm's impact from 0 (little impact) to 5 (catastrophic damage to exposed utility systems).

Lincoln expects at least a level 1- isolated or localized utility interruptions every year due to ice.

Figure 5 SPIA Index

The Sperry-Piltz Ice Accumulation Index, or "SPIA Index" – Copyright, February, 2009

ICE DAMAGE INDEX	* AVERAGE NWS ICE AMOUNT (in inches) *Revised-October, 2011	WIND (mph)	DAMAGE AND IMPACT DESCRIPTIONS
0	< 0.25	< 15	Minimal risk of damage to exposed utility systems; no alerts or advisories needed for crews, few outages.
1	0.10 – 0.25	15 - 25	Some isolated or localized utility interruptions are possible, typically lasting only a few hours. Roads and bridges may become slick and hazardous.
	0.25 – 0.50	> 15	
2	0.10 – 0.25	25 - 35	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulation.
	0.25 – 0.50	15 - 25	
	0.50 – 0.75	< 15	
3	0.10 – 0.25	> = 35	Numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is excessive. Outages lasting 1 – 5 days.
	0.25 – 0.50	25 - 35	
	0.50 – 0.75	15 - 25	
	0.75 – 1.00	< 15	
4	0.25 – 0.50	> = 35	Prolonged & widespread utility interruptions with extensive damage to main distribution feeder lines & some high voltage transmission lines/structures. Outages lasting 5 – 10 days.
	0.50 – 0.75	25 - 35	
	0.75 – 1.00	15 - 25	
	1.00 – 1.50	< 15	
5	0.50 – 0.75	> = 35	Catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeks in some areas. Shelters needed.
	0.75 – 1.00	> = 25	
	1.00 – 1.50	> = 15	
	> 1.50	Any	

(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)

Impact and Damage Extent

The Lincoln Hazard Mitigation Committee is most concerned about ice taking down trees, knocking out power, blocked roads, and structure damage. Falling trees have taken out

power lines, damaged buildings, and essentially shut down the town. Flash freezes and icy roads can also cause dangerous driving conditions.

Climate Change Impacts

Warming temperatures may mean less snowfall but if there is enough moisture in the atmosphere, it may fall as freezing rain, coating everything in ice. Lincoln should expect more ice events.

History

Due to the unique weather in New England, ice storms are usually part of larger snow events. The winter storm event that crippled the state in February 1978 did include a FEMA disaster declaration for snow and ice. Subsequent storms have included ice warnings when there are rapidly warming and cooling temperatures. Rhode Island was spared the brunt of the 2008 ice storm which affected more than a million people across New Hampshire, Vermont, Massachusetts, Maine, Connecticut, and New York.

Lightning/Thunderstorms

Description

Thunderstorms are formed when the right atmospheric conditions combine to provide moisture, lift, and warm unstable air that can rise rapidly. Thunderstorms occur any time of the day and in all months of the year but are most common during summer afternoons and evenings and in conjunction with frontal boundaries. The National Weather Service (NWS) classifies a thunderstorm as severe if it produces hail at least one inch in diameter, winds of 58 MPH or greater, or a tornado. About 10 percent of the estimated 100,000 annual thunderstorms that occur nationwide are considered severe. Thunderstorms affect a smaller area compared with winter storms or hurricanes, but they can be dangerous and destructive for a number of reasons. Storms can form in less than 30 minutes, giving very little warning; they have the potential to produce lightning, hail, tornadoes, powerful straight-line winds, and heavy rains that produce localized flooding.

All thunderstorms contain lightning. Thunderstorms can occur singly, in clusters, or in lines. Therefore, it is possible for several thunderstorms to affect one location over the course of a few hours. Thunderstorms usually bring heavy rains (which can cause localized floods), strong winds, hail, lightning, and tornadoes. Lightning is caused by the attraction between positive and negative charges in the atmosphere, resulting in the buildup and discharge of electrical energy. Lightning is one of the most underrated severe weather hazards yet ranks as the second-leading weather killer in the United States. "Hundreds of people across the nation are injured annually by lightning, most commonly when they are moving to a safe place but have waited too long to seek shelter. Lightning strike victims often suffer long-term effects such as memory loss, sleep disorders, weakness and fatigue, chronic pain, depression and muscle spasms. Lightning has the potential to start both house fires and wildfires. Lightning causes an average of 55-60 fatalities, 400 injuries, and over $1 billion in insured losses annually nationwide." Lightning often strikes as far as 10 miles away from any rainfall.

Location

All of Lincoln is susceptible to lightning/thunderstorms.

Probability of Future Occurrence

Highly Likely.

Extent (Event Magnitude)

There is no universally accepted standard for measuring the strength or magnitude of a lightning storm. Similar to modern tornado characterizations, lightning events are often measured by the damage they produce. Building construction, location, and nearby trees or other tall structures will have a large impact on how vulnerable an individual facility is to a lightning strike. A rough estimate of a structure's likelihood of being struck by lightning can be calculated using the structure's ground surface area, height, and striking distance between the downward-moving tip of the stepped leader (negatively charged channel jumping from cloud to earth) and the object. In general, buildings are more likely to be struck by lightning if they are located on high ground or if they have tall protrusions such as steeples or poles which the stepped leader can jump to.

Impact and Damage Extent

Lightning can strike buildings and accessory structures, often causing structure fires. Electrical and communications utilities are also vulnerable to direct lightning strikes. Damage to these lines has the potential to cause power and communication outages for businesses, residencies, and critical facilities.

Electrical and communications utilities are also vulnerable to direct lightning strikes. Damage to these lines has the potential to cause power and communication outages for businesses, residencies, and critical facilities.

Human vulnerability is largely determined by the availability and reception of early warnings for the approach of severe storms, and by the availability of nearby shelter. Swimming, boating, and fishing are particularly dangerous during periods of frequent lightning strikes, which can also cause power outages, topple trees, and spark fires. Individuals who immediately seek shelter in a sturdy building or metal-roofed vehicle are much safer than those who remain outdoors. Early warnings of severe storms are also vital for aircraft flying through the area.

Climate Change Impacts

Changing weather patterns may lead to more severe thunder and lightning storms.

History

There has been no reported loss of human life in Lincoln in the past 50 years due to lightning.

Table 12 History of Lightning Events in Lincoln[17]

Date	Damages	Comments
05/31/2002	$100,000	Lightning struck a house in Lincoln
01/11/2008	Unknown	Several locations in the area were without power due to lightning strikes, including the Lincoln Mall
07/15/2010	$10,000	Lightning struck a large tree that splintered, damaging a house
06/25/2012	$150,000	Lightning struck a house causing a fire.
06/29/2012	$1,000	Lightning struck a house hitting the electrical system.

Tornadoes

Description

A tornado is a violent windstorm with a twisting, funnel-shaped cloud. They are often spawned by thunderstorms or hurricanes. Tornadoes are produced when cool air overrides a layer of warm air, forcing the warm air to rise rapidly. The damage from a tornado is a result of the high wind velocity and wind-blown debris. Tornado season is generally March through August, although tornadoes can occur at any time of year. Over 80 percent of all tornadoes strike between noon and midnight. During an average year, about 1,000 tornadoes are reported across the United States, resulting in 80 deaths and over 1,500 injuries. The most violent tornadoes are capable of tremendous destruction with wind speeds of 250 mph or more. Damage paths can be in excess of one-mile-wide and 50 miles long.

Tornadoes are categorized according to the damage they produce using the Fujita Scale (F-scale). Below is the Enhanced Fujita (EF) Scale and the Old Fujita (F) Scale. An F0 tornado causes the least amount of damage, while an F5 tornado causes the most amount of damage. Relatively speaking, the size of a tornado is not necessarily an indication of its intensity. On August 7th, 1986, a rare outbreak of seven tornadoes occurred in New England. One such tornado, rated F2 on the Fujita Scale, carved its way through Cranston, RI, and Providence, RI, causing twenty injuries and $2,500,000 in damages. Table 14 highlights more tornado events that have affected, Rhode Island.

Table 13 Fujita Scale

Fujita Scale			Enhanced Fujita Scale		
F Number	Fastest ¼ mile (MPH)	3 Second Gust (MPH)	EF Number	3 Second Gust (MPH)	Damage Scale
0	40-72	45-78	0	65-85	Light damage. Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged.
1	73-112	79-117	1	86-110	Moderate damage. Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.

17 NOAA Storm Event Database www.ncdc.noaa.gov and the Town of Lincoln

Table 13 Fujita Scale

Fujita Scale			Enhanced Fujita Scale		
F Number	Fastest ¼ mile (MPH)	3 Second Gust (MPH)	EF Number	3 Second Gust (MPH)	Damage Scale
2	113-157	118-161	2	111-135	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
3	158-207	162-209	3	136-165	Severe damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
4	208-260	210-261	4	166-200	Devastating damage. Well-constructed houses leveled; structures with weak foundations blown away some distance; cars were thrown and large missiles generated.
5	261-318	262-317	5	Over 200	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yds); trees debarked; incredible phenomena will occur.

Probability of Future Occurrence

Possible.

Location

The Hazard Mitigation Committee recognizes that the risk of tornadoes is low for the State of Rhode Island but with the recent changing weather patterns and touchdowns of tornadoes, it would be unwise not to consider them a possible hazard. This is a change in risk perception from the 2016 Hazard Mitigation Plan which did not discuss tornadoes.

Extent (Event Magnitude)

Historically, Lincoln isn't known to be a hotbed of tornado activity. In 2018 an EF-1 tornado touched down in Lincoln suddenly requiring the Town to reconsider their risk. It is expected that future tornadoes will be 0 or 1 on the F-Scale of magnitude.

Impact and Damage Extent

Tornadoes can cause significant damage to buildings, trees and above ground utility lines. Flying debris can be cause injuries to residents. In 2018 the Town of Lincoln experienced downed powerlines which caused a fire, damage to the tree canopy, fallen trees blocking roads, and damage to homes and businesses. The tornado caused extensive damage on Angell Road and Riata Drive. Damage became more sporadic farther north on Elden Court, Dennell Drive, and Christopher Drive, where a few large trees and branches were downed.

Climate Change Impacts

It is uncertain how climate change will affect tornado outbreaks in Lincoln.

History

Table 14 Recent Tornado Events in Rhode Island[18]

Date	EF-Scale	Injuries	Damage	Location
8/16/2000	0	0	$0	Providence County
8/7/2004	0	0	$0	Kent County
7/23/2008	1	0	$47,987	Bristol County
8/10/2012	0	0	$50,000	Washington County
10/24/2018	1	0	unknown	North Providence and Lincoln

Dam Failure

Description

Dams are classified as high hazard, significant hazard or low hazard. The classification is not based on whether a dam is deemed safe or unsafe. As of 2019, there are 96 high hazard dams, 82 significant hazard dams and 491 low hazard dams in the state.[19] Each dam's hazard classification determines the frequency of inspection. The higher the classification, the more frequently the inspection is conducted.

- A *High Hazard* dam is one whose failure or misoperation will result in a probable loss of human life.
- A *Significant Hazard* dam is one whose failure or misoperation results in no probable loss of human life but may cause major economic loss, disruption of lifeline facilities or impact other concerns detrimental to the public's health, safety or welfare.
- A *Low Hazard* dam is one whose failure or misoperation results in no probable loss of human life and low economic losses.

As part of each Rhode Island Department of Emergency Management (RIDEM) inspection, the major components of the dam are subjectively rated as good, fair or poor. The major components are the embankment, the spillway and the low-level outlet. Good means the dam meets the minimum Army Corps of Engineers (ACOE) guidelines. Fair means the dam has one or more components that require maintenance. Poor means a component of a dam has deteriorated beyond maintenance and is in need of repair.

Flood events call into question the structural integrity of dams that would affect Lincoln. In 2018, RIDEM identified 20 dams in the Town of Lincoln. Ten of the 20 dams are classified as high hazard dams. The remainder are considered low hazard.

Location

The dams in Lincoln were built during the Industrial Revolution to power the textile mills. See Appendix C for the locations of various dams in Lincoln.

18 Rhode Island Emergency Management Agency (RIEMA), Rhode Island 2014 Hazard Mitigation Plan Update

19 2019 Annual Report to the Governor on the Activities of the Dam Safety Program. STATE OF RHODE ISLAND, RIDEM, Office of Compliance and Inspection, Dam Report 2019

Table 15 High Hazard Dams in Lincoln

Dam #	Name	Hazard Class	Ownership
097	Butterfly Pond	High	Town of Lincoln
099	Moffett Pond	High	Private Property Owner
101	Barney Pond	High	Town of Lincoln
102	Olney Pond	High	RIDEM
104	Bleachery Pond	High	Private Property Owner
295	Lime Rock Reservoir	High	
391	Handy Pond Upper	High	Town of Lincoln
408	Bridlewood Pond	High	
649	Bridlewood Upper End	High	Unknown
070	Woonsocket Reservoir #1	High	Town of North Smithfield

Probability of Future Occurrence

Possible.

Extent (Event Magnitude)

Two dam hazard classifications are represented in Lincoln. The extent of a failure would vary. The Lincoln Hazard Mitigation Committee has identified failure as a break in the dam, sending water downstream.

Impact and Damage Extent

The Lincoln Hazard Mitigation Committee recognizes that a dam failure is not a natural hazard in itself but several of the hazards listed in the hazard list could bring dam failure upon the Town of Lincoln. Severe winter storms, flooding, and a hurricane could all bring enough rain and or snowfall to cause a dam failure. The age of these dams also poses a risk to the structural integrity of these dams. A failure of the earth or masonry construction materials could cause loss of lives, property, the natural environment, and economy.

Climate Change Impacts

Related to flooding, more intense rain events may stress the structural integrity of dams which would lead to failure.

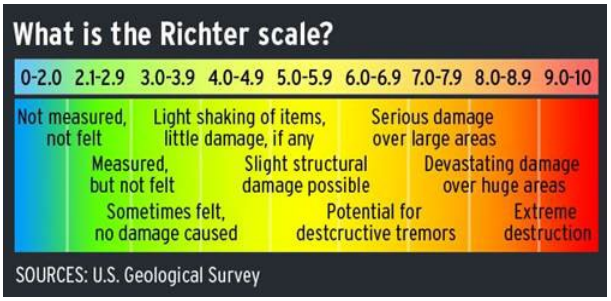
History

During the floods of 2010, there were no dam failures in Lincoln. In July 2014 there was seepage in the spillway at the Barney Pond Dam.

Earthquake

An earthquake (also known as a quake, tremor or temblor) is the result of a sudden release of energy in the Earth's crust that creates seismic waves. The seismicity or seismic activity of an area refers to the frequency, type and size of earthquakes experienced over a period of

time. Earthquakes are measured with a seismometer. The size or magnitude is recorded on a device known as a seismograph. Earthquakes with a magnitude 3 or lower are mostly imperceptible (too low to recognize) and magnitude 7 earthquakes cause serious damage over large areas.



Although earthquakes are not considered to be a major problem in the Northeast United States, they are more prevalent than one might expect. Table 17 presents historical seismic activity for Rhode Island. It highlights the earthquake epicenter, the Richter magnitude at the epicenter, and the Mercalli Intensity Level. Richter magnitudes are technical quantitatively based calculations that measure the amplitude of the largest seismic wave recorded. Richter magnitudes are based on a logarithmic scale and are commonly scaled from 1 to 8. The higher the magnitude on the Richter Scale, the more severe the earthquake. Mercalli intensity levels are based on qualitative criteria that use the observations of the people who have experienced the earthquake to estimate the intensity level. The Mercalli scale ranges from I to XII. The higher the intensity level on the scale, the closer the person is to the epicenter.

Table 16 Mercalli Scale

Modified Mercalli Intensity	Description of Intensity Level
I	Not felt except by a very few under especially favorable circumstances.
II	Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.
III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibration similar to the passing of a truck. Duration estimated.
IV	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Felt by all; many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Damage negligible in building of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motorcars.
VIII	Damage slight in specially designed structures; considerable in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.

Table 16 Mercalli Scale

Modified Mercalli Intensity	Description of Intensity Level
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
XI	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
XII	Damage total. Lines of sight and level distorted. Objects thrown into the air.

Despite the low probability of a high impact earthquake, physical characteristics in Rhode Island may increase earthquake vulnerability:

- **Hard Rock:** Due to the geological makeup of New England's base rock, seismic energy is conducted on a greater scale (four (4)-10 times that of an equivalent Richter magnitude earthquake in California).
- **Soft Soil:** Many coastal regions of New England are made up of soft soils. These soils can magnify an earthquake as much as two times.
- **Structures:** The New England region, being one (1) of the first settled areas of the United States, has an abundance of older, unreinforced masonry structures that are inherently brittle and very vulnerable to seismic forces.
- **Low Public Awareness of Vulnerability:** Little public recognition of earthquake threat, and no established system of educating or informing the public of the threat or how to prepare for or respond during an earthquake. Therefore, higher losses will occur here than in other regions of the country.

Location

Rhode Island is located in the North Atlantic tectonic plate and is in a region of historically low seismicity. Only three (3) or four (4) earthquakes of Modified Mercalli Intensity Scale (MMI) V or greater have been centered in Rhode Island, including the 1951 South Kingstown earthquake of magnitude 4.6 on the Richter scale.

Probability of Future Occurrence

Possible.

Extent (Event Magnitude)

Damaging earthquakes do not normally occur in this region. Rhode Island is located in an area of "moderate" seismicity and "high" risk. Seismic risk applies to the seismic hazard, location demographics, and regional economics to the vulnerabilities of the structure or lifeline on the site. Seismologists have estimated that there is about a 50% probability of a very damaging magnitude 5.0 earthquake occurring anywhere in New England, in a 50-year period.[20]

20 RI Emergency Management Agency, State of Rhode Island Hazard Identification and Risk Assessment. November 2016

Impact and Damage Extent

The committee recognizes that the potential for an earthquake to strike the Town of Lincoln is relatively low but the hazard could afflict town-wide damage, causing power outages, building collapses, water main breaks, dam failures, gas leaks, fires and injuries or deaths. Buildings that are most at risk from earthquakes are the historic structures.

Climate Change Impacts

It is uncertain how climate change will affect earthquake magnitude in and around Lincoln.

History

No major earthquakes have happened in Lincoln but have been felt in the state.

Figure 6 Rhode Island Earthquake Epicenters (1974 -2018)

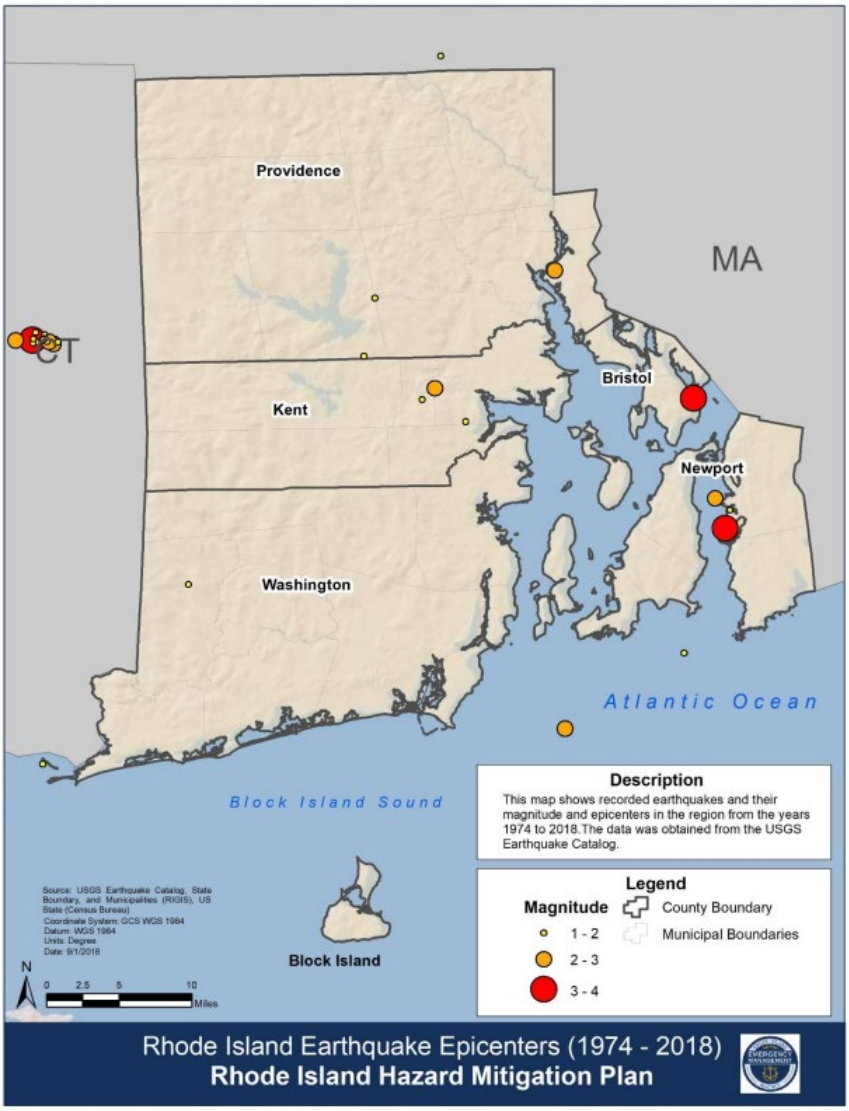


Table 17 Historic Seismic Activity in/near Rhode Island[21]

Date	Epicenter	Epicenter Magnitude	Mercalli Intensity Level
10/16/1963	Coastal MA	4.5	Caused some cracked plaster (MMI V) at Chepachet, Rhode Island.
6/14/1973	Western Maine	unknown	The intensities in Rhode Island were IV at Charlestown and I-III at Bristol, East Providence, Harmony, and Providence.
03/11/1976	Near Newport, RI	3.5	Intensity level VI shock effects felt throughout Southern New England. This earthquake has the distinction of being the largest earthquake to originate in Rhode Island.
04/20/2002	Plattsburgh, NY	5.2	Intensity level II to III shock effects felt throughout Rhode Island.
03/11/2008	Central Connecticut	2.9	No data reported for Rhode Island.
06/23/2010	Ontario-Quebec	5.0	Felt throughout Rhode Island.
2011	Rhode Island	0.9	Felt locally.
2012	Rhode Island	1	Felt locally.
2013	Kingston, RI	Unknown	Felt locally.
04/04/2013	Hope Valley, RI	1.8	Felt locally.
01/12/2015	Wauregan, CT	3.3	Felt locally in RI, but maybe not in Lincoln.
07/22/2015	East Providence, RI	2.3	Felt locally in RI, including Lincoln.
11/08/2020	Buzzards Bay	3.6	Felt locally in RI, including Lincoln
11/22/2020	Buzzards Bay	2.0	Felt locally in RI, including Manville (a village in Lincoln)

Brushfire

Description

Brushfires are fueled by natural cover, including native and non-native species of trees, brush and grasses, and crops along with weather conditions and topography. While available fuel, topography, and weather provide the conditions that allow wildfires to spread, most wildfires are caused by people through criminal or accidental misuse of fire.

Brushfires pose serious threats to human safety and property in rural and suburban areas. They can destroy crops, timber resources, recreation areas, and habitat for wildlife. Wildfires are commonly perceived as hazards in the western part of the country; however, smaller brushfires are a growing problem in the wildland/urban interface of the eastern United States, including Rhode Island.

Brushfires are dependent upon the quantity and quality of available fuels. Fuel quantity is the mass per unit area. Fuel quality is determined by a number of factors, including fuel density,

21 United States Geologic Survey http//neic.usgs.gov/neis/states/rhode_island/rhode_island_history.html and Earthquake Hazards Program "*Did You Feel It*" Archives.

chemistry, and arrangement. Arrangement influences the availability of oxygen. Another important aspect of fuel quality is the total surface exposed to heat and air. Fuels with large area-to-volume ratios, such as grasses, leaves, bark and twigs, are easily ignited when dry.

Climatic and meteorological conditions that influence wildfires include solar insulation, atmospheric humidity, and precipitation, all of which determine the moisture content of wood and leaf litter. Dry spells, heat, low humidity, and wind increase the susceptibility of vegetation to fire. In Rhode Island, common factors leading to large fires include short-term drought, humidity below 20%, and fuel type.

Various natural and human agents can be responsible for igniting brushfires. Natural agents include lightning, sparks generated by rocks rolling down a slope, friction produced by branches rubbing together in the wind, and spontaneous combustion.

Human-caused brushfires are typically worse than those caused by natural agents. Arson and accidental fires usually start along roads, trails, streams, or at dwellings that are generally on lower slopes or bottoms of hills and valleys. Nurtured by updrafts, these fires can spread quickly uphill. Arson fires are often set deliberately at times when factors such as wind, temperature, and dryness contribute to the fires' spread.

The temperate climate in Lincoln is not set up to endure long periods of drought that lead to widespread vegetation loss. Destructive lightning fires in remote locations are rare but there is always a risk of fires from arson or careless fire use.

Location

The open fields, forested areas, and grassy areas throughout the town are most at risk. See Figure 4: Conservation Land. In 2021, about 6 acres of vegetated land in the Lime Rock area were burned by brushfires.

Probability of Future Occurrence

Highly Likely.

Extent (Event Magnitude)

Brushfires average about 36 per year with a burn area of generally 10 acres. The extent has decreased over the years due to better response equipment, faster response time, and the widespread use of cell phones used to report fires. However, the wildland-urban interface is growing, potentially putting more infrastructure and lives at risk.

Impact and Damage Extent

Individual buildings may be more or less vulnerable to damage from brushfires based on factors such as the clear distance around the structure and the structure's construction materials. Brushfires primarily impacts timber and forest ecosystems, although the threat to nearby buildings is always present.

The likelihood of brushfires occurring and having widespread impacts has decreased over the years as fields and wooded areas are taken over by development.

Climate Change Impacts

Longer dry periods and droughts may increase the probability of brushfires but their extent has diminished over the years due to advances in detecting and firefighting technologies.

History

There have been no significant brushfires in the past 25 years in Lincoln.

Drought

Description

Drought is characterized as a continuous period of time in which rainfall is significantly below the norm for a particular area over a multi-year period. The American Meteorology Society defines drought as a period of abnormally dry weather sufficiently long enough to cause a serious hydrological imbalance. Drought differs from other natural hazards in that they occur suddenly. Rather, a drought evolves over months or even years and, while causing very little structural damage, can have profound economic, environmental, and social impacts.

Drought in nearby Connecticut.
Source: Bob Luckey Jr./ Hearst Connecticut

There are four different ways that a drought can be defined:

1. **Meteorological** – A measure of departure of precipitation from normal. Due to climatic differences, what is considered a drought in one location may not be a drought in another location.
2. **Agricultural** – refers to a situation when 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 shortage begins to effect people.

Characteristics and impacts of drought differ in many ways, so it is difficult to quantify drought. An existing index called the Palmer Drought Severity Index (PDSI) that used temperature and precipitation levels to determine dryness, measuring a departure from the normal rainfall in a given area. The advantage of the PDSI is that it is standardized to local climate, so it can be applied to any part of the country to demonstrate relative drought or rainfall conditions. A monthly PDSI value below -2.0 indicates moderate drought, and a value below -3.0 indicates severe drought.

The U.S. Drought Monitor tracks drought conditions in Rhode Island and in the rest of the nation. They create maps based on climate data, hydrologic and soil conditions, as well as reported impacts and observations from over 350 contributors nationwide.

Table 18 Drought Severity [22]

Severity	Category	PDSI Index Value	Drought Level	Possible Impacts
Exceptional Drought	D4	-5 or less	Emergency	Widespread crop/pasture losses, shortages of water creating water emergencies.
Extreme Drought	D3	-4 to -4.9	Warning	Major crop/pasture losses, widespread water shortages or restrictions.
Severe Drought	D2	-3 to -3.9	Watch	Crop or pasture losses likely, water shortages common, water restrictions imposed.
Moderate Drought	D1	-2 to -2.9	Advisory	Some damage to crops/pastures, developing water shortages, voluntary water-use restrictions requested.
Mild Drought/Abnormally Dry	D0	-1 to -1.9	Normal	Short term dryness slowing planting or crop growth.
Incipient Dry Spell		-0.9 or less	–	–

Rhode Island, as with most states within the United States, uses both the Palmer Drought Severity Index (PDSI) and the Crop Moisture Index (CMI) as indices for a drought occurrence. The CMI (a derivative of the PDSI) provides information on the short-term or current status of purely agricultural drought or moisture surplus. The PDSI is most effective for determining long-term drought conditions, while the CMI is effective at helping determine short-term drought.

The RI Drought Steering Committee assigns drought levels for the seven designated drought regions in the state, based on hydrological indices such as precipitation, groundwater, stream flow, and the PDSI, as well as on local supply indices such as static groundwater levels and reservoir levels. The Normal, Advisory, and Watch levels are issued statewide. The Warning and Emergency levels are issued on a regional basis and consider local conditions, source of water supply, and water storage capacity issues.

Location

According to the Rhode Island Water Resource Board the potential for a drought exists every eleven years in Rhode Island. Although temporary drought conditions may occasionally exist in Rhode Island, affecting Lincoln, devastating long term drought conditions are not indicative of this temperate region.

Probability of Future Occurrence

Highly Likely.

22 http://droughtmonitor.unl.edu/AboutUs/ClassificationScheme.aspx

Extent (Event Magnitude)

According to The National Weather Service Rhode Island receives on average 39" to 54" of rain annually. Notwithstanding the same, the State experiences extended periods of dry weather. Some type of drought in Rhode Island occurs approximately once every 11 years.

Impact and Damage Extent

The main impacts of meteorological drought are periods of very high fire danger and low drinking water supplies. Lincoln's drinking water is supplied by surface water resources. Changes in water levels can impact not only the quantity of available water but also the quality.

Drought conditions have been known to trigger the rapid increase of the gypsy moth populations in the region. The extended period of dry weather (specifically in May and June) slows the fungus that usually keeps the gypsy moth caterpillars at bay. Denuded trees can have cascading effects on the local ecosystem.

Climate Change Impacts

Even though rain events may intensify due to climate change, the periods between them may be longer. Rhode Island expects longer periods of drought. According to the 2016 Rhode Island Hazard Identification and Risk Assessment, "Recent climate change studies[23] have indicated that although precipitation is projected to increase throughout this century, it will be in the form of short duration, intense, and less frequent events. In addition, it is projected by the Northeast Climate Impacts Assessment Group (NECIA) and the New York City Panel on Climate Change (NPCC) that most of this increased precipitation may occur during colder times of the year, such as winter, in the form of snow or ice. Furthermore, it is projected that the frequency and intensity of both long-term and short-term droughts throughout the Northeast will increase throughout the century with the impacts beginning to occur with a greater degree of frequency beginning in the mid-century (2050s)."

History

Extended droughts are rare in Rhode Island with a record of six major droughts (those lasting for more than one year) since 1929. The longest and most severe drought occurred in 1963-67 and affected most of the northeast. Water shortages affected most communities in Rhode Island and several municipal-supply wells were drilled to augment declining public supplies (USGS: Rhode Island Floods and Droughts).

23 Information derived from two recent studies: Confronting Climate Change in the Northeast, by the Northeast Climate Impacts Assessment Group, July 2007, and Climate Risk Information, by the New York City Panel on Climate Change, 2/17/09.

Table 19 History of Droughts[24]

Date	Area Affected	Category	Remarks
1930-31	Statewide	D1/D2	Stream flow of 70% normal.
1941-45	Statewide	D1	Stream flow of 70% normal in Blackstone and Pawtuxet Rivers.
1949-50	Statewide	D1/D2	Stream flow of 70% normal.
1963-67	Statewide	D1-D3	Water restrictions/well replacements common.
1980-81	Statewide	D1	Groundwater deficient in eastern part of state. Considerable crop damage.
1987-88	Southern part of the state	D0/D1	$25 million crop damage.
1998-99	Statewide	D1-D3	Spring through summer the State experienced 75% of normal flow.
2012	Statewide	D2	January –April 2012. Meteorological drought due to precipitation levels one half of normal.
2016	Statewide	D2	August to November. Severe Drought due to below normal precipitation.
2020	Statewide	D3	September to November. Extreme Drought

Extreme Temperatures

Description

Extreme cold may accompany winter storms, be left in their wake, or can occur without storm activity. Extreme cold can lead to hypothermia and frostbite, which are both serious medical conditions. The definition of an excessively cold temperature varies according to the normal climate of a region. In areas unaccustomed to winter weather, near freezing temperatures are considered "extreme cold." In Rhode Island, extreme cold usually involves temperatures below zero degrees Fahrenheit (Rhode Island State Hazard Mitigation Plan 2019).

The wind chill index attempts to quantify the cooling effect of wind with the actual outside air temperature to determine a wind chill temperature that represents how cold people and animals feel, based on the rate of heat loss from exposed skin. A wind chill index of -5 indicates that the effects of wind and temperature on exposed flesh are the same as if the air temperature alone were five degrees below zero, even though the actual temperature could be much higher. The NWS issues a wind chill advisory when wind chill temperatures are potentially hazardous and a wind chill warning when the situation can be life-threatening (Rhode Island State Hazard Mitigation Plan 2019).

24 USGS; RI Water Resources Board http://www.wrb.ri.gov/work_programs_drought/Drought_Facts_110607.html; and NOAA National Centers for Environmental Information https://droughtmonitor.unl.edu/AboutUSDM/AbouttheData/DroughtClassification.aspx

The National Weather Service issues **extreme (or excessive) heat** warnings when the maximum expected heat index is expected to be 105° F or higher for at least 2 consecutive days and night time air temperatures are not expected to fall below 75°. In the northeast, these criteria are generally modified to a heat index of 92° for higher for 2 consecutive days.

Location

An extreme heat or cold event would be a regional issue affecting Lincoln and significant portions of Southern New England.

Probability of Future Occurrence

Highly Likely.

Extent (Event Magnitude)

In 2011, T.F. Green Airport reported heat indexes of 105 to 106 over an 8-hour period.

Wind chills of 32 below zero were reported at T.F. Green Airport in 2016.

Impact and Damage Extent

Extreme temperatures could have a serious impact on private and public structures, as well as the general population throughout Lincoln. During a heat wave, water supplies for drinking and firefighting may be stressed.

Personal exposure to dangerous heat conditions may lead to heat cramps, heat exhaustion, and heat stroke. These are especially important to monitor in children, elderly, and vulnerable populations that are not able to move to cooler conditions.

Extreme cold conditions may occur during, after, or without any connection to a winter storm. Exposure to extreme cold can lead to hypothermia and frostbite.

Climate Change Impacts

Over the coming century, extremely hot days (over 90 degrees F) is projected to increase in New England.[25]

"Extreme cold in Rhode Island is projected to continue as extreme weather events experience an upswing due to climate change. The specific likelihood of extreme cold is unpredictable, as days of frigid, arctic air and below freezing temperatures may be followed by days of mild temperatures in the 40s or 50s."[26]

History[27]

NOAA's Storm Events Database does not have any records specifically for Lincoln but reports at nearby T.F. Green Airport are usually available.

25 Confronting Climate Change in the Northeast, by the Northeast Climate Impacts Assessment Group, July 2007

26 RI Emergency Management Agency, State of Rhode Island Hazard Identification and Risk Assessment. November 2016

27 Intellicast http://www.intellicast.com/Local/History.aspx?month=2

Table 20 Extreme Temperatures (Excessive Heat, and Extreme Cold/Wind Chill) at T.F. Green Airport[28]

Date	Temperature	Comments
05/09/2000	91	Third day in a row of high temps exceeding 90 degrees at nearby T.F. Green airport. Earliest heatwave on record since 1904.
05/03/2001	91	Record high for the day at T.F. Green Airport
05/04/2001	92	Third day of temperatures reaching 90 degrees or higher, making it the new earliest heat wave on record in greater Providence.
05/12/2001	90	The high temperature of 90 degrees at T.F. Green State Airport in nearby Warwick broke the record high for the date, which was 87 degrees set in 1959.
07/06/2010	105-106	Heat index values at the T.F. Green Providence Airport (KPVD) Automated Surface Observing System were 105 to 106 degrees.
07/22/2011	105-106	The Automated Surface Observing System at T.F. Green State Airport (KPVD) recorded heat indexes of 105 to 106 over an eight-hour period.
02/16/2015	-26	Wind chills as low as 26 below zero were reported at T.F. Green Airport
02/14/2016	-32	Wind chills as low as 32 below zero were reported at T.F. Green Airport

The following temperature records are for nearby T.F. Green Airport.[29]

- In 2011, T.F. Green Airport reported heat indexes of 105 to 106 over an 8-hour period.
- Wind chills of 32 below zero were reported at T.F. Green Airport in 2016.

Climate Change

Changing climate patterns globally and in Rhode Island will worsen the effects of natural hazards and affect future planning and mitigation efforts. Changes are already being observed and documented. Long-term climate change is likely to cause the following impacts in Lincoln:

- Heavier, more frequent precipitation events, which may cause more riverine flooding and flash flooding events.
- Longer periods of drought which may affect water availability and increase the threat for wildfires.
- Increasing air and water temperatures.
- More frequent high heat days and heat waves.

How rapidly these changes will be felt is debatable but there is certainty within the state that municipalities need to be prepared. The Town aims to become more adaptable/resilient to the changing conditions.

Through the exercise of creating this plan, the Town of Lincoln is exploring ways to reduce their long and short-term risks to a variety of hazards. Any storm that comes up the eastern seaboard will likely impact the town. As climate conditions intensify, the HMC is prepared to update this plan accordingly.

28 National Climate Data Center, 2021

29 National Climate Data Center, 2021

4

Risk Assessment

Facilities/Resources Inventory

The first step in the assessment process was to create the inventory of facilities and resources of special concern to the Town. The HMC identified the following as community assets:

- Flood prone drainage systems, streets, or infrastructure
- Bridges
- Wastewater facilities
- Water supply systems
- Town services/utilities
- Public communication equipment
- Dams
- Critical municipal hazard response facilities
- Populations
- Businesses
- Schools
- Recreational facilities
- Natural resources
- Historic resources

During the review of these assets, the HMC came to the conclusion that not all of these are so vulnerable they require a new mitigation action within the next 5 years. For some assets, the Town will continue with ongoing actions. As infrastructure ages, and climate conditions change, the HMC will update this plan accordingly.

These most vulnerable assets are identified in the Community Assets Matrix located at the end of this section.

Hazard Mitigation Mapping

The Town's GIS database, including parcel data, orthophotography and FEMA flood zone information, were utilized to complete the assessment. The use of this system allowed the HMC to estimate potential fiscal and population impacts for individual parcels.

The final output of this exercise is the Town of Lincoln Community Assets Map in Appendix C. The focus of the maps is not to duplicate all of the spatial information generated through the inventorying process but rather to present the location of the identified risks as they relate to the Town's response facilities.

Fiscal Impact Analysis

Although wind and heavy snow can certainly rack up substantial damages, flooding is one of the hazards that most frequently affects area populations. The Town of Lincoln's parcel data and FEMA's 1% annual chance floodplain data were utilized to generate estimates of potential fiscal impacts from natural hazard events such as flooding. The information utilized from the tax assessor's database and GIS included the improvement values, land usage, and unit counts. The analysis showed that Lincoln is comprised of 12,101 acres of land, with about 640 acres in the regulatory floodplain (296 of which are floodway). These 640 acres are largely located along the Blackstone River, Moshassuck River, and connected ponds.

HAZUS-MH is a software tool that contains models for estimating potential losses from earthquakes, floods, and hurricanes. HAZUS-MH was used to further understand the potential risk from a large hurricane. For the purpose of this plan, a scenario was run that capture the town's risk from hurricane damage. The table below summarizes some of the potential damages. The hurricane scenario model uses the same path as the hurricane which tracked west of Lincoln.

In 1954 Hurricane Carol (Category 1, peak gusts at 94 mph) tore through Southern New England, causing extensive damage throughout Rhode Island. If this same storm were to strike again today, it would cause over $27 million dollars in total economic losses (property damage and business interruption loss) in Lincoln.[30] About 80 buildings are expected to be at least moderately damaged.[31]

30 2014 dollars.

31 A representative analysis. No particular building is identified.

HAZUS Qualitative Damage Description

- No Damage or Very Minor Damage
- Little or no visible damage from the outside. No broken windows, or failed roof deck.
- Minimal loss of roof over, with no or very limited water penetration.

Minor Damage

- Maximum of one broken window, door or garage door. Moderate roof cover loss that can be covered to prevent additional water entering the building. Marks or dents on walls requiring painting or patching for repair.

Moderate Damage

- Major roof cover damage, moderate window breakage. Minor roof sheathing failure. Some resulting damage to interior of building from water

Severe Damage

- Major window damage or roof sheathing loss. Major roof cover loss. Extensive damage to interior from water.

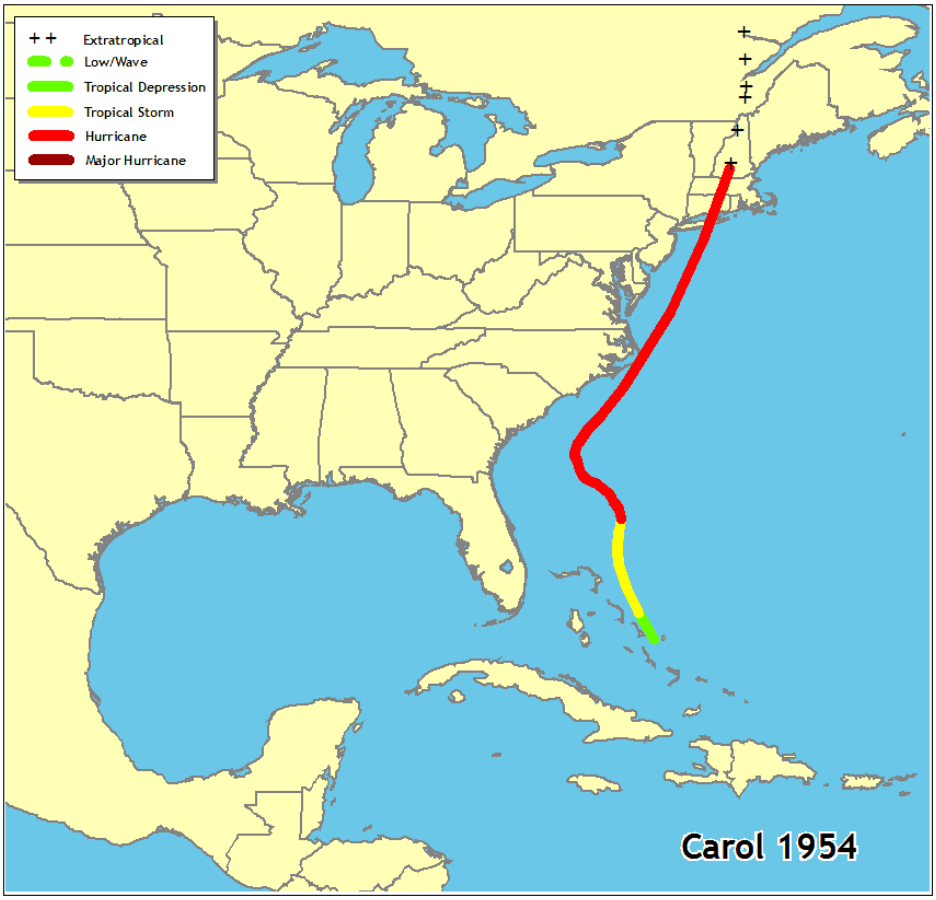
Destruction

- Complete roof failure and/or, failure of wall frame. Loss of more than 50% of roof sheathing.

Table 21 HAZUS-MH Scenarios for Lincoln, RI

1954 Hurricane Carol Scenario – If It Happened Today	
Estimated Damage	**Amount**
Debris generated	9,068 tons
Buildings destroyed	1
Buildings at least moderately damaged	80 (1% of total number of buildings)
Displaced households	28 households may be displaced. 15 people out of a population of 21,731 will seek temporary shelter in public shelters.
Essential Facility Damage (fire, police, schools)	21 facilities would expect to be non-operational for less than a day.
Residential Property (capital stock)	$25,655,600
Business interruptions	$1,746,960

Figure 7 Hurricane Carol Path



During non-cyclone events, flooding can still impact the Town. Table 22 displays potential damage estimates of property values of buildings within the Town's Special Flood Hazard Area (SFHA), or regulatory floodplain. The parcel information, using the best available data, provides the number of parcels in the SFHA, and values of the buildings on each property. Land value was not considered for this exercise. The values provided are an estimate only. This percentage was calculated in order to assist with identifying which areas are at greater risk. According to Table 22, the town-wide total potential building damages for these floodplain areas are nearly $5 million.

Approximately 66% of Lincoln's revenue is generated from real estate taxes.[32] Should any of the properties forming the tax base be destroyed by a hazardous event, a causal effect would be those property owners whose parcels remain intact would carry and increased financial burden with regards to property taxes. It is an important course of action for the Town to protect both lives and property from natural disasters. However, as Lincoln's population grows, the burden of protecting lives and property grows.

Using data from the E-911 structure data from the RI Geographic Information System (RIGIS) and information from the Lincoln Tax Assessor, the following table summarizes the value of

32 Town of Lincoln Annual Reports and Approved Budget Fiscal Year 2019 – 2020.

the insurable buildings that are located within the Special Flood Hazard Areas. Accessory buildings such as sheds located in the SFHA were not included in the summaries.

Table 22 Property Values with Structures in Special Flood Hazard Areas by Flood Zone[33]

Flood Zone	# of Parcels	Total Acres	Building Value
A*	0	0	0
AE	15	48	$4,945,900
TOTAL	**15**	**48**	**$4,945,900**

*The narrow A-Zone in Lincoln is located on the border with North Smithfield, along the Crookfall Brook. Although the desktop analysis did not show any built structures in the A-Zone, the area is included in some parcel boundaries owned by the Water Division.

Table 23 Property Values with Structures in Special Flood Hazard Areas by Land Use Type

Land Use Type	# of Parcels	Total Acres	Building Value
Industrial	2	7.38	$2,731,500
Commercial	7	8.25	$851,600
Public (State/Municipal)	3	22.48	$896,300
Residential	3	10.00	$466,500
TOTAL	**15**	**48.11**	**$4,945,900**

Built Environment

According to HAZUS-MH, Lincoln has over an estimated 7,000 buildings with a total replacement value (excluding contents) of $3.4 billion (2014 dollars). Approximately 89% of the buildings and 68% of the value are associated with residential housing.

Using the Rhode Island GIS e911 structure file, and the Town's GIS, it was determined that there are total of 15 non-accessory structures within 15 parcels that are located in Town's Special Flood Hazard Areas (7 are commercial buildings, 2 are industrial buildings, 3 are public buildings, and 3 are residential buildings).

There are 221 flood insurance policies in place for a town that has 15 non-accessory buildings in the regulatory floodplain (AE-zones). In the lower risk X-zones, 220 policies are in place, just in case it floods. These polices are more affordable than those in the A-Zones.

33 Based on RIFIS e911 Sites, FEMA 2015 Flood Insurance Rate Maps, and 2017 parcel information from the Town. This data is to be used for planning purposes only to prove estimate values.

Table 24 Flood Insurance Information[34]

Total Number of Policies	221
Total Premiums	$67,097
Insurance in Force	$57,613,200
Total Number of Closed Paid Losses	42
$ of Closed Paid Losses	$1,757,745
Repetitive Loss Properties	6 (5 commercial; 1 condo)
Severe Repetitive Loss Properties	2

Number of Policies in Each Zone:

Zone	Policies
A-Zone	1
X-Zone (Standard)	195
X-Zone (Preferred)[1]	25

1 Preferred Risk Policies (PRP) are more affordable policies cover structures that were built in an X zone but due to new mapping, are now located in a Special Flood Hazard Area.

Areas that didn't used to flood are now more vulnerable as riverine flood intensity and frequency increases The Town has been encouraging development in less risky areas but most of this development predates recent regulations requiring flood proofing, leaving many vulnerable areas unprepared to face a storm of any significance.

FEMA A-Zone vs. AE-Zone

Both are considered Special Flood Hazards Areas- areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage.

AE Zone: Base Flood Elevations (BFEs) are provided on the FEMA maps. Formerly A1-A30 numbered zones.

A Zones: Detailed studies have not been conducted which indicate depth or base flood elevation.

The HMC has identified critical infrastructure listed in the Community Asset Matrix (Table 25). The list includes: flood prone drainage systems, streets or infrastructure; bridges; wastewater; water supply; services/utility facilities; public communication equipment; dams; critical municipal hazard response facilities; populations; businesses; schools; recreational facilities; and historic resources. All of these important community resources have the potential to be affected by natural disasters. The magnitude of the losses would be dependent upon the type, location, and extent of each unique hazard.

The Town's zoning laws help dictate future development while maintaining Lincoln's unique character. Continued enforcement of Rhode Island State building codes and new regulations as required will lessen potential damage caused by a natural hazard event. The codes adopted by the Town of Lincoln range from building codes and design standards, to zoning regulations.

34 As per the State Hazard Mitigation Officer May 10, 2021

Population Impact Analysis

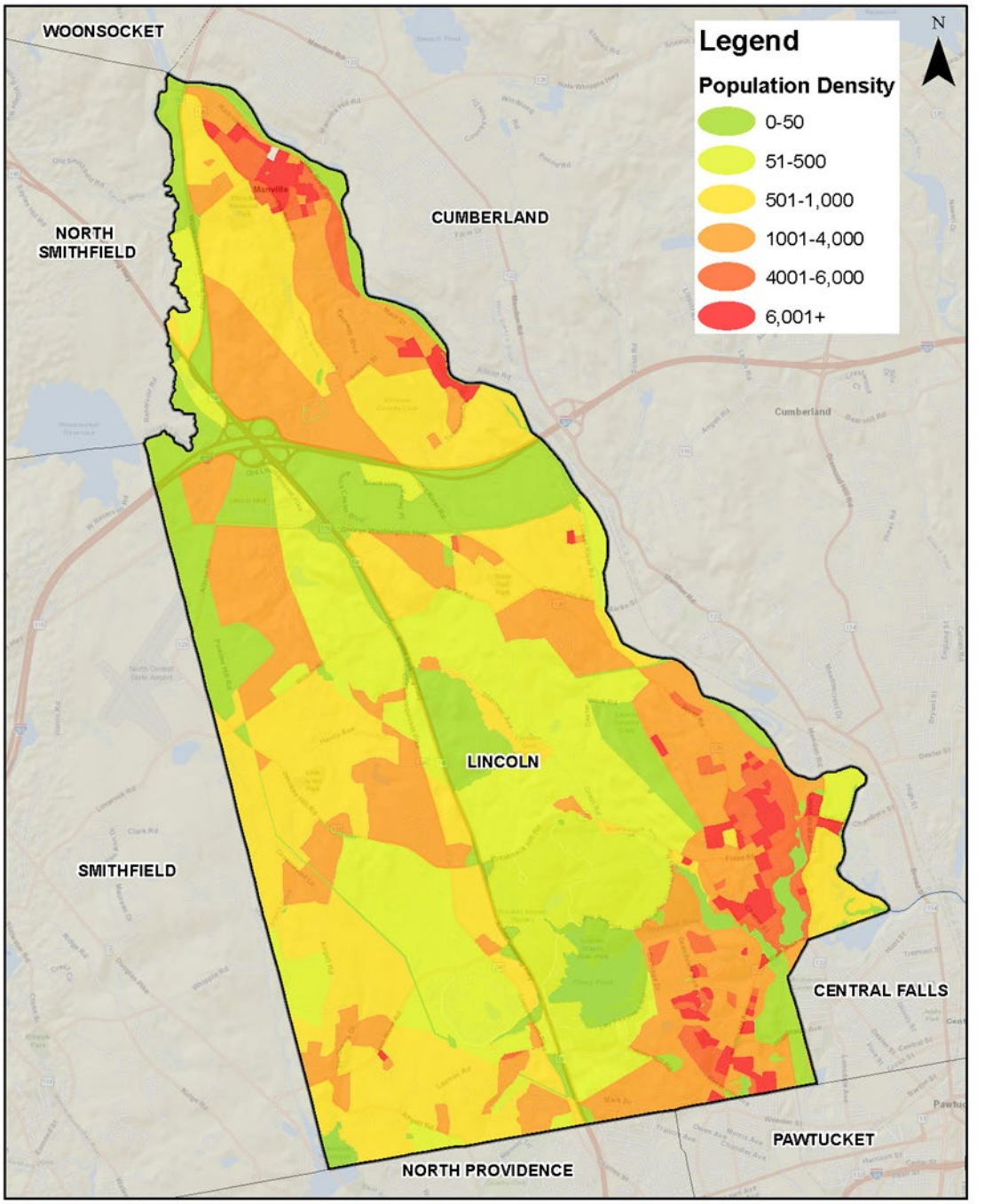
Of primary concern during a hazard event is protecting the health and safety of Lincoln residents. In addition to knowing the total population, it's also important to estimate how many people would be impacted by loss of service or need to evacuate. According to the 2019 American Community Survey 5-Year Estimates, there are 8,863 housing units in Lincoln supporting a population estimate of 21,731. The population in Lincoln is generally clustered in the south east villages Lonsdale and Saylesville. Other pockets of residents include the northern Manville neighborhood along the Blackstone River. The 2010 Population data was used in Figure 8 to estimate the most densely populated areas based on the best available data.

Employees from out-of-town represent a segment of the vulnerable population. These non-residents may be unfamiliar with evacuation routes, or flood risks.

Residents and non-residents may not be familiar with the flood risk along the Blackstone River, or emergency procedures during severe weather. Improving emergency response and educating these populations is important to the Town.

A significant hazard can significantly cripple the Town. In addition to direct damage to personal property, impacts can include the disruption of vital services, the loss of utilities, and the emotional strain from financial and physical losses. This is especially jarring when residents are forced to evacuate their homes.

Figure 8 Population Density of Lincoln



Natural Environment

The Lincoln Comprehensive Plan identifies the following critical natural resources:

- Blackstone River and Moshassuck River Water Systems
- Wetlands
- Floodplains
- Soils
- Aquifers
- Habitats and Endangered Species
- Forests

The largest uniform natural resource in Lincoln is the Blackstone River. Defining the northeast border of the town, the Blackstone River was the original driver of industrial development in Lincoln. Although most industries are no longer water-dependent and have moved inland, the Blackstone River is still subject to runoff and is impaired by pathogens, lead and cadmium.[35]

"There are 21 major wetland systems in Lincoln, the largest being the Townline Swamp and the Valley Pond (Lonsdale Marshes) wetlands. Key threats to these sensitive systems include filling, sediment erosion, landfill runoff, developed area runoff pollution (phosphorus, pesticides and toxic organic compounds such as oil), and surface water diversion with its resulting lowering of surface water flow, lowering the water table and draining of wetlands. Additionally, development that occurs near wetlands can disturb some, though not all, plant and animal species."[36]

Rhode Island has experienced a significant increase in both flood frequency and flood severity over the past 80 years. Climate change is expected to result in more frequent heavy rains, affecting stream flow.[37]

The biggest threats to the natural environment in Lincoln are non-point source pollution, point source pollution, industrial contamination discharges, and development pressures.

Impacts of severe weather events to the natural environment include loss of habitat, damage to trees, threats to ecosystems/ species, and contamination of potable water supply. The Town of Lincoln recognizes the importance of maintaining the health of the natural systems surrounding the regional potable water supply.

35 Rhode Island Department of Environmental Management, *Total Maximum Daily Load Analysis for Blackstone River Watershed*, 2013 RI DEM/Water Resources-Blackstone River Watershed TMDL for Pathogen and Trace Metals Impairments

36 Town of Lincoln Comprehensive Plan, 2003. Planning - Rhode Island Town of Lincoln (lincolnri.com)

37 Rhode Island's Environmental Climate Change Coordinating Council (EC4) Science and Technical Advisory Board, *Current State of Climate Science in Rhode Island*, May 1, 2016 Microsoft Word - STAB_Ann_Rpt_Final.docx (ri.gov)

Vulnerability of Future Structures

The Town of Lincoln is approaching maximum build out capacity. The majority of the remaining developable residential land is in the Moshassuck River Valley in East Lime Rock. Maintaining the Town's zoning districts helps to maintain these less densely developed areas. Growth should only occur when there is an available capacity for municipal services to absorb the growth, and there is a fiscal ability and community agreement to the expanded infrastructure required for growth.

Future growth is occurring at the transformed Saylesville Mill Complex (90 Industrial Circle) and the re-designed mill complex at 40 Walker Street.

Lincoln's vulnerability to natural hazards is not expected to change dramatically over the next five years due to increased development. Enforcement of current building codes will ensure that development will be stronger and more resilient than some of the older, historic structures in Lincoln.

Future Vulnerability

As climate conditions change, increased storm intensity or frequency may put considerable stress on the infrastructure in Lincoln. Roads will flood more often and may eventually become unusable. Drainage infrastructure may be overwhelmed more often. Fire hydrants, pump stations, and sewer and water lines will be stressed or inaccessible by the rising streams and rivers. Areas that are not used to flooding may see flood waters inch closer to their property.

Community Assets Matrix

The matrix (Table 25): Critical Infrastructure/Community Assets represents the culmination of the risk assessment process and is the final product. Its purpose is to gather all the pertinent results in one place for ease of presentation and to serve as a starting point for discussion of specific mitigation actions. It not only lists the specific areas of concern, but provides detailed location information, summarizes the applicable hazard, problem, and mitigation benefits

Table 25 Lincoln Critical Infrastructure/Community Assets

At Risk	Location	Hazard/Problem	Ongoing Actions	New Mitigation Actions
Flood Prone Drainage Systems, Streets, or Infrastructure	• Heath Street to Hazel Street (2-3 inches, some moving water, then standing, few drains in the area, gravity fed) • Route 146 and Breakneck Hill Rd (State owned) • Route 146 NB at Wilbur Rd Overpass (State owned) • In front of 39 Rockridge- flow downhill. Drainage from neighbor across the road freezes (may be sump pump issue) • Summer Street and Old River Road (State Road, maybe undersized catchbasin) • Smithfield at Grandview Ave- catchbasins need time to catch up. • Stonybridge Drive and Route 123: Old Jencks Hill Road (no drains), may lead to puddling on Stonybidge. • Drain on Jenks Hill Rd has failed structurally (State owned) • Spruce Street • Ballou Avenue • Higgins Avenue • Allen Drive and Front Street into Lincoln Woods. • Old River Rd. and Rt 116 (State owned)	Hurricane/Nor'easters Flooding	• Erosion and Sediment Control Plan and Stormwater Pollution Prevention Plan bylaw	1. Reduce street flooding a) Spruce Street b) Ballou Avenue c) Allen Drive and Front Street d) Old River Road and Route 116 2. Reduce flooding of the Blackstone River a) Army Corps of Engineers (ACOE) study of the entire Blackstone River system b) Dredge the canal c) Upgrade flood control from manual systems to automated systems in the canal.
Bridges (s) State-owned	Albion Trench (s) Kelly House (s) Reservoir (T/North Smithfield) Barney's Pond/Smithfield Ave (s)	Hurricane/Nor'easters Flooding Winter Storms Tornadoes	Moshassuck- weight limit and inspected every year	3. Upgrade to Moshassuck River Bridge if more residential development occurs.

At Risk	Location	Hazard/Problem	Ongoing Actions	New Mitigation Actions
(T) Town-owned	Old Louisquisset Pike (s) Breakneck Hill Road (s) Twin River Rd (s) Higginson Ave (T/s) Louisquisset Pike North (s) Louisquisset Pike South (s) Old River Rd (s) Blackstone River (s) Rt. 146 Ramp (s) Moshasuck Road (T) Sherman Ave (culvert/bridge) (T) Walker Street (s) Town owns sidewalk?	Earthquakes		4. Replace old stone bridge on Reservoir Avenue. 5. Work with RIDOT on repairing the sidewalk on the Walker Street bridge, especially if there is more development
Wastewater	100 miles of gravity sewers and 32 pump stations (26 submersible pumps stations, 5 dry pit/wet well pumping stations, and 1 screw pump)	High Wind/Microburst Hurricane/Nor'easters Flooding Winter Storms Lightning Tornadoes Earthquakes Drought Heat Wave Dam Failure	• All 32 pump station recently upgraded between 2012 and 2018. • Portable generator and bypass pump recently obtained through HMP grant • Currently have 2 portable generators	6. Purchase a 3rd portable generator for the pump stations. 7. Permanent generators for the Rollingwood, Lori Ellen, and Eagles Nest wastewater pump stations.
Water Supply Systems	Town-wide	Hurricane/Nor'easters Flooding Winter Storms Lightning Tornadoes Earthquakes Drought Heat Wave Dam Failure		8. Replace or re-line sections of the Town's waterlines.

At Risk	Location	Hazard/Problem	Ongoing Actions	New Mitigation Actions
		Drought issues in the summer Aging infrastructure Operating at a reduced capacity		
Other Services/Utilities	Utility lines	High Wind/Microburst Hurricane/Nor'easters Flooding Winter Storms Lightning Tornadoes Earthquakes Drought Heat Wave Dam Failure	• Town tree trimming program	None at this time.
Public Communication Equipment	Equipment at Police Station, repeaters throughout town Private cell towers/in church steeples Communication Tower at RI State Police	High Wind/Microburst Lightning		9. Maintain local emergency communication equipment compatibility.
Dams (and ownership)	<u>High Hazard Dams</u> Handy Brook Handy Pond Upper (#391)- unknown owner Moshassuck River Butterfly Pond (#097)- town Moshassuck River Moffett Pond (#099)- private Moshassuck River Barney Pond (#101)- town Moshassuck River Bleachery Pond (#104)- private Moshassuck River Limerock Reserve (#295)- town Moshassuck River-Trib Bridlewood Pond (#408)- private Moshassuck River-Trib Bridlewood Upper End (#649)- private	Hurricane/Nor'easters Flooding Winter Storms Tornadoes Earthquakes	• Dam EAPs for all dams in Town, except for Crookfall	10. Identify a viable solution to address the seepage at Barney Pond Dam. 11. Improvements to Handy Pond Dam.

At Risk	Location	Hazard/Problem	Ongoing Actions	New Mitigation Actions
	Threadmill Brook Olney Pond (#102)- state Crookfall Brook-Woonsocket Reservoir-Woonsocket			
Critical Municipal Hazard Response Facilities	Albion Fire Station Albion Youth Center Animal Shelter Lime Rock Fire Station Lime Rock Sub Station Lincoln Highway Garage Lincoln Public Library Lincoln Rescue Facility Lincoln High School and School Administration Bldg. Lincoln Town Hall/Police Dept. Lincoln Water Commission Lonsdale Rescue Facility Manville Fire Station Quinnville Fire Station Saylesville/Albion Fire Station Lincoln Senior Center Lincoln Middle School RI State Police Twin River- used for staging Lincoln Commons- used for staging	High Wind/Microburst Hurricane/Nor'easters Flooding Winter Storms Lightning Tornadoes Earthquakes		12. Safety upgrades to all town-owned buildings. a) Assessment b) Prioritize 13. Build a new Rescue station.
Populations	Care Facilities • Atria Lincoln Place (private) • The Lighthouse at Lincoln (private) • Lincoln Manor (housing complexes) • Manville Manor (housing complexes) • Washington Hills (private) • Holiday Nursing Home (private)	Hurricane/Nor'easters Flooding Winter Storms Lightning Tornadoes Earthquakes Drought Heat Wave	• Special Needs Registry List is updated.	14. Improve promotion of the RI Special Needs Registry. 15. Improve public outreach efforts and available

At Risk	Location	Hazard/Problem	Ongoing Actions	New Mitigation Actions
	Group Homes/Long Term Care facilities • New River Road • Dexter Rock Road • Harris Avenue • Angel Road • Cobble Hill			information on the Town's website. a) Post current fire rating on Town website b) Create a space on the site for storm preparedness and other readiness information.
Businesses	Ryco Fabrics – 25 Carrington St. RI Vent – 25 Carrington St. Lonsdale Bleachery Complex along Blackstone River – off of Front Street and Carrington St.	High Wind/Microburst Hurricane/Nor'easters Flooding Winter Storms Lightning Tornadoes Earthquakes	• Take personal responsibility for flooding. • Town lifts flood control boards to reduce flooding from upstream residents, but floodwaters end up downstream	2. Reduce flooding of the Blackstone River a) Army Corps of Engineers (ACOE) study of the entire Blackstone River system b) Dredge the canal c) Upgrade flood control from manual systems to automated systems in the canal.
Schools	Lincoln Middle School Lincoln High School Elementary Schools • Saylesville • Lonsdale • Central Lincoln	High Wind/Microburst Hurricane/Nor'easters Flooding Winter Storms Lightning Tornadoes	• Remote learning	

At Risk	Location	Hazard/Problem	Ongoing Actions	New Mitigation Actions
	• Northern Lincoln Blackstone Valley Upper Elementary School Community College of Rhode Island (CCRI)	Earthquakes		
Recreation Facilities	(See Open Space Element in Comprehensive Plan) • Playgrounds and Fields • Major/State Park • Conservation Area • Special Area (i.e. indoor recreation and cultural facility)	Hurricane/Nor'easters Flooding Winter Storms Lightning		None at this time.
Natural Resources	Blackstone River and Moshassuck Water Systems Wetlands Floodplains Soils Aquifers Rare and Endangered Species habitat: Lime Rock quarry area and the Lonsdale Marshes (Valley Falls Pond area) Forests	High Wind/Microburst Hurricane/Nor'easters Flooding Winter Storms Lightning Tornadoes Earthquakes Drought Heat Wave	Improved firefighting for brushfires	16. When request is formalized by RIDEM, act on the identified Total Maximum Daily Loads (TMDLs) to improve water quality.
Historic Resources	Lonsdale Bleachery Hearthside- lightning, winter, strong winds Great Road: Scenic Roadway (RIDOT) Breakneck Hill Road: Scenic Roadway (RIDOT) Valentine Whitman House	High Wind/Microburst Hurricane/Nor'easters Flooding Winter Storms Lightning Tornadoes Earthquakes		17. Create an Inspection Plan or Pre-Disaster Resiliency for Moffett Mill and Hearthside.

5

Programmatic Capabilities

Purpose

This capability assessment examines the existing studies, plans, programs, and policies that have incorporated hazard mitigation and other pro-active tools into the Town system. The purpose of the capability assessment is to highlight successes, identify shortcomings, and to lay the groundwork for possible improvement. The Town of Lincoln recognizes that the inclusion of mitigation initiatives not only benefits the community by reducing human suffering, damages and the costs of recovery, but also helps build and maintain the sustainability and economic health of the Town. This section details the Town's existing relevant plans, programs, and policies that were reviewed during the drafting of this plan.

Primary Plans, Regulations, and Departments

Capital Improvement Plan (CIP): Last updated in 2013, the CIP prioritizes public infrastructure projects over the next five years. Capital expenses include new or expanded physical facilities that are large, expensive, and permanent. Examples include senior centers, schools, town hall, public safety buildings, roads, public libraries, and park and recreational facilities. Such facilities are expensive and cannot normally be financed on a "pay-as-you-go" basis. Actions identified in this tool are reviewed when updating the natural hazard mitigation plan.

Comprehensive Plan: In 1970, the Town developed its first Comprehensive Plan, which was most recently updated in 2003. Lincoln's Comprehensive Plan identifies actions that can be taken to address increased development pressures, economic stability, open space and recreation issues, and public infrastructure and facilities. It outlines goals, policies, issues, and actions to provide a framework for everyday operations within the Town.

Lincoln has recognized the importance of incorporating mitigation initiatives (both Pre- and Post-Disaster) into the Comprehensive Plan and has adopted the mitigation strategy and planning process into its publicized Town-planning initiatives. Further revisions of the Comprehensive Plan will reflect the mitigation actions set forth in this plan, as well as revisions of such, when setting goals for the Town, which will allow all Town plans to incorporate comprehensive mitigation planning for the Town. Hazard mitigation identification and activities are expected to be incorporated into the Comprehensive Plan update per State recommendations.

Continuity of Operations Plan (COOP)/Continuity of Government (COG): Town operations should be performed efficiently with minimal disruption, especially during an emergency. The plan provides an overview of continuity of operations efforts. Departments have further specific plans outlining procedures necessary to maintain essential services on a day-to-day basis.

Dam Emergency Action Plans (EAPs): The Town has dam EAPs for all high hazard dams in Town, except for Crookfall Brook which is on the North Smithfield border.

Emergency Operations Plan: This plan addresses the response to extraordinary emergency situations associated with natural, man-made, and technological disasters. The Town's Emergency Operations Plan further addresses pre- and post-disaster strategies to affectively deal with the hazards addressed in this plan such as hurricane and flooding evacuation, public warning and sheltering during natural disasters. Lincoln's plan combines mitigation, preparedness, response, and recovery. Future revisions of the EOP by the Lincoln Emergency Management department will continue to incorporate mitigation activities; including those listed in the Plan. This plan is reviewed and updated every few years to include changes in policy, new information, or changes in hazard threats.

Erosion and Sediment Control Plan and Stormwater Pollution Prevention Plan (SWPP): This bylaw was adopted to ensure that land disturbance activities do not increase stormwater run-off. Applicants must file an erosion and sediment control plan as well as a soil erosion and sediment control permit application. For disturbance areas greater than one acre, a stormwater pollution prevention plan (SWPP) must also be approved. Where applicable, a Rhode Island freshwater wetlands permit is required.

Land Development and Subdivision Regulations: Written and approved by the Planning Board, these regulations: promote the protection of the existing natural and built environment from fire, flood, and other hazards or damages.

National Flood Insurance Program (NFIP): The Town of Lincoln is an active and compliant member of the National Flood Insurance Program since 1982. As such, Lincoln residents are able to purchase flood insurance to protect their property against flood losses. The Town of Lincoln has adopted the most recent (October 2, 2015) Flood Insurance Rate Maps (FIRM) and Flood Insurance Study (FIS). The Town has designated the Building Inspector as the NFIP Coordinator to manage the program. Article VIII, Section 260-46 of the Zoning Ordinance is dedicated to the floodplain management program. The special flood hazard areas make up the flood plain overlay district.

Floodplain Education: The NFIP Coordinator is available to answer questions that residents may have about flood insurance, compliance, or floodplains. There are also flood-related print materials available at the Building Official's office.

Town Tree Trimming Program: In partnership with local utility companies the Town of Lincoln's Department of Public Works regularly maintains trees along public roads. The Town has a chipper for branches and utilizes the State Master Price Agreement for larger trimming projects. The Town does not work near power lines. Trimming near power and utility lines are done by the various utilities using their own crews and equipment or contractors.

Zoning Ordinance: Among other things, the Lincoln Zoning Ordinance manages growth and land use. As discussed in Article VIII, Section 260-46 of the Zoning Ordinance, Lincoln's Flood Hazard Overlay District was created to minimize hazards to persons and property from inland flooding, to protect water courses from encroachment and to maintain the capacity of floodplains to retain and carry off floodwaters.

Departments/Organizations

Building Department: The Lincoln Building Department handles building permits, mechanical permits, electrical permits, plumbing permits, zoning applications, and many other services.

The Building Department helps the Town improve resiliency and reduce damages and cost from hazards by reviewing every site that is proposed for new development and/or redevelopment to ensure the sewer, water and stormwater regulations are followed during the design, the construction and the final acceptance of the site.

Conservation Commission: The purpose of the Conservation Commission is to promote and develop the natural resources, to protect the watershed resources and to preserve natural aesthetic areas within the Town. Among other things, volunteers maintain an index of all open spaces within the Town in public or private ownership, including open marshlands, swamps and other wetlands, for the purpose of obtaining information on the proper use of such areas.

Department of Public Works: The Public Works Department manages public infrastructure projects including the sewer system, town owned roads, and the municipal tree services. The Public Works Department is continually improving road conditions and drainage systems, and implements an annual street sweeping program.

Elements of this hazard mitigation plan will help the public works department prioritize projects and facilitate grant applications for funding. This department is out in the Town every day and offers firsthand experience on vulnerable systems, and infrastructure needs. The Lincoln Public Works Department, in conjunction with National Grid, engage in an ongoing tree-trimming program which reduces the probability of downed utility lines, and reduces storm debris.

School Department Buildings and Grounds: In cooperation with Town Public Works, the School Department is responsible for the maintenance of all school buildings and school

grounds. This includes sand spreading, and snow and ice clearing from roofs and around storm drains.

Fire Department: Lincoln businesses and residents are protected from fires, medical, hazardous material or environmental mishaps. The Town of Lincoln is served by four fire districts: Lime Rock Department and Lime Rick Sub Station, Manville Fire Department, Quinnville Fire District, and the Lincoln Fire District (includes the Saylesville Fire Station and the Albion Fire Station.

The town is served by 34 permanent and 66 call firefighters at five fire districts. Overall equipment inventory includes:

- 6 pump engines (3 reserve)
- 2 ladder trucks (quints)
- 1 brush truck

Planning: The Planning Department is the lead on the hazard mitigation plan update. Elements from their work on the Comprehensive Plan, and Land Development and Subdivision Regulations are incorporated into the hazard mitigation plan. Actions as outlined in this hazard mitigation plan will help prioritize the growth and resiliency goals of the community.

Police: The Police Department aims to create a partnership with the community to provide the best in public safety and service to the Town of Lincoln. The members of the department are empowered to enforce state and local laws to ensure that the peace and tranquility of our neighborhoods are maintained, and that crime and the fear of crime are reduced. The Lincoln Police Department is staffed by 34 sworn police officers and supported by 1 animal control officer, and 1 administrative assistant.

The Department operates twenty-four hours a day and responds to all criminal complaints, calls for service and Town-wide emergencies. In 2020, officers responded to over 20,595 calls. The Department is located at 100 Old River Road and has the following equipment:

- 10 marked front line vehicles
- 6 detail/traffic vehicles
- 8 unmarked/detective vehicles

Rescue Department/Public Safety/Emergency Medical Services (EMS): Lincoln's Rescue Department is responsible for providing pre-hospital care, as well as protecting the safety and well-being of the public. The Rescue Department is served by 17 full-time employees and 2 ambulances (1 reserve).

The Town of Lincoln's Public Safety "System" is a collaborative effort between Lincoln Rescue, Lincoln Police, the four fire districts/departments, Rhode Island Department of Health (RIDOH), Rhode Island Emergency Management Agency (RIEMA), and any other appropriate local, state, or federal entity. The EMS Service is charged with maintaining a state of readiness for emergency response, providing emergency and non-emergency response, providing aid to the public, and providing specific community services.

The permanently established Emergency Operations Center (EOC) is located at 115 Main Street, in the village of Albion. The EOC has a diesel generator servicing the entire building.

Lincoln uses the CodeRED emergency telephone notification system to provide important emergency information to citizens.

Town Administrator: Responsible for the execution of laws and the administration of Town government.

Town Council: These 5 elected members are the governing body by which new plans and policies may be adopted. They take a holistic view of the Town's operations when formulating policies and exercising town powers. Educating the Town Council members about the importance of hazard mitigation is not only beneficial for the Town's resiliency but also facilitates plan adoption.

State Programs

Rhode Island Enhanced 9-1-1 Telephone System: Lincoln utilizes the state's E-911 system which provides 24-hour public safety communication services from one answering point in North Scituate. Each call is routed to the appropriate response team. The system processes both landline and wireless 9-1-1 calls.

Rhode Island State Building Code: All municipalities within the State of Rhode Island share a single building code (RIGL 23-27.3-100 et. al.). The Code itself (which incorporates the International Building Code) was last amended in 2012 and provides comprehensive construction requirements designed to mitigate the impacts from natural hazards, such as high wind events. The Code is enforced by the West Warwick Building Department and provides an additional layer of regulatory control to those discussed above.

Rhode Island State Fire Code Regulations: Lincoln has adopted the Rhode Island Fire Safety Codes to safeguard life and property from the hazards of fire and explosives in accordance with safe practice. The Fire Code provides reasonable minimum requirements for fire prevention and protection. For existing structures, the Fire Code is enforced by the four fire districts for existing structures. The Building Official enforces the Fire Code for new structures.

Rhode Island State Dam Safety Program: The Town of Lincoln participates in the State Dam Safety Program because of the high hazard dams in the town. The State Dam Safety Program was created to facilitate the enforcement of the primary dam inspection law (RIGL 46-19, Inspection of Dams and Reservoirs). RIGL 46-19 states that dam owners are responsible for the safe operation, maintenance, repair, and rehabilitation of a dam, which are the essential elements in preventing dam failure; furthermore, dam owners are liable for the consequences of accidents or failures of their dams. According to the State of Rhode Island 2017 Dam Safety Program Report, the following have been identified as program limitations: unclear ownership of numerous high hazard dams, construction of buildings within inundation areas below dams, lack of funding to repair of remove privately owned dams, inadequate spillway capacities and engineering analyses, lack of Emergency Action Plans across the state, inadequate staffing, increase in rainstorm intensities. With the exception of Crookfall Dam, all have Emergency Action Plans on file.

Rhode Island DEM Division of Law Enforcement: The Rhode Island DEM Division of Law Enforcement serves to protect the natural resources and ensure compliance with all environmental conservation laws through law enforcement and education.

Rhode Island DEM Wetland Regulations: The Rhode Island Department of Environmental Management (DEM) is responsible for regulating alterations of the freshwater wetlands throughout the State. Since many floodplains are also wetlands, appropriately managing these resources help maintain proper floodplain function. These regulations ensure that actions in this plan which alter the physical landscape will not do so at the expense of wetlands.

Rhode Island Department of Health: The Rhode Island Department of Health (RIDOH), not only strives to prevent disease and increase health and safety, but they also promote the Special Needs Emergency Registry. By voluntarily enrolling in this list, local police, fire, and other local first responders can better prepare for and respond to an individual's needs during a disaster.

Rhode Island Emergency Management Agency: The Rhode Island Emergency Management Agency (RIEMA) is the State agency assigned to reduce the loss of life and property for the whole community while ensuring that as a state we work together to build, sustain, and improve our capability to prepare for, protect against, respond to, recover from, and mitigate all natural, human-caused, and technological hazards. RIEMA is also the pass-through agency for FEMA mitigation funding.

Other

United Way 2-1-1: United Way 2-1-1 in Rhode Island is a free, confidential service that provides information, referrals, and is available in multiple languages. This service connects residents with community services they may need such as childcare, housing, health insurance, and tax preparation.

Federal Programs

Federal Emergency Management Agency: The Federal Emergency Management Agency (FEMA), an agency of the U.S. Department of Homeland Security, coordinates disaster response when local and state resources are maxed out. The agency also provides grant funding for pre-and post-disaster mitigation projects.

6

Mitigation Actions

Mission Statement

Preserve and enhance the quality of life, property, and resources by identifying areas at risk from natural hazards and implementing priority hazard mitigation strategies to protect Lincoln's citizens, infrastructure, and historical, cultural, and natural resources.

Mitigation Goals

To effectuate the mission statement, the Town establishes the following hazard mitigation goals, toward which all action must reach:

1. Develop and implement projects and programs which minimize losses associated with natural hazards
2. Protect critical infrastructure and maintain essential services
3. Preserve cultural, historical, and natural resources
4. Facilitate a rapid recovery process following natural disasters
5. Facilitate actions so that businesses are able to rapidly recover from a disaster.

Status of Proposed 2016 Actions

Table 26 Status of Proposed 2016 Actions

Action	Status?	Reason why it is not complete (shift in focus, funding, etc.)	Other comments
Evaluation of Structural Integrity of Dams	**Ongoing**		Completed by DEM.
Research Use of Computer Based Models to Simulate Dam Failure	**Done**		Completed by DEM for high hazard dams.
Establish a Priority List of Dam Repair	**Done**		
Public Education and Outreach for Downstream Residents	**No**	Not needed at this time.	Contacts are in EAP for emergencies.
Improve Existing Conditions of Dams	**Ongoing**		Regular maintenance
Evaluation of Functionality of Local Utilities	**Ongoing**	Wastewater ongoing.	Ongoing: Mill complexes being renovated and require to upgrade/repair as necessary.
Establish a Priority List for Utilities	**Ongoing**		
Improve Existing Conditions of Local Public Utilities Structures	**Ongoing**	Wastewater ongoing.	
Evaluate Structural Integrity of Bridges			
Establish a Priority List for Repairs (bridges)	**Done**		
Public Education and Outreach for Bridge Users	**No**	Not needed at this time.	Weight restrictions have been posted.
Improve Existing Conditions of Bridges	**No**	Not needed at this time for locally owned bridges.	RIDOT identified a guardrail deficiency which has been fixed. Major repairs would coincide with dredging of canal. State is actively repairing bridges.
Priority List of Street Repair Subject to Flooding	**Ongoing**		
Create a Standard to Review Drainage on New Developments/Projects	**Done**		Comply w DEM Stormwater manual (for projects over an acre). Have hired larger engineering firms as necessary.
Public Education and Outreach for Property Owners along Blackstone River	**No**		Done by various organizations for the Blackstone.
Evaluate Which Properties are Subject to Basement Flooding and Educate Owners	**Done**		They have talked to commercial businesses ahead of a storm. Provided options for elevating equip/goods.
Explore Possibility of Acquiring Repetitive Loss Property		Only 6 repetitive loss properties- 5 of which are commercial space. Not needed at this time.	Very few residential properties in SFHA.
Improve Existing Conditions of Properties and Streets Subject to Flooding from Poor Drainage	**Ongoing**		

Table 26 Status of Proposed 2016 Actions

Action	Status?	Reason why it is not complete (shift in focus, funding, etc.)	Other comments
Join Community Rating System	**No**	Not necessary at this time.	Very few residential properties in SFHA.
Continue Working Relationship with Tree Companies	**Ongoing**		
Public Education and Outreach for Town Residents to Identify Readiness	**Ongoing**		Improve on this effort. Move to 2022 Actions.
Develop and Distribute Educational Pamphlet	**No**		
Establish Area on Town Website to Post Fire Rating	**No**	Collected by Fire Districts	Improve on this effort. Move to 2022 Actions.
Develop Working Relationship with School Departments	**Done**		
Continue Working with Police and All Fire Districts on Natural Hazard Planning	**Ongoing**		
Develop Working Relationship with Privately Owed Medical Facilities	**Ongoing**		
Increase Pump Station Functionality	**Done**		
Improve Electrical Safety of Public Buildings	**Done**		
Maintain Safety and Care of Facility Residents	**Ongoing**		

Additional Actions Since Last Plan Update

Since the 2016 Hazard Mitigation Plan, the Town of Lincoln has the following notable successes in making their town more resilient and accessible.

- Upgraded restroom facilities at Lincoln Woods State Park built to also improve water quality.
- All parks have been upgraded to have similar facilities.
- Improvements to the Blackstone Regional Animal Shelter which now meet current RIDEM standards.
- Increased parking at the Senior Center which also serves as an Emergency Shelter.
- Renovations to Lincoln High School.
- The Town has received a portable bypass pump to use at the major pump stations.
- First responders have switched to an 800MHz radio system.
- The response to the 2020/2021 COVID-19 pandemic has enhanced remote learning capabilities.

Mitigation Actions

The Lincoln Hazard Mitigation Plan Committee decided to propose actions that addressed certain vulnerabilities that were identified earlier in the planning process. See Chapter 4.

The worksheets below summarize the specific problem and proposed possible solution, details the primary tasks to be undertaken, identifies an appropriate lead and anticipates financing options. Each action was given a priority ranking of low, medium, or high as determined by the Committee. This helps to generally prioritize needs when funding becomes available or budgeted. Funding and staff time will be the determining factors on when various actions are completed. The Committee understands that implementation of many of these proposed actions require the Town to secure external funding.

This HMP includes actions which prevent or reduce the consequences of disaster (mitigation), planning and education (preparedness), improved response in the immediate aftermath of an event (response), and improved restoration efforts (recovery). Those which are true mitigation actions are noted as such. There are necessary planning elements that need to be completed before additional mitigation actions can be considered. The Committee has identified a range of actions below, some of which are planning activities. However, there is a mitigation action identified for each vulnerable area where applicable.

Priority Level

- **High:** Reduces the greatest risks, is important to accomplish first
- **Medium:** May need other actions to be completed first
- **Low:** Less of an impact on safety and property

Time Frame (from date of plan adoption)

- **Short Term:** within 1-3 years
- **Medium Term:** within 3-5 years
- **Long Term:** greater than 5 years

Goals

1. Develop and implement projects and programs which minimize losses associated with natural hazards
2. Protect critical infrastructure and maintain essential services
3. Preserve cultural, historical, and natural resources
4. Facilitate a rapid recovery process following natural disasters
5. Facilitate actions so that businesses are able to rapidly recover from a disaster.

VULNERABLE AREA: Flood Prone Drainage Systems, Streets, or Infrastructure

Mitigation Action	Mitigation Type	Alignment with Plan Goals	Action Priority
1. Reduce street flooding by improving the following locations: a. Spruce Street b. Ballou Avenue c. Allen Drive and Front Street d. Old River Road and Route 116	☒ Local Plans and Regulations ☒ Structure and Infrastructure ☐ Natural Systems Protection ☐ Education and Awareness This is a true mitigation action.	☒ 1 ☐ 4 ☒ 2 ☐ 5 ☒ 3	☐ High ☒ Medium ☐ Low **Action Status** New

Rationale – Why Is This Important?

- Spruce Street is a dead-end street with a low point and a dry well that can't keep up with sheet flow during heavy rains. (short-term action)
- Ballou Avenue is a low area in a residential neighborhood that experiences chronic flooding. The current headwall to direct water flow is failing. (short-term action)
- Allen Drive and Front Street intersection has undersized drainage infrastructure. (long-term action)
- Old River Road and Route 116 (owned by RIDOT) has undersized/underperforming drainage infrastructure. (long-term action)

Benefits	Obstacles	
Improved infrastructure function can reduce standing water on the streets after a heavy rainfall. Reducing the time standing water is on the road deduces damage to the road and keeps traffic moving.	Funding and coordination for RIDOT projects	
Lead/Champion	**Support**	
Lincoln Public Works and RIDOT		
Potential Funding Sources	**Estimated Cost (by location above)**	**Timeline**
› FEMA mitigation grants › Capital Improvement	a) $50,000 b) $250,000 c) $250,000 d) unknown	☒ Short Term (0-3 years) ☐ Medium Term (3-5 years) ☒ Long Term (more than 5 years)

Other Notes

VULNERABLE AREA: Flood Prone Drainage Systems, Streets, or Infrastructure

Mitigation Action	Mitigation Type	Alignment with Plan Goals	Action Priority
2. Reduce flooding of the Blackstone River a. Army Corps of Engineers (ACOE) to perform a study of the entire Blackstone River system b. Dredge the canal c. Upgrade flood control from manual systems to automated systems in the canal.	☒ Local Plans and Regulations ☒ Structure and Infrastructure ☐ Natural Systems Protection ☐ Education and Awareness This is a true mitigation action.	☒ 1 ☐ 4 ☒ 2 ☐ 5 ☒ 3	☐ High ☒ Medium ☐ Low **Action Status** New

Rationale – Why Is This Important?

The Blackstone River drains a watershed of approximately 540 square miles in Rhode Island and Massachusetts. Residential and industrial development along the river are susceptible to riverine flooding during high rainfall events. Rather than piecemeal downstream mitigation efforts, local municipalities would benefit from a regional system-wide study that would dictate what types of mitigation actions (such as dredging the canal and upgrading flood control systems) would be most beneficial.

Benefits	Obstacles	
A holistic approach to reducing river flooding within the entire system.	Funding and coordination for RIDOT projects	
Lead/Champion	**Support**	
Lincoln Public Works and RIDEM	Army Corps of Engineers	
Potential Funding Sources	**Estimated Cost**	**Timeline**
› Army Corps of Engineers	a) unknown b) unknown, based on previous study c) depends on location	☐ Short Term (0-3 years) ☐ Medium Term (3-5 years) ☒ Long Term (more than 5 years)

Other Notes

The Blackstone River Valley National Historic Park was established in 2014; the 402nd unit of the National Park Service.

This will be led by the Army Corps of Engineers.

VULNERABLE AREA: Bridges

Mitigation Action	Mitigation Type	Alignment with Plan Goals	Action Priority
3. Upgrade to Moshassuck River Bridge if more residential development occurs.	☐ Local Plans and Regulations ☒ Structure and Infrastructure ☐ Natural Systems Protection ☐ Education and Awareness	☒ 1 ☐ 4 ☒ 2 ☐ 5 ☒ 3	☐ High ☐ Medium ☒ Low **Action Status** New

Rationale – Why Is This Important?

Mill complex at 40 Walker Street is being redeveloped. That will bring increased traffic and use to the area over the Moshassuck River. It is approximately 10 feet wide by 15 feet long, unpassable by two-traffic. As the area of Town gets developed, this will cause a traffic stress point.

Benefits	Obstacles	
User safety for river crossing.	Permitting for work above the river	
Lead/Champion	**Support**	
Town Engineer	Public Works	
Potential Funding Sources	**Estimated Cost**	**Timeline**
› Offsite improvement funds › Public State/Local Capital Expense	$500,000	☐ Short Term (0-3 years) ☐ Medium Term (3-5 years) ☒ Long Term (more than 5 years)

Other Notes

Preparedness activity to aid in user safety and disaster response.

VULNERABLE AREA: Bridges

Mitigation Action	Mitigation Type	Alignment with Plan Goals	Action Priority
4. Preservation activities to old stone bridge on Reservoir Avenue over Crookfall Brook.	☐ Local Plans and Regulations ☒ Structure and Infrastructure ☐ Natural Systems Protection ☐ Education and Awareness	☐ 1 ☐ 4 ☒ 2 ☐ 5 ☐ 3	☐ High ☐ Medium ☒ Low **Action Status** New

Rationale – Why Is This Important?		
Unsafe conditions.		
Benefits	**Obstacles**	
User safety for river crossing.	Permitting for work above the river	
Lead/Champion	**Support**	
RIDOT and Federal Highway Administration (FHWA)		
Potential Funding Sources	**Estimated Cost**	**Timeline**
State and Federal highway improvement funds	Part of a larger state effort estimating $147,500[38]	☐ Short Term (0-3 years) ☐ Medium Term (3-5 years) ☒ Long Term (more than 5 years)

Other Notes

Reservoir Bridge No. 188, which carries Route 146 over Crookfall Brook, which serves as the boundary line between North Smithfield and Lincoln.

In design phase at the State level.

Preparedness and recovery activity.

[38] State Transportation Improvement Program FFY 2022-2031, RIDOT Major Capital Projects Program http://www.planning.ri.gov/documents/tip/2021/Section%203%20-%20STIP%2012.2.21.pdf

VULNERABLE AREA: Bridges

Mitigation Action	Mitigation Type	Alignment with Plan Goals	Action Priority
5. Work with RIDOT on repairing the sidewalk on the Walker Street bridge, especially if there is more development.	☐ Local Plans and Regulations ☒ Structure and Infrastructure ☐ Natural Systems Protection ☐ Education and Awareness	☒ 1 ☐ 4 ☒ 2 ☐ 5 ☐ 3	☐ High ☐ Medium ☒ Low **Action Status** New

Rationale – Why Is This Important?

The sidewalk on the south side of Walker Street over Bleachery Pond has collapsed. Pedestrians are forced to walk on a narrow strip of sidewalk closer to traffic. This area is in a regulatory floodway.

Benefits	Obstacles	
Public access around mill complex which is being redeveloped. Structural improvements to a bridge that may be compromised with additional flooding.	Difference in priorities between the RIDOT and the Town of Lincoln.	
Lead/Champion	**Support**	
RIDOT	Public Works	
Potential Funding Sources	**Estimated Cost**	**Timeline**
RIDOT	$35,000 (design only)	☐ Short Term (0-3 years) ☒ Medium Term (3-5 years) ☐ Long Term (more than 5 years)

Other Notes

Part of RIDOT 10-year plan. It has been unsafe for 20 years!

May have to tie the sidewalk repair into a more comprehensive bridge repair project.

This is a recovery activity.

Google image of collapsed sidewalk on Walker Street bridge.

VULNERABLE AREA: Wastewater

Mitigation Action	Mitigation Type	Alignment with Plan Goals	Action Priority
6. Purchase a 3rd portable generator for the pump stations.	☐ Local Plans and Regulations ☒ Structure and Infrastructure ☐ Natural Systems Protection ☐ Education and Awareness	☐ 1 ☐ 4 ☒ 2 ☐ 5 ☐ 3	☐ High ☐ Medium ☒ Low **Action Status** New

Rationale – Why Is This Important?

The 23 pump stations could use another portable generator for backup power. During a power outage, it is important for public health and the environment to be able to keep the wastewater moving through the system. A portable generator could be temporary located to where it's needed.

Benefits	Obstacles	
Public health	Funding	
Lead/Champion	**Support**	
Lincoln Public Works		
Potential Funding Sources	**Estimated Cost**	**Timeline**
› FEMA Pre-Disaster Mitigation Grant › FEMA Hazard Mitigation Grant Program funding	$45,000	☒ Short Term (0-3 years) ☐ Medium Term (3-5 years) ☐ Long Term (more than 5 years)

Other Notes

This is a Preparedness activity.

VULNERABLE AREA: Wastewater

Mitigation Action	Mitigation Type	Alignment with Plan Goals	Action Priority
7. Permanent generators for the Rollingwood, Lori Ellen, and Eagles Nest wastewater pump stations.	☐ Local Plans and Regulations ☒ Structure and Infrastructure ☐ Natural Systems Protection ☐ Education and Awareness	☐ 1 ☒ 4 ☒ 2 ☒ 5 ☐ 3	☐ High ☒ Medium ☐ Low **Action Status**

Rationale – Why Is This Important?

During a power outage, it is important for public health and the environment to be able to keep the wastewater moving through the system. These 3 pump stations experience higher flows than others and would benefit from a permanent generator to supply backup power.

Benefits	Obstacles	
Public health	Funding	
Lead/Champion	**Support**	
Lincoln Public Works		
Potential Funding Sources	**Estimated Cost**	**Timeline**
› FEMA Pre-Disaster Mitigation Grant › FEMA Hazard Mitigation Grant Program funding	Estimate $100,000	☐ Short Term (0-3 years) ☒ Medium Term (3-5 years) ☐ Long Term (more than 5 years)

Other Notes

The public infrastructure located within the mill complexes will need to be replaced/upgraded in the future as/if development continues in the area.

This is a preparedness activity.

VULNERABLE AREA: Water Supply Systems

Mitigation Action	Mitigation Type	Alignment with Plan Goals	Action Priority
8. Replace or re-line sections of the Town's waterlines.	☐ Local Plans and Regulations ☒ Structure and Infrastructure ☐ Natural Systems Protection ☐ Education and Awareness	☐ 1 ☒ 4 ☒ 2 ☒ 5 ☐ 3	☐ High ☒ Medium ☐ Low **Action Status**

Rationale – Why Is This Important?		
Aging water infrastructure system. Increasing water demand.		
Benefits	**Obstacles**	
Public health	Funding	
Lead/Champion	**Support**	
Lincoln Water Commission	Lincoln Public Works	
Potential Funding Sources	**Estimated Cost**	**Timeline**
› Lincoln Water Commission Capital Improvement Program › Lincoln Water Commission Infrastructure Rehabilitation Plan	Unknown at this time	☐ Short Term (0-3 years) ☐ Medium Term (3-5 years) ☒ Long Term (more than 5 years)

Other Notes

Lincoln Water Commission is currently conducting a system-wide analysis. Results from this study (expected by 2025) will determine priority areas for replacement or re-lining of water pipes.

The public infrastructure located within the mill complexes will need to be replaced/upgraded in the future as/if development continues in the area.

This is a preparedness activity.

VULNERABLE AREA: Public Communication Equipment

Mitigation Action	Mitigation Type	Alignment with Plan Goals	Action Priority
9. Maintain local emergency communication equipment compatibility.	☐ Local Plans and Regulations ☒ Structure and Infrastructure ☐ Natural Systems Protection ☐ Education and Awareness	☐ 1 ☒ 4 ☒ 2 ☐ 5 ☐ 3	☐ High ☒ Medium ☐ Low **Action Status** New

Rationale – Why Is This Important?

The emergency communication equipment currently used by the Town is compatible with State systems. However, as technology improves, the equipment (such as routers) may need to be replaced.

Benefits	Obstacles	
Public safety	Funding	
Lead/Champion	**Support**	
Lincoln Police Department	RI State Police	
Potential Funding Sources	**Estimated Cost**	**Timeline**
› Public State/Local Capital Expense	Unknown at this time	☐ Short Term (0-3 years) ☐ Medium Term (3-5 years) ☒ Long Term (more than 5 years)

Other Notes

This is a preparedness activity.

VULNERABLE AREA: Dams

Mitigation Action	Mitigation Type	Alignment with Plan Goals	Action Priority
10. Identify a viable solution to address the seepage at Barney Pond Dam.	☐ Local Plans and Regulations ☒ Structure and Infrastructure ☐ Natural Systems Protection ☐ Education and Awareness This is a mitigation activity.	☒ 1 ☐ 4 ☐ 2 ☐ 5 ☒ 3	☒ High ☐ Medium ☐ Low **Action Status** New

Rationale – Why Is This Important?

Currently the seepage is being controlled with a low-flow outlet that is exercised annually. However, this issue needs a long-term solution. This is classified as a high hazard dam. Failure may result in widespread damage.

Benefits	Obstacles	
Improved dam integrity	Funding	
Lead/Champion	**Support**	
Public Works/Engineering		
Potential Funding Sources	**Estimated Cost**	**Timeline**
Lincoln Capital Improvement Funds	At least $100,000	☒ Short Term (0-3 years) ☐ Medium Term (3-5 years) ☐ Long Term (more than 5 years)

Other Notes

Short term solution: injection of grout $100,000

Long term solution: continued maintenance. Maybe install sheet pile and advanced grouting program.

Barney Pond Dam

VULNERABLE AREA: Dams

Mitigation Action	Mitigation Type	Alignment with Plan Goals	Action Priority
11. Improvements to Handy Pond Dam.	☐ Local Plans and Regulations ☒ Structure and Infrastructure ☐ Natural Systems Protection ☐ Education and Awareness This is a mitigation activity.	☒ 1 ☐ 4 ☐ 2 ☐ 5 ☒ 3	☐ High ☒ Medium ☐ Low **Action Status** New

Rationale – Why Is This Important?

RIDEM has noted deficiencies in the dam- seepage, old stumps, and excessive foot traffic along the top of the dam. The Town of Lincoln is currently contesting ownership of the dam. This is classified as a high hazard dam. Failure may result in widespread damage.

Benefits	Obstacles	
Public Safety	Identifying ownership	
Lead/Champion	**Support**	
Public Works		
Potential Funding Sources	**Estimated Cost**	**Timeline**
Capital Improvement Funds if it is determined that the Town owns it. FEMA BRIC funds	Unknown	☐ Short Term (0-3 years) ☒ Medium Term (3-5 years) ☐ Long Term (more than 5 years)

Other Notes

Maybe sheetpile to stabilize embankment.

Short term: Determine ownership.

VULNERABLE AREA: Critical Municipal Hazard Response Facilities

Mitigation Action	Mitigation Type	Alignment with Plan Goals	Action Priority
12. Safety upgrades to all town-owned buildings. a) Assessment b) Prioritize	☐ Local Plans and Regulations ☒ Structure and Infrastructure ☐ Natural Systems Protection ☐ Education and Awareness	☐ 1 ☐ 4 ☒ 2 ☐ 5 ☐ 3	☒ High ☐ Medium ☐ Low Action Status New

Rationale – Why Is This Important?

Safety upgrades need for cameras, lighting, and communications.

Benefits	Obstacles	
Public Safety	Funding	
Lead/Champion	**Support**	
Lincoln Planning and Rescue	Public Works	
Potential Funding Sources	**Estimated Cost**	**Timeline**
Lincoln Capital Improvements Operating Budget Federal Infrastructure Bill (ARPA) Federal funding for improved air quality	• Town Hall and Highway Garage Assessment: $50,000 each • Rescue stations safety upgrades: $50,000	☒ Short Term (0-3 years) ☐ Medium Term (3-5 years) ☐ Long Term (more than 5 years)

Other Notes

Town Hall and Highway Garage need building assessments: High Priority

Safety upgrades to existing rescue stations is a High Priority

Preparedness activities.

VULNERABLE AREA: Critical Municipal Hazard Response Facilities

Mitigation Action	Mitigation Type	Alignment with Plan Goals	Action Priority
13. Build a new Rescue station to accommodate consolidation and meet demands of growth.	☐ Local Plans and Regulations ☒ Structure and Infrastructure ☐ Natural Systems Protection ☐ Education and Awareness	☐ 1 ☐ 4 ☒ 2 ☐ 5 ☐ 3	☒ High ☐ Medium ☐ Low Action Status New

Rationale – Why Is This Important?

Lincoln experiences a 1-2% population growth annually. The Town would like a centrally located Rescue station that would replace the stations at the north and south ends of town. This would improve response times.

Benefits	Obstacles	
Public Safety	Funding	
Lead/Champion	**Support**	
Lincoln Rescue		
Potential Funding Sources	**Estimated Cost**	**Timeline**
Lincoln Capital Improvements Operating Budget Federal Infrastructure Bill (ARPA) Federal funding for improved air quality	$7-$8 million	☒ Short Term (0-3 years) ☐ Medium Term (3-5 years) ☐ Long Term (more than 5 years)

Other Notes

A location has been sited between Town Hall and DPW Garage for a comprehensive EMA complex.

This is a Preparedness activity

VULNERABLE AREA: Populations

Mitigation Action	Mitigation Type	Alignment with Plan Goals	Action Priority
14. Improve promotion of the RI Special Needs Registry.	☐ Local Plans and Regulations ☐ Structure and Infrastructure ☐ Natural Systems Protection ☒ Education and Awareness	☒ 1 ☒ 4 ☐ 2 ☐ 5 ☐ 3	☒ High ☐ Medium ☐ Low **Action Status** New

Rationale – Why Is This Important?

The Department of Health and Rhode Island Emergency Management Agency have worked with E-911 to notify first responders when they are responding to a household that may have someone enrolled in the Registry.

Benefits	Obstacles	
Public Safety	Priorities in the Town	
Lead/Champion	**Support**	
Public Safety	Police and Rescue	
Potential Funding Sources	**Estimated Cost**	**Timeline**
Public Safety Budget	Staff time	☒ Short Term (0-3 years) ☐ Medium Term (3-5 years) ☐ Long Term (more than 5 years)

Other Notes

https://health.ri.gov/emergency/about/specialneedsregistry/

This is a Preparedness activity.

VULNERABLE AREA: Populations

Mitigation Action	Mitigation Type	Alignment with Plan Goals	Action Priority
15. Improve public outreach efforts and available information on the Town's website. a) Post current fire rating on Town website b) Create a space on the site for storm preparedness and other readiness information.	☐ Local Plans and Regulations ☐ Structure and Infrastructure ☐ Natural Systems Protection ☒ Education and Awareness	☒ 1 ☒ 4 ☐ 2 ☐ 5 ☐ 3	☒ High ☐ Medium ☐ Low **Action Status** From 2016

Rationale – Why Is This Important?

The recent survey in conjunction with this plan update showed that Lincoln residents are looking to social media and email for pre-storm educational information.

Carryover mitigation actions from 2016 include posting the current fire rating on the Town's website and having a Public Education and Outreach component for Town Residents to Identify Readiness.

Benefits	Obstacles	
Preparedness		
Lead/Champion	**Support**	
Public Safety	Planning	
Potential Funding Sources	**Estimated Cost**	**Timeline**
Public Safety Budget	Staff time	☒ Short Term (0-3 years) ☐ Medium Term (3-5 years) ☐ Long Term (more than 5 years)

Other Notes

The Town is currently developing a more informative website.

This is a Preparedness activity.

VULNERABLE AREA: Natural Resources

Mitigation Action	Mitigation Type	Alignment with Plan Goals	Action Priority
16. When request is formalized by RIDEM, act on the identified Total Maximum Daily Loads (TMDLs) to improve water quality.	☒ Local Plans and Regulations ☐ Structure and Infrastructure ☒ Natural Systems Protection ☐ Education and Awareness	☐ 1 ☐ 4 ☐ 2 ☐ 5 ☒ 3	☒ High ☒ Medium ☐ Low **Action Status** New

Rationale – Why Is This Important?		
Water Quality		
Benefits	**Obstacles**	
Improved water quality	Funding	
Lead/Champion	**Support**	
Public Works		
Potential Funding Sources	**Estimated Cost**	**Timeline**
EPA Clean Water grants	Unknown at this time	☐ Short Term (0-3 years) ☒ Medium Term (3-5 years) ☐ Long Term (more than 5 years)

Other Notes

RIDEM has mentioned to the Town that multiple water bodies do not meet state water quality criteria. RIDEM works with municipal officials, watershed groups and other partners and interested parties in developing the water quality restoration plans. Once a TMDL is completed including public review and comment on the draft plan, the document is submitted to US EPA for its final review and approval.

This is a Response activity.

VULNERABLE AREA: Historic Resources

Mitigation Action	Mitigation Type	Alignment with Plan Goals	Action Priority
17. Create an Inspection Plan or Pre-Disaster Resiliency for Moffett Mill and Hearthside.	☒ Local Plans and Regulations ☒ Structure and Infrastructure ☐ Natural Systems Protection ☐ Education and Awareness	☐ 1 ☐ 4 ☐ 2 ☐ 5 ☒ 3	☐ High ☒ Medium ☐ Low **Action Status** New

Rationale – Why Is This Important?

These historic properties are part of the Town's identity. In Lincoln. historic properties and cultural resources are also valuable economic assets that can increase property values and attract businesses and tourists.

Benefits	Obstacles	
Planning for potential natural disasters can reduce future damages and ensure the future growth of safe and sustainable historic communities.		
Lead/Champion	**Support**	
Public Works	Planning, Friends of Hearthside	
Potential Funding Sources	**Estimated Cost**	**Timeline**
Historic Preservation Grants Town Capital (reserved for a capital project) or Operating Budget (annual budgeted item) Funding. The operation of Hearthside is from Operating budget and fundraising.	$50,000 Mill $50,000 Hearthside	☐ Short Term (0-3 years) ☒ Medium Term (3-5 years) ☐ Long Term (more than 5 years)

Other Notes

Along the Moshassuck River, the small mill is believed to be the first machine shop constructed in Rhode Island and is a rare example of a wooden mill built during the first wave of industrialization in the Blackstone Valley. This is a Preparedness activity.

Moffett Mill

Hearthside House

7

Implementation and Adoption

Prioritization of Mitigation Actions

Implementing the Plan

The Town of Lincoln and the Lincoln Hazard Mitigation Committee realize that successful hazard mitigation is an ongoing process that requires implementation, evaluation, and updates to this plan. The Town also understands the importance of integrating appropriate sections of the plan into the Town's Comprehensive Plan, Emergency Operations Plan, and site plan review process. It is intended that this plan and the ongoing efforts of the HMC will preserve and enhance the quality of life, property, and resources for the Town of Lincoln.

Adoption of this mitigation plan increases Lincoln's eligibility for federal hazard mitigation grants. These grants originate from FEMA's Pre-Disaster Flood Mitigation Assistance (FMA), Pre-Disaster Mitigation (PDM), Building Resilient Infrastructure in Communities (BRIC) and post-disaster Hazard Mitigation Grant (HMGP) Programs.

Monitoring

The HMC, under the leadership of the Town Planner, will meet annually (or more frequently if necessary), to monitor and evaluate the actions contained in the plan. At each meeting, the committee members will discuss the actions assigned to them to ensure continual progress with mitigation efforts. The status of each mitigation action will be documented, and minutes recorded for the record. The HMC will also continue to re-evaluate membership on the committee to ensure effective engagement of the appropriate parties. New members may be invited to serve on the HMC as priorities shift.

Evaluation

At the annual meetings, the HMC will evaluate both the actions and the planning process. The HMC will base its evaluation on whether or not the actions have met the following criteria: increased public awareness/education, reduction in hazard damage, actions being implemented in the designated time frames, and actions staying within the cost estimate. The committee will document and report its findings to the Planning Board and Town Council. The HMC will involve the public in the action evaluation process by holding an annual advertised public meeting in order to review the evaluation and solicit input.

During the annual evaluation process, the plan will be promoted online for public review. Comments and suggests can be sent directly to Town Planner or brought up at the advertised public meeting.

Revisions

Recognizing that this is a living document, the HMC will make changes to it after each annual revision or a disaster, as conditions warrant. These revisions will also reflect changes to priorities and funding strategies that may have been implemented.

A full revision of the plan will commence a year in advance of the current plan expiration date in order to ensure the Town always has an approved plan. The update will be completed every five years and will incorporate a formalized process for prioritizing actions and weighing the cost/benefit of such actions. All updates or revisions to the plan will be submitted to the RIEMA. The Town Council will involve the public in the plan revision process by holding an annual advertised public meeting to present recommended revisions and solicit input. Revised plans will also be sent to the neighboring communities for comment.

All future meetings will again be open to the public and it is the hope of the Hazard Mitigation Committee that once the public education and outreach actions begin, public involvement in the Plan will increase and will be reflected in future revisions. The Committee will involve the public in the annual meeting by posting it on the website, in the local library, and in the local newspaper to encourage involvement.

Adoption

After each evaluation cycle (every 5 years), the Lincoln Hazard Mitigation Plan will be presented to and adopted by the Town Council. The associated ordinance documentation will be kept as part of this plan.

Appendix A: Survey Results

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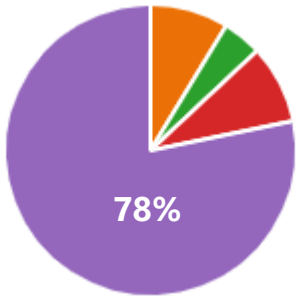
Lincoln Natural Hazards Survey
February 2021

23	04:52	Active
Responses	Average time to complete	Status

1. How long have you been in Lincoln?

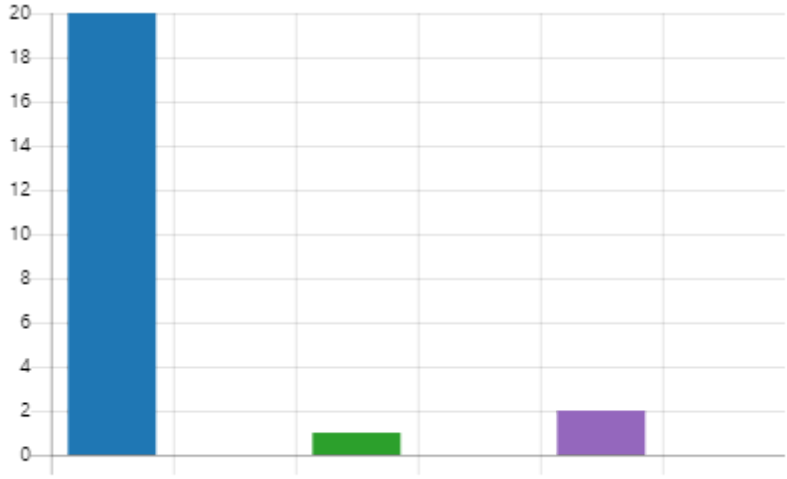
Less than a year	0
1 to 5 years	2
6 to 9 years	1
10 to 19 years	2
20 years or more	18



2. What is your primary connection to Lincoln?

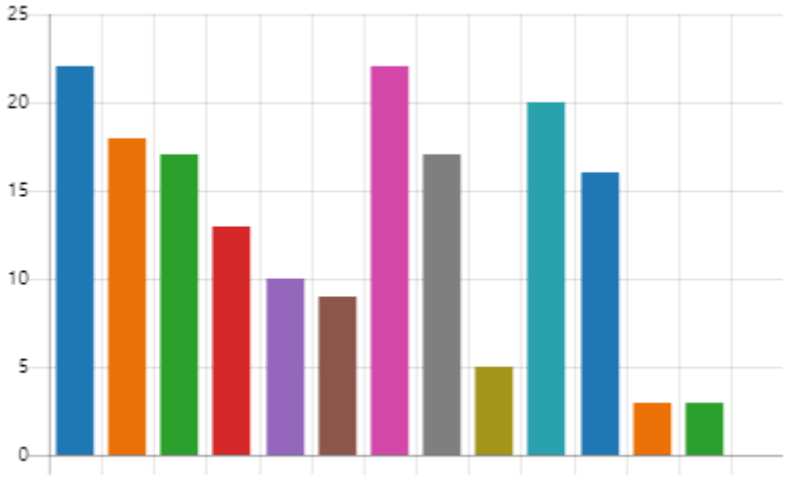
Insights

Resident	20
Business Owner	0
Resident and Business Owner	1
Non-Resident Property Owner	0
Local Employee	2
Student/Other	0



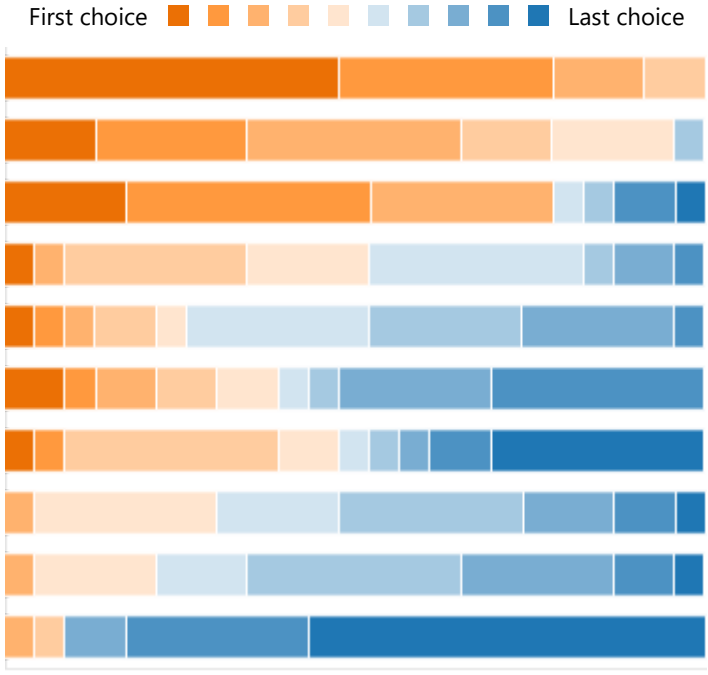
3. What types of natural events/natural disasters have you experienced in Lincoln? Check all that apply.

High Winds	22
Lightning	18
Extreme Cold	17
Extreme Heat	13
Drought	10
Earthquake	9
Winter storm (snow and ice)	22
Hail	17
Tornado	5
Hurricane/Tropical Storm/Nor'...	20
Street Flooding from Heavy R...	16
Riverine Flooding	3
Brushfire	3
Dam Failure	0



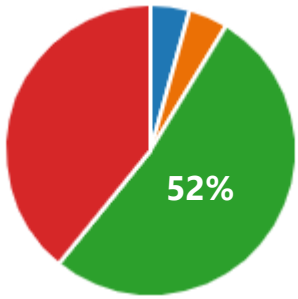
4. Please re-order the list of hazards so that the 3 you are most concerned about are at the top.

Rank	Options
1	Hurricane/Tropical Storm/Nor'...
2	High Winds/Tornado
3	Winter Storm (snow and ice)
4	Lightning
5	Extreme Cold
6	Flooding
7	Dam Failure
8	Extreme Heat
9	Drought
10	Brushfire



5. How prepared do you feel that you are for the probable impacts of natural hazards?

Not Prepared- no need	1
Not Prepared- never thought ...	1
Somewhat prepared for some ...	12
Prepared for most events	9



6. Does your street flood when it rains?

Insights

Always	2
Sometimes	4
No	17

7. If "always" or "sometimes", please provide the street name and nearest cross street. Or tell us of a place you know floods.

6

Responses

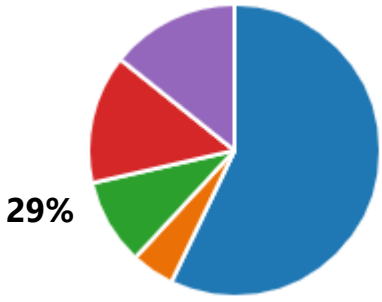
Responses:

Heath Street
146 and Breakneck Hill Rd
In front of 39 Rockridge
Summer St. and Old River Rd.
Grandview Ave.
Stonybridge Drive and Route 123

8. How many times has that street flooded in the last 12 months?

Insights

0	12
1	1
2-3	2
Over 5	3
I don't know.	3



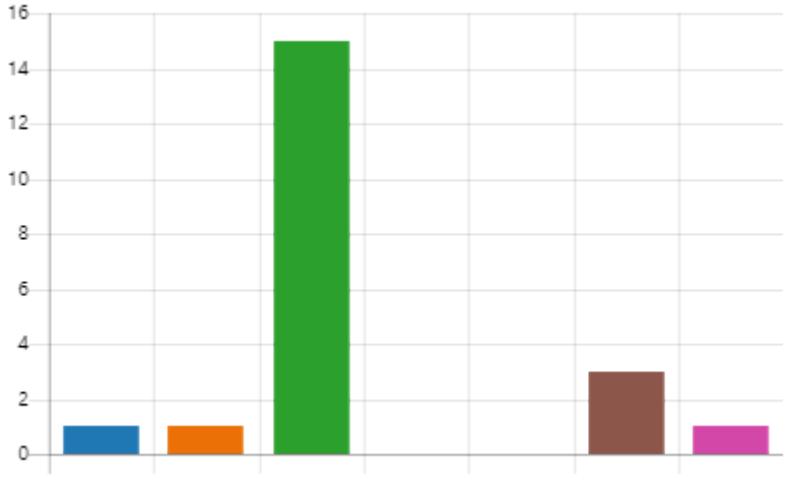
9. Do you currently have flood insurance on your home/business?

Yes	1
No	18
I don't know.	4

10. If you don't have flood insurance, please indicate the main reason why.

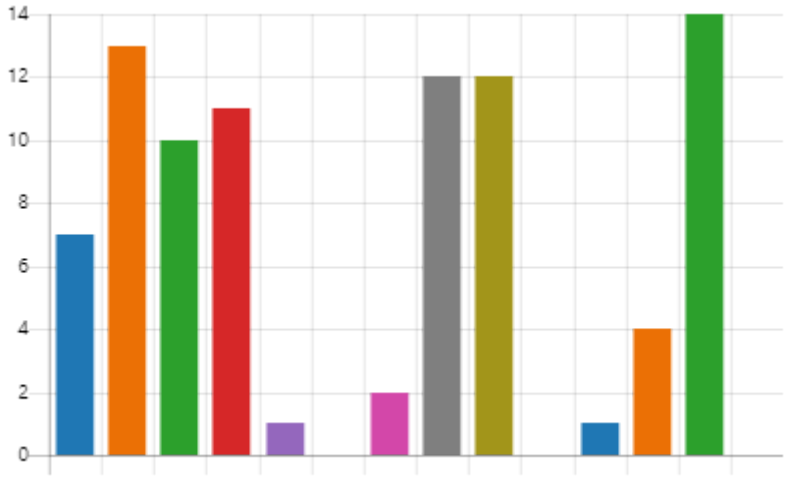
Insights

Never really considered it.	1
It never floods.	1
Not located in a floodplain.	15
Too expensive.	0
My house is elevated or other...	0
I'm not required to do so (I do...	3
Other	1



11. How do you prefer to receive pre-storm information about how to better protect your home, business, or neighborhood? Check all that apply. (Don't worry, we aren't adding you to a list.)

Local newspaper	7
Television	13
Radio	10
Town Website	11
Public workshops and meetings	1
School meetings and messages	0
Direct mailings	2
Email	12
Social media (Facebook, Twitt...	12
Information at the library	0
Information on utility bills	1
Roadside message boards or ...	4
Phone call from "Code Red"/R...	14
Not interested	0



12. Additional thoughts on how Lincoln can better prepare for the next natural event/disaster.

4

Responses

Responses:

- *Clean drainage basins and all related areas on a regular maintenance schedule and hold development accountable.*
- *Encourage National Grid to update their equipment or maintain trees over power lines so there are not so many power outages. I feel that the Town does a great job with snow/ice storms and clean up after a hurricane or tornado, but there is really nothing the Town can do for extreme heat or cold but to open up an emergency shelter for people who need air condition or heat. The Town has also done a great job in repairing/replacing high hazard dams.*
- *Better equipped with machinery and people to help with emergency*
- *Help residents with mitigation efforts tree trimming, cleaning/clearing storm drains, grants to reinforce homes*

Appendix B: Public Outreach

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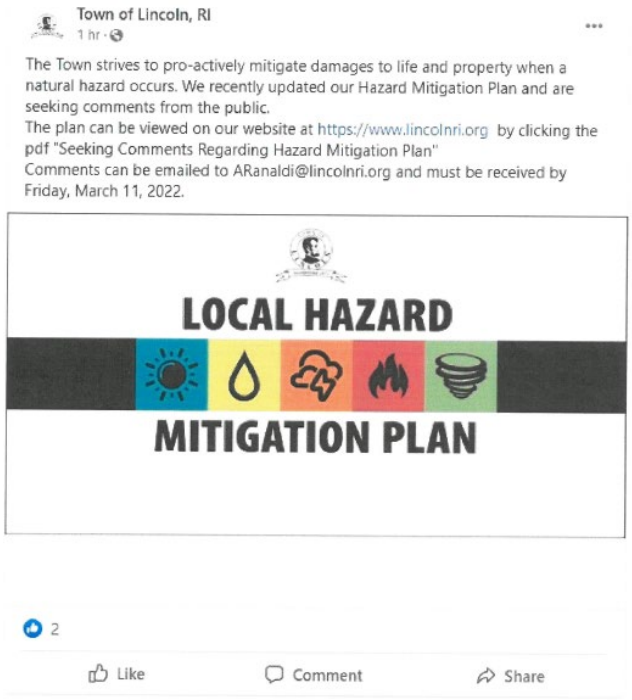
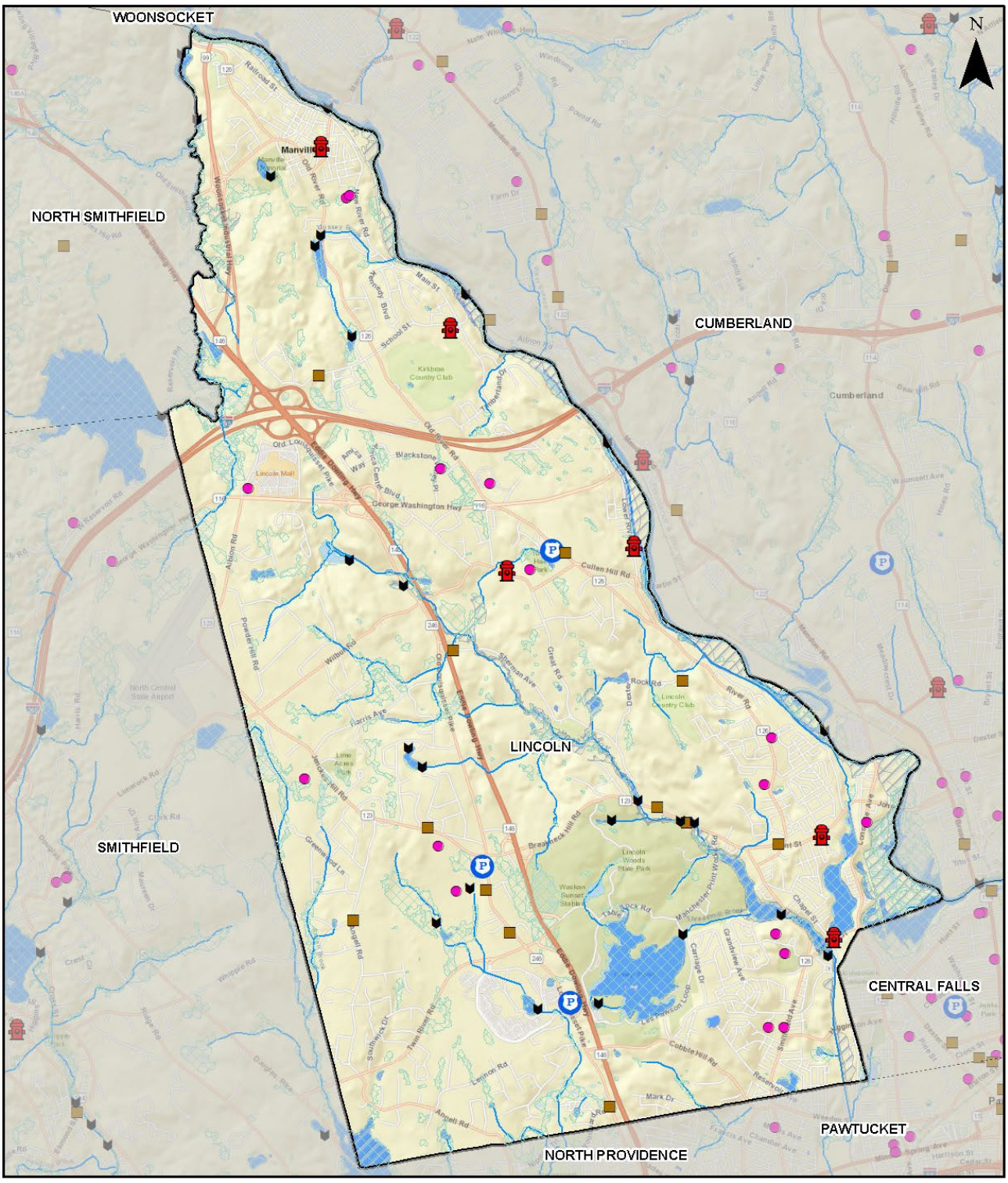
Facebook Post



Town Survey Post to be inserted.

Town Council Agenda to be inserted

Appendix C: Community Assets Map



Legend

- Historic Sites
- Police Stations
- Fire Stations
- Schools
- Dams
- Wetlands
- Town Line
- Special Flood Hazard Area
- Lakes, Rivers, Streams

Community Assets Lincoln, RI

0 0.5 1 2 Miles

Source: RI Geographic Information System, 2021