Multi-Hazard Mitigation Plan Update 2018

City of Dover, NH

Adopted 2006
Updated February 1, 2013
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Submitted to the New Hampshire Homeland Security & Emergency Management

By the

City of Dover, NH
with Strafford Regional Planning Commission

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The 2006 and 2013 Dover Multi-Hazard Mitigation Committee
New Hampshire Homeland Security Emergency Management (HSEM)
City of Dover

The 2018 City of Dover Multi-Hazard Mitigation Planning Committee

14 people have attended meetings and/or been instrumental in completing this plan:

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Cover: Cochecho River flooding outdoor deck of the Tavern Grill at the Falls (formerly Kelley's Row); 2006
Photo credit: Richard Driscoll, Former Assistant Fire Chief, Dover Fire & Rescue

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Executive Summary

This Plan was revised and updated to meet statutory requirements and to assist the City of Dover in reducing and mitigating future losses from natural and man-made hazardous events. An initial edition of this Plan was developed and presented to FEMA in 2006. The plan was revised in 2013, and was updated in 2018 to reflect the most recent information obtained through the evolution of the hazard mitigation program at the State. This update was developed by Strafford Regional Planning Commission (SRPC) and participants from the Multi-Hazard Mitigation Planning Team. This team was made up by the Fire Chief/EMD, Police Chief, Planning Director/Assistant City Manager, City Engineer, Director of Human Resources/Executive, Building Official, Economic Development Director, Recreation Department Director, Asset Management Admin/IT, Director of Welfare, Library Director, Media Services Manager, Community Services Director, and Deputy Director of Community Services.

The Plan references historical events, as well as identifies specific vulnerabilities that are likely to impact the City. Overall threats include:

- ∴ 5 hazards rated as having a High overall risk in Dover: flooding (riverine/extreme rain event), hurricanes & tropical storms, severe winter storms, severe thunderstorms, and public health threats
- ∴ 3 hazards rated as having a Moderate overall risk in Dover: hazardous materials, tornado and downburst, and coastal flooding (storm surge and sea-level rise)
- ∴ 6 hazards rated as having a Low overall risk in Dover: extreme temperatures, drought, flooding (dam failure), earthquake and landslide, wildfire, and cyber-attacks

Each hazard was provided with a description and information on the hazard's extent, past events and impacts, potential future impacts to the community, and potential loss estimates. As part of this analysis, the planning team reviewed past and existing mitigation strategies and made updates for improvement. Lastly, the planning team developed a series of new mitigation actions to be completed over the course of this plan's five-year cycle. Each mitigation action was prioritized using the STAPLEE Method and responsibilities for implementation were identified.

This plan provides an updated list of Critical Facilities and Key Resources (CF/KR) categorized as follows: Emergency Response Facilities (ERF), Non-Emergency Response Facilities (NERF), Critical Facilities (CF), Vulnerable Populations to Protect (VPP), and Water Resources (WR). All critical assets were inventoried and mapped.

The revision process included reviewing other City Hazard Plans, technical manuals, federal and state laws, the State Hazard Mitigation Plan, research data, and other available mitigation documents from multiple sources. Combining elements from these sources, the Planning Team was able to produce this integrated multi-hazards plan and recognizes that such a plan must be considered a work in progress.

The City of Dover received conditional approval on Feb. 13, 2018. A public meeting was held and the plan was adopted by the City Council on Feb. 28, 2018. The Plan received formal approval from FEMA on Mar. 30, 2018.

In addition to periodic reviews there are three specific situations, which require a formal review of the plan. The plan will be reviewed:

∴ Annually to assess whether the existing and suggested mitigation strategies have been successful and remain current in light of any changes in federal state and local regulations and statutes. This review will address the Plan's effectiveness, accuracy and completeness in regard to the implementation strategy. The review will address any recommended improvements to the Plan, and address any weaknesses identified that the Plan did not adequately address. This report will be filed with the City Council.

∴ Every five years the Plan will be thoroughly reviewed, revised and updated using the same criteria outlined above. At that time it is expected to be thoroughly reviewed and updated as necessary. The public will be allowed and encouraged to participate in that five year revision process.

∴ After any declared emergency event, the EMD using the same criteria outlined above.

∴ If the City adopts any major modifications to its land use planning documents, the jurisdiction will conduct a Plan review and make changes as applicable.

Flooding at Henry Law Park, 2016

Chapter 1: Multi-Hazard Mitigation Planning Process

Authority

Dover's original Multi-Hazard Mitigation Plan was prepared pursuant to Section 322, Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (the Act), herein enacted by Section 104 of the Disaster Mitigation Act of 2000 (DMA) (P.L. 106-390). This Act provides new and revitalized approaches to mitigation planning. Section 322 of DMA 2000 emphasizes the need for State, local and tribal entities to closely coordinate mitigation planning and implementation efforts. This revised multi-hazard plan will be referred to as the "Plan". Dover's Plan has been prepared by the Multi-Hazard Mitigation Planning Team with the assistance and professional services of Strafford Regional Planning Commission (SRPC) under contract with New Hampshire Homeland Security Emergency Management (HSEM) operating under the guidance of Section 206.405 of 44 CFR Chapter 1 (10-1-2010 Edition). This plan is funded, in part, by HSEM through grants from FEMA (Federal Emergency Management Agency). Funds from matching funds for team member's time are also part of the funding formula.

Purpose and History

The ultimate purpose of Disaster Mitigation Act of 2000 (DMA) is to:

- *establish a national disaster hazard mitigation program –*
- *reduce the loss of life and property, human suffering, economic disruption and disaster assistance costs resulting from natural disasters; and*
- *provide a source of pre-disaster hazard mitigation funding that will assist States and local governments (including Indian tribes) in implementing effective hazard mitigation measures that are designed to ensure the continued functionality of critical services and facilities after a natural disaster.*

DMA 2000 amends the Robert T. Stafford Disaster Relief and Emergency Assistance Act by, among other things, adding a new section "322 – Mitigation Planning" which states:

As a condition of a receipt of an increased Federal share for hazard mitigation measures under subsection (e), a State, local, or tribal government shall develop and submit for approval to the President a mitigation plan that outlines processes for identifying the natural hazards, risks, and vulnerabilities of the area under the jurisdiction of the government.

HSEM's goal is for all New Hampshire communities to complete a local multi-hazard plan as a means to reduce future losses from natural and man-made events before, during, or after they occur. HSEM has outlined a process whereby communities throughout the state may become eligible for grants and other assistance upon completion of this multi-hazard plan. The state's regional planning commissions are charged with providing assistance to selected communities to help develop local plans.

Dover's Multi-Hazard Mitigation Plan is a planning tool for reducing future losses from natural and man-made disasters as required by the Disaster Mitigation Act of 2000.

The DMA places new emphasis on local mitigation planning. It requires local a local jurisdiction to prepare and adopt a FEMA approved jurisdiction-wide Hazard Mitigation Plan as a condition for receiving Hazard Mitigation Assistance (HMA) project grants and other grants every five years. In addition to updating their plans every five years to continue program eligibility, local governments should review the plan yearly.

Jurisdiction and Scope of the Plan

This Plan addresses only one jurisdiction: the City of Dover, NH. The Plan addresses 15 types of natural and man-made hazards that may affect the City:

- Flooding (Riverine/Extreme Rain Event)
- Flooding (Dam Failure)
- Coastal Hazards (Storm Surge & Sea-Level Rise)
- Hurricane & Tropical Storms
- Tornado & Downburst
- Severe Winter Storms
- Severe Thunderstorms
- Wildfire
- Earthquake/Landslide
- Extreme Temperatures
- Drought
- Public Health Threats
- Hazardous Material
- Cyber Attacks
- Domestic Terrorism

It describes each hazard and identifies past occurrences of hazard events and assesses probability of future hazard events in the City. The Plan assesses the vulnerability of key infrastructure and critical facilities; existing residential buildings and other structures within Dover; and future development. The Plan also addresses the administrative, technical, and physical capacity of emergency response services and response coordination between federal, state, and local entities.

Flooding on the Snows Court, 2016

Multi-Hazard Mitigation Goals

The City's multi-hazard goals are based on the State of New Hampshire Multi-Hazard Mitigation Plan (2013) goals and include:

- *Ensure the protection of the general population, citizens and guests of Dover New Hampshire, before during and after a hazard.*
- *Protect existing properties and structures through mitigation activities.*
- *Provide resources to residents of Dover, when needed, to become more resilient to hazards that impact the city's critical support services, critical facilities, infrastructure, economy, environment, historical & cultural treasures and private property.*
- *Support the Presidential Policy Directive (PPD-8) through prevention, mitigation, preparedness, and response and recovery actions.*
- *Work regionally to identify, introduce and implement cost effective hazard mitigation measures in order to accomplish the city's goals.*
- *Develop and implement programs to promote hazard mitigation to protect infrastructure throughout the city to reduce liability with respect to natural and human-caused hazards generally.*
- *To address the challenges posed by climate change as they pertain to increasing risks in the city's infrastructure and natural environment.*

Multi-Hazard Mitigation Planning Process

Overview

The Plan was developed and updated with substantial local, state, and federal coordination. The completion of this new multi-hazard plan required significant planning preparation and represents the collaborative efforts of the City of Dover, an ad-hoc local Multi-Hazard Mitigation Planning Committee, and SRPC. The Committee followed an established ten step multi-hazard mitigation planning process (see box, right).

The Committee met four times over a two month period to discuss the range of hazards included in this plan as well as brainstorm mitigation needs and strategies to address these hazards and their impacts on people, business, and infrastructure in the City. All meetings were geared to accommodate brainstorming, open discussion, and an increased awareness of potential threats to the City. This process results in significant cross talk regarding all types of natural and man-made hazards.

Ten Step Multi-Hazard Mitigation Planning Process

1. Establish and Orient a Hazard Mitigation Planning Committee
2. Identify Past and Potential Hazards
3. Identify of Hazards and Critical Facilities
4. Assess Vulnerability – Estimating Potential Losses
5. Analyze Development Trends
6. Identify Existing Mitigation Strategies and Proposed Improvements
7. Develop Specific Mitigation Measures
8. Prioritize Mitigation Measures
9. Prepare Mitigation Action Plan
10. Adopt and Implement the Plan

Committee Meetings

The Plan is being developed with substantial local, state and federal coordination; completion of this new multi-hazard plan required significant planning preparation. All meetings are geared to accommodate brainstorming, open discussion and an increased awareness of potential threats to the City. Below is a brief summary of each meeting. Meeting agendas and sign-in sheets are included in the Plan's Appendix B.

Meeting # 1: October 31, 2017

Members present: Jim Maxfield (Building Official/Inspection Services), Kathleen Meyers (Asset Management Admin/IT), Lena Nichols (Director of Welfare), Dan Barufaldi (Director of Economic Development), Susan Daudelin (Director of Human Resources/Executive), Anthony Colarusso (Police Chief), Cathy Beaudoin (Library Director), Mike Gillis (Media Services Manager), John Storer (Community Services Director), Gary Bannon (Emergency Shelter Manager/Recreation Director), Eric Hagman (Fire Chief/EMD), Dave White (City Engineer/Community Services), and Christopher Parker (Assistant City Manager/Planning).

Strafford Regional Planning Commission (SRPC) staff provided a brief overview of the update process and the federal requirements set forth in the City's grant. This included information on the five-year plan cycle, eligibility of future funding opportunities, and the City's existing plan that is set to expire on 2/1/18. SRPC staff detailed the in-kind match documentation, committee responsibilities, and steps towards successful adoption.

SRPC, and the committee, reviewed the draft community profile chapter. Committee members provided the following feedback:

1. The City will provide local housing data to ensure more accurate housing unit information
2. The City will provide 2017 building permit data that will be added into the plan
3. SRPC will include additional build-out information that was updated in the 2014 land use analysis master plan chapter

SRPC, and the committee, reviewed the draft asset inventory chapter. Committee members provided the following feedback:

1. Revisions to Table 4: Emergency Response Facilities (ERF) include:
    a. City Hall remains a primary facility due to its administrative and IT-based functions
    b. Removal of two helipad locations (Liberty Mutual and Dover High School)
    c. Add the following facilities: McConnell Center (primary shelter); Dover Middle School (radiological emergency preparedness reception center); Woodman Park (back-up shelter); and Dover High School (will function as the primary back-up shelter once completed in August, 2018)
    d. The Fire Chief will gather all local evacuation routes that have already been identified in other emergency management plans for inclusion
2. Revisions to Table 5: Non-Emergency Response Facilities (NERF) include:
    a. Add Dover Transportation Center (Amtrak) on Chestnut Street

    b. Add NH Park and Ride (Exit 9 off US 16) as potential logistics and staging area during emergencies
    c. Add both River Street and Varney Brook pump stations
3. Revisions to Table 6: Critical Facilities (CF) include:
    a. Add Stonewall (Mast Road) pump station
    b. Add both water towers (Garrison Hill and Long Hill Road)
    c. The City will reach out to Eversource to determine where the power substation in Rochester is located
    d. The Fire Chief will gather Unitil regulating stations are located
    e. The City Engineer will contact Eversource to determine the location of all switching stations
    f. Add three new communication towers on Garrison Hill, Long Hill Road, and Middle Road
    g. Remove combine antenna on City Hall and the cell tower on Garrison Ave
    h. SRPC will work with the City to obtain GIS information for as many critical facilities as possible
    i. Note that both Sawyer Mill dams (lower and upper) are scheduled for removal
    j. Include the fish ladder for Central Ave Dam (Cochecho Falls)
    k. Identify the Whittier Street Bridge as under construction and formerly a redlist bridge
    l. SRPC will work with both the Fire Chief and Police Chief to determine the most critical intersections for inclusion; a more detailed prioritization will be recommended as a new mitigation strategy
4. Revisions to Table 8: Vulnerable Populations to Protect (VPP) include:
    a. Combine Dover High School with Regional Career Technical Center
    b. Add Dover Alternative School (50 Alumni Drive)
    c. Remove Westwood Nursery
    d. Add Honey Hill School, Seacoast Charter School (171 Watson Road), and Little Tree (383 Sixth Street)
    e. SRPC will work with the City to get an accurate listing of active day cares and preschools
    f. The Assistant City Manager will provide additional assisted living and nursing home information
5. Revisions to Table 9: Water Resources (WR) include:
    a. Add the following groundwater wells:
        i. DPH-1
        ii. Willand Pond
        iii. Lowell WTP, Bouchard Well WTP, and Griffin Well WTP
        iv. Potential additional well at Shaws Lane, which would provide additional irrigation capacity for the athletic fields (this is under investigation)
    b. Add fire hydrant as an emergency interconnection with Somersworth (pending 2018)
    c. SRPC will follow up with the Fire Chief to inquire if there are any locations along the rivers that can be used as auxiliary fire aid

SRPC, and the committee, reviewed the all the past mitigation strategies. Committee members provided the following feedback:

1. The Assistant City Manager would provide more information on the Environmental Management Systems project

2. The Committee requested more time to review the table and would email SRPC staff with additional comments

The next meeting was set for November 14th at 10AM at the McConnell Center. SRPC staff indicated that materials would be sent out prior to the meeting date to give the committee adequate time to be prepared to discuss agenda items.

Meeting # 2: November 14, 2017

Members present: Members present: Jim Maxfield (Building Official/Inspection Services), Kathleen Meyers (Asset Management Admin/IT), Dan Barufaldi (Director of Economic Development), Anthony Colarusso (Police Chief), Cathy Beaudoin (Library Director), Mike Gillis (Media Services Manager), John Storer (Community Services Director), Gary Bannon (Emergency Shelter Manager/Recreation Director), Eric Hagman (Fire Chief/EMD), and Christopher Parker (Assistant City Manager/Planning).

SRPC staff opened the meeting by reviewing the notes from the October meeting with the Planning Committee; there were no additional comments. SRPC briefly went over the to-do list and asked that identified committee members submit their tasks as soon as possible for inclusion into the plan.

Next, the Planning Committee reviewed the City's National Flood Insurance Program (NFIP) status and past floodplain management actions. Past actions included: sending out flood insurance brochures to existing residents and new homeowners located in the flood zone[1] (handouts were also made available at City Hall); encouraging the City to participate in the Community Rating System (CRS) to reduce flood insurance rates; sending one municipal staff member to receive Certified Floodplain Managers (CFM) training; including a question about properties in the floodplain into the City's LEAN review process; and working with a property owner on Snows Court to donate a repetitive loss structure to the City for conversion into a public park.

The Planning Committee then discussed the descriptions of each hazard. Below is a summarized list of additional data that will be included into the Plan:

1. Flooding
    a. Add information on the 1896 ice jam event; add information about the ice jam that happened in the 1900's that impacted the Dover Point Bridge.
    b. Include additional areas that were impacted from flooding, such as Willand Pond, which flooded the boat launch, walking trails, the parking lot, and parts of New Rochester Road; residential homes on Littleworth Road near Barbadoes Pond; the Children's Museum; the Madbury Apartments on Knox Marsh Drive; areas near Dean Drive and French Cross Road; and the mill buildings (#5) along Central Ave and Main Street.
    c. Add impacts from dams outside the City – specifically Milton Dam (Milton) and Bow Lake (Barrington).

[1] It should be noted that the brochure distribution was completed before the adoption of the 2015 map updates and the City should complete another mail-out with information on the new maps.

2. Hurricane and Tropical Storms
    a. Minor impacts during Hurricane Sandy, included periods of heavy rain and short-term power outages
    b. Minor impacts during Tropical Storm Irene, included periods of heavy rain, downed branches, and short-term power outages.
3. Tornado and Downburst
    a. In July, 2017 there was a significant microburst that impacted a handful of residential homes and a few small businesses along Tolend and French Cross roads. According to Fosters.com there were a number of downed trees that blocked roads, took down power lines and hit homes and cars.
    b. In October, 2017 a wind storm that was accompanied with heavy rain produced sustained winds of 60 mph that resulted in wide-spread power outages caused by downed trees and power lines. Upwards of 45% of the City was without power, which included Wentworth Douglass Hospital, and all the schools were cancelled for at least one day.
4. Severe Winter Weather
    a. Impacts for the Ice Storm of 1998 included long-term power outages (upwards of 7+ days), 1 fatality associated with carbon monoxide poisoning, school closures, and challenges with traffic at busy intersections.
    b. Impacts for the Ice Storm of 2008 included long-term power outages (there were a lot of impacts to transmission lines outside the state), and school closures.
    c. Impacts for the Blizzard of 2013 included snow removal challenges.
    d. Impacts for the Blizzard of 2015 included snow removal challenges, economic impacts in the downtown, and line of site issues due to high snow banks along sidewalks and pedestrian intersections.
    e. Additional events to add are the Halloween Snow Event (2011), which produced heavy, wet snow and leaf-on conditions that resulted in downed trees and caused major power outages throughout the City, and the Thanksgiving Day snow event in late November (2017), which also produced heavy, wet snow that resulted in sporadic power outages and disrupted travel plans for the holiday weekend, including major delays at airports and hazardous travel on local and state roadways.
5. Severe Thunderstorms and Lightning
    a. Past strikes have occurred at the wastewater treatment facility on Middle Road.
    b. The SCADA antenna on Garrison Hill has been hit before.
    c. A woman was struck on Governor Sawyer Lane during a storm event – fortunately this event did not result in a fatality.
    d. Hail has caused significant damage to vehicles during storms.
6. Wildfire
    a. There were multiple brush fires back in 1985; however, many of those problematic areas have since been developed.
    b. Many of the downed trees and fuel load near Bellamy Park have been cleaned up in associated with the maintenance and upkeep of the Frisbee golf course.
    c. The potential risk for large scale wildfires within the City is low (natural breaks); however, more rural areas adjacent to Tolend Road towards Barrington may be more susceptible.

7. Earthquakes and Landslide
    a. All new construction has to be engineered and designed to handle appropriate seismic activity.
    b. The Planning Committee recognizes that some of the older structures within the City may be more vulnerable. It is unclear as to the impacts to the mill buildings if a large earthquake were to hit.
8. Extreme Temperatures
    a. The City sends out advisory notices whenever the National Weather Service issues cold/heat index warnings.
    b. The McConnell Center is opened as a cooling station at least once or twice on average during the summer months. Likewise, the McConnell Center is opened as a heating station at least once or twice on average during the winter months.
    c. During prolonged heat waves, the City extends hours for the outdoor pool and dials back outdoor programs to ensure public safety.
9. Drought
    a. The City, in partnership with the Strafford Regional Planning Commission, will be considering adopting new water efficiency regulations to address water usage during future drought scenarios.
10. Public Health Threats
    a. NHDES has offered a free water testing program (documents arsenic levels and assesses biological activity for a variety of bacteria), in which Dover has chosen to participate in. SRPC staff would follow up with NHDES to determine if any results for Dover are available to include into the plan.
    b. Contamination of public drinking water wells to elevated levels of the unregulated contaminant perfluorooctane sulfonic acid (PFOS) has become an emerging threat; however, natural occurring radionuclides (radium, uranium) found in private drinking water supplies is also an important public safety hazard.
    c. Dover has experienced 13 confirmed drug overdose fatalities in 2017; 12 in 2016, and 12 in 2015. Substance abuse, specifically the opioid epidemic, has directly impacted Dover's workforce – with the restaurant business getting hit particularly hard. This problem has also impacted the crime rate, with increases in the cases of car break-ins and credit card fraud.
    d. The City is currently exploring options to limit, or potentially ban, pesticide and herbicide spraying protocols. There was some concern that this wide-spread ban may have an adverse impact if there was to be a vector-borne disease breakout that needed spraying. This topic is still being discussed at the City Council, and Chris Parker would give an update to the Committee at the next meeting in December.
    e. The Dover High School is a Point of Dispensing (POD) location for large-scale vaccinations. In 2016, the City's Police and Fire Departments participated in a state-wide drill to simulate the distribution of medications, vaccines, or medical supplies to a large community of people during an emergency.
    f. During construction of the new police department, low levels of arsenic were found; however, the levels were low enough where it was dumped into the City's dredge cell.
11. Hazardous Materials
    a. Add the two large heating vendors on Fourth Street and Broadway (fuel storage).
    b. Add Route 4 to the transportation corridors.

c. Add the Pan-Am rail line (propane and fuel oil).
d. Add the Unitil distribution system for natural gas and the Ecoline pipeline, which transports purified methane gas from the Waste Management's Turnkey Recycling and Environmental Enterprise (TREE) in Rochester to the University of New Hampshire.
e. Dover is within the 50-mile ingestion pathway if the Seabrook Station Nuclear Power Plant were to have a nuclear release.
f. The Planning Committee could only recall one hazardous spill associated with a truck accident. It took place on the off-ramp on Route 4 westbound to Durham; a semi-tractor trailer truck that was carrying propane flipped over.
g. The City's Fire Department has responded to sporadic calls for locomotive fires at the rail yard.
h. The City identified the Newington Sea-3 expansion project as an important hazardous materials threat. This import/export project includes three 90,000-gallon tanks and associated chilling and pumping equipment in order to refrigerate and bulk store pressurized propane that is being railed in.

12. Coastal Hazards
    a. There has been some significant erosion of the shoreline along the Bellamy River, in close proximity to Spur Road. This has resulted in ongoing repairs of docks and deck issues.

The Planning Committee expressed interested in adding both cyber-attacks and domestic terrorism to the list of potential hazards. SRPC agreed to work on these hazards and present them at the meeting in December.

SRPC asked that the Committee review Table 12: Hazard Vulnerability Assessment Tool, and come prepared to discuss changes to the overall threat levels at the next meeting.

The next meeting was set for December 12th at 10AM at the McConnell Center. SRPC staff indicated that materials would be sent out prior to the meeting date to give the committee adequate time to be prepared to discuss agenda items.

Meeting # 3: December 12, 2017

Members present: Members present: Kathleen Meyers (Asset Management Admin/IT), Anthony Colarusso (Police Chief), Eric Hagman (Fire Chief/EMD), Cathy Beaudoin (Library Director), Christopher Parker (Assistant City Manager/Planning), John Storer (Community Services Director), and Lena Nichols (Director of Welfare).

SRPC staff opened the meeting by reviewing the notes from the November 14th meeting with the Planning Committee; there were no additional comments. SRPC briefly went over the to-do list and asked that identified committee members submit their tasks as soon as possible for inclusion into the plan.

Next, the Planning Committee reviewed and ranked each of the identified hazards using the hazard vulnerability assessment tool. The results are as follows:

- ∴ 5 hazards rated as having a High overall risk in Dover: flooding (riverine/extreme rain event), hurricanes & tropical storms, severe winter storms, severe thunderstorms, and public health threats
- ∴ 3 hazards rated as having a Moderate overall risk in Dover: hazardous materials, tornado and downburst, and coastal flooding (storm surge and sea-level rise)
- ∴ 6 hazards rated as having a Low overall risk in Dover: extreme temperatures, drought, flooding (dam failure), earthquake and landslide, wildfire, and cyber-attacks

The Planning Committee then discussed existing mitigation strategies (refer to Table 21: Existing Programs and Policies). The committee determined what the effectiveness was of each existing program and provided an update. Some actions existing programs, due to their relevance to other plans were combined.

Lastly, Planning Committee began brainstorming potential mitigation actions. A few ideas were developed; however, it was determined that it would be a better use of everyone's time if SRPC could send the committee a copy of the action table over the next two weeks and ask that members fill it out and come prepared for the final meeting in December.

The next meeting was set for December 27th at 10AM at the McConnell Center. SRPC staff indicated that materials would be sent out prior to the meeting date to give the committee adequate time to be prepared to discuss agenda items.

Meeting #4: December 27, 2017

Members present: Dave White (City Engineer/Community Services), Anthony Colarusso (Police Chief), Cathy Beaudoin (Library Director), Christopher Parker (Assistant City Manager/Planning), Lena Nichols (Director of Welfare), Mike Gillis (Media Services Manager), and Eric Hagman (Fire Chief/EMD).

SRPC staff opened the meeting by reviewing the notes from the December 12th meeting with the Planning Committee; there were no additional comments. SRPC briefly went over the to-do list and asked that identified committee members submit their tasks as soon as possible for inclusion into the plan.

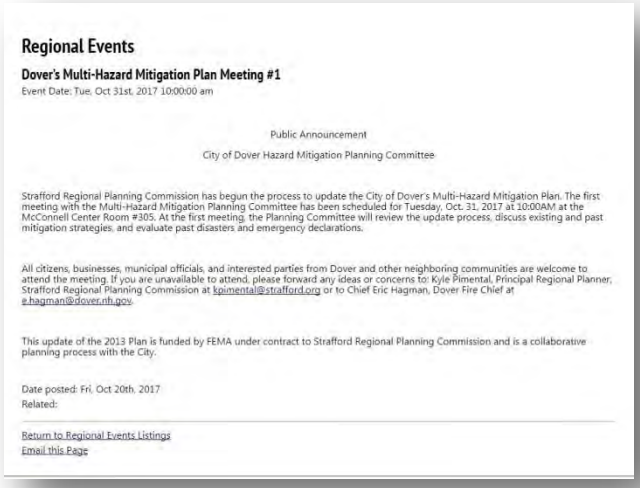
SRPC staff explained that there were no hard copies of the maps, due to issues with the office printer. Instead, the maps were shown on a projector and would be emailed to the committee after the meeting for final review and any additional comments.

Next, the Planning Committee continued to develop new mitigation actions for inclusion in the plan. Each action was discussed as a group in order to determine the following criteria: hazard type, action category, responsible party, timeframe, location, and potential funding sources. Once a complete list was developed, the Planning Committee used the STAPLEE method to organize each of the actions. SRPC would be tasked with final organization of all new strategies and existing actions that were being carried over from the 2013 Plan.

The meeting ended with next steps for conditional approval, City adoption, and final FEMA adoption.

Public Involvement

Public involvement is an important part of the planning process. A local Multi-Hazard Mitigation Planning Committee (the Committee) was formed to guide and oversee the development of this Plan. Members of the City Council, Conservation Commission, Planning Department; Police, Fire, and Highway Departments; and local business owners, interested organizations, and Dover residents were invited to participate on the Committee. Community officials were encouraged to contact as many people as they could to participate in the planning process. Members of the public and other stakeholders from neighboring communities were also informed of and encouraged to attend the Committee's meetings.



Regional Events

Dover's Multi-Hazard Mitigation Plan Meeting #1

Event Date: Tue, Oct 31st, 2017 10:00:00 am

Public Announcement

City of Dover Hazard Mitigation Planning Committee

Strafford Regional Planning Commission has begun the process to update the City of Dover's Multi-Hazard Mitigation Plan. The first meeting with the Multi-Hazard Mitigation Planning Committee has been scheduled for Tuesday, Oct. 31, 2017 at 10:00AM at the McConnell Center Room #305. At the first meeting, the Planning Committee will review the update process, discuss existing and past mitigation strategies, and evaluate past disasters and emergency declarations.

All citizens, businesses, municipal officials, and interested parties from Dover and other neighboring communities are welcome to attend the meeting. If you are unavailable to attend, please forward any ideas or concerns to: Kyle Pimental, Principal Regional Planner, Strafford Regional Planning Commission at kpimental@strafford.org or to Chief Eric Hagman, Dover Fire Chief at e.hagman@dover.nh.gov.

This update of the 2013 Plan is funded by FEMA under contract to Strafford Regional Planning Commission and is a collaborative planning process with the City.

Date posted: Fri, Oct 20th, 2017
Related:

Return to Regional Events Listings
Email this Page

To build awareness of the Plan and opportunity to be involved, an announcement about the Plan update was included on the Strafford Regional Planning Commission's website and information about the Plan was included in SRPC's news updates in order to ensure that adjacent communities were aware of Dover's committee meetings and had the opportunity to attend. A public notice, stressing the public nature of the process, was posted on the City's website and notices were hung at City Hall in advance of each Committee meeting. The Committee met four times between October 31, 2017 and December 27, 2017. All feedback from participants of the planning committee was incorporated into the Plan. There was no participation from surrounding communities. There was no other public participation in the plan update process.

The public will have the opportunity for future involvement as the Plan will be periodically reviewed and the public will be invited to participate in all future reviews and updates to this plan. There will also be a public meeting before each formal review and before any change/update is sent to HSEM.

Once final approval by HSEM has been received, copies of the Plan will be distributed to the relevant City Departments and personnel, HSEM, and FEMA and other state and local governmental entities; the Plan will then be distributed by these entities per requirements. Copies of the Plan will remain on file at the Strafford Regional Planning Commission (SRPC) in both digital and paper format.

Adoption and Integration

Once approved by the Planning Committee, the Plan will be forwarded to HSEM for Conditional Approval. Upon review and conditional approval by HSEM, the City Manager will host a workshop with the City Council to review the revised Plan, and will hold a public meeting to consider public comments and must promulgate a signed Resolution to Adopt the Plan.

Elements of the Plan will be incorporated into other planning processes and documents, such as the City's Master Plan, Capital Improvement Plan, and Emergency Operations Plan. The City will refer to this Multi-Hazard Mitigation, as appropriate, in other documents.

Chapter 2: Community Profile

Overview

The City of Dover is located in the center of the Seacoast region and is the easterly gateway to the White Mountains and Lakes region of New Hampshire. It is about 12 miles Northwest from Portsmouth, 40 miles east of Concord. The City of Somersworth is to the northeast; Eliot, Maine is to the east, from which it is separated by the eastern branch of the Piscataqua River; and the Town of Madbury is to the southwest. With a population of 30,534 (according to the 2015 American Community Survey), Dover has experienced roughly an 11.6% increase in total population since 2000 (26,993). This population increase mimics the regional demographic trend of Strafford County, which experienced a 10.9% increase between 2000 and 2010 and represents one of the fastest growing areas in the state of New Hampshire

Map 1: Dover Locus Map (Source: SRPC, 2017)

The City of Dover covers a total area of 29.1 square miles (18,592.1 acres), with a land area of 26.8 square miles (17,130.4 acres) and a water area of 2.3 square miles (1,461.7 acres). The principal watersheds are the Cochecho River, which has its source in New Durham, and the Bellamy River, which rises in Barrington. These two rivers take a southeasterly course through the City, where the Cochecho River unites with the Salmon Falls River. The City extends along a four-mile long peninsula to the south between the Salmon Falls and Bellamy Rivers. Where the land ends the rivers merge to form the Piscataqua River. According to the Dover C-RiSe Report [2017], the inland coastal portion of Dover that is most susceptible to coastal flooding is located in low areas along the Bellamy River; the Piscataqua River; at the confluence of the Cochecho River and the Salmon Falls River; and along the shores of Little Bay. Many of these areas are all within the coastal floodplain area, making them particularly vulnerable to flooding from seasonal high tides, coastal storms, and sea-level rise

Dover's land use pattern is well established, with little remaining undeveloped land within its urban core. The downtown is surrounded by land zoned residential, commercial and industrial, and important natural resources. Dover is bisected by the Spaulding Turnpike (NH Route 16) which connects northern New Hampshire and the Seacoast region. Additionally, NH and US Routes 4 travel through Dover, as do Routes 155, 108 and 9. It borders eight New Hampshire communities, and is easily accessible by three Maine communities.[2]

There are no mountains or high hills within the city boundary as it lies within a coastal plain. The average elevation is 80 feet. The highest place in the city is Garrison Hill, about 284 feet, on the border with the Town of Rollinsford. From the top of the hill, a bird's-eye view of the city can be obtained. In the southern part of the city, there are several gentle swells of lands, which provide a delightful view of Little Bay area, adjacent shores and distant mountains.

[2] City of Dover, New Hampshire Master Plan. 2015 Land Use Analysis Chapter.

Housing

In the period between 2011 and 2015, Dover experienced an overall increase of 567 total housing units (roughly 4.2%). Dover experienced the lowest number of total housing units in 2011, and the highest in 2015. According to housing tenure data for that same 5-year time period, the total renter-occupied unit counts increased by 8.5% while owner-occupied housing units decreased by 4.4%. During this time period, the vacant housing units significantly increased by 35.6% and total occupied housing units stayed relatively the same, with a small increase of 1.9%. As of 2015, Dover's occupied housing units are roughly 51.5% owner-occupied and 48.5% renter occupied. Vacant housing units varied from a high of 921 in 2015 to a low of 593 in 2011. Currently, the City exhibits a 6.8% vacancy rate; this rate does not take into consideration Dover's limited seasonal homes. The 2010 Census estimates (not shown) that 82 homes in the City are for seasonal, recreational, or occasional use. Unfortunately, these estimates are not available for other years, but if these numbers are substituted in 2015, a slightly more accurate vacancy rate would be 6.2%.

Table 1: Housing Data 2011 - 2015

	2011	2012	2013	2014	2015	% Change 2011-2015
Total Housing Units	13,022	13,252	13,190	13,447	13,589	+4.2%
Occupied Housing Units	12,429	12,512	12,435	12,586	12,668	+1.9%
Owner Occupied Housing Units	6,806	6,495	6,260	6,375	6,521	-4.4%
Renter Occupied Housing Units	5,623	6,017	6,175	6,211	6,147	+8.5%
Vacant Housing Units	593	740	755	861	921	+35.6%

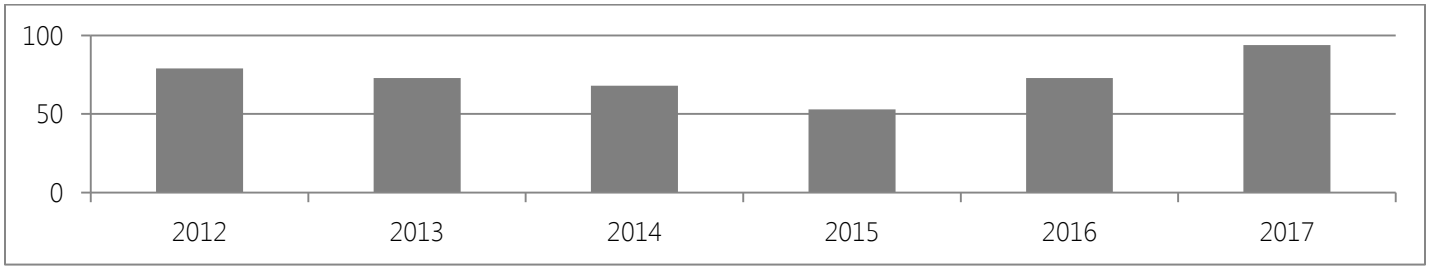
Source: U.S. Census Bureau, American Community Survey 5-Year Estimates

NOTE: More localized total housing units' data from the City's Planning Department shows a slight discrepancy for years 2012-2015. Total housing units equal 13,814; 13,909; 14,024; and 14,094 respectively.

Building Permit Data

According to the data that was received from the City, a total of 440 building permits have been issued from 2012 through 2017. Dover experienced an average of roughly 73 new structures (mostly single-unit residential, with some mixed use, manufactured, and commercial/industrial development) between 2012 and 2017. Figure 1 (below) shows that Dover has seen relatively consistent growth with no discernible drops or spikes. This data represents the best available information at the time of the preparation of the Plan; however, it should be noted that the issuance of a building permit does not always directly correlate with new development.

Figure 1: New Building Permits 2012 - 2017



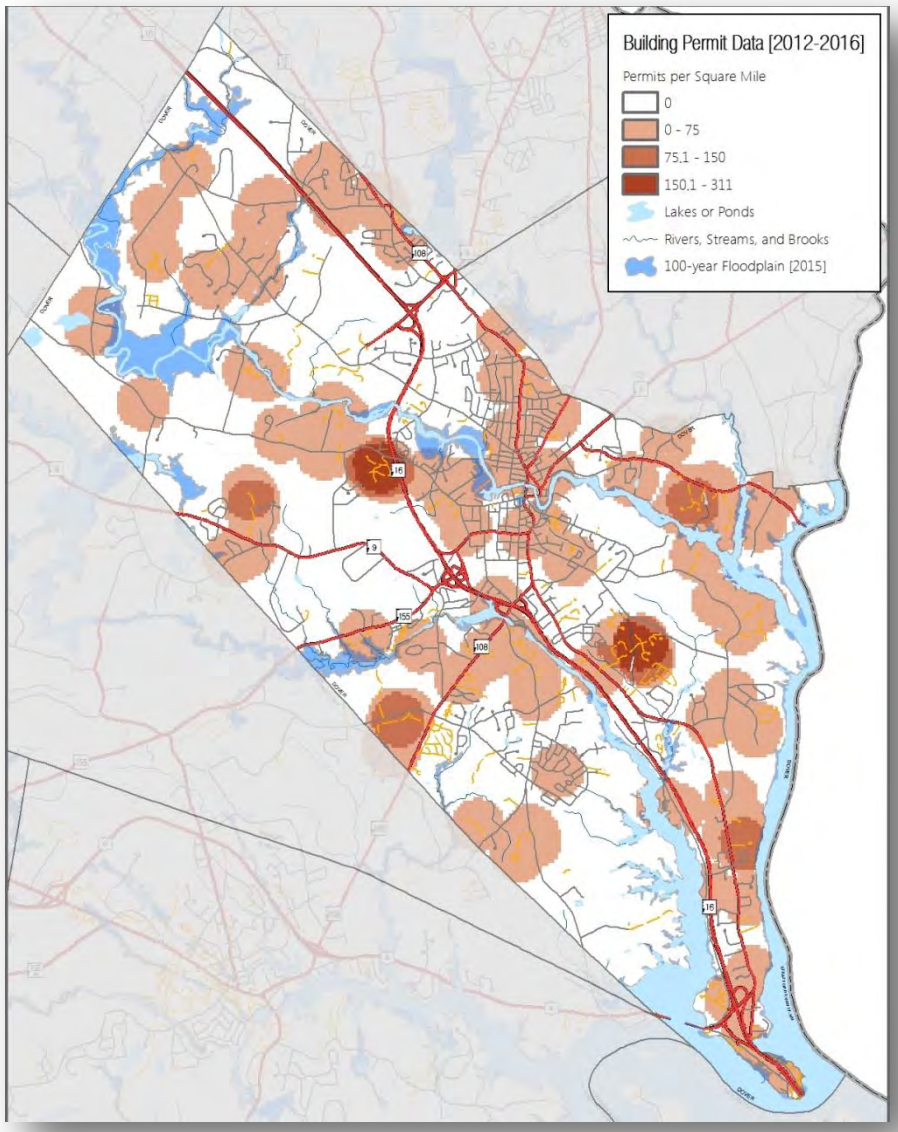
Source: Dover's Building Official and Inspection Services Department

Development Trends

A GIS density analysis was completed using building permit data collected from 2012 – 2016 in order to identify and map clusters of development.

The results indicate that the predominant development type over the last several years has been residential and has been largely scattered throughout the city along existing transportation corridors. Some of the higher densities are located in the following areas: Emerald Lane; Melody Terrace and Stocklan Circle; Childs Drive; Cielo Drive; Shore Lane; and along roadways adjacent to Thornwood Lane, including Teresa Drive, Julia Drive, and Sierra Drive.

As mentioned above, the issuance of a building permit does not always directly correlate with new development and these maps should be used for general planning purposes only.



Map 2: Development Density Map (Source: SRPC/Dover, 2017)

By looking at these past development trends the City recognizes that it will continue to grow in the coming years and will continue to monitor and improve their floodplain management regulations, as needed, for all subdivision and site plan proposals in order to reduce or eliminate flood damage.

Development within the FEMA Floodplain

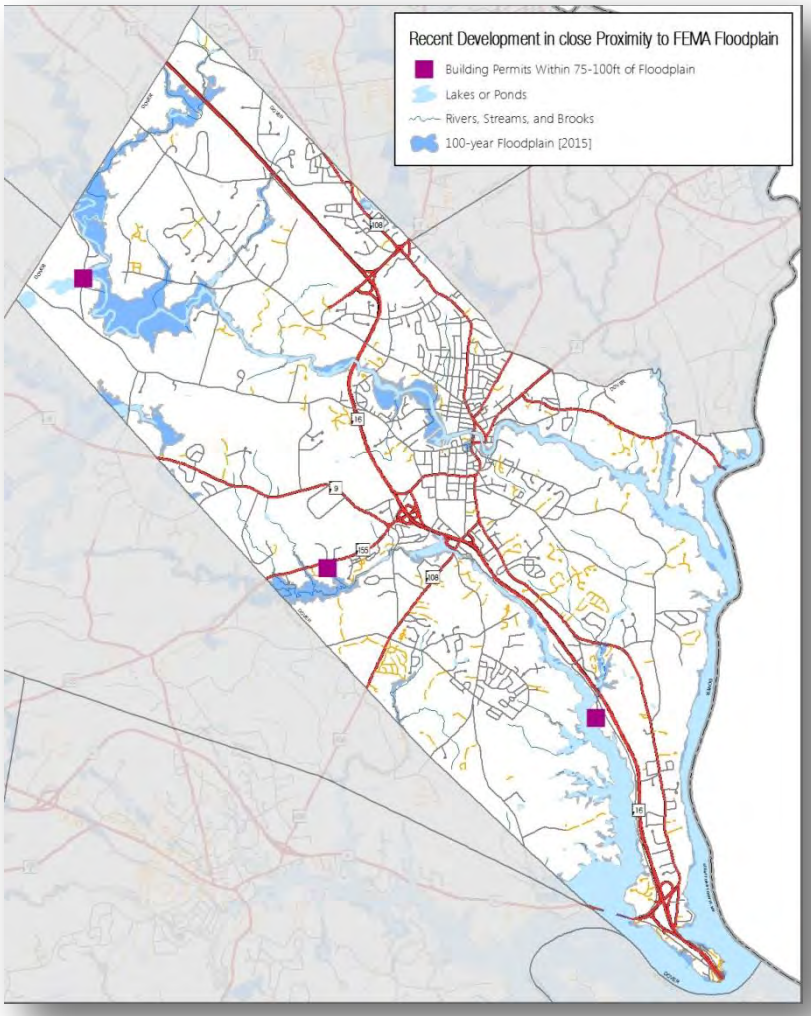
According to a simple GIS analysis, of all the building permits issued over the course of the last five years (2012 – 2016), there were zero homes identified to be within the FEMA floodplain; however, a follow-up analysis was completed to select locations that may be within 75 to 100 feet adjacent to the FEMA floodplain. The results of that analysis indicated that only three potential locations were in close proximity to the floodplain and are shown on Map 3. It is important to note building permit data does not always correlate directly with new construction; permits may refer to renovations or additions to existing structures.

Over the course of the last five years, there were only three new residential building permits issues that were within an estimated 75-100 feet of the FEMA floodplain. It is unclear as to the exact location of those structures and whether or not they are vulnerable to flooding. The locations of those three building permits are identified in more detail in Table 2 below.

Table 2: Building Permits Within Floodplain

Location	Year	Type
Lilac Lane	2013	Single Family
Nute Road	2014	Single Family
Glen Hill Road	2014	Single Family

[Source: City of Dover, 2017]



Map 3: Building Permits within the FEMA Floodplain (Source: SRPC/OEP, 2017)

As shown on Map 3, over the course of the last five years, Dover has successfully steered almost all new developments away from existing and potential flooding dangers; however, as more extreme precipitation events occur Dover will need to continue to proactively plan for future flooding scenarios. Along with guiding development away from vulnerable areas, the City has also revised and improved its floodplain management.

In 2012, the City updated its floodplain regulations and adopted more stringent freeboard requirements, which require the lowest floor of residential and non-residential structures that are new construction or substantial improvements to be elevated two feet above base flood elevation. Given that most new development has not taken place within the FEMA floodplain, and with the addition of more stringent floodplain regulations, the community's vulnerability has been reduced.

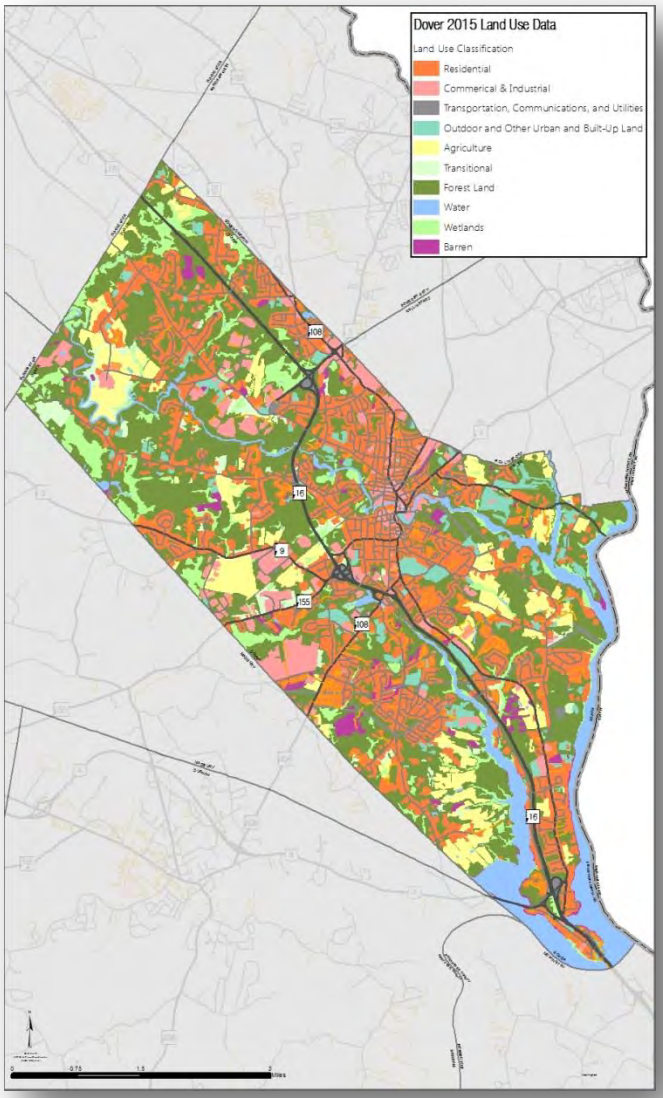
Looking ahead, the City will use this Plan as a guide to determine where past hazards have been documented and try to steer potential development away from these hazard areas.

Land Use Changes

It is much easier to identify and analyze regional land use trends, compared to strictly looking at land use conversion changes at the local level; however, this data remains an important component of long-term planning efforts. As previously mentioned, Dover has experienced a significant population increases over the course of the last decade. This has resulted in an increase in the amount of land converted to residential use over the span of the last fifteen years. See Table 3 for a more detailed analysis of land use changes of time.

According to the 2015 regional land use layer, roughly 25% (4,725 acres) of the city's total acreage is currently classified as residential, scattered throughout the city and along existing road corridors. Dover did not experience a substantial increase in residential land use conversion in the last five years (>2%). Nor did the city see any major changes in commercial and industrial uses, agriculture, or wetlands. The city experienced roughly a 1.5% loss of forest land due to land conversion.

The City's ongoing Master Plan update process hopes to improve existing land use regulations which may include zoning amendments, as necessary, to help guide development.



Map 4: 2015 Land Use Data (Source, GRANIT, 2017)

Table 3: Land Use Data 2010 - 2015

Land Use Classification	Acres (2010)	% of total acreage	Acres (2015)	% of total acreage	5-year (+/-) % change
Residential	4,724.9	25.4%	4,926.3	26.5%	+1.1%
Commercial & Industrial	991.1	5.3%	1,011.0	5.4%	+0.1%
Agriculture	1,442.3	7.8%	1,439.7	7.7%	-0.1%
Forest Land	6,590.4	35.4%	6,308.4	33.9%	-1.5%
Wetlands	1,145.3	6.2%	1,138.6	6.1%	-0.1%
TOTAL	18,592.1	80.1%	18,592.1	79.7	N/a

This analysis does not include: transportation, communications, and utilities; outdoor and other urban built-up land; transitional; open water; and barren lands, which together make up the remaining 20-21%.

Chapter 3: Asset Inventory

Critical Facilities and Key Resources

This chapter includes Critical Facilities and Key Resources (CF/KR) within the City of Dover that were identified by the Committee during the update of this plan.

FEMA describes the term 'critical facilities' as all manmade structures or other improvements that, because of their function, size, service area, or uniqueness, have the potential to cause serious bodily harm, extensive property damage, or disruption of vital socioeconomic activities if they are destroyed, damaged, or if their functionality is impaired.[3] These facilities include all public and private facilities that a community considers essential for the delivery of vital services for the protection of the community, such as emergency operations centers, shelters, or utilities. [4]

"Critical facilities, and the functions they perform, are the most significant components of the system that protects the health, safety, and well-being of communities at risk."

-FEMA Critical Facility Design Considerations

Tables include a list of CF/KR, including the type of facility and building, and the address of the CF/KR, if available. Appendix D contains a correlating map set. Facilities in bold are located in other communities and are not mapped.

Table 4: Emergency Response Facilities (ERF)

ERF's are primary facilities and resources that may be needed during an emergency response

Facility	Type	Address
City Hall	Administrative (Information Technology)	288 Central Ave
Police Station	Primary Emergency Operations Center	46 Chestnut Street
Liberty North End Fire Station	Back-up Emergency Operations Center	262 Sixth Street
Central Fire Station	Fire	9-11 Broadway
South End Fire Station	Fire	25 Durham Road
McConnell Center	Primary Emergency Shelter	61 Locust Street
Dover High School (August, 2018)	Primary Back-Up Emergency Shelter	25 Alumni Drive
Woodman Park	Back-Up Emergency Shelter	11 Towle Ave
Communication Tower	Primary Communication Tower	46 Chestnut Street
Dover Middle School	Radioactive Reception Center	16 Daley Drive
State Shed	Emergency Fuel	Indian Brook Drive
Public Works Garage	Emergency Fuel (diesel only)	271 Mast Road
Wentworth Douglass Hospital	Medical Facility	789 Central Ave
Helipad Locations	Emergency Medical Evacuation	Wentworth Douglass Hospital Industrial Park Drive Bellamy Fields
Evacuation Routes	Evacuation Planning	State Routes 4, 9, 16, 108, 155 Spaulding Turnpike Interstate 95 (Exit 5)

[3] https://www.fema.gov/media-library-data/20130726-1557-20490-2839/fema543_chapter1.pdf
[4] Ibid

Table 5: Non-Emergency Response Facilities (NERF)

NERF's are facilities considered essential, that although critical, not necessary for the immediate emergency response effort.

Facility	Type	Address
Water Treatment Plant	Water Plant	Lowell Avenue
Water Treatment Plant	Water Plant	Griffin Well
Water Treatment Plant	Water Plant	French Cross Road
Wastewater Treatment Plant	Wastewater Plant	Middle Road
Solid Waste/Recycling Center	Residential Waste	265 Mast Road
Pump Station(s)	Pump Station	River Street Varney Brook (Gerrish Road)
Dover Transportation Center	Transportation Center	Chestnut Street
NH Park and Ride	Potential Logistics and Staging Area	Indian Brook Drive (Exit 9)

Table 6: Critical Facilities (CF)

CF are important structures that may be vulnerable during a hazardous event

Facility	Type	Address
Pump Station(s)	Pump Station	River Street Charles Street Mill Street Crosby Road Middle School (Daley Drive) Varney Brook (Gerrish Road) Piscataqua (Wentworth Terrace) Boston Harbor Road Leighton Way Brickyard (Isaac Lucas Circle) Mast Road Spruce Drive Cochecho Street County Farm Road Strafford (New Rochester Road) Cranbrook Drive Watson Road Hampshire Circle Mount Pleasant (Back Road) Clay Hill (Sullivan Drive) Stonewall (Mast Road)
Distribution Substation(s)	Power Substation	75 Cochecho Street Miles Lane (Madbury) 483 Portland Street (Rochester)
Water Tower	Water Reservoir	Garrison Hill Long Hill Road
Smaller Substation(s)	Smaller Voltage Substation	36 Dover Point Rd (Stark Avenue) 7 Drew Road 71 Littleworth Rd 799 Central Ave (Wentworth Douglass)

Table 6: Critical Facilities (CF)

Natural Gas Stations	Gas Regulator Stations	Rutland Street at Silver Street Sixth Street at Maple and Horne Street Gulf Road toward Eliot Bridge
Switching Stations	Switching Stations	193 Knox Marsh Road
Communication Tower(s)	Communication Function	Mast Road Garrison Hill Long Hill Road Middle Road
Sawyers Mill Upper Dam	*High Hazard Dam	Bellamy River
Sawyers Mill Lower Dam	High Hazard Dam	Bellamy River
Watson Waldron Dam	**Low Hazard Dam	Cochecho River
Central Ave Dam and Fish Ladder (Cochecho Falls)	Low Hazard Dam	Cochecho River
Redden Pond Dam	Low Hazard Dam	Redden Pond
Thornwood Commons Pond	****Significant Hazard Dam	Varney Brook

* A High Hazard dam has a high hazard potential because it is in a location and of a size that failure or misoperation of the dam would result in probable loss of human life.
**A Low Hazard dam has a low hazard potential because it is in a location and of a size that failure or misoperation of the dam would result in no possible loss of life and low economic loss to structures/property.
*** A Significant Hazard dam has a low hazard potential because it is in a location and of a size that failure or misoperation of the dam would result in no possible loss of life but major economic loss to structures or property
NOTE: The Sawyer Upper and Lower dams are currently being evaluated for removal in 2018.

Critical Intersections	Critical Transportation	Indian Brook & Central Ave New Rochester & Hotel Dr Indian Brook & Weeks Lane Central Ave & Weeks lane Central Ave & Glenwood Central Ave & Morin St Central Ave & Merry St Central & Washington Central & Broadway Main & Chapel Washington St & Chestnut St Indian Brook & Members Way Indian Brook & Sixth St Indian Brook & Exit 9 NB Ramp Indian Brook & Exit 9 SB Ramp Central Ave & Silver St Silver St & Locust St Silver St & Arch St Central Ave & Exit 7 NB (Burger King) Central Ave & Locust St Central Ave & Mill St Exit 7 South Bound Durham Rd & Back River Rd Central Ave & Old Rollinsford Oak & Portland Littleworth Rd & Knox Marsh Rd

Table 6: Critical Facilities (CF)

		New Rochester & Longhill Sixth St & Venture Way Sixth St & Whittier St Central Ave & Oak St Oak & Broadway Chestnut St & First St Central Ave & Stark Ave Durham Rd & Mast Rd Route 4 & Boston Harbor Rd Durham Rd & Daley Dr (South End Fire)
Bridge (057/173)	Transportation (City Owned)	Sixth Street over Blackwater Brook
Bridge (079/140)	Transportation (City Owned)	Watson Road over Cochecho River
Bridge (111/132)	Transportation (City Owned)	Whittier Street over Cochecho River
Bridge (120/098)	Transportation (City Owned)	Bellamy Road over Bellamy River
Bridge (120/118)	Transportation (City Owned)	Washington Street over PAR
Bridge (123/126)	Transportation (City Owned)	Fourth Street over Cochecho River
Bridge (128/122)	Transportation (City Owned)	Chestnut Street over Cochecho River
Bridge (130/099)	Transportation (City Owned)	NH108 over Bellamy River
Bridge (131/123)	Transportation (City Owned)	NH108 (SB) over Cochecho River
Bridge (134/122)	Transportation (City Owned)	NH108 (NB) over Cochecho River
Bridge (136/123)	Transportation (City Owned)	Washington St. over Cochecho River
Bridge (069/046) (6 tons)	Transportation (State)	Oak Street over PAR (Rollinsford)
Bridge (109/106)	Transportation (State)	NH9 over BMRR
Bridge (169/130)	Transportation (State)	Gulf Road over Fresh Creek
Bridge (174/034)	Transportation (State)	US4 over Bellamy River
Bridge (182/123)	Transportation (State)	Gulf Road over Salmon Falls River
Bridge (084/165)	Transportation (Turnpike Bureau)	NH16 over Long Hill Road
Bridge (101/150)	Transportation (Turnpike Bureau)	Indian Brook Drive over NH16
Bridge (104/143)	Transportation (Turnpike Bureau)	Glenwood Ave over NH16
Bridge (105/133)	Transportation (Turnpike Bureau)	NH16 over Cochecho River
Bridge (105/138)	Transportation (Turnpike Bureau)	Sixth Street over NH16
Bridge (106/125)	Transportation (Turnpike Bureau)	Tolend Road over NH16
Bridge (106/133)	Transportation (Turnpike Bureau)	NH16 over Cochecho River
Bridge (113/111)	Transportation (Turnpike Bureau)	NH16 (SB) over BMRR
Bridge (113/112)	Transportation (Turnpike Bureau)	NH16 (NB) over BMRR
Bridge (121/106)	Transportation (Turnpike Bureau)	Silver Street over NH16
Bridge (127/104)	Transportation (Turnpike Bureau)	Cataract Ave over NH16
Bridge (132/101)	Transportation (Turnpike Bureau)	NH16 (SB) over NH108/PAR
Bridge (132/102)	Transportation (Turnpike Bureau)	NH16 (NB) over NH108/PAR
Bridge (160/083)	Transportation (Turnpike Bureau)	Gerrish Road over NH16
Bridge (174/034)	Transportation (Turnpike Bureau)	NH16 over New Bellamy Lane
Bridge (181/039)	Transportation (Turnpike Bureau)	US4 (WB) over NH16
Bridge (200/023) - Closed	Transportation (Turnpike Bureau)	General Sullivan over Little Bay
Bridge (201/024)	Transportation (Turnpike Bureau)	NH16 (NB) over Little Bay
Bridge (201/025)	Transportation (Turnpike Bureau)	NH16 (SB) over Little Bay

Table 6: Critical Facilities (CF)		
Bridge (132/130)	Transportation (Railroad)	PAR over Broadway Street
Bridges have been identified by the NHDOT Bridge Design Bureau; Dams have been identified by the NHDES, Water Division Note: According to NHDOT, there are two REDLIST bridges in the City of Dover, and one in Rollinsford along the municipal boundary		

Table 7: Vulnerable Populations to Protect (VPP)		
Vulnerable populations can be defined broadly to include those who are not able to access and use the standard resources offered in disaster preparedness and planning, response, and recovery		
Facility	Type	Address
Woodman Park	Elementary School	11 Towle Ave
Garrison	Elementary School	50 Garrison Road
Horne Street	Elementary School	78 Horne Street
Middle School	Middle School	16 Daley Drive
High School and Regional Career Technical Center	Senior High School	25 Alumni Drive
Dover Alternative School	Special Education Program	50 Alumni Drive
Cochecho Academy of the Arts	College-Preparatory School	40 Hampshire Circle
St. Thomas Aquinas	Catholic High School (Private)	199 Dover Point Road
Portsmouth Christian Academy	College-Preparatory School (Private)	20 Seaborne Drive
Saint Mary Academy	Catholic School (Private)	222 Central Ave
Children in Motion	Preschool/Daycare	274 County Farm Road
My School	Preschool/Daycare	118 Locust Street
Dover Children's Home	Preschool/Daycare	207 Locust Street
Happy Helpers Preschool	Preschool/Daycare	6 Heather Lane
JB's Learning House	Preschool/Daycare	25 Mathes Hill Drive
Strafford County Head Start	Preschool/Daycare	62A Whittier Street
Strafford County YMCA	Preschool/Daycare	21 Daley Drive
Strafford County YMCA	Preschool/Daycare	50 Garrison Road
Strafford County YMCA	Preschool/Daycare	78 Horne Street
Strafford County YMCA	Preschool/Daycare	11 Towle Ave
WDH Early Learning	Preschool/Daycare	789 Central Ave
Michelle Michaud's Daycare	Preschool/Daycare	6 Wallace Drive
Our House for Girls	Preschool/Daycare	576 Central Ave
Shannonigans Childcare	Preschool/Daycare	168 Mast Road
Stay & Play Early Learning	Preschool/Daycare	9 Nelson Street
Dover Daycare Learning	Preschool/Daycare	32 Saint Thomas Street
Honey Tree Learning	Preschool/Daycare	36 Olive Meadows Lane
Cross Road Children's Center	Preschool/Daycare	18 French Cross Road
Peter Cotton Tail Preschool Daycare	Preschool/Daycare	42 Long Hill Road
Shenanigans Early Learning	Preschool/Daycare	2 Apache Street
Honey Hill Child Care	Preschool/Daycare	57 Central Ave
Seacoast Charter School	Preschool/Daycare	171 Watson Road
Little Tree Education	Preschool/Daycare	383 Sixth Street
Bright Beginnings Daycare	Preschool/Daycare	50 Back River Road
Garrison City Early Childhood Center	Preschool/Daycare	103/105 Durham Road

Our Little Ones	Preschool/Daycare	7 Birch Drive
Lu Daycare	Preschool/Daycare	7 Tennyson Ave
Susie's Daycare	Preschool/Daycare	28 Tennyson Ave
Little Lamb Nursery	Preschool/Daycare	31 Tennyson Ave
Miss Patty's Children Center	Preschool/Daycare	49 Piscataqua Road
Melissa's After School Care	Preschool/Daycare	42 Pearl Street
Riverside Rest Home	Nursing Home	276 County Farm Road
Saint Ann House	Nursing Home	195 Dover Point Road
Langdon Place	Nursing Home	60 Middle Road
Wentworth Home	Assisted Living	795 Central Ave
Bellamy Fields	Assisted Living	150 Garrison Road
Watson Fields	Assisted Living	201 Watson Road
Wadleigh House	Assisted Living	10 Summer Street
Residence at Silver Square	Assisted Living	100 Sterling Way
Mast Landing Senior Care Housing	Assisted Living	250 Mast Road
Johnson Creek Village	Assisted Living	301 Durham Road
Pointe Place Memory Care	Assisted Living	Pointe Place
Cochecho River Manor	Assisted Living	262 County Farm Road
My Friends Place	Homeless Shelter	368 Washington Street

Table 8: Water Resources

Sources of water that may be of potential use during emergencies.

Facility	Type	Address
Water Tower	Water Reservoir	Garrison Hill Long Hill Road
Groundwater Wells	Public Water Supply	Griffin Well Ireland Well Calderwood Well Campbell Well Smith & Cummings Well Hughes Well Bouchard Well DPH-1 Willand Pond Lowell Ave - WTP Bouchard Well - WTP Griffin Well – WTP Shaws Lane (potential, 2018)
Surface Water (Bellamy and Isinglass Rivers)	Aquifer Recharge Stations (Secondary Public Water Supply)	Pudding Hill Aquifer Hoppers Aquifer
Willand Pond	Auxiliary Fire Aid	Route 9
Fire hydrant	Hydrant to Hydrant Emergency Water Interconnection (*Somersworth*)	Old Rochester Road & Hickory Lane
Cistern(s)	Auxiliary Fire Aid	Upper Factory 115 Industrial Park

Chapter 4: Vulnerable Structures and Potential Loss

Critical Facilities/Key Resources and Other Assets

It is important to identify critical facilities and other structures that are most likely to be damaged by hazards. A GIS-based analysis was completed to determine, spatially, which critical facilities and key resources (CF/KR) within the city intersected with the FEMA floodplain, identified past and potential flooding areas from previous hazard mitigation updates, or the 6.3ft of sea-level rise with a storm surge. Table 9 lists the 24 CF/KRs located within those areas with a potential loss value estimate of $78,072,582 at 100%.

Table 9: Vulnerable Critical Facilities/Key Resources

CF/KR and Other Assets	Hazard	100% of Structure Value
Critical Facilities		
Dams		
Central Ave Dam and Fish Ladder	FEMA Floodplain & Past Flooding	The Dam Bureau at NHDES has looked into assessing values for state-owned dams with marginal success. They considered bond ratings, market value, and construction costs. They also developed a formula that calculated the cubic feet of water impounded as a monetary value. Because dams serve different purposes (recreational, hydro-power), assessed values are hard to estimate and cannot be determined.
Watson Waldron Dam	Past Flooding	
Bridges		
Whittier Street over Cochecho River	FEMA Floodplain	$2,904,000 (121 x 24 x $1,000)
NH108 (SB) over Cochecho River	FEMA Floodplain & Past Flooding	$3,360,000 (140 x 24 x $1,000)
NH108 (NB) over Cochecho River	FEMA Floodplain, Past Flooding, Sea Level Rise (6.3ft w/ storm surge)	$2,424,000 (101 x 24 x $1,000)
Sixth Street over Blackwater Brook	FEMA Floodplain & Past Flooding	$384,000 (16 x 24 x $1,000)
Chestnut Street over Cochecho River	FEMA Floodplain	$4,992,000 (208 x 24 x $1,000)
Washington St. over Cochecho River	FEMA Floodplain, Past Flooding, Sea Level Rise (6.3ft w/ storm surge)	$3,960,000 (165 x 24 x $1,000)
Fourth Street over Cochecho River	FEMA Floodplain & Past Flooding	$4,296,000 (179 x 24 x $1,000)
Bellamy Road over Bellamy River	FEMA Floodplain & Past Flooding	$408,000 (17 x 24 x $1,000)
NH108 over Bellamy River	FEMA Floodplain	$2,232,000 (93 x 24 x $1,000)

CF/KR and Other Assets	Hazard	100% of Structure Value
US4 over Bellamy River	FEMA Floodplain & Sea Level Rise (6.3ft w/ storm surge)	$27,336,000 (1,139 x 24 x $1,000)
Gulf Road over Salmon Falls River	FEMA Floodplain	$11,736,000 (489 x 24 x $1,000)
NH16 over Cochecho River	FEMA Floodplain	$6,456,000 (269 x 24 x $1,000)
Watson Road over Cochecho River	Past Flooding	$3,480,000 (145 x 24 x $1,000)
PAR over Broadway Street	Past Flooding	$1,200,000 (50 x 24 x $1,000)
Critical Transportation Assets		
Central Ave and Washington Street	Past Flooding	N/A
Route 4 & Boston Harbor Road	Sea Level Rise (6.3ft w/ storm surge)	N/A
Pump Stations		
Boston Harbor Pump Station	Sea Level Rise (6.3ft w/ storm surge)	$110,378 (building + contents)
Mill Street Pump Station	Sea Level Rise (6.3ft w/ storm surge)	$431,472 (building + contents)
Wentworth Terrace Pump Station	Sea Level Rise (6.3ft w/ storm surge)	$1,311,151 (building + contents)
Watson Road Pump Station	Past Flooding	$490,722 (building + contents)
Water Resources		
Hughes Well (Water Supply)	FEMA Floodplain	$560,859 (building + contents)
Willand Pond (Auxiliary Fire Aid)	FEMA Floodplain	N/A
	Total	$78,072,582

Note: The approximate assessed value for the bridges was calculated by multiplying $1,000.00 per square foot of bridge. This estimate was provided by the Bridge Design Bureau at NHDOT and includes all cost (engineering, consulting and in-house design, construction, etc.) to build a new bridge.

The GIS analysis completed by Strafford Regional Planning Commission showed that no emergency or non-emergency response facilities fell within the FEMA floodplain, any past identified flooding areas, or the 6.3ft of sea-level rise + a storm surge scenario. The data did reflect significant impacts to the City's transportation infrastructure, specifically bridges – both City and State owned. It should be noted that due to limitations with the mapping data, it was impossible to determine what the extent of the damage would be at each location; however it is safe to say that these areas are likely vulnerable to flooding under a variety of scenarios.

Other infrastructure included two dams, four pump stations, two critical intersections, one well, and one fire aid. Fire aids, like Willand Pond, are intentionally located in close proximity to waterbodies to allow fire trucks to draft water during an emergency; therefore, they will inherently be vulnerable to flooding issues and do not raise big concerns for the City.

Buildings and Utilities

It is difficult to ascertain the amount of damage that could be caused by a natural or man-made hazard because the damage will depend on the hazard's extent and severity, making each hazard event somewhat unique. The assumption used here when calculating the damage to property is equal to: 0-1%, 1-5%, or 5-10% of Dover's structures, depending on the nature of the hazard, whether or not the hazard is localized, and its economic impact.

The total local assessed value included in this analysis is **$2,089,293,400** including **$2,029,935,600** for buildings and **$59,357,800** for utilities. Based on this assumption, the potential loss from any of the identified hazards under a low, medium, and high damage scenario of buildings and utilities would range from **$0 to $20,892,934 (low)** or **$20,892,934 to $104,464,670 (medium)** or **$104,464,670 to $208,929,340 (high)** based on the 2016 Dover City valuation. Table 10 provides more detail on these estimated economic losses.

Table 10: Economic Loss Data

Local Assessed Valuation				
	Total Assessed Value (2016)	Economic Loss		
		Low 1% Damage	Medium 5% Damage	High 10% Damage
Buildings				
Residential	$1,431,850,700	$14,318,507	$71,592,535	$143,185,070
Manufactured Housing	$33,924,500	$339,245	$1,696,225	$3,392,450
Commercial Industrial	$564,160,400	$5,641,604	$28,208,020	$56,416,040
Total Buildings	**$2,029,935,600**	$20,299,356	$101,496,780	$202,993,560
Utilities				
Public Water	-			
Gas	$23,789,500	$237,895	$1,189,475	$2,378,950
Electric	$35,568,300	$355,683	$1,778,415	$3,556,830
Total Utilities	**$59,357,800**	$593,578	$2,967,890	$5,935,780
Net Valuation Building and Utilities	**$2,089,293,400**	**$20,892,934**	**$104,464,670**	**$208,929,340**

Source: NH Department of Revenue Administration. 2016 Annual Report. Assessed value does not include value of land or local exemptions. (https://www.revenue.nh.gov/mun-prop/property/equalization-2016/documents/tbc-alpha.pdf)

Human loss of life was not included in the potential loss estimates, but could be expected to occur, depending on the severity and type of the hazard.

Chapter 5: National Flood Insurance Program (NFIP)

The Office of Strategic Initiatives, (OSI) administers the National Flood Insurance Program (NFIP) in New Hampshire. The NFIP is a partnership between a community and the federal government. Communities participate by agreeing to adopt and enforce a floodplain management ordinance designed to reduce future flood risks and in return all residents in those participating communities (whether in floodplain or not) can purchase flood insurance. Currently 217 communities (92 percent) that participate in the NFIP have adopted at least the minimum standards of the NFIP.

Through FEMA's Community Assistance Program, OSI provides technical assistance to communities and the public on floodplain management and helps to promote sound land use planning techniques that will reduce flood losses. OSI conducts Community Assistance Visits to ensure that communities participating in the NFIP are meeting program goals.

Dover's National Flood Insurance Program Status

According to FEMA's Community Status Book Report, Dover has been a member of the National Flood Insurance Program (NFIP) since April 15, 1980. The City has significant portions of land and property in the 100-year floodplain specifically along the mainstem of the Cochecho River and its tributaries (Blackwater Brook, Clark Brook, Reyners Brook); Fresh Creek; the Salmon Falls River; the Bellamy River; and the Piscataqua River. There are also portions of land in the 100-year floodplain around the Bellamy Reservoir. According to a previous GIS analysis, the City has an estimated 214 parcels with structures that fall within the floodplain, with a value of $30,016,754; however, this analysis was completed prior to the delineation of the new FEMA flood maps and may no longer be accurate.

Article VII of the City's Zoning Ordinance (as revised 7/22/2015) outlines the City's floodplain development regulations. The City of Dover recognizes the need to minimize the potential loss of life and property during periods of flooding regulating the alteration and/or the development of those areas of special flood hazard identified by FEMA. The following regulations shall apply to all lands designated as areas of special flood hazard by FEMA in its "Flood Insurance Study for the County of Strafford, N.H." dated September 30, 2015,

According to information from the FEMA Community Overview (as of 5/31/2017) provided by NH OSI Assistant Planner Kellie Shamel, Dover has 78 total policies (49 single family homes, 3 multi-family homes, 14 other residential structures, and 12 non-residential homes) in the floodplain hazard area. There have been 29 paid loss claims totaling $861,259 with five repetitive loss[5] claims totaling $287,439.84. The five repetitive losses are all residential structures, including one single family home, three apartment buildings, and one multi-family dwelling. Three of the repetitive loss properties have flood insurance (two of these properties have been transferred to the NFIP's Special Direct Facility as they have been identified as having a high frequency of losses or a high value of claims); two do not have insurance. Of the 78 total policies, 55 are standard and preferred risk policies and are not required. Standard and preferred risk offers policies for buildings that are located in moderate-to-low risk areas (B, C, and X Zones).

[5] Repetitive losses are defined as residential property that is covered under an NFIP flood insurance policy and that has had at least four NFIP claim payments over $5,000 each, and the cumulative amount of such claims payments exceeds $20,000; as well as at least two separate claims payments that have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building. At least two of the claims must have occurred within any ten-year period, and must be greater than 10 days apart.

Table 11: Dover's Insurance Zone Policies

Zone	Policies in Force	Premium	Insurance in Force	Number of Closed Paid Loses	Amount of closed Paid Loses	Repetitive Loses
AE Zones	21	$54,754	$6,162,000	3	$23,726.58	1
A Zones	2	$4,820	$410,500	9	$430,412.59	2
B,C & X Zone						
Standard	22	$14,139	$4,477,200	10	$349,763.72	1
Preferred	33	$12,324	$9,875,000	7	$57,356.55	1
TOTAL	78	$86,037	$20,924,700	29	$861,257.00	5

In order to remain NFIP compliant, Dover has implemented a number of actions, including:

∴ In 2011, a FEMA Community Assistance Visit (CAV) was completed (the previous CAV was completed in 2004). The results did not find any major problems with the existing floodplain management regulations. The report indicated that the City's building permit application did not include the question as to whether the property was in a floodplain. The Planning Committee did not believe this question was included in the building permit application; however, it was suggested to be added into their ongoing LEAN review process.

∴ The City sent out flood insurance brochures to existing residents and new homeowners located in the flood zones (information on the 2015 map updates needs to be sent out again). Brochures are available at City Hall.

∴ The City is actively pursuing options to join the Community Rating System to reduce flood insurance rates.

∴ Dover sent one municipal staff member to receive Certified Floodplain Managers training.

∴ Dover is currently working with a property owner on Snows Court to donate a repetitive loss structure to the City for conversion into a public park.

∴ In 2015, the City adopted new floodplain maps, which were delineated as part of the Coastal NH Floodplain Mapping Update, to include all lands designated as special flood hazard areas by the Federal Emergency Management Agency (FEMA) in its "Flood Insurance Study for the County of Strafford, NH" dated September 30, 2015, are declared to be part of the Dover Zoning Ordinance and are hereby incorporated by reference.

∴ In 2015, Dover made the decision to enforce regulations that exceed the NFIP minimum standards by adopting freeboard regulations, which require the lowest floor of residential and non-residential structures that are new construction or substantial improvements to be elevated two feet above base flood elevation.

∴ In 2016, Dover participated in a training workshop conducted by the New Hampshire Office of Energy and Planning, NH GRANIT, and the Strafford Regional Planning Commission. The purpose of this workshop was to provide an introduction to the FEMA's Flood Risk Products, present community-specific flood risk data and information, and show how the flood risk data and information can be used in planning initiatives to increase flood resiliency. Dover is actively using data from FEMA's Risk Mapping, Assessment, and Planning (Risk MAP).

Chapter 6: Hazards & Mitigation Strategies

Overview

This section describes the location and extent of hazards that could impact the City of Dover, presents past hazard events in the City or elsewhere in New Hampshire, and discusses their rank order placement. The Multi-Hazard Mitigation Planning Committee investigated past and potential hazards using a variety of sources and techniques, including but not necessarily limited to interviewing City historians and other citizens; researching historical records archived at the City Library; scanning old newspapers; reading published City histories; consulting various hazard experts; and extracting data from the NH Hazard Mitigation Plan and other state and federal databases. Past and potential hazards were mapped where spatial data was available.

Rating Probability, Severity, and Overall Risk of Future Disasters

The nature of each hazard type and the quality and availability of corresponding data made the evaluation of hazard potential difficult. The Multi-Hazard Planning Committee considered what data was at hand and used its collective experience to formulate statements of impact or potential. Each hazard type was rated using a hazard vulnerability assessment tool (refer to Table 12).

This tool estimates the probability of occurrence, severity, and overall risk of an event using a projected number system answering questions, which answer High (3), Moderate (2), and Low (1). A zero (0) score meant that there is no likelihood the hazard would impact the City in the next 25 years. The ranges established for the average to determine severity were:

- ∴ High = >3
- ∴ Moderate = 2
- ∴ Low = 1 or below

The overall risk is a numeric indication developed by multiplying the total numbers of the probability and the severity.

Probability of Occurrence

Probability is based on a limited objective appraisal of a hazard's probability using information provided by relevant sources, observations and trends. The Planning Committee discussed and rated probability of each hazard.

- ∴ High: There is a very strong likelihood (67-100% chance) that Dover will experience a hazardous event within the next 25 years. Score = 3
- ∴ Moderate: There is moderate likelihood (34-66% chance) that Dover will experience a hazardous event within the next 25 years. Score = 2
- ∴ Low: There is little likelihood (0-33% chance) that Dover will experience a hazardous event within the next 25 years. Score = 1

Severity

Severity is an estimate generally based on a hazard's impact human, property and business. The Planning Committee discussed the severity of each hazard. The severity was calculated by the average of human, property and business.

- ∴ High: The total population, property, commerce, infrastructure and services of the City are uniformly exposed to the effects of a hazard of potentially great magnitude. In a worst case scenario there could be a disaster of major to catastrophic proportions. Score = 3
- ∴ Moderate: The total population, property, commerce, infrastructure and services of the City are exposed to the effects of a hazard of moderate influence; or the total population, property, commerce, infrastructure and services of the community is exposed to the effects of a hazard, but not all to the same degree; or an important segment of population, property, commerce, infrastructure or service is exposed to the effects of a hazard. In a worst case scenario there could be a disaster of moderate to major, though not catastrophic, proportions. Score = 2
- ∴ Low: A limited area or segment of population, property, commerce, infrastructure or service is exposed to the effects of a hazard. In a worst case scenario there could be a disaster of minor to moderate proportions. Score = 1

Overall Risk

The overall risk number can help Dover weigh the hazards against one another to determine which hazard is most detrimental. This is calculated by multiplying the Probability of Occurrence score by the average of the Severity score (human, property, and business impacts).

- ∴ High: There is a great risk of this hazard in Dover. Score = 7 or greater
- ∴ Moderate: There is moderate risk of this hazard in Dover. Score = 4-6
- ∴ Low: There is little risk of this hazard in Dover. Score = 0-3

Hazards Ratings in Dover, NH

The Committee determined that the hazards are distributed as follows:

- ∴ 5 hazards rated as having a High overall risk in Dover: flooding (riverine/extreme rain event), hurricanes & tropical storms, severe winter storms, severe thunderstorms, and public health threats
- ∴ 3 hazards rated as having a Moderate overall risk in Dover: hazardous materials, tornado and downburst, and coastal flooding (storm surge and sea-level rise)
- ∴ 6 hazards rated as having a Low overall risk in Dover: extreme temperatures, drought, flooding (dam failure), earthquake and landslide, wildfire, and cyber-attacks

Table 12 is the City's vulnerability assessment tool, which provides more information on the multi-hazard threat analysis that was completed during a brainstorming session with the Planning Committee.

Hazard Vulnerability Table

Table 12: Hazard Vulnerability Assessment Tool – City of Dover

Impact Rankings 0 – N/a 1-Low 2-Moderate 3-High	Human Impact *Probability of death or injury*	Property Impact *Physical losses and damages*	Business Impact *Interruption of service*	Severity *Average of human, property, and business impacts*	Probability *Likelihood this will occur within 25 years*	Overall Threat *Low = 0-3* *Moderate = 4-6* *High = > 7* *(Severity x probability)*
Hazard Event						
Flooding (*Riverine/Extreme Rain Event*)	2	3	3	2.7	3	8.0
Hurricane & Tropical Storms	2	3	3	2.7	3	8.0
Severe Winter Storms	2	3	3	2.7	3	8.0
Severe Thunderstorms	2	3	3	2.7	3	8.0
Public Health Threats	3	3	2	2.7	3	8.0
Hazardous Materials	2	2	2	2.0	3	6.0
Tornado & Downburst	2	3	2	2.3	2	4.7
Coastal Flooding (*Storm surge and sea-level rise*)	1	3	2	2.0	2	4.0
Cyber Attacks	1	1	3	1.7	2	3.3
Extreme Temperatures	1	1	1	1.0	3	3.0
Drought	1	1	1	1.0	2	2.0
Flooding (*Dam Failure*)	1	2	1	1.3	1	1.3
Earthquake & Landslide	1	1	1	1.0	1	1.0
Wildfire	1	1	1	1.0	1	1.0

Declared Disasters and Emergency Declarations

Table 13: Presidentially Declared Disasters (DR) 1990-October 2016 impacting the City of Dover

Date Declared	Event	Date of Event	Source	Program	Amount (Statewide)	Remarks
September 9, 1991	Hurricane Bob	August 18-20, 1991	FEMA 917-DR	PA	$2,293,449	Severe storm and wind; no power; trees knocked down
October 29, 1996	Severe Storms & Flooding	Oct 20-23, 1996	FEMA 1144-DR	PA	$2,341,273	Severe storms, flooding
January 15, 1998	Ice Storm	January 7-35, 1998	FEMA 1199-DR	PA/IA	$12,446,202	Major tree damage, electric power interrupted for many days; schools were closed
May 25, 2006	Severe Storm & Flooding	May 12-23, 2006	FEMA 1643-DR	PA/IA	$17,691,586	Severe storm causing; massive flooding; road closures; evacuations
April 27, 2007	Severe Storm & Flooding	April 15-23, 2007	FEMA 1695-DR	PA/IA	$26,826,780	Severe storms and flooding.
August 11, 2008	Severe Storms, Tornado, & Flooding	July 24, 2008	FEMA 1782-DR	PA	$3,673,097	Severe storms; tornado; and wind damage
January 2, 2009	Severe Winter Storm	December 11-23, 2008	FEMA 1812-DR	DFA/PA	$14,898,663	Winter storm; snow removal; some people without power for a week
March 29, 2010	Severe Winter Storm	February 23-March 3, 2010	FEMA 1892-DR	PA	$6,841,093	Severe winter storm; minor power outages; no major damage

Date Declared	Event	Date of Event	Source	Program	Amount (Statewide)	Remarks
September 3, 2011	Tropical Storm Irene	August 26 – Sept 6, 2011	FEMA 4026-DR	PA	$17,684,244	Powerful gusts of wind and periods of heavy rain; no major damage; a few trees down, but no long-term power outrages or closures.
March 19, 2013	Severe Snow and Blizzard	February 9-11, 2013	FEMA 4105-DR	PA	$6,153,471	Emergency protective measures; snow removal assistance; and cost-sharing basis for emergency work.
March 25, 2015	Severe Snow & Snowstorm	January 26-29, 2015	FEMA 4209-DR	PA	$4,939,214	Emergency protective measures; snow removal assistance; cost-sharing basis for emergency work; economic impacts in the downtown; and line of site issues due to high snow banks along sidewalks and pedestrian intersections.
August 9, 2017	Severe Storms and Flooding	July 1-2, 2017	FEMA 4329-DR	PA	$6,218,291	Strafford County was not included in the designated counties; however, the City did experience minor flooding impacts, associated with drainage issues in various parts of the City.
12 declarations totaling approximately $122,007,363						
Program Key: PA: Public Assistance, IA: Individual Assistance, DFA: Direct Federal Assistance						

Table 14: Emergency Declaration (EM) 1990-October 2016 impacting the City of Dover

Date Declared	Event	Date of Event	Source	Program	Amount (Statewide)	Remarks
March 16, 1993	Heavy Snow	March 13-17, 1993	FEMA 3101-EM	PA	$832,396	Snow removal; high winds.
March 28, 2001	Snow Emergency	March 5-7, 2001	FEMA 3166-EM	PA	$3,433,252	Snow removal
March 11, 2003	Snow Emergency	February 17-18, 2003	FEMA 3177-EM	PA	$2,288,671	Snow removal
March 30, 2005	Snow Emergency	January 22-23, 2005	FEMA 3207-EM	PA	$3,611,491	Snow removal
December 13, 2008	Severe Winter Storm	December 11-23, 2008	FEMA 3297-EM	DFA/PA	$900,000	Winter storm; snow removal
November 1, 2011	Severe Winter Storm	October 29-30, 2011	FEMA 3344-EM	PA	Data not available	Heavy, wet snow and leaf-on conditions that resulted in downed trees and caused major power outages throughout the City
October 30, 2012	Hurricane Sandy	October 26-31, 2012	FEMA 3360-EM	PA	$643,660	Minor impacts, including periods of heavy rain and short-term power outages
7 emergency declarations totaling approximately $11,709,470						
Program Key: PA: Public Assistance, DFA: Direct Federal Assistance						

Flooding

Overview	
Hazard Type	Flooding
Location/Extent	Cochecho River and its tributaries (Blackwater Brook, Clark Brook, Reyners Brook); Fresh Creek; the Salmon Falls River; the Bellamy River; the Piscataqua River; and areas surrounding the Bellamy Reservoir.
Vulnerability	
Severity	2.7
Probability	3.0
Overall Threat	8.0 (high)

Description of the Hazard

Riverine flooding is the most common natural disaster to impact New Hampshire. Riverine flooding occurs when surface water runoff introduced into streams and rivers exceeds the capacity of the natural or constructed channels to accommodate the flow. As a result, water overflows the river banks and spills out into adjacent low lying areas.[6] Floods are most likely to occur in the spring due to the increase in rainfall and the melting of snow; however, floods can occur at any time of the year because of heavy rains, hurricane, or a Nor'easter.

New Hampshire's climate ranges from moderate coastal to severe continental, with annual precipitation ranging from about 35 inches in the Connecticut and Merrimack River valleys, to about 90 inches on top of Mount Washington. Localized street flooding occasionally results from severe thundershowers, or over larger areas, from more general rain such as tropical cyclones and coastal "nor'easters." More general and disastrous floods are rare, but some occur in the spring from large rainfall quantities combined with warm, humid winds that rapidly release water from the snowpack. Causes of flooding that could potentially affect Dover include:

The "100-year flood" Term:

The "100-year flood" is a term often used to describe a flood that has a 1% chance of occurring in any year. But the phrase is misleading, and often causes people to believe these floods happen every 100 years on average. The truth is, these floods can happen quite close together, or not for long stretches of time, but the risk of such a flood remains constant from year to year. The 100-year-flood term was originated to delineate areas on a map to determine what properties are subject to the National Flood Insurance Program. Properties within the 100-year-floodplain, as defined by the Federal Emergency Management Agency, have special requirements and mortgage holders will require owners to carry flood insurance on these properties.

[Source: The Nurture Nature Center: Focus on Floods]

- ∴ 100-year rainstorm event
- ∴ Severe tropical storm (hurricane or tropical storm) that can bring torrential rainfall in excess of that from a 500-year storm.
- ∴ Rapid snow pack melt in spring can be a significant potential flooding source, given the northern, relatively cold location and climate of Dover
- ∴ River ice jams, which could occur, although the Army Corps of Engineers Ice Jam Database contains no record of ice jams in Dover; however, the Planning Committee identified two historic ice jams that caused significant damage. The first was in 1896, known locally as "Dover's Black Day", resulted in large chunks of ice that rushed down the Cochecho River producing an extensive amount of damage. According the WMUR.com

[6] FEMA Training Chapter 2 Types of Floods and Floodplains (https://training.fema.gov/hiedu/docs/fmc/chapter%202%20-%20types%20of%20floods%20and%20floodplains.pdf)

Dover experienced the destruction of five bridges, the loss of the Bracewell Building (a 700-pound piece of granite from the foundation is said to have made it all the way downriver to New Castle), and damage to the Cochecho Sawyer Mills. The busy shipping industry, which saw more than 200 vessels come to port each year, was completely wiped out. The second took place sometime in the 1900s (the Planning Committee could not determine the exact date) and impacted the Dover Point Bridge.

∴ Dam breach or failure.

Extent of the Hazard

Flooding can occur in any area of the City but is more likely to occur within the 100-year floodplain, downstream of dams, along river and stream banks, near wetlands and road crossings, and other low-lying areas. Dover has approximately 13.6% (2,532.1 acres) of its area in 100-yr. floodplain (see Map 5). It should be noted that this estimation is likely overstated due to the fact that the FEMA floodplain contains open water. If the tidal portions along the Cochecho, Piscataqua, and Bellamy rivers were removed the approximate acreage may be more accurately depicted as 5.1% (944.1 acres)

Based on extent of the floodplain, the City has significant portions of land and property in the 100-year floodplain specifically along the mainstem of the Cochecho River and its tributaries (Blackwater Brook, Clark Brook, Reyners Brook); Fresh Creek; the Salmon Falls River; the Bellamy River; and the Piscataqua River. There are also portions of land in the 100-year floodplain around the Bellamy Reservoir.

Although flooding of the full extent of this floodplain by definition would require a 100-year storm, smaller storms with a higher annual probability of occurrence could still flood significant portions of that floodplain. Structures that could be impacted by a 100-year storm could also be affected by smaller, more frequent flooding. There are a large number of structures within this floodplain. It is likely that the 100-year floodplain will change in area when flood maps are continually updated to reflect changes in development patterns and better mapping technology and current precipitation data.

Flooding on the Cochecho River at Henry Law Park, 2006

According to the C-RiSe assessment report, the inland coastal portion of Dover that is most susceptible to coastal flooding is located in low areas along the Bellamy River; the Piscataqua River; at the confluence of the Cochecho River and the Salmon Falls River; and along the shores of Little Bay. Many of these areas are all within the coastal floodplain area, making them particularly vulnerable to flooding from seasonal high tides, coastal storms, and sea-level rise.

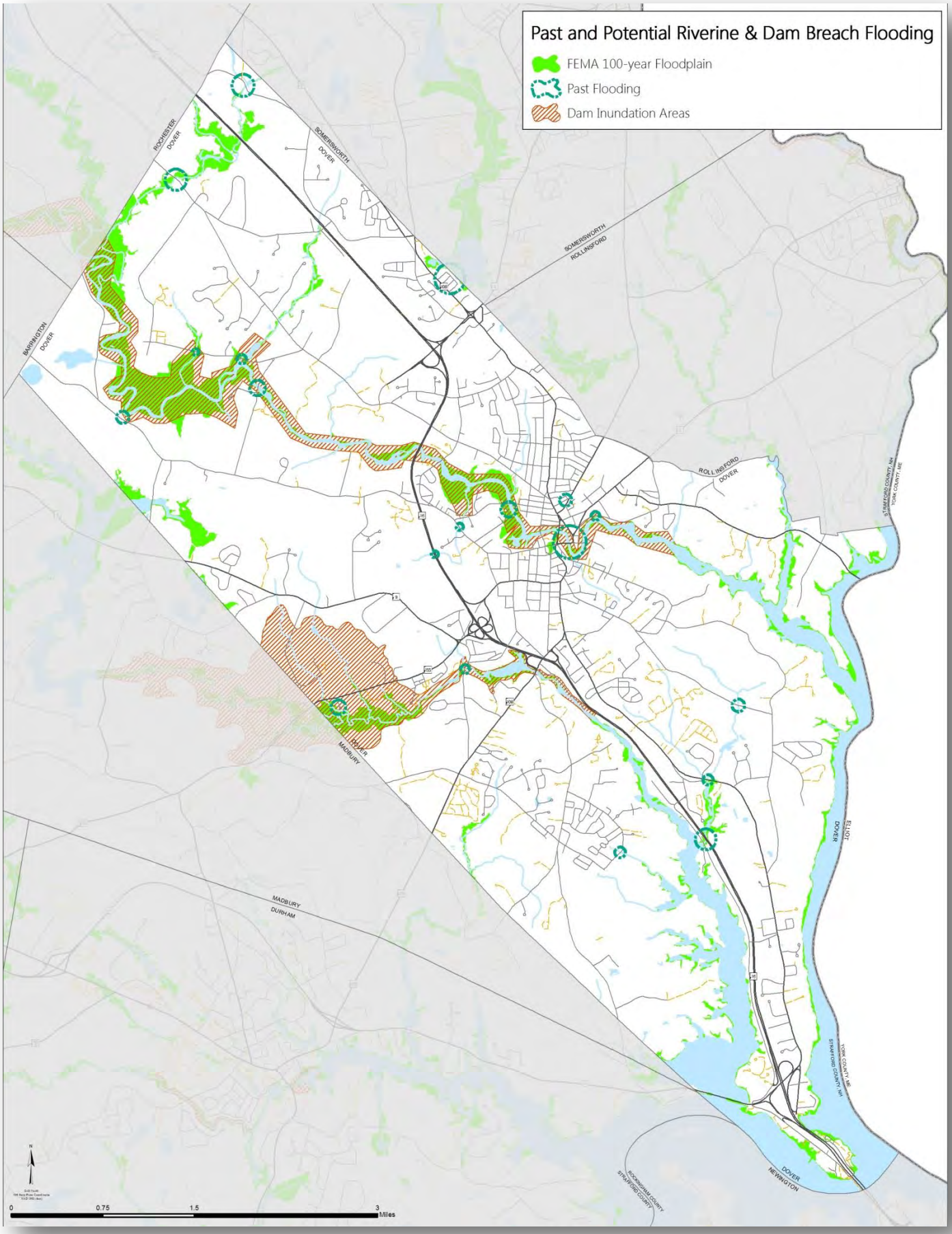
Past Events and Impacts

Although the storm could not be classified, a 1936 event was described at the time as causing "the greatest damage in New Hampshire's history" (Fahey 1936). Two other consequential flooding events took place in 2006 and 2007, both of which were considered 100-year events. During those events, there were several areas where Dover experienced severe impacts to local transportation infrastructure, including: Middle Street over Canney Brook, County Farm Road over Jackson Brook, Blackwater Road over Blackwater Brook, and Watson Road over the Cochecho River.

Cochecho River Dam, October 2017

The Planning Committee identified several other locations that have experienced frequent flooding issues in the past, including: Willand Pond, which flooded the boat launch, walking trails, the parking lot, and parts of New Rochester Road; residential homes on Littleworth Road near Barbadoes Pond; the Children's Museum; the Madbury Apartments on Knox Marsh Drive; areas near Dean Drive and French Cross Road; and the mill buildings (#5) along Central Ave and Main Street.

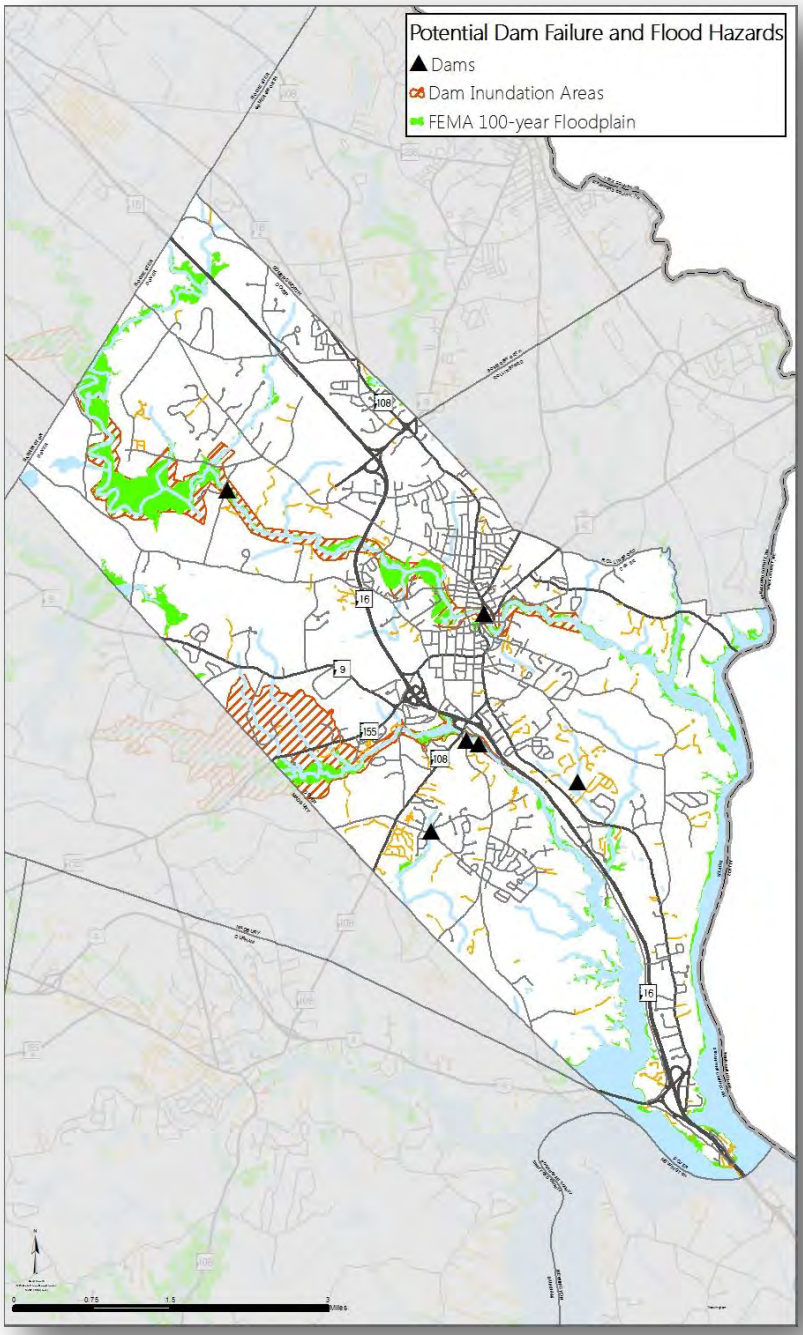
Other areas that needed repairs and upgrades were Broadway (new culvert design), Richardson Drive (narrowed the road to reduce impervious coverage and improve stormwater infiltration), and Keating Ave (best management practices for drainage and stormwater improvements). The City has also updated its stormwater regulations and installed multiple rain gardens in the Berry Brook watershed to help reduce flooding.



Map 5: Past and Potential Hazards (Source: FEMA, GRANIT, and the City of Dover 2017

Dam Failure

Dam failure could potentially result in flooding in Dover. According to the NHDES 2015 database, there are a total of 28 active dams (there are an additional 26 dams that are classified as ruins, removed, breached, not built, pending, or exempt). There are two high hazard dams in Dover (Sawyer Mill Upper and Lower dams); however, both these dams are being considered for removal. There is one significant hazard dam (Thornwood Commons Pond), and three low hazard dams (Watson Waldron, Central Ave at Cochecho Falls, and Redden Pond)



Map 6: Dam Inundation Zones (Source: NHDES, 2015)

While the NHDES Dam Bureau has determined that the Sawyer Mills dams have a high hazard class, the Planning Committee felt strongly that the Central Ave dam should be considered to be the highest risk for loss of life and damage to private and public property due to its close proximity to the downtown Mill buildings and private property downstream.

There are two delineated dam inundation zones that have origins outside the City's borders. One is located east of the Bellamy Reservoir dam that follows the Bellamy River. If this dam were to fail there would likely be significant impacts to areas along Crosby Road, stretches of Route 155, and portions of Bellamy Road. The other is located east of Bow Lake that follows the Cochecho River. Impacts to areas adjacent to County Farm Road, Watson Road, Whittier Street, Fourth Street, and Chestnut Street would be likely. To the best of the committee's knowledge there have been no recent major dam failures in the City; however, the Planning Committee did express concern of potential dam failures at the Milton Three Ponds dam in Milton, the Bow Lake dam in Barrington, and the Bellamy Reservoir dam in Madbury.

In 2006, it was feared that the Milton Three Ponds dam would fail; however, the dam was never breached, is continually inspected, and is in good condition.

A more comprehensive list of dams, their associated classifications, and inspection schedules in Dover are located in Table 15.

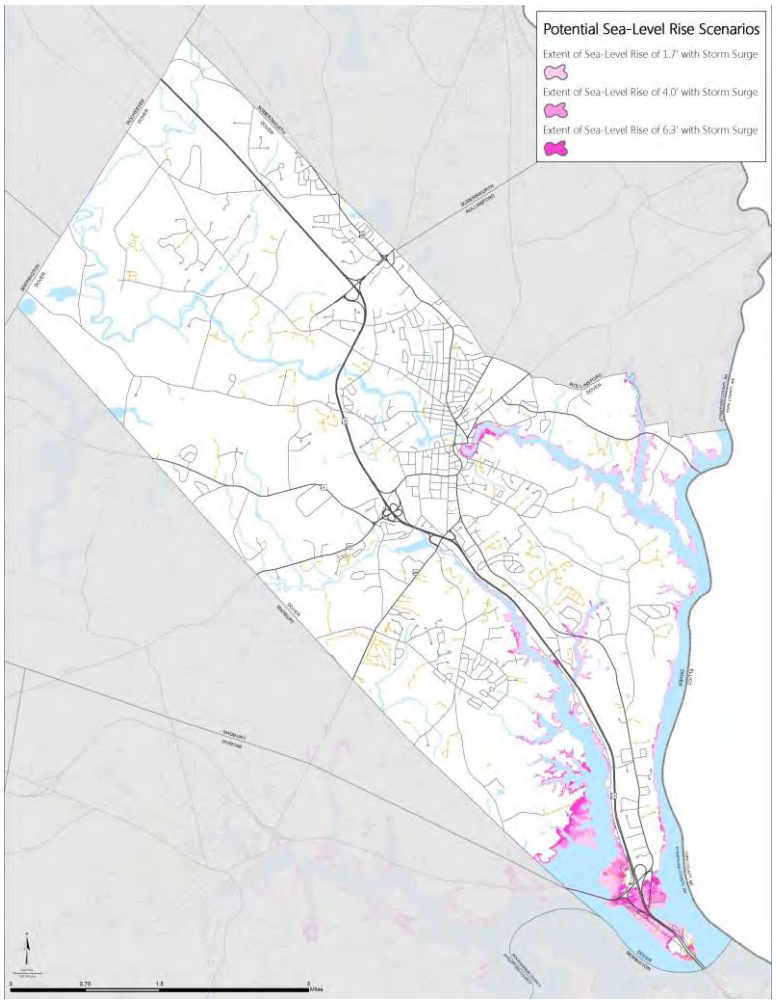
Table 15: Active Dams in Dover

Dam Classification	Classification Definition	Number of Dams in Dover	Inspection Interval (Years)
High	Dam that has a high hazard potential because it is in a location and of a size that failure or misoperation of the dam would result in probable loss of human life.	2	2
Significant	Dam that has a significant hazard potential because it is in a location and of a size that failure or misoperation of the dam would result in no probable loss of lives but major economic loss to structures or property.	1	4
Low	Dam that has a low hazard potential because it is in a location and of a size that failure or misoperation of the dam would result in no possible loss of life and low economic loss to structures/property.	3	6
Non-Menace	Dam that is not a menace because it is in a location and of a size that failure of misoperation of the dam would not result in probable loss of life or loss to property.	22	6

Coastal Flooding and Sea-Level Rise

According to the C-RiSe vulnerability assessment, Dover can expect to see impacts along the Bellamy River; the Piscataqua River; at the confluence of the Cochecho River and the Salmon Falls River; and along the shores of Little Bay. There are a handful of critical facilities impacted, including water and sewer pipes, transmission lines, seven pump stations, and two dams. Several transportation assets are impacted, including evacuation routes on Routes 16 and 4, future NHDOT projects, and local urban compact areas that should also be considered during long-term planning efforts. Dover also can expect to experience impacts to residential homes on Spur Road, Boston Harbor Road/Dover Point Road, and Wentworth Terrace.

Key findings for Dover are based on evaluation of the 1.7 feet (intermediate-low), 4.0 feet (intermediate), and 6.3 feet (highest) sea-level rise projections at the year 2100 and these sea-level rise projections with the 100-year storm surge. Map 7 provides the spatial extend of the three different sea-level rise scenarios.



Map 7: Future Sea-Level Rise + Storm Surge Scenarios

Potential Future Impacts on the Community

Overall, flooding potential in Dover is high and flood conditions will continue to affect the City. Both seasonal flooding and flooding due to extreme weather events have the potential to occur during all seasons. Future sea-level rise may impact certain low-lying, tidal areas.

Estimated Potential Losses

Based on the high hazard ranking and assessed value of residential, commercial, and utilities structures, there is approximately **$208,929,340** in estimated potential losses from flooding.

Hurricane and Tropical Storms

Overview	
Hazard Type	Hurricane and Tropical Storms
Location/Extent	City-wide
Severity	2.7
Probability	3.0
Overall Threat	8.0 (high)

Description of the Hazard

A hurricane is the term used for tropical cyclones that occur in the Northern Hemisphere east of the International Dateline to the Greenwich Meridian. Tropical cyclones originate over tropical or subtropical waters and are characterized by organized deep convection and a closed surface wind circulation about a well-defined center. These events are called typhoons if they occur west of the International Dateline. Hurricane season in the Atlantic runs from June 1 to November 30.

According to the State Hazard Mitigation Plan (2013) tropical cyclones with maximum sustained winds of less than 39 mph are called tropical depressions. Once the tropical cyclone reaches winds of at least 39 mph, they are typically called a tropical storm and assigned a name. If the winds reach 74 mph or greater, they are upgraded and called a hurricane.

Extent of the Hazard

Hurricanes may impact all areas of the City. The Saffir-Simpson Hurricane Wind Scale is a 1 to 5 rating system based on a hurricane's sustained wind speed. This scale estimates potential property damage. Hurricanes reaching Category 3 and higher are considered major hurricanes because of their potential for significant loss of life and damage. Category 1 and 2 storms are still dangerous, however, and require preventative measures.

Scale Number (Category)	Sustained Winds (MPH)	Damage	Storm Surge
1	74-95	**Minimal:** Unanchored mobile homes, vegetation and signs.	4-5 feet
2	96-110	**Moderate:** All mobile homes, roofs, small crafts, flooding.	6-8 feet
3	111-130	**Extensive:** Small buildings, low-lying roads cut off.	9-12 feet
4	131-155	**Extreme:** Roofs destroyed, trees down, roads cut off, mobile homes destroyed. Beach homes flooded.	13-18 feet
5	More than 155	**Catastrophic:** Most buildings destroyed. Vegetation destroyed. Major roads cut off. Homes flooded.	Greater than 18 feet

Past Impacts and Events

These severe tropical storms may occur anytime from early spring to late fall, and in general are less common than other storms, e.g. nor'easters. As wind events, historically hurricanes have caused damage in Dover, most notably in 1938 and 1954 (Hurricane Carol).

The NOAA National Climatic Data Center's Storm Events database (NCDC 2017) does not list any Hurricanes as directly affecting Strafford County from January 1, 2007 to July 31, 2017; however, Strafford County did experience impacts from Hurricane Sandy. Hurricane Sandy was the last hurricane to hit the region during the period of October 26 to November 8, 2012. Local impacts included periods of heavy rain and short-term power outages.

The database does report one tropical storm event, which is detailed as follows:

> Tropical Storm Irene (August 28, 2011) - brought a prolonged period of strong and gusty winds and heavy rain to the state. The high winds snapped or uprooted numerous trees throughout the state causing more than 160,000 customers to lose electrical and/or communication services. The heavy rains caused rivers and streams throughout the state to flood causing damage to bridges, roads, and property. The strongest winds across the state began Sunday morning in southern areas and spread northward during the day. Winds continued to be gusty overnight as the storm moved away from the area. Observed maximum wind gusts included 63 mph at Portsmouth, 52 mph at Concord, and 51 mph at Manchester. On the top of Mt. Washington, winds gusted to 104 mph as the storm approached and 120 mph as it moved away. The combination of wet soil and the prolonged period of strong and gusty winds brought down numerous trees throughout the state. One person was killed and three people were injured across the state due to falling trees or branches. Rainfall amounts across the state ranged from 1.5 to 3 inches across southeastern New Hampshire. Local impacts included periods of heavy rain, downed branches, and short-term power outages.

Potential Future Impacts on Community

Based on historical data and statistical predictors, the Atlantic Basin averages approximately 12 total named storms per year. Six of those storms will become hurricanes with three becoming a category three or higher. With variability in sea-level pressure and sea-surface temperatures in the Atlantic Ocean, it is difficult to predict with certainty the number of storms in any given year. It is even more difficult to determine which of those storms will make landfall. Because Dover is located in closer proximity to the New Hampshire coast, wind speeds may still hold their coastal strength; however, significant impacts would be dependent on the exact track of these concentrated storms.

Dover remains vulnerable to hurricane hazards, including: high winds, heavy rainfall, and inland flooding; therefore the recurrence potential of hurricane and tropical storm hazards is moderate. Given that the 2017 Atlantic hurricane season was hyperactive, which featured 17 named storms (tying it with 1936 as the fifth-most active season since reliable records began in 1851) and three that were major hurricanes (Harvey, Irma, and Maria), it is likely that the region will be impacted by a significant storm of tropical origin within the foreseeable future.

Estimated Loss Potential

Based on the high hazard ranking and assessed value of residential, commercial, and utilities structures, there is approximately $208,929,340 in estimated potential losses from impacts associated from hurricanes and tropical storms.

Tornado & Downburst

Overview	
Hazard Type	Tornado & Downburst
Location/Extent	City-wide – dependent upon tornado track
Severity	2.3
Probability	2
Overall Threat	4.7 (moderate)

Description of the Hazard

A tornado is a violent windstorm characterized by a twisting, funnel shaped cloud with winds in excess of 200 mph, often accompanied by violent lightening, peripheral high winds, severe hail, and severe rain. Tornadoes develop when cool air overrides a layer of warm air, causing the warm air to rise rapidly. The atmospheric conditions required for the formation of a tornado include great thermal instability, high humidity, and the convergence of warm, moist air at low levels with cooler, drier air aloft. Most tornadoes remain suspended in the atmosphere, but if they touch down they become a force of destruction.

Tornadoes produce the most violent winds on earth, at speeds of 280 mph or more. In addition, tornadoes can travel at a forward speed of up to 70 mph. Damage paths can be in excess of one mile wide and 50 miles long. Violent winds and debris slamming into buildings cause the most structural damage. A tornado is usually accompanied by thunder, lightning, heavy rain, and a loud "freight train" noise. In comparison to a hurricane, a tornado covers a much smaller area but can be more violent and destructive.

A downburst is a severe localized wind blasting down from a thunderstorm. These "straight line" winds are distinguishable from tornadic activity by the pattern of destruction and debris. Downbursts fall into two categories: microburst, which covers an area less than 2.5 miles in diameter and macroburst, which covers an area at least 2.5 miles in diameter.

Extent of the Hazard

The Fujita Scale is the standard scale for rating the severity of a tornado as measured by the damage it causes. The scale measures wind speeds of 65 to greater than 200 miles per hour. The damage path of a tornado can be in excess of one mile wide and 50 miles long, whereas a downburst is typically less than 2.5 miles. Downbursts can have wind speeds of 150 miles per hour.

Enhanced Fujita Scale	
EF–0	65–85 mph winds
EF–1	86–110 mph
EF–2	111–135 mph
EF–3	136–165 mph
EF–4	166–200 mph
EF–5	>200 mph

Past Impacts and Events

Tornadoes are rare in New Hampshire. The NCDC Storm Events database (NCDC 2017) lists only seven tornadoes that have impacted Strafford County since 1950. One was an EF-0 event (65-85 mph); one was an EF1 event (73-112 mph); and five were EF2 events (111-135 mph). Over the course of the past six decades, there haven't been any fatalities, 0 injuries, but approximately $2.9 million in property damages associated with tornados. The majority of property damage was sustained during an event that took place in 1981. The most recent touchdown was in 2008. There have been no direct impacts in Dover.

Table 16: Tornado Data for Strafford County

Date	Magnitude	Death	Injuries	Property Damages
06/09/1953	EF1	0	0	250
05/14/1963	EF2	0	0	25,000
05/03/1976	EF2	0	0	250,000
06/22/1981	EF2	0	0	2,500,000
08/02/1993	EF0	0	0	5,000
07/06/1999	EF2	0	0	0
07/24/2008	EF2	0	0	126,000
	TOTAL	0	0	$2,906,000

Between 1991 and 2010, the average annual number of tornadoes in New Hampshire was one.[7] Though the frequency of tornado events in New Hampshire is not great, the state has experienced large tornados throughout its history. An early example is the tornado that stuck the state in September 1821. This tornado was reported to have tracked from the Connecticut River, near Cornish, and terminating near Boscawen. When the skies cleared, 6 people were dead, hundreds injured and thousands homeless.

In 1998 an F2 tornado in Antrim, N.H. blew down a 45-foot by 12-foot section of the Great Brook Middle School. Witnesses reported seeing a funnel cloud, and the weather service, after an inspection, confirmed it was a tornado. According to the June 2, 1998 edition of the Eagle Tribune, John Jensenius from the National Weather Service in Gray, Maine estimated that the twister cut a path half a mile long, up to 100 yards wide, and was on the ground for several minutes.

In July 2008, an F2 tornado and high winds created a path of destruction through five New Hampshire counties that destroyed homes, displaced families, downed trees and forest lands and closed major state roadways. The impact to residents was extensive, with over 100 homes rendered uninhabitable. Phone and electric service was cut off to over 12,500 customers. One fatality is attributed to a building collapse, and local hospitals reported numerous physical injuries associated with this severe storm.[8] Since the July 2008 tornado, the NCDC Storm Events database reports that nine tornados have hit New Hampshire; however, none have hit Strafford County. The most recent event occurred in July 2016 in Pittsburg.

[7] NOAA. U.S. Tornado Climatology (https://www.ncdc.noaa.gov/climate-information/extreme-events/us-tornado-climatology)
[8] New Hampshire Department of Safety. State of NH Natural Hazard Mitigation Plan 2013. Homeland Security and Emergency Management.

Downburst activity is very prevalent throughout the State. However, the majority downburst activity is mostly unrecognized unless a large amount of damage has occurred. Several of the more significant and recent events are highlighted below:

- ∴ Central, NH – July 6, 1999 – Damages: Two roofs blown off structures, downed trees, widespread power outages, and damaged utility poles and wires; two fatalities.
- ∴ Stratham, NH – August 18, 1991 – Damages: $2,498,974 worth of damages; five fatalities.
- ∴ Moultonborough, NH – July 26, 1994 – Damages: Downed trees, utility poles and wires. Approximately 1,800 homes without power and 50-60 homes damages.
- ∴ Bow, NH – September, 6, 2011 – Damages: City Auto in Bow had 15 campers damaged and estimated $200,000 in damage.

In July, 2017 there was a significant microburst that impacted a handful of residential homes and a few small businesses along Tolend and French Cross roads. According to Fosters.com there were a number of downed trees that blocked roads, took down power lines and hit homes and cars.

October microburst event, 2017 [Source: Fosters.com]

In October, 2017 a wind storm that was accompanied with heavy rain produced sustained winds of 60 mph that resulted in wide-spread power outages caused by downed trees and power lines. Upwards of 45% of the City was without power, which included Wentworth Douglass Hospital, and all the schools were cancelled for at least one day.

While tornados are not common, they would cause significant impacts in the City. The probability of reoccurrence of a downburst may be higher. A tornado or downburst can impact the entire jurisdiction and may cause greater damage in the community center.

Potential Future Impacts on Community

There have been 7 reported tornadoes over the course of 67 years in Strafford County; the average annual probability of recurrence, therefore, is 10.4% (7/67 x 100). The probability may be slightly higher if local reports of tornadoes were considered; however, this 10.6% probability is for all of Strafford County – not just Dover. The actual probability for Dover should be much lower, considering the great dependence of impact upon the actual track of any tornado. The NCDC identified two tornadoes that touched down relatively close (Strafford and New Durham) to the City, which would suggest the average annual probably of recurrence to be less than 3%. The tornado recurrence probability for Dover, therefore, is relatively low.

Estimated Loss Potential

Based on the moderate hazard ranking and assessed value of residential, commercial, and utilities structures, there is approximately $104,464,670 in estimated potential losses from impacts associated from tornadoes and downbursts.

Severe Winter Weather

Overview	
Hazard Type	Severe Winter Weather
Location/Extent	City-wide
Severity	2.7
Probability	3.0
Overall Threat	8.0 (high)

Description of the Hazard

Winter snow and ice events are common in New Hampshire. The National Climatic Data Center (NCDC 2017) Storm Events database reports 60 severe winter weather events, which include: 2 blizzards, 51 heavy snow events, 1 ice storm, and 6 winter storms (nor'easters) that have impacted Strafford County from January, 1 2007 to July 31, 2017.

March Nor'easter, March 2017 [Source: WMUR.com]

Heavy snow typically brings significant snow removal costs along with delays in transportation schedules. Wet snow can result in major infrastructure damage from heavy snow loads and has been the cause of human harm during long periods of shoveling, including back injuries and in some cases heart attacks to older individuals. The most severe damage, though, often comes from ice storms and winter nor'easters.

The State's Multi-Hazard Mitigation Plan Update 2013 identifies four types of winter storms:

- ∴ *Heavy snowstorms*: A storm that deposits four or more inches of snow (or 10 cm) in a twelve-hour period
- ∴ *Blizzards*: A violent snowstorm with winds blowing at a minimum speed of 35 miles (56 kilometers) per hour and visibility of less than one-quarter mile (400 meters) for three hours
- ∴ *Nor'easter*: A large weather system traveling from south to north, passing along the coast. As the storm's intensity increases, the resulting counterclockwise winds which impact the coast and inland areas in a Northeasterly direction. Winds from a Nor'easter can meet or exceed hurricane force winds.
- ∴ *Ice Storms*: An event that occurs when a mass of warm, moist air collides with a mass of cold, arctic air. The less dense warm air will rise and the moisture may precipitate out in the form of rain. When this rain falls through the colder, denser air and comes in contact with cold surfaces, ice will form and may continue to form until the ice is as thick as several inches.

Extent of the Hazard

Snow and ice storms are a City-wide hazard.

Sperry-Piltz Ice Accumulation Index

The Sperry–Piltz Ice Accumulation Index, or SPIA Index, is a forward-looking, ice accumulation and ice damage prediction index that uses an algorithm of researched parameters that, when combined with National Weather Service forecast data, predicts the projected footprint, total ice accumulation, and resulting potential damage from approaching ice storms. It is a tool to be used for risk management and/or winter weather preparedness.

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	

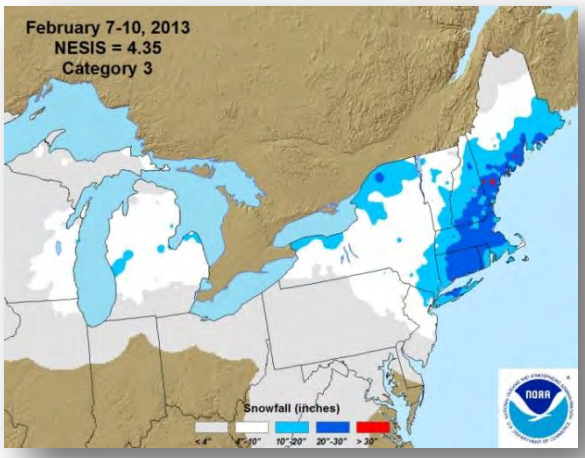
(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)

Past Events and Impacts

Four events of those listed in the NCDC database are of particular note for their severity:

The Ice Storm of 1998: (January 7th – 9th) was a severe ice storm that is recognized as the worst event in recent memory. Ice accreted several inches thick on trees, power lines, and other exposed surfaces causing many people in those areas to lose electrical service. Statewide, the storm knocked out power to about 55,000 customers, an estimated 125,000 people. Those impacted had to contend with snow, additional freezing rain, rain, slippery roads, falling ice and other debris, sub-zero temperatures, strong winds, and dangerous wind chills. Local impacts included long-term power outages (upwards of 7+ days), 1 fatality associated with carbon monoxide poisoning, school closures, and challenges with traffic at busy intersections.

The Ice Storm of 2008 (December 11th – 12th) was a major winter storm that brought a mixture of snow, sleet, and freezing rain. The greatest impact in the state was in southern and central New Hampshire where a significant ice storm occurred. Following the ice storm, recovery and restoration efforts were negatively impacted by additional winter weather events that passed through the state. The freezing rain and sleet ranged from 1 to 3 inches, ice accretion to trees and wires in these areas generally ranged from about a half inch to about an inch. The weight of the ice caused branches to snap, and trees to either snap or uproot, and brought down power lines and poles across the region. About 400,000 utility customers lost power during the event, with some customers without power for two weeks. Property damage across northern, central and southeastern NH was estimated at over $5 million. Local impacts included long-term power outages (impacts to transmission lines outside the state), and school closures.

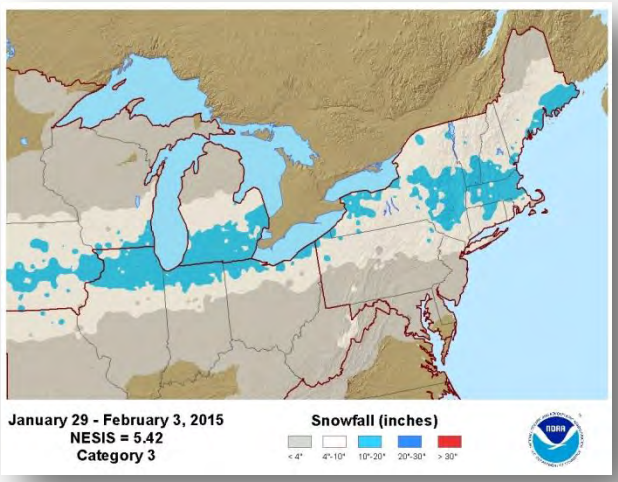


The Blizzard of 2013 – NEMO (February 8th-9th) was an area of low pressure developed rapidly off the Carolina coast late on the 7th and early on the 8th. The storm moved very slowly northeast during the 8th and 9th as it continued to intensify. By the morning of the 10th, the storm was located just to the east of Nova Scotia. The storm brought heavy snow, high winds,

and blizzard conditions to the southeastern part of the state. Snowfall amounts were generally 18 inches or more in the southeast where blizzard conditions caused considerable blowing and drifting snow. In western and northern sections, snowfall amounts were in the 4 to 18 inch range. Southeastern New Hampshire had blizzard conditions for about 3 to 10 hours.

The NCDC Regional Snowfall Index for the stations near Dover reported between 18 and 24 inches of snow (Rochester and Nottingham) and 12 to 18 inches (between Epson and Northwood) from February 8-February 10, 2013. According to the NH Union Leader, wind gusts of over 30-miles-per hour were expected to occur with the storm; however, the NH Electric Co-op reported only minor power outages.[9] Local impacts included snow removal challenges.

The Blizzard of 2015 – JUNO (January 26th – 28th) was area of low pressure developed off the Delmarva peninsula on Monday, January 26th, and intensified rapidly as it moved slowly northward through the 27th. Snow spread northward across the region Monday night and became heavy on Tuesday, the 27th. Winds became strong during the day Tuesday leading to blizzard conditions at times along and inland from the coast. The snow persisted into Tuesday night in many areas with blowing and drifting snow. Snowfall amounts ranged from 10 to more than 30 inches across much of the southeastern part of the state.



Juno was ranked on the NESIS as a 'major' event based on the area affected, the amount of snow, and the number of people living in the path of the storm. The Regional Snowfall Index for the station near Dover reported between 18 and 24 inches from January 25-January 28th, 2015[10]. Similar to the storm in 2013, this snow storm brought heavy bands of snow and wind, causing blizzard-like conditions. Local impacts included snow removal challenges, economic impacts in the downtown, and line of site issues due to high snow banks along sidewalks and pedestrian intersections.

Other, less recent events were also damaging. The nor'easter of December 7, 1996 was especially damaging to power systems and is described in the NCDC database as "the most extensive and costliest weather related power outage in the state's history," at least until 1996 when that database entry was made. The 1998 ice storm probably surpassed this storm in power systems impact. This storm is thought to have been of the same magnitude as the one that occurred in the region in 1929, indicating a return period of approximately 70 years (CRREL 1998).

[9] New Hampshire Union Leader. February 9, 2013.
http://www.unionleader.com/apps/pbcs.dll/article?AID=/20130209/NEWS1101/130209041/0/OPINION02
[10] http://gis.ncdc.noaa.gov/map/viewer/#app=cdo&cfg=rsi&theme=rsi

Extended Power Failures

When discussing extended power failure in this plan, it is referring to power failure that can last for a period of days or weeks. Many things can cause power failure: downed power lines (due to storm, wind, accident, etc.); failure of public utilities to operate or failure of the national grid. Extended power failure can present not only lighting difficulties but also challenges to heating, water supply and emergency services. In Dover, there have been extended power outages on occasion; the worst in recent years was the ice storm of 2008 where power was out for over a week in some places. Additional events to add are the Halloween Snow Event (2011), which produced heavy, wet snow and leaf-on conditions that resulted in downed trees and caused major power outages throughout the City, and the Thanksgiving Day snow event in late November (2014), which also produced heavy, wet snow that resulted in sporadic power outages and disrupted travel plans for the holiday weekend, including major delays at airports and hazardous travel on local and state roadways.

Potential Future Impacts on Community

Dover will continue regularly to receive impacts from severe, regional winter weather events.

Estimated Loss Potential

Based on the high hazard ranking and assessed value of residential, commercial, and utilities structures, there is approximately $208,929,340 in estimated potential losses from impacts associated from severe winter weather.

Severe Thunderstorms & Lightning

Overview	
Hazard Type	Severe Thunderstorm and Lightning
Location/Extent	City-wide (sporadic)
Severity	2.7
Probability	3.0
Overall Threat	8.0 (high)

Description of the Hazard

As defined by NOAA, a thunderstorm is a rain shower during which thunder is heard. Because thunder comes from lightning, all thunderstorms have lightning. A thunderstorm is the result of convection, which is the upward atmospheric motion that transports whatever is in the air (such as moisture) with it. A thunderstorm is classified as severe if it has hail one inch or greater, winds gusting in excess of 50 knots (57.5 mph), or a tornado. Thunderstorm-related hazards that could impact Dover include: high winds and downburst, lightning, hail, and, torrential rainfall. Thunderstorms and severe thunderstorms are a City-wide hazard. They are most likely to occur in spring and summer.

Lightning can cause significant, sometimes severe, damage. Lightning strikes can cause direct damage to structures and serious injury or death to people and animals. Extensive damage also commonly results from secondary effects of lightning, such as electrical power surges, wildfire, and shockwave. According to lightning fatality data collected by the National Oceanic and Atmospheric Administration (NOAA) over the last decade, lightning kills an average of 32 people each year in the United States. There were 320 fatalities (254 were men; 66 were women) in the United States from 2007 to 2017.

Extent of the Hazard

Lightning heats air to a temperature of 50,000 degrees Fahrenheit and causes the air to expand and contract rapidly, which causes thunder. A lightning strike occurs very quickly but can occur multiple times during a storm.

Table 17: Lightning Activity Scale

Lightning Activity Level (LAL)	Conditions
LAL1	No thunderstorms activity
LAL2	Isolated thunderstorms
LAL3	Widely scattered thunderstorms
LAL4	Scattered thunderstorms
LAL5	Numerous thunderstorms
LAL6	Widely scattered, scattered, or numerous DRY thunderstorms

Past Events and Impacts

Thunderstorms are common in New Hampshire but can be considered generally less severe than in other areas of the country, such as the Great Plains states. Severe thunderstorms do occur in New Hampshire, though. The NCDC database lists 53 reported events of severe thunderstorm winds in Strafford County from January 1, 2007 to July 31, 2017. Three events took place in in Dover. On June 6, 2010 a severe thunderstorm produced multiple reports of trees down in Dover; on June 24, 2010 a severe thunderstorm snapped a utility pole in half and downed numerous trees in Dover; and on July 20, 2017 a severe thunderstorm downed trees on Route 9 in Dover.

There were no reported lightning strike related deaths in New Hampshire. The NCDC database lists four reported lightning events in Strafford Country from January 1, 2007 to July 31, 2017; none of which occurred in Dover. The Planning Committee identified the wastewater treatment facility (Middle Road) and the SCADA antenna at Garrison Hill as places that have been hit in the past. There was also one woman struck by lightning on Governor Sawyer Lane during a storm event – fortunately this event did not result in a fatality.

Finally, hail is a fairly common part of thunderstorms in New Hampshire, but damaging hail is apparently not. The damage that can result from hail is mostly to cars and windows. The NCDC Storm Events database lists 52 reported hailstorms in Strafford County from January 1, 2007 to July 31, 2017. Five of these events took place in Dover. On June 5, 2007 a severe thunderstorm produced hail varying in size from 0.75 to 1.75 inches; on July 6, 2007 a severe thunderstorm produced 0.75 inch hail; on July 18, 2008 a severe thunderstorm produced 0.75 inch hail; on June 24, 2010 a severe thunderstorm produced 1 inch hail; and on June 1, 2011 a severe thunderstorm produced hail varying in size from 0.88 to 1 inch. Hail has caused significant damage to vehicles during storms.

Potential Future Impacts on Community

The annual recurrence probability of thunderstorms in general is effectively 100%. Dover will continue to experience thunderstorms and should expect to sustain significant damage periodically.

Estimated Loss Potential

Based on the high hazard ranking and assessed value of residential, commercial, and utilities structures, there is approximately $208,929,340 in estimated potential losses from impacts associated from severe thunderstorms and lightning.

Wildfire

Overview	
Hazard Type	Wildfire
Location/Extent	City-wide (Unfragmented, wooded areas)
Severity	1.0
Probability	1.0
Overall Threat	1.0 (low)

Description of the Hazard

Wildfire is defined as an uncontrolled and rapidly spreading fire. A forest fire is an uncontrolled fire in a woody area. Forest fires occur during drought and when woody debris on the forest floor is readily available to fuel the fire. Grass fires are uncontrolled fires in grassland areas. Dover is an urban city with a limited forested landscape. Exposure to natural factors such as lightning that can cause wildfires is consequently high and can occur throughout the jurisdiction.

Extent of the Hazard

The National Wildfire Coordinating Group (NWCG) categorizes the size of a wildfire in six classes depending on acres burned, ranging from less than ¼ acre to greater than 5,000 acres (see box to the right). The US Forest Service's surface fire behavior fire characteristics chart illustrates primary fire behavior values including the spread rate and the intensity of the fire, which can be used to compare predicted and observed fire behavior and to describe potential fire behavior.[11]

The National Wildfire Coordinating Group (NWCG) defines the size of a wildfire as:
Class A - one-fourth acre or less;
Class B - more than one-fourth acre, but less than 10 acres;
Class C - 10 acres or more, but less than 100 acres;
Class D - 100 acres or more, but less than 300 acres;
Class E - 300 acres or more, but less than 1,000 acres;
Class F - 1,000 acres or more, but less than 5,000 acres;

Past Impacts and Events

Wildfires in New Hampshire historically have tended to run in 50-yr cycles, which can be observed starting from the 1800s. This 50-year cycle is partially based upon human activities and, therefore, may not prove to be accurate into

[11] How to Generate and Interpret Fire Characteristics Charts for Surface and Crown Fire Behavior. (https://www.fs.fed.us/rm/pubs/rmrs_gtr253.pdf)
11 New Hampshire Department of Safety. State of NH

the future.[12] The peak in wildfires in the late 1940's and early 1950's is thought to be related to the increased fuel load from trees downed in the 1938 hurricane. Here, 60 years later, New Hampshire officials are again concerned about the high fuel load created by the 1998 and 2008 ice storms that hit New Hampshire. The NCDC Storm Events database lists 0 reported wildfires in Strafford County from January 1, 2007 to July 31, 2017. Locally, there were multiple brush fires back in 1985; however, many of those problematic areas have since been developed. Many of the downed trees and fuel load near Bellamy Park have been cleaned up in associated with the maintenance and upkeep of the Frisbee golf course. The potential risk for large scale wildfires within the City is low (natural breaks); however, more rural areas adjacent to Tolend Road towards Barrington may be more susceptible.

Potential Future Impacts on Community

The probability of occurrence of wildfires in the future is effectively impossible for the Hazard Mitigation Committee to predict due to the dependence of wildfire on the occurrence of the causal hazards and the variability of numerous factors that affect the severity of a wildland fire. In general, if a wildfire occurred in one of the large, unfragmented woodland areas, the cost of the timber loss would probably be in the range of several million dollars.

Estimated Loss Potential

Based on the low hazard ranking and assessed value of residential, commercial, and utilities structures, there is approximately $20,892,934 in estimated potential losses from impacts associated from wildfire.

Earthquakes & Landslide

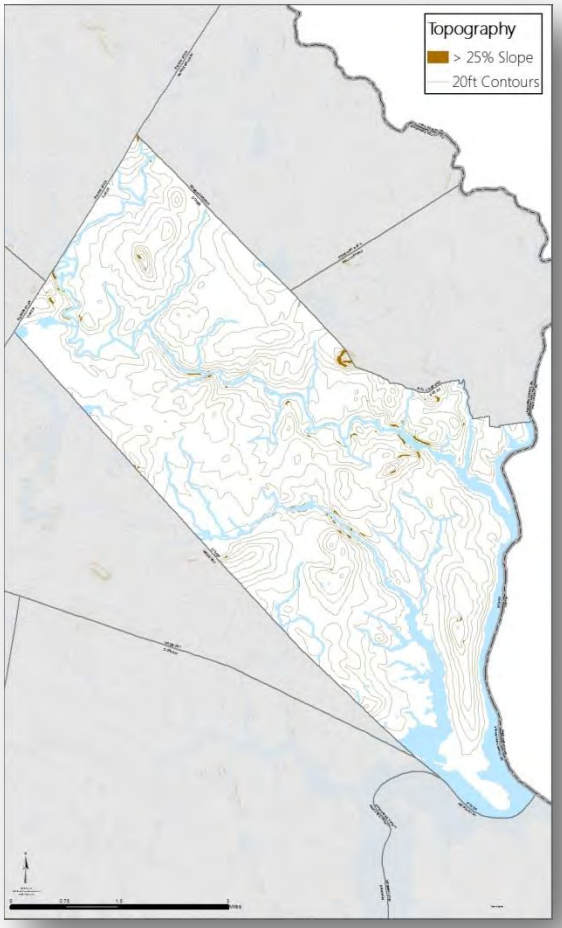
Overview	
Hazard Type	Earthquake & Landslide
Location/Extent	City-wide and areas with steep slopes (>25%)
Severity	1.0
Probability	1.0
Overall Threat	1.0 (low)

Description of the Hazard

The USGS defines an earthquake as a term used to describe both sudden slip on a fault, and the resulting ground shaking and radiated seismic energy caused by the slip, or by volcanic or magmatic activity, or other sudden stress changes in the earth. Earthquakes can cause buildings and bridges to collapse, disrupt gas, electric and phone lines, and often cause landslides, flash floods, fires, avalanches, and tsunamis. Larger earthquakes usually begin with slight tremors but rapidly take the form of one or more violent shocks, and are followed by vibrations of gradually diminishing force called aftershocks.[13] Earthquakes in the Northeast are not associated with specific know faults.

[12] New Hampshire Department of Safety. State of NH Natural Hazard Mitigation Plan 2013. Homeland Security and Emergency Management.
[13] The Northeast States Emergency Consortium Earthquake Hazards. http://nesec.org/earthquakes-hazards/. Viewed on 8/10/15

Due to the geology of the region, the area impacted by an earthquake in the Northeast can be up to 40 times greater than the same magnitude event occurring on the West coast. Earthquakes can occur at any time without warning. An earthquake can impact all areas of the jurisdiction. People at greatest risk from earthquakes are those who live in unreinforced masonry buildings build on filled land or unstable soil.[14]



Map 8: Steep Slopes in Dover (Source: SRPC, 2015)

Landslides could occur in Dover in areas with steep slopes, where soils and loose bedrock formations would tend to slough off and move en masse downhill under gravity. Earthquakes could readily cause landslides, as could ground saturation from extended heavy precipitation events. Given seismic or precipitation events that could initiate landslide, landslide hazard is likely quite high in steep slope areas; however, there are only approximately 58.1 acres (<1%) of steep slopes greater than 25% in Dover.

Extent of the Hazard

The magnitude and intensity of an earthquake is measured by the Richter scale and the Modified Mercalli Intensity (MMI) scale, respectively. The Richter magnitude scale was developed in 1935 by Charles F. Richter of the California Institute of Technology as a mathematical device to compare the size of earthquakes. The magnitude of an earthquake is determined from the logarithm of the amplitude of waves recorded by seismographs. Adjustments are included for the variation in the distance between the various seismographs and the epicenter of the earthquakes.

The Modified Mercalli Intensity (MMI) scale was developed in 1931 by the American seismologists Harry Wood and Frank Neumann. This scale, composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction, is designated by Roman numerals. It does not have a mathematical basis; instead it is an arbitrary ranking based on observed effects actually experienced at a given place and therefore has a more meaningful measure of severity.[16]

MODIFIED MERCALLI SCALE		RICHTER SCALE	
I.	Felt by almost no one.	2.5	Generally not felt, but recorded on seismometers.
II.	Felt by very few people.		
III.	Tremor noticed by many, but they often do not realize it is an earthquake.	3.5	Felt by many people.
IV.	Felt indoors by many. Feels like a truck has struck the building.		
V.	Felt by nearly everyone; many people awakened. Swaying trees and poles may be observed.		
VI.	Felt by all; many people run outdoors. Furniture moved, slight damage occurs.	4.5	Some local damage may occur.
VII.	Everyone runs outdoors. Poorly built structures considerably damaged; slight damage elsewhere.		
VIII.	Specially designed structures damaged slightly, others collapse.	6.0	A destructive earthquake.
IX.	All buildings considerably damaged, many shift off foundations. Noticeable cracks in ground.		
X.	Many structures destroyed. Ground is badly cracked.	7.0	A major earthquake.
XI.	Almost all structures fall. Very wide cracks in ground.	8.0 and up	Great earthquakes.
XII.	Total destruction. Waves seen on ground surfaces, objects are tumbled and tossed.		

[14] http://nesec.org/earthquakes-hazards/
[15] USGS. Earthquake Hazard Program. http://earthquake.usgs.gov/learn/glossary/?term=Richter%20scale. Viewed on 8/10/15
[16] USGS. Earthquake Hazard Program. http://pubs.usgs.gov/gip/earthq4/severitygip.html. Viewed on 8/10/15

Past Impacts and Events

Due to the state's location in an area of moderate seismic activity earthquakes are a common event in New Hampshire, but significantly damaging earthquakes are not. The Northeast States Emergency Consortium (NESEC, 2016) website presents a history of earthquake in the Northeast and documents that New Hampshire is an area of high earthquake probability. Three hundred and sixty earthquakes occurred in New Hampshire from 1638 to 2007. Approximately 40-50 earthquakes are detected in the Northeast annually.[17] However, New Hampshire has only experienced ten earthquakes of significant magnitude (Richter Magnitude 4.0 or greater) in that time period (one was located in Maine). There have been no major earthquake or landslide events. Locally, all new construction has to be engineered and designed to handle appropriate seismic activity. The Planning Committee recognizes that some of the older structures within the City may be more vulnerable. It is unclear as to the impacts to the mill buildings if a large earthquake were to hit.

Earthquakes are on average an annual occurrence but significant quakes have an annual probability of occurrence (based on the 1638 to 2012 period) of about 2.7%.

Table 18: Notable Historic Earthquakes in NH 1638-2012 (Magnitude 4.0 or Greater)

Location	Date	*Intensity MMI Scale*	Magnitude *Richter Scale*
Central New Hampshire	June 11, 1638	-	6.5
Portsmouth	November 10, 1810	V	4.0
Near Hampton	July 23, 1823	IV	4.1
Ossipee	October 9, 1925	VI	4.0
Ossipee	December 20, 1940	VII	5.5
Ossipee	December 24, 1940	VII	5.5
West of Laconia	January 19, 1982	-	4.7
Northeast of Berlin	October 20, 1988	-	4.0
Southeast of Berlin	April 6, 1989	-	4.1
Hollis Center (Maine)	October 16, 2012	-	4.0

[Source: Northeast States Emergency Consortium, 2016]

Potential Future Impacts on Community

Earthquakes could readily cause landslides, as could ground saturation from extended heavy precipitation events. Given seismic or precipitation events that could initiate landslide, landslide hazard is likely quite high in steep slope areas. The Hazard Mitigation Committee did not have the expertise available to analyze the actual probability of landslide in Dover; however, to the best of the committee's knowledge no significant landslides have ever occurred. The USGS (1997) classifies landslide incidence regionally as very low (less than 1.5% of land area involved). The local probability in Dover however, will depend on specific soil/rock types and upon the probability of initiating events.

[17] http://nesec.org/earthquakes-hazards/

Estimated Loss Potential

Based on the low hazard ranking and assessed value of residential, commercial, and utilities structures, there is approximately $20,892,934 in estimated potential losses from impacts associated from earthquakes and landslides.

Extreme Temperatures

Overview	
Hazard Type	Extreme Temperatures
Location/Extent	City-wide
Severity	1.0
Probability	3.0
Overall Threat	3.0 (low)

Description of the Hazard(s)

Extreme temperatures can be describes as heat waves and cold waves (or winter storm and extreme winter conditions.

A *heat wave* is a prolonged period of excessively hot and sometimes also humid weather relative to normal climate patterns of a certain region. Heat kills by pushing the human body beyond its limits. In extreme heat and high humidity, evaporation is slowed and the body must work extra hard to maintain a normal temperature. Most heat disorders occur because the victim has been overexposed to heat or has over-exercised for his or her age and physical condition. Older adults, young children, and those who are sick or overweight are more likely to succumb to extreme heat. Conditions that can induce heat-related illnesses include stagnant atmospheric conditions and poor air quality. Consequently, people living in urban areas may be at greater risk from the effects of a prolonged heat wave than those living in rural areas. Also, asphalt and concrete store heat longer and gradually release heat at night, which can produce higher nighttime temperatures known as the "urban heat island effect."[18]

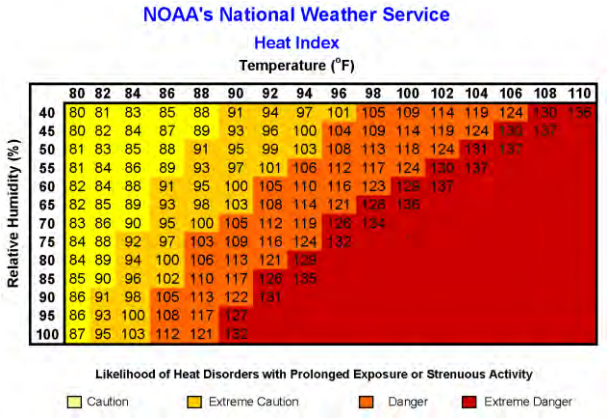
A *cold wave* can be both a prolonged period of excessively cold weather and the sudden invasion of very cold air over a large area. Along with frost it can cause damage to agriculture, infrastructure, and property. Cold waves, heavy snowfall and extreme cold can immobilize an entire region. Even areas that normally experience mild winters can be hit with a major snowstorm or extreme cold. Winter storms can result in flooding, storm surge, closed highways, blocked roads, downed power lines and hypothermia.

[18] International Federation of Red Cross and Red Crescent Societies. Climatological hazards: extreme temperatures. http://www.ifrc.org/en/what-we-do/disaster-management/about-disasters/definition-of-hazard/extreme-temperatures/

Extent of the Hazard

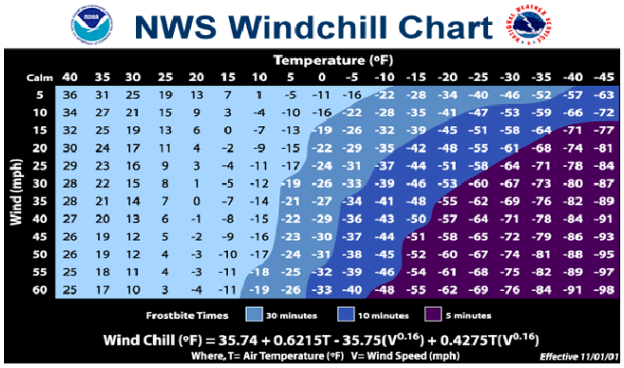
Extreme Heat

Extreme heat events can be described as periods with high temperatures of 90°F or above. The graph to the right displays the likelihood of heat disorders with prolonged exposure or strenuous activity.



Extreme Cold

What constitutes extreme cold varies by region. Characteristics of an extreme cold event in northern states include temperatures at or below zero for an extended period of time. According to the National Weather Service (NWS), extreme cold is a daily concern during the winter months for northern states. The NWS Wildchill Temperature index calculates the dangers from winter winds and freezing temperatures (Source: NWS)



The City sends out advisory notices whenever the National Weather Service issues cold/heat index warnings.

Past Impacts and Events

According to a 2014 study of climate change by Climate Solutions New England, Climate Change in Southern New Hampshire, from 1970 to 1999, southern New Hampshire experienced an average of seven days per year above 90°F each year. This is projected to increase to 22 days per year under a low emissions scenario to nearly 50 days per year under a high emissions scenario. Between 1980 and 2009, an average of one day per year reached 95°F in southern New Hampshire. By the end of the century, the number of days per year over 95°F is expected to increase as much as six to 22 days per year. Additionally, the average daytime maximum temperature on the hottest day is expected to increase to as much as 98°F to 102°F (depending on the emissions scenario), compared to the historical average of 93°F.[19] Between 1960 and 2012, there was an average of 8.3 days per year (or 0.8 days/decade) greater than 90°F recorded in Durham (the closest of four stations to Dover included in the study). During this time the hottest day of the year averaged 95.0°F.[20] Whenever the City experiences a prolonged heat wave, there are extended hours for the outdoor pool and dialed back outdoor programs to ensure public safety. The McConnell Center is opened as a cooling station at least once or twice on average during the summer months.

Between 1960 and 2012, the average temperature of the coldest day of the year was -14.5°F in Durham (the closest of four stations to Dover included in the study).[21] Between 1980 and 2009, there were an average of 164 days per year under 32°F and 16 days per year under 0°F in southern New Hampshire. By the end of the century, southern

[19] Wake, C. et al. "Climate Change in Southern New Hampshire; Past, Present, and Future." Climate Solutions of New England. 2014
[20] Ibid
[21] Ibid

New Hampshire is expected to see 20 fewer days below 32°F and only about 2 to 5 days per year under 0°F. Locally, the McConnell Center is opened as a heating station at least once or twice on average during the winter months.

Potential Future Impacts on Community

Annual average temperatures may increase on average by 3-5°F by 2050 and 4-8°F by 2100[22]

Estimated Loss Potential

Based on the low hazard ranking and assessed value of residential, commercial, and utilities structures, there is approximately $20,892,934 in estimated potential losses from impacts associated from extreme temperatures.

Drought

Overview	
Hazard Type	Drought
Location/Extent	City-wide
Severity	1.0
Probability	2.0
Overall Threat	2.0 (low)

Description of the Hazard

A drought is defined as a long period of abnormally low precipitation, especially one that adversely affects growing or living conditions. The impacts of droughts are indicated through measurements of soil moisture, groundwater levels, and stream flow. The effect of drought on these indicators is variable during any particular event. For example, frequent minor rainstorms can replenish the soil moisture without raising groundwater levels or increasing streamflow. Low streamflow also correlates with low ground-water levels because ground water discharge to streams and rivers maintains streamflow during extended dry periods. Low streamflow and low ground-water levels commonly cause diminished water supply.

Drought is a regional hazard and can impact the entire jurisdiction. Agricultural land and residents who use dug, shallower wells may be more vulnerable to the effects of drought.

Extent of the Hazard

The National Drought Monitor classifies the duration and severity of the drought using precipitation, stream flow, and soil moisture data coupled with information provided on a weekly basis from local officials. There are five magnitudes of drought outlined in the New Hampshire State Drought Management Plan: Exceptional, Extreme, Severe, Moderate, and Abnormally Dry. At the development of this Plan, Dover was several months removed from an extreme drought.

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Past Impacts and Events

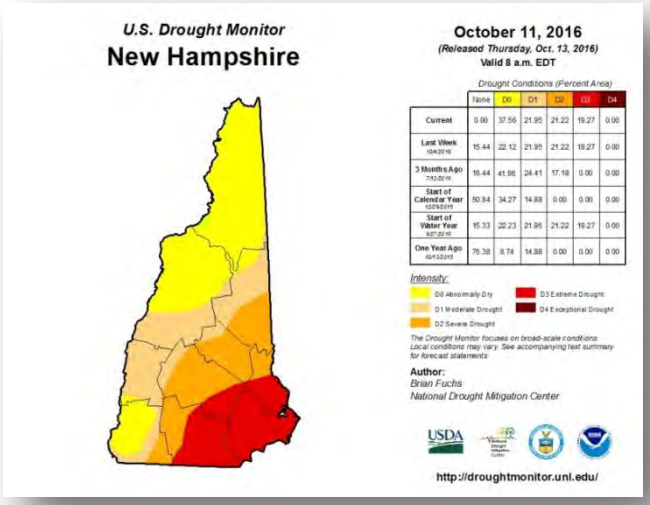
While the impacts of drought are typically not as damaging and disruptive as floods or storm events, the impacts of long term drought or near drought conditions can impact crops and the water supply.

Periods of drought have occurred historically in New Hampshire. Six droughts of significant extent and duration were evident in the 20th century as noted below in Table 2.5. The most severe drought recorded in New Hampshire occurred from 1960 to 1969. This drought encompassed most of the northeastern United States (1956-1966). The drought of 1929-1936 was the second worst and coincided with severe drought conditions in large areas of the central and eastern United States. The drought of 2001-2002 was the third worst on record.[23]

Table 19: Severe Drought Conditions in New Hampshire

Dates	Area Affected	Magnitude	Remarks
1929 – 1936	Statewide	-	Regional; recurrence interval 10 to > 25 years
1939 – 1944	Statewide	Severe Moderate	Severe in southeast NH and moderate elsewhere in the State. Recurrence interval 10 to > 25 years.
1947 – 1950	Statewide	Moderate	Recurrence interval 10 to >25 years
1960 – 1969	Statewide	Extreme	Longest recorded continuous spell of less than normal precipitation. Encompassed most of the northeast US. Recurrence interval >25 years.
2001 – 2002	Statewide	Severe	Recurrence interval 10 to >25 years
2015-2016	Central & Southern NH	Moderate	Recurrence interval cannot yet be determined

In more recent years, drought has again become a problem in New Hampshire. In 1999, a drought warning was issued by the Governor's Office. In March 2002, all counties in New Hampshire with the exception of Coos County were declared in Drought Emergency. This was the first time that low-water conditions had progressed beyond the Level Two, Drought Warning Stage.



Normal precipitation for the state averages 40 inches per year. During the summer of 2015, most of central and southern New Hampshire experienced its most recent drought, the first since 2001 – 2002 (was the 3rd worst on record, exceeded only by the national droughts of 1956-1966 and 1941-1942). While many communities experienced record snowfall totals this past winter (2014-2015), the lack of rainfall and higher-than-average temperatures resulted in river and groundwater levels to be lower than average. This resulted in the implementation of local water conservation plans throughout the region.

[23] NHDES. Drought Management Program. Publications. *NH Drought Historical Events*. Viewed on 8/10/15. http://des.nh.gov/organization/divisions/water/dam/drought/documents/historical.pdf

Drought conditions continued and intensified into 2016 in New Hampshire and in Southeast New Hampshire in particular. The drought was due to a combination of a below average snowpack in the spring, little precipitation to recharge the groundwater, an increase of evapotranspiration (the process by which water is transferred from the land to the atmosphere by evaporation from the soil and other surfaces and by transpiration from plants) in the summer, and the inability of New Hampshire watersheds to store large volumes of water due to their geology.

In October 2016, at the peak of the drought, nearly 20% of the state was categorized as being in extreme drought. One hundred and sixty community water systems had reported implementing a water restriction or ban, and 13 municipalities had reported implementing voluntary or mandatory outdoor use bans in the state. Dover implemented a voluntary conservation request and asked all water users to conserve water and limit outdoor water use except for hand watering of vegetable gardens, flower gardens and new plantings, and to shut off automatic irrigation systems. The Dover Utilities Commission did not enact mandatory water restrictions on residents but did implement conservation measures for watering on City-owned recreational fields during the drought.

In 2018, the City, in partnership with the Strafford Regional Planning Commission, will be considering adopting new water efficiency regulations to address water usage during future drought scenarios.

Potential Future Impacts on Community

The National Drought Mitigation Center website (NDMC 2004) emphasizes that reliable drought prediction for regions above 30°N latitude is effectively impossible. With extreme variation in environmental conditions due to climate change possibly on the rise and population increases, drought probability may grow in the future and put more of a strain on long-term water resources. Currently, drought possibility seems moderate. The large amount of water resources and relatively sparse population in New Hampshire have tended to minimize the impacts of drought events in the region, but this regional protection may be endangered in the future with increases in drought frequency or severity, especially in the State's densely populated areas along the seacoast and south-central NH.

Estimated Potential Losses

Based on the low hazard ranking and assessed value of residential, commercial, and utilities structures, there is approximately $20,892,934 in estimated potential losses from drought.

Public Health Threats

Overview	
Hazard Type	Public Health Threats
Location/Extent	City-wide
Severity	2.7
Probability	3.0
Overall Threat	8.0 (high)

Description of the Hazard

Epidemic

As defined by the CDC, and epidemic is "the occurrence of more cases of disease than expected in a given area or among a specific group of people over a particular period of time."[24] In addition to being categorized by the type of transmission (point-source or propagated), epidemics may occur as outbreaks or pandemics. As defined in the State Hazard Mitigation Plan, an outbreak is a sudden increase of disease that is a type of epidemic focused to a specific area or group of individuals. A pandemic is an epidemic that spreads worldwide, or throughout a large geographic area.

Epidemics may be caused by infectious diseases, which can be transmitted through food, water, the environment or person-to-person or animal-to-person (zoonoses), and noninfectious diseases, such as a chemical exposure that causes increased rates of illness. Infectious disease that may cause an epidemic can be broadly categorized into the following groups[25]:

- Foodborne (Salmonellosis, Ecoli)
- Water and Foodborne (Cholera, Giardiasis)
- Vaccine Preventable (Measles, Mumps)
- Sexually Transmitted (HIV, Syphilis)
- Person-to-Person (TB, Aseptic meningitis)
- Arthropodborne (Lyme, West Nile Virus)
- Zoonotic (Rabies, Psittacosis)
- Opportunistic fungal and fungal infections (Candidiasis).

An epidemic may also result from a bioterrorist event in which an infectious agent is released into a susceptible population, often through an enhanced mode of transmission, such as aerosolization (inhalation of small infectious disease particles).[26] For the purposes of this Plan, widespread drug and substance abuse may also be considered epidemics.

The Dover High School is a Point of Dispensing (POD) location for large-scale vaccinations. In 2016, the City's Police and Fire Departments participated in a state-wide drill to simulate the distribution of medications, vaccines, or medical supplies to a large community of people during an emergency.

Lyme Disease

Lyme disease, which is spread to humans by the bite of an infected tick, is a growing threat in New Hampshire. New Hampshire has one of the highest rates of Lyme disease in the U.S.

[24] Slate; http://www.slate.com/id/2092969/
[25] New Hampshire Department of Safety. State of NH Natural Hazard Mitigation Plan 2013. Homeland Security and Emergency Management.
[26] Ibid

Radon

Radon is a radioactive gas which is naturally occurring as a result of the typical decay of uranium commonly found in soil and rock (especially granite). Radon has carcinogenic properties and is a common problem in many states; New Hampshire has some isolated areas that are among the highest levels of radon in the United States according to the US Environmental Protection Agency (EPA). Whether or not a particular type of granite emanates radon is dependent on the geochemistry of that particular granite, some types are a problem and some are not. In other parts of the country, radon is associated with certain black shales, sandstones, and even limestones. The EPA has estimated that radon in indoor air is responsible for about 13,600 lung cancer deaths in this country each year (EPA document, EPA 811-R-94-001, 1994).[27]

Arsenic

Arsenic is a semi-metal element that is odorless and tasteless. Arsenic is a hazard because it can enter drinking water supplies, either from natural deposits in the earth or from agricultural and industrial practices.[28] Wells drilled into New Hampshire's bedrock fractures have about a 1 in 5 probability of containing naturally occurring arsenic above 10 parts per billion. In addition, wells within short distances (~50 feet) can present very different water quality because of our highly fractured bedrock. Arsenic in water has no color or odor, even when present at elevated levels. Therefore, the only way to determine the arsenic level in your well water is by testing.

The Planning Committee identified that the contamination of public drinking water wells to elevated levels of the unregulated contaminant perfluorooctane sulfonic acid (PFOS) has become an emerging threat; however, natural occurring radionuclides (radium, uranium) found in private drinking water supplies is also an important public safety hazard.

Extent of the Hazard

Public health threats are events or disasters that can affect an entire community.

Past Impacts and Events

Epidemic

While not an infectious disease outbreak, New Hampshire is currently among those states in the Northeast combating a serious opioid epidemic, which according to the Union Leader has resulted in 479 expected drug overdose deaths since 2012. As of November 2017, Dover had experienced 13 confirmed drug overdose fatalities in 2017; there were 12 in 2016 and 12 in 2015. Leading causes have been from heroin and/or fentanyl. New Hampshire has some of the highest percentages of illicit drug use among young adults in not just the Northeast, but the entire country. Carfentanyl has emerged as an additional drug that is causing significant problems. Substance abuse, specifically the opioid epidemic, has directly impacted Dover's workforce – with the restaurant business getting hit particularly hard. This problem has also impacted the crime rate, with increases in the cases of car break-ins and credit card fraud.

[27] Ibid
[28] EPA. Arsenic in Drinking Water. (http://water.epa.gov/lawsregs/rulesregs/sdwa/arsenic/index.cfm)

Lyme Disease

The number of New Hampshire residents diagnosed with Lyme disease has increased over the past 10 years, with significant increases occurring since 2005.[29] In 2009, the rate of cases of Lyme disease reported in New Hampshire residents was 108 cases per 100,000 persons, which is significantly higher than the Healthy People 2010 science-based 10-year national objective for improving the health of all Americans objective of 9.7 cases per 100,000 persons.[30] From 2009 to 2013, reported cases of Lyme disease in New Hampshire increased by approximately 20% from 1416 cases per year to 1691 cases per year.[31] Rockingham, Strafford, and Hillsborough counties had the highest rates of disease in 2008-2009. In 2012, there were 172 reported cases of Lyme disease in Strafford County.[32]

Radon

Exposure is a significant hazard in New Hampshire. According to a NH Bureau of Environmental & Occupational Health (BEOH) study looking at >15,000 indoor radon test results in single-family dwellings, households in northern, eastern, and southeastern regions of New Hampshire especially tend to have nominally high concentrations of radon in air or water (BEOH 2004); however, values in excess of the US Environmental Protection Agency's 4.0 picocurie per liter (pCi/L) action guideline have been found in nearly every community in New Hampshire. Values exceeding 100 pCi/L have been recorded in at least eight of New Hampshire's ten counties. The highest indoor radon reading in New Hampshire known to NHDES is greater than 1200 pCi/L; higher values probably exist.

In Dover, between 20.0 – 29.9% of homes tested by homeowners from 1987 to 2008 tested at or above the radon action level of 4.0 pCi/L. The probability of significant radon exposure is fairly high.[33]

Arsenic

From 1975 until 2001, the federal maximum contaminant limit (MCL) for arsenic in water supplied by public water systems was 50 parts per billion, because the health effects of exposure to lower concentrations was not recognized. Based on an exhaustive review of the new information about arsenic's health effects, in January 2001 EPA established a goal of zero arsenic in drinking water. At the same time, EPA adopted an enforceable MCL of 10 parts per billion (ppb) based on balancing treatment costs and public health benefits. Studies have shown that chronic or repeated ingestion of water with arsenic over a person's lifetime is associated with increased risk of cancer (of the skin, bladder, lung, kidney, nasal passages, liver or prostate) and non-cancerous effects (diabetes, cardiovascular, immunological and neurological disorders). The same studies found that dermal absorption (skin exposure) of arsenic is not a significant exposure path; therefore, washing and bathing do not pose a known risk to human health.[34] Locally, the Planning Committee identified that during construction of the new police department, low levels of arsenic were found; however, the levels were low enough where it was dumped into the City's dredge cell.

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[29] 2011 New Hampshire State Health Profile; Improving Health, Preventing Disease, Reducing Costs for All. NH Division of Public Health Services Department of Health and Human Services. http://www.dhhs.nh.gov/dphs/documents/2011statehealthprofile.pdf

[30] HealthyPeople.gov. About Healthy People. Accessed April 2014. Available at: http://healthypeople.gov/2020/about/default.aspx

[31] NHDHHS. State of New Hampshire Tickborne Disease Prevention Plan. March 31, 2015. http://www.dhhs.state.nh.us/dphs/cdcs/lyme/documents/tbdpreventionplan.pdf)

[32] 2011 New Hampshire State Health Profile; Improving Health, Preventing Disease, Reducing Costs for All. NH Division of Public Health Services Department of Health and Human Services. http://www.dhhs.nh.gov/dphs/documents/2011statehealthprofile.pdf

[33] NHDES https://www.des.nh.gov/organization/divisions/air/pehb/ehs/radon/documents/radon_by_town.pdf

[34] New Hampshire Environmental Services. Drinking Water and Groundwater Bureau. Arsenic in Drinking Water Fact Sheet.

In 2017, NHDES offered a free water testing program (documents arsenic levels and assesses biological activity for a variety of bacteria), in which Dover has chosen to participate in. Data from this research project was not available at the time of this plan update; however, the City should follow up later in 2018 for results.

Potential Future Impacts on Community

With the occurrence of worldwide pandemics such as SARS, H1N1 and Avian Flu, Dover could be susceptible to an epidemic and subsequent quarantine. While all individuals are potentially vulnerable to the hazard of an epidemic, epidemics often occur among a specific age group or a group of individuals with similar risk factors and exposure.[35] Lyme disease will continue to impact public health, and with changes in climate, in particular warmer winters, higher rates of Lyme disease will be an ongoing concern.

The City is currently exploring options to limit, or potentially ban, pesticide and herbicide spraying protocols. There was some concern that this wide-spread ban may have an adverse impact if there was to be a vector-borne disease breakout that needed spraying. This topic is still being discussed at the City Council, and remains unresolved.

Radon, arsenic, and other potential groundwater containments will continue to need to be addressed. There have been reports by the EPA that lung cancer deaths nationwide can be attributed to radon exposure, but nothing inclusive has been determined at this point. With assistance from epidemiological health experts, for future plan updates the Committee may be able to use the life-table or concentration risk analysis methodologies in the EPA study (EPA 2003) together with demographic and behavioral health data to arrive at a reasonable estimate of risk.

The heroin and drug epidemic remains an ongoing problem.

Estimated Potential Losses

Based on the high hazard ranking and assessed value of residential, commercial, and utilities structures, there is approximately $208,929,340in estimated potential losses from impacts associated from public health threats.

Hazardous Materials

Overview	
Hazard Type	Hazardous Materials
Location/Extent	City-wide
Severity	2.0
Probability	3.0
Overall Threat	6.0 (moderate)

[35] New Hampshire Department of Safety. State of NH Natural Hazard Mitigation Plan 2013. Homeland Security and Emergency Management.

Description of the Hazard

Hazardous materials in various forms can cause death, serious injury, long-lasting health effects, and damage to buildings, homes, and other property. Many products containing hazardous chemicals are used and stored in homes routinely. These products are also shipped daily on the nation's highways, railroads, waterways, and pipelines. Chemical manufacturers are one source of hazardous materials, but there are many others, including service stations, hospitals, and hazardous materials waste sites. Hazardous materials continue to evolve as new chemical formulas are created.

Extent of the Hazard

Incidents involving hazardous materials could potentially occur at any residence or business or along any road; however, it is more likely that a spill would occur along the Spaulding Turnpike; Routes 4, 9, 155, and 108; and the Pan-Am rail line (propane and fuel oil). The Planning Committee identified several other areas of concern, including: two large heating vendors on Fourth Street and Broadway that have large fuel storage tanks; the Unitil distribution system for natural gas; and the Ecoline pipeline, which transports purified methane gas from the Waste Management's Turnkey Recycling and Environmental Enterprise (TREE) in Rochester to the University of New Hampshire. Lastly, Dover is within the 50-mile ingestion pathway if the Seabrook Station Nuclear Power Plant were to have a nuclear release.

Past Impacts and Events

The Planning Committee could only recall one hazardous spill associated with a truck accident. It took place on the off-ramp on Route 4 westbound to Durham; a semi-tractor trailer truck that was carrying propane flipped over due to excessive speed. The City's Fire Department has responded to sporadic calls for locomotive fires at the rail yard.

Potential Future Impacts on Community

The Pan-Am rail line, because of the sheer quantity, is one of the largest future threats to the City. As the rail line travels through the City, it crosses important natural resource features including waterbodies (Kelly Brook, Knox Marsh Brook, and Cochecho River), wetlands, and forested land; industrial complexes; and passes through the economic core of the downtown (Chestnut Street, Third Street, Fourth Street, and Main Street). Any derailment would have significant impacts for the City.

The City identified the Newington Sea-3 expansion project as an important hazardous materials threat. This import/export project includes three 90,000-gallon tanks and associated chilling and pumping equipment in order to refrigerate and bulk store pressurized propane that is being railed in.

Estimated Potential Losses

Based on the moderate hazard ranking and assessed value of residential, commercial, and utilities structures, there is approximately $104,464,670 in estimated potential losses from hazardous materials impacts.

Coastal Hazards

Overview	
Hazard Type	Coastal Hazards
Location/Extent	Bellamy River; the Piscataqua River; at the confluence of the Cochecho River and the Salmon Falls River; and along the shores of Little Bay.
Severity	2.0
Probability	2.0
Overall Threat	4.0 (moderate)

Description of the Hazard

Coastal hazards are often associated with storm surge, extreme precipitation events, and sea-level rise can be devastating to human health and safety, public and private structures and facilities, and the economies of coastal and inland coastal communities.

Extent of the Hazard

Dover is an inland coastal community, one of seventeen communities in the New Hampshire Coastal Zone, but has limited risk and vulnerability in regard to flooding caused by wave action. However storm surges brought on by large storm events like hurricanes and nor'easters, accompanied by high tides and potential sea level rise are valid concerns around low-lying areas along the Bellamy River; the Piscataqua River; at the confluence of the Cochecho River and the Salmon Falls River; and along the shores of Little Bay.

King Tide Event at Hilton Park, November 2017 (Source: SRPC)

Past Impacts and Events

There has been some significant erosion of the shoreline along the Bellamy River, in close proximity to Spur Road. This has resulted in ongoing repairs of docks and deck issues.

Potential Future Impacts on Community

In 2014, the Coastal Risk and Hazards Commission (CRHC) released their Sea-Level Rise, Storm Surges, and Extreme Precipitation in Coastal New Hampshire: Analysis of Past and Projected Future Trends report that provides the best available and relevant scientific information to inform decision-makers. The report projects that New Hampshire's coast could see a range of 0.6ft to 2.0ft of sea level rise by the year 2050. By 2100, that range could be from 1.6ft all the way to 6.6ft depending on different emission scenarios.

In 2017, NOAA released a report titled Global and Regional Sea Level Rise Scenario for the US that indicates global sea-level projections may be in the range of 6.6ft to 8.9ft of rise by 2100 under the highest scenario. These results take into consideration the instability of the Antarctic ice-sheet and indicate that these higher outcomes may be more likely than previously thought. While these projections are based on models and there is always a high level of uncertainty, the trend continues to go up – not down.

According to the CRHC report annual precipitation (not extreme events) is expected to increase by as much as 20% with most increases occurring during winter and spring during this century. Extreme precipitation events are expected to increase in frequency and in the mount of precipitation produced; however it is unclear as to how much those events will increase.

Estimated Potential Losses

Based on the moderate hazard ranking and assessed value of residential, commercial, and utilities structures, there is approximately $104,464,670 in estimated potential losses from coastal hazard impacts.

Cyber Attacks

Overview	
Hazard Type	Cyber Attacks
Location/Extent	City-wide
Severity	1.7
Probability	2.0
Overall Threat	3.3 (low)

Description of the Hazard

The field of cyber security is primarily concerned with protecting against damage and disruption to or theft of hardware, software, or information. Due to the variety of services they provide, local government organizations collect, store, and work with large amounts of personal data and other sensitive information. While the security of this information has always been important, increasing use of digital networks to store and transmit that information makes the security of those networks a priority. Furthermore, local governments provide critical services such as police, fire, utilities, and other services, and disruption to these services could be devastating for residents. Types of cyber threat include:[36]

- Malware: Malicious software that can damage computer systems, including monitoring system activity, transferring information, or even taking control of computers or accounts. This includes a wide variety of viruses, Trojans, ransomware, and other programs that are usually installed by clicking on infected links, files, or email attachments.

[36] Sullivan, Megan. 8 Types of Cyber Attacks Your Business Needs to Avoid (http://quickbooks.intuit.com/r/technology-and-security/8-types-of-cyber-attacks-your-business-needs-to-avoid/)

- Phishing: These attacks come in the form of emails, often disguised as a trusted or legitimate source, that attempt to extract personal data.
- Denial of Service: This is a large-scale attack designed to disrupt network service by overloading the system with connection requests. These attacks are more likely to impact large, high-profile organizations, but such attacks can occasionally have residual impacts on other organizations in the same network.
- Man in the Middle: By imitating an end user (e.g. an online bank), an attacker can extract information from a user. The attacker can then input that information to the end user to access additional information, including sensitive data such as personal or account information.
- Drive-by Downloads: Malware installed on a legitimate website causes a system to download a program simply by visiting that website. This program then downloads malware or other files directly to the user's system.
- Malvertising: This attack type downloads malware or other files to your computer when you click on an infected advertisement.
- Rogue Software: Attackers use pop-up windows to mimic legitimate anti-virus or other security software in order to trick users into clicking on links to download malware or other files.
- Sponsored Attacks: These threats, which could be perpetrated by state or non-state actors, include specific attacks to damage or disrupt infrastructure such as utilities or wastewater facilities.

Extent of the Hazard

Cyber threats are a City-wide hazard that have the potential to impact any location if critical services are disrupted, or any resident, business, contractor, or employee whose information is stored in city records in the event of a data breach. The severity of any impact depends upon the type of incident – targeted phishing attacks may be focused upon a single employee or account, while malware attacks could impact an entire department or gain access to an entire database of personal information.

Past Impacts and Events

A global ransomware attack began on May 12, 2017 that impacted more than 100,000 organizations in 150 countries.[37] Ransomware is a type of malware that encrypts a user's files, making them inaccessible, and demands a ransom to return access. While ransomware has existed for years, it is becoming more prevalent. An IBM study of the impacts of ransomware found that nearly 40% of all spam emails contain a ransomware attachment, up from 0.6% in 2015.[38] The FBI estimates that over $1 billion in ransoms were paid by businesses and consumers in 2016 compared to $24 million in 2015.[39]

The Durham Police Department was the victim of a ransomware attack in June 2014. The attack originated from a phishing attack that linked to a Dropbox account containing malware. The malware locked access to files in a shared directory, effectively preventing the department from filing or accessing reports, sending and receiving emails, or researching the record management system. In this case, damage was limited by the fact that the officer who opened

[37] http://www.npr.org/sections/thetwo-way/2017/05/14/528355526/repercussions-continue-from-global-ransomware-attack
[38] IBM X-Force. Ransomware: How consumers and businesses value their data. 2016
[39] http://www.nbcnews.com/tech/security/ransomware-now-billion-dollar-year-crime-growing-n704646

the file did not have local administrative rights to make changes to the computer or system. The Durham IT department was able to restore service by isolating and identifying infected computers and drives before reimaging computers and replacing system files with external backups. These preventative measures of limiting administrative rights and backing up data regularly to external servers meant that the biggest impact was the network downtime necessary to restore the computers and servers, and recovery was relatively quick. In total, it took the Town three days to restore full service (police servers were unavailable for two days) at a cost of $3,500.

There have been no cyber-attacks in Dover.

Potential Future Impacts on Community

Dover is most likely to be at risk from malware, phishing, and other methods of acquiring personal information. These threats may be targeted, as in the case of phishing emails sent to employee accounts, or threats that individuals encounter during their regular computer usage. Cyber threats are also constantly evolving in order to find new weaknesses in anti-virus software and other network defenses. As noted above, ransomware has become an increasingly prevalent form of malware in recent years, and is likely to continue to be a threat in years to come.

Estimated Potential Losses

Based on the low hazard ranking and assessed value of residential, commercial, and utilities structures, there is approximately $20,892,934 in estimated potential losses from cyber-attacks.

Hazards Not Included in this Plan

The State of New Hampshire identifies avalanches as a hazard in the State Multi-Hazard Mitigation Plan Update of 2013. Avalanches are not included in this Plan for the City of Dover. Avalanches were not identified by the present or past Planning Committee as a local hazard due to the fact that there are no significant mountains or topographical features, where avalanches would be likely to or have occurred in the past. The City will re-evaluate the need to include additional hazards to this Plan during subsequent updates of the Plan.

The Planning Committee also discussed several forms of domestic/foreign terrorism, including: active shooter events in schools, municipal buildings, or other large crowd public events; deliberate contamination to regional and local water supplies; and specific targets to the rail system (transporting passengers, freight, and shale oil). It should be noted that while Dover, itself, may not be a likely location for a foreign attack, the Seacoast of New Hampshire – generally speaking – has a much higher vulnerability. Targets such as the Portsmouth Naval Shipyard, Pease International Trade port, the Seabrook Station Nuclear Power Plant, and the numerous oil storage tanks along the Piscataqua River are all potential targets that would impact surrounding communities in varying degrees. While these threats remain important, there are other – more specific – emergency preparedness documents and protocols that are better suited to address these concerns and therefore are not included in this plan.

Chapter 7: Action Plan

Past Mitigation Strategies

During past updates the Planning Committee developed a list of strategies to implement over the course of the Plan's life-cycle. Table 20 summarizes those strategies, and provides updated information as to if the strategy was accomplished or not.

Table 20: Accomplishments Since Last Plan Adoption

Proposed Mitigation Action	Update 2018
1. Police Dispatch Radio Replacement – A new radio system and console are needed to replace the existing Motorola Gold Elite System, which is 11 years old. Motorola is no longer manufacturing replacement parts and will only be available for the next few years. The system is essential to communicate to Police, Fire, EMS, and Community Services.	Completed Action. In 2016, using city funds, in combination with a grant, the city purchased new radios for community services, police, and fire. Currently, the city is in the midst of constructing four new communication towers that will allow for a microwave transmission link to improve point-to-point communications (see action 34).
2. Police Facility Design and Construction – Design, engineering and construction of a plan to construct a new police facility. This new facility would act as a backup EOC.	Completed Action. In March 2016, the new police facility was completed and currently serves as the primary emergency operations center for the city. The former police facility space at city hall is currently being rehabbed and will function as a customer services center for residents.
3. South End Station Generator Replacement – Essential replacement of 1991 Station generator. The life expectancy is 20 years.	Completed Action. In 2015, a duel fuel (diesel/gas) generator was purchased through an emergency preparedness grant.
4. Bridge Replacement at Whittier Street – Bridge has been placed on state aid Bride Replacement Program for 2013. The bridge deck has been repaired with temporary fix.	Completed Action. Replacement of the bridge is currently wrapping up. The new bridge has been installed and the roadway approaches were just paved. The new bridge will be open by Thanksgiving 2017, with final paving in early 2018.
5. Street Reconstruction at Piscataqua and Rabbit Road – Design and reconstruction of Piscataqua and Rabbit Road.	Deferred Action. The road received a thin pavement overlay in the summer of 2017. The project remains in the city's capital improvements program (CIP); but it has been moved out to FY 2022.
6. Street Reconstruction at Silver Street – This project would design the replacement of drainage, sidewalks, and roadway on Silver Street.	Completed Action. This project was completed in 2016, and included upgrades to water, sewer, drainage, and sidewalks; new traffic lights; benches; lightning; COAST stops; and bike lanes. Currently, the city is conducting a downtown wayfinding to improve signage and navigation.

Proposed Mitigation Action	Update 2018
7. Street Reconstruction at Broadway – Design and proposed reconstruction including drainage curb, sidewalk, and road construction.	Deferred Action. This project is expected to be completed over the course of three phases. *Phase I. Red's Railroad Box Culvert Replacement*. The city is finalizing all necessary easements and has completed all design plans. Construction is slated to begin in 2018. *Phase II. Reconstruction of Broadway and Oak*. The city plans to hire a consultant to assist in the design plans for upgrades to water, sewer, drainage, curbs, and sidewalks on Floral Ave, High Ridge Drive, and Brick Road. This project remains in the city's CIP. *Phase III. Oak/Ham/Ela Area Reconstruction*. After all the drainage improvements have been completed, the city will begin reconstruction work in these areas. This project remains in the city's CIP.
8. Environmental Management Systems (EMS) Computer/Software Upgrade – Upgrade of computer and current telephone modem dependent system to IP/cable network with upgraded software for managing heating and cooling systems in several municipal buildings; McConnell Center, Library, City Hall, Indoor Pool, Arena, and Public Works.	Completed Action. The CIP in 2017 included the EMS project. It was an upgrade of computer and current telephone modem dependent system to IP/cable network with upgraded software for managing heating and cooling systems in several municipal buildings i.e. McConnell Center, Library, City Hall, Indoor Pool, Arena and Public Works. The upgrade provides improved reliability of communication between remote locations and control center and increase efficiency of operating staff.
9. Pump Station Equipment Replacement and Maintenance – Equipment upgrades and replacements for several sewer-pumping stations, including backup power to at least 3 or 4 of the stations.	Ongoing Action. New construction of the Leighton Way pump station has been completed. The Varney Brook pump station on Gerrish Road is currently out to bid for reconstruction. The Cochecho Street pump station remains the city's CIP. Currently, three stations don't have back-up generators; however, those that do not have stand-by power do have outside hook-ups.
10. Purchase up to 5 generators – Needed for the Water Treatment Plant.	Completed Action. Reconstruction at the water treatment plant on Lowell Ave is ongoing and expected to be completed by the summer of 2018. Both Calderwood and Campbell stations have been reconstructed, with only a few punch-list items that may need until spring 2018 for completion. Reconstruction at Smith and Cummings has been designed and construction is set to begin in 2018 and completed by 2019. All three projects include generators. The city has also purchased a portable generator using HSEM funding in 2013 and bought an additional one using city funds in 2014.

Proposed Mitigation Action	Update 2018
11. 2-Way radio system upgrade – A new radio system would allow better communication with CS staff and other departments.	Completed Action. All new radio systems have been installed for the community service trucks. There is still a need to coordinate efforts with ongoing work with the communication towers.
12. 3" & 4" Pump and Hoses – Community Services staff uses these pumps to pump from flooded areas to non-flooded areas during emergency events.	Ongoing Action. The city continued to purchase pump and hoses on an as needed basis through the city's operating budget.
13. Atlantic Avenue Reconstruction – This road is a main artery in and out of the city. Reconstruction is to replace the major drainage component of the road.	Deferred Action. This project remains in the city's capital improvements program (CIP), currently projected for FY2020.
14. Chainsaws – Are used during emergency situations such as trees down caused by ice and windstorms.	Completed Action. The city bought two new chainsaws in 2017. Crews were sufficiently equipped to address storm damage of 10/30/2017.
15. Clam bucket for loader – Used during emergency situations such as trees down caused by ice and windstorms.	Completed Action. The City did acquire a clamshell bucket for removal of trees/debris. It was utilized during storm of 10/30/2017
16. County Farm Road Bridge Replacement – Would provide additional access in and out of the North End area of the City.	Deferred Action. In 2017, the city submitted this project to the NHDOT state aid bridge replacement program. This project remains in the city's capital improvements program (CIP) and is an important link to Rochester. Important infrastructure, including the court house, human society, hospice center, as well as a number of residential neighborhoods would be better served and less vulnerable to isolation issues if this project is completed.
17. Message Boards – Used for evacuation plans, flooded areas, street closures and other emergency events.	Ongoing. The city purchased two new message boards in 2015. The city has expressed interest in purchasing a few additional boards as they are currently under-equipped.
18. New Bucket Truck – The current truck is 20 yrs. old and a replacement is needed for traffic lights and tree removal during emergency events.	Ongoing. The old truck was replaced in 2013; however the new bucket truck has experienced chronic problems with the lift mechanism. Additionally, the crew does not feel it is sufficiently stable to reach higher levels in order to cut trees. As a result, the city routinely hires a contractor for any tree work.

Proposed Mitigation Action	Update 2018
19. New Wood Chipper – To provide additional resources to assist in clean up after an emergency event.	Deferred Action. Due to funding restraints there has been no action taken by the city.
20. Oak Street Railroad Bridge Replacement – Current bridge is only a 6-ton limit and is a major access thruway for both Dover and Rollinsford.	Deferred Action. In 2017, the city submitted this project to the NHDOT state aid bridge replacement program. This bridge lies on the boundary with Rollinsford. If approved for funding, unless a funding agreement was executed, under State Law Dover and Rollinsford would be expected to prorate construction costs on the basis of population.
21. Oak/Ham/Ela Area Reconstruction – This area sees major flooding during rain events. Incorporates drainage and road construction. Also a main artery in and out of the City.	Removed Action. This project is part of Action #7.
22. Old Colony Drainage – Two or three home have major flooding during heavy rain events and winter melting. New drainage would resolve this problem.	Deferred Action. There has been no action taken by the city.
23. Piscataqua Road Reconstruction – Major access for the Southern end of the City. Need of new drainage, culverts, and road reconstruction.	Removed Action. This project is part of Action #5.
24. Outer Sixth Street Replace Bridge & Culvert – Major overflows during heavy rain events. Replace bridge and raise the road. Provide additional access in and out of the North End area of the City.	Deferred Action. In 2017, the city submitted this project to the NHDOT state aid bridge replacement program. Due to funding restraints, work is unlikely unless State Aid is granted.
25. Portable 4" Pump – To be used at sewer pump stations to pump from the wet well to a gravity main during power outages.	Completed Action. The city purchased two 4" pumps during the dredging of the Cochecho River. There are two additional pumps (4" and 6") that were purchased for the Spaulding Turnpike construction. Once construction is completed, those pumps will return to the city.
26. Portable Generator – Will be used to replace the current 20 yr. old portable generator for both water wells and sewer pump stations.	Completed Action. A generator was purchased in 2013 using a HSEM grant.

Proposed Mitigation Action	Update 2018
27. Portable Light – Will be used during emergency events such as flooded areas, water breaks and loss of power.	Completed Action. The city purchased a truck mounted light in 2015. The light is kept at the community services department. There is a need for an additional light.
28. Raise County Farm Road – Maintain access to the Strafford County Complex, which includes the rest home, court, hospice care and jail.	Deferred Action. Due to funding restraints there has been no action taken by the city. This is not currently in the city's CIP. It is important to note that if the County Farm bridge replacement project is completed, this project will be removed.
29. Red's Railroad Box Culvert Replacement – Existing culvert has partially collapsed and is in need of replacement. This culvert drains the urban area between Broadway and Central Avenue to Oak Street, over 100 acres.	Removed Action. This project is part of Action #7.
30. River Gauges – Would be installed on the bridges crossing the major rivers to assist emergency personnel during flooding events.	Deferred Action. Due to funding restraints there has been no action taken by the city. The City may be required to install a gage on the Bellamy River related to its drinking water recharge project. The city needs to determine if the river gauge at Whittier Street is going to remain or not.
31. Sewer Jet – Equipment would replace the current 15-year-old unit.	Deferred Action. This project remains in the city's capital improvements program (CIP); however it has been moved out to FY2020.
32. St. Thomas Street Drainage – Flooding occurs in this area due to the age of the infrastructure. Needs new design/reconstruction.	Deferred Action. Due to funding restraints there has been no action taken by the city. This is not currently in the city's CIP.
33. Stand-by Power for Pump Stations – Currently there are three pump stations that do not have standby power: Spruce Drive, Strafford Road, and Cranbrook Lane. Need to upgrade standby power at Varney Brook, Wentworth Terrace, Crosby Road, Boston Harbor and County Farm Road.	Completed Action. All sewer pump stations, with the exception of Spruce Drive, Strafford Road, and Cranbrook Lane have generator back-up. The three remaining stations have been wired for temporary generator hook-ups. The Varney Brook station will have a generator as part of the reconstruction project.
34. Stand-by Power for Radio Towers – The City currently has two radio towers for the SCADA system. This equipment would be used to maintain power during outages.	Completed Action. The city is constructing 4 new communications towers (radio, microwave), which will be completed in 2017-2018) that will all have stand-by power. The two communications towers used for SCADA on the water tanks remain.

Proposed Mitigation Action	Update 2018
35. Tire Excavator – Would be used for cleaning drainage ditch lines throughout the City.	Completed Action. The city purchased a tire excavator in 2015.
36. Tree Program – Using the City GPS and GIS program to identify all City trees. Also determine the health and potential hazards.	Deferred Action. The city has hired a GIS technician that will eventually complete this task; however, work will not begin until all other major infrastructure data collection has been completed. The city is in need of one more GPS unit.
37. Purchase generators –To power traffic lights at five critical intersections: Weeks Crossing, Central & Broadway, Central & Washington, NH9, and NH155. There is also consideration for: Glenwood & Central, Sixth and Whittier.	Ongoing Action. The city purchased three generators in 2014, which are housed at the facilities and grounds building, and are used at the Weeks Crossing, Central & Broadway, Central & Washington, NH9, and NH155 intersections. The Glenwood & Central intersection will be under construction and have an assessment for additional hook-ups. After the October 2017 storm, estimates have been developed to outfit more intersections with backup power.
38. Needs Assessment – Conduct a needs assessment for stormwater infrastructure.	Completed Action. The city is currently following guidance from the new MS4 permit, which includes: GPS locating all stormwater infrastructure and conducting catch basin inspections and cleaning on a biennial basis.
39. Central Falls Dam project – Investigate the structural integrity of retaining wall to determine if future repairs are needed.	Ongoing Action. The Public Works Department has put $1,100,000 in the pending CIP to repair the 40 year old retaining wall adjacent to the Central Falls dam and the fish ladder located off Central Ave downtown. FY2019 will be for design engineering $(100,000), and FY2020 will be for construction (1,000,000).
40. Interconnection Study – Work off of the completed interconnection study to link municipality's water utilities together to provide emergency aid to each other and create a regional water system.	Ongoing Action: The city has moved into Phase II of this project. The city hired a consultant to design two new wells at Willand Pond that will be constructed in 2018. As part of that project, Dover will construct a permanent connection with Somersworth. The city is also installing a hydrant on Hickory Lane and Old Rochester Road for additional fire aid.
41. Develop a Fact Sheet – Safety measures that residents can take to lessen the effect of hazards.	Completed Action. The city has hired a media services manager to improve outreach and engagement, as well as link with ongoing Police and Fire services to increase situational awareness during storms to residents. The city's online presence has improved with the use of social media and is referenced in the City's Strategic Plan to strengthen.

Status Update:

Completed Action – This program continues to be an implemented mitigation action item since the last updated plan was developed

Deferred Action – At the time of developing this plan, more time is required for completion

Removed Action – This existing program is no longer a priority to the City

Ongoing Action – This program will occur throughout the life of the plan

Existing Mitigation Strategies

During the update the Planning Committee developed a list of existing programs and strategies that were ongoing planning mechanisms to help reduce impacts from future hazards. Table 21 summarizes those programs, and provides information on the effectiveness, any changes in priority, and a list of recommendations to improve them during the next life-cycle of this plan.

Table 21: Existing Programs and Policies

Existing Program	Description	Effectiveness	2018 Update
Building Codes	Establishes regulations for the design and installation of building systems	Excellent	The City is currently using the 2009 IBC and is waiting for the state to adopt the new codes. At the time of this plan update, the state building code review board was trying to get legislation passed to adopt the 2015 codes (House Bill 92).
Local Emergency Operations Plan (LEOP)	Defined notification procedures and actions that should be taken in different emergency situations.	Excellent	This was last fully updated in 2015 by a grant funded contractor with minor updates in 2016 and 2017 to reflect new EOC in new Police Station. The City's 2009 Disaster Plan is rolled into this document and was removed from this list.
Storm Drain Infrastructure Improvements	Responsible for catch basins, culverts cleaning, ditch maintenance, structure upkeep and maintenance for the entire City in compliance with MS4 stormwater regulations	Excellent	The City has implemented a catch basin cleaning schedule (1/2 each year), which includes assessments and necessary repairs. The City remains in full compliance with MS4 permit requirements and has allocated upwards of $300,000 in the annual budget for storm drain infrastructure maintenance and improvements.
Tree Maintenance	Utility companies and NHDOT have tree maintenance programs to clear trees and limbs from power lines and roadways.	Good	The City addresses tree cutting and maintenance on an as needed basis with their existing bucket truck, and has a $20,000 annual budget for contracting services to handle higher more dangerous trees. Eversource has their own maintenance schedules they adhere to on a yearly basis.
Evacuation and Notification	Evacuation and notification procedures are defined in Dover's LEOP.	Excellent	News updates and evacuation notification are broadcasted on channels 22 and 95, and also sent out to residents through press releases, electronic email alerts, and posted on the City's website and to social media outlets including Facebook, WebEOC, and Twitter. The City also uses the statewide notification system and may use the school's notification phone system on an as needed basis to reach students, parents, teachers, and other school employees.

Existing Program	Description	Effectiveness	2018 Update
Emergency Back-Up Power and Emergency Shelters	Offers temporary shelter during extended periods without power	Excellent	The police station acts as the primary emergency operations center (EOC). The Liberty North End Fire Station serves as the back-up EOC. Both are equipped with generators. The remaining two fire stations have emergency generators, along with the Middle School, City Hall, and Public Works building. Woodman Park is fitted for partial power. The McConnell Center (partial funding from a HSEM grant) acts as the primary emergency shelter. The Dover High School (August 2018) serves as the primary back-up emergency shelter and Woodman Park serves as the back-up emergency shelter. The communication towers are all equipped with back-up power, as well as the majority of the pump stations. Those without – have access to portable generators.
Hazardous Materials Response Team	The City of Dover is a member of the START Hazardous Materials Emergency Response Team, a regional effort to combine resources to mitigate hazardous materials incidents. On-going training, education and acquisition of resources are important for the team.	Excellent	Dover's ongoing training is up-to-date. Dover has 9 employees on the team and houses one response trailer. Dues from participating communities in the region fund the team training recertification requirements that apply under federal law, and needed equipment.
Floodplain Management Ordinance	Local ordinance to regulate development in the floodplain.	Good	In 2015, the City adopted new floodplain maps and freeboard regulations, which require the lowest floor of residential and non-residential structures that are new construction or substantial improvements to be elevated two feet above base flood elevation.
Shoreline Water Quality Protection Act	Establishes minimum standards for the subdivision, use and development of the shorelands along the state's larger waterbodies	Excellent	State requirements are on portions of the Cochecho River, Bellamy River, Barbadoes Pond, Cochecho Mill Dam, Farm Pond, Fresh Creek Pond, Sawyers Mill Dam, Watson-Waldron Dam, and Willand Pond are referenced in the City's zoning as an overlay district. Dover's local regulations are more stringent than current state requirements and will be continually monitored for revisions on an as needed basis.

Existing Program	Description	Effectiveness	2018 Update
Master Plan	A guiding document used to manage Dover's growth and development through local land use regulations.	Excellent	Dover is committed to updating a Master Plan chapter on a yearly basis. The last several years include the development of the Stewardship Chapter and an update to their existing Transportation Chapter. Currently, the City is in the midst of developing a climate adaptation chapter that will address climate-related impacts such as, sea-level rise, extreme precipitation events, storm surge, vector-borne diseases, drought, etc. At the end of each year, the Assistant City Manager reports to the City Council at their March meeting on what actions have been undertaken and completed.
Dover Host Plan	The Plan is part of the New Hampshire Radiological Emergency Preparedness (REP) Program and contains the planning information and procedures specific to the City of Dover.	Excellent	The 2017-2018 revision has been approved by FEMA and currently awaiting Dover's promulgation. Exercises are scheduled to test Dover specific requirements as a Host Community in spring of 2018. NH HSEM staff have been refreshing Fire & Rescue in 2017 on radiological equipment usage and emergency response in preparation for the 2018 exercises
Emergency Planning for Potable Water Supplies	The purpose of the Plan is to assess the vulnerability of the municipal water system in regards to extreme conditions or events. The Plan covers the entire city, and was last revised in 2008.	Excellent	The Planning Committee was unaware if this plan had been updated; however, was able to provide information on how the City has implemented its recommendations through the following activities: moving ahead with the interconnection study with Somersworth, land protection efforts around existing aquifers, groundwater exploration and research, and the future installation of the Shaws Lane well.
Capital Improvements Program (CIP)	A program that helps to address improvement projects over a period of time.	Excellent	This six year program links infrastructure spending to the goals and values outlined in the City's Master Plan. The City Council adopted the CIP for fiscal years 2019-2024 at their December, 2017 meeting.

Effectiveness:

Excellent – The existing program works as intended and is exceeding its goals

Good – The existing program works as intended and meets its goals

Average – The existing program does not work as intended and/or does not meet its goals

Poor – The existing program is negatively impacting the community

2018 Update: Recommendations for improvement

The Planning Committee's Understanding of Multi-Hazard Mitigation Strategies

The Planning Committee determined that any strategy designed to reduce personal injury or damage to property that could be done prior to an actual disaster would be listed as a potential mitigation strategy.

This decision was made even though not all projects listed in Tables 22 (New Mitigation Actions) and 23 (Implementation Plan) are fundable under FEMA HMA grant programs. The Planning Committee determined that this Plan was in large part a management document designed to assist the City Council and other City officials in all aspects of managing and tracking potential emergency planning strategies. For instance, the Planning Committee was aware that some of these strategies are more properly identified as readiness issues. The Planning Committee did not want to "lose" any of the ideas discussed during these planning sessions and thought this method was the best way to achieve that objective.

The Planning Committee identified 10 new strategies and is carrying over an additional 20 from the previous (2013) iteration to implement during the life of this Plan. These strategies are intended to supplement existing programs and the ongoing and not yet completed mitigation strategies identified in previous plan updates. When identifying new strategies, the Planning Committee balanced a number of factors including capacity to implement strategies, priority projects, existing strategies, policies, and programs, the hazard ranking, and whether a strategy will reduce risk associated with multiple hazards.

Future Mitigation Strategies

The Committee identified several new mitigation strategies to reduce vulnerability to hazards. The Committee focused on identifying the best appropriate strategies for the community and the hazards it is most vulnerable based on the vulnerability assessment. Some of the mitigation strategies are strategies for multiple hazards. The goal of each proposed mitigation strategy is reduction or prevention of damage from a multi-hazard event.

New mitigation strategies are listed in Table 22, which also includes a feasibility assessment and prioritization of each hazard.

Feasibility & Prioritization

A technique known as a STAPLEE evaluation, which was developed by FEMA, was used to evaluate new mitigation strategies based on a set of criteria (see below). The STAPLEE method is commonly used by public administration officials and planners.

S	Social:	Is the proposed strategy socially acceptable to the community? Is there an equity issue involved that would result in one segment of the community being treated unfairly?
T	Technical:	Will the proposed strategy work? Will it create more problems than it solves?
A	Administrative:	Can the community implement the strategy? Is there someone to coordinate and lead the effort?
P	Political:	Is the strategy politically acceptable? Is there public support both to implement and to maintain the project?
L	Legal:	Is the community authorized to implement the proposed strategy? Is there a clear legal basis or precedent for this activity?
E	Economic:	What are the costs and benefits of this strategy? Does the cost seem reasonable for the size of the problem and the likely benefits?
E	Environmental:	How will the strategy impact the environment? Will it need environmental regulatory approvals?

The Committee evaluated each mitigation strategy using the STAPLEE and ranked each of the criteria as poor, average, or good. These rankings were assigned the following scores: *Poor=1; Average=2; Good=3.*

The following questions were used to guide further prioritization and action:

- Does the action reduce damage?
- Does the action contribute to community objectives?
- Does the action meet existing regulations?
- Does the action protect historic structures?
- Can the action be implemented quickly?

The prioritization exercise helped the committee evaluate the new hazard mitigation strategies that they had brainstormed throughout the multi-hazard mitigation planning process. While all actions would help improve the City's multi-hazard and responsiveness capability, funding availability will be a driving factor in determining what and when new mitigation strategies are implemented.

Table 22: Future Mitigation Actions & STAPLEE

New Mitigation Project	S	T	A	P	L	E	E	Total
Implement an action identified in the City's Strategic Plan to develop a community-wide risk reduction plan	3	3	2	3	3	3	3	20
			Capacity issues to implement					
Ensure that all new and proposed CIP projects are required to consider the impacts from climate change, including sea-level rise and increases in extreme precipitation.	3	3	3	3	3	3	3	21
Review all existing CIP projects that are in design phase to ensure they are considering impacts from climate change, including sea-level rise and increases in extreme precipitation.	3	3	3	3	3	3	3	21
Develop and complete drainage improvements and shoreland stabilization along Cochecho River in coordination with waterfront development project.	3	3	3	3	3	2	1	18
						Cost associated with project	NHDES permitting issues	
Develop a framework for an ongoing public education campaign on all-hazard preparation and self-resiliency for the 3 day - 72 hour event. The campaign will build off efforts currently underway with the elementary students, and will include a series of public service announcements for general and seasonal events.	3	3	2	3	3	3	3	20
			Capacity issues to implement					

New Mitigation Project	S	T	A	P	L	E	E	Total
Update and resend floodplain management brochure that was completed a few years ago (prior to the 2015 FEMA map adjustments and revisions to the City's floodplain ordinance). The updated brochure will include additional information on flood risk, revised freeboard and building permit requirements, and suggested flood-proofing techniques for homeowner to consider.	3	3	3	3	3	3	3	21
Review the updated floodplain model ordinance from Office of Strategic Initiatives and update the City's floodplain ordinance, as needed.	3	3	3	3	3	3	3	21
Determine the appropriate locations for additional warming/cooling stations throughout the city.	3	3	3	3	3	3	3	21
Continue to implement the ongoing signalization project to install cameras at all 33 traffic lights locations to alleviate congestion areas and adjust timings as needed. This project will increase capacity to coordinate direction and traffic flow, as well as help during emergency widespread evacuation protocols.	3	3	3	3	3	2	3	20
						Large cost if no grant are available		
Incorporate changes into the City's Site Plan and/or Subdivision Regulations based on the state's model water efficiency landscaping ordinance.	3	3	3	3	3	3	3	21
*Street Reconstruction at Piscataqua and Rabbit Road – Design and reconstruction of Piscataqua and Rabbit Road.	3	3	3	3	3	3	3	21

New Mitigation Project	S	T	A	P	L	E	E	Total
*Street Reconstruction at Broadway – Design and proposed reconstruction including drainage curb, sidewalk, and road construction.	3	3	3	3	3	3	3	21
*Pump Station Equipment Replacement and Maintenance – Equipment upgrades and replacements for several sewer-pumping stations, including backup power to at least 3 or 4 of the stations.	3	3	3	3	3	3	3	21
*Purchase 3" & 4" Pump and Hoses – Community Services staff uses these pumps to pump from flooded areas to non-flooded areas during emergency events.	3	3	3	3	3	3	3	21
*Atlantic Avenue Reconstruction – This road is a main artery in and out of the city. Reconstruction is to replace the major drainage component of the road.	3	3	3	3	3	3	3	21
*County Farm Road Bridge Replacement – Would provide additional access in and out of the North End area of the City.	3	3	3	3	3	3	3	21
*Message Boards – Used for evacuation plans, flooded areas, street closures and other emergency events.	3	3	3	3	3	3	3	21
*New Bucket Truck – The current truck is 20 yrs. old and a replacement is needed for traffic lights and tree removal during emergency events.	3	3	3	3	3	3	3	21

New Mitigation Project	S	T	A	P	L	E	E	Total
*New Wood Chipper – To provide additional resources to assist in clean up after an emergency event.	3	3	3	3	3	3	3	21
*Oak Street Railroad Bridge Replacement – Current bridge is only a 6-ton limit and is a major access thruway for both Dover and Rollinsford.	3	3	3	3	3	3	3	21
*Old Colony Drainage – Two or three home have major flooding during heavy rain events and winter melting. New drainage would resolve this problem.	3	3	3	3	3	3	3	21
*Outer Sixth Street Replace Bridge & Culvert – Major overflows during heavy rain events. Replace bridge and raise the road. Provide additional access in and out of the North End area of the City.	3	3	3	3	3	3	3	21
*Raise County Farm Road – Maintain access to the Strafford County Complex, which includes the rest home, court, hospice care and jail.	3	3	3	3	3	3	3	21
*River Gauges – Would be installed on the bridges crossing the major rivers to assist emergency personnel during flooding events.	3	3	3	3	3	3	3	21
*Sewer Jet – Equipment would replace the current 15-year-old unit.	3	3	3	3	3	3	3	21

New Mitigation Project	S	T	A	P	L	E	E	Total
*St. Thomas Street Drainage – Flooding occurs in this area due to the age of the infrastructure. Needs new design/reconstruction.	3	3	3	3	3	3	3	21
*Tree Program – Using the City GPS and GIS program to identify all City trees. Also determine the health and potential hazards.	3	3	3	3	3	3	3	21
*Purchase generators –To power traffic lights at five critical intersections: Weeks Crossing, Central & Broadway, Central & Washington, NH9, and NH155. There is also consideration for: Glenwood & Central, Sixth and Whittier.	3	3	3	3	3	2	3	20
						Budget constraints		
*Central Falls Dam Project – investigate structural integrity of structure of retaining wall.	3	3	3	3	3	2	2	19
						Budget constraints	Possible environmental effects	
*Interconnection Study – Work off of the completed interconnection study to link municipality's water utilities together to provide emergency aid to each other and create a regional water system.	3	3	3	1	2	1	3	16
				Potential problems with a regional water system	Legal issues on who pays what	Budget constraints		

*Ongoing and deferred actions from the 2013 Plan. Previous STAPLEE scores were reaffirmed.

Implementation Schedule for Prioritized Strategies

After reviewing the finalized STAPLEE numerical ratings, the Team prepared to develop the Implementation Plan (Table 23). To do this, the Team developed an implementation plan that outlined the following:

- ∴ Type of hazard
- ∴ Affected location
- ∴ Type of Activity
- ∴ Responsibility
- ∴ Funding
- ∴ Cost Effectiveness; and
- ∴ Timeframe

The following questions were asked in order to develop an implementation schedule for the identified priority mitigation strategies.

WHO? Who will lead the implementation efforts? Who will put together funding requests and applications?

WHEN? When will these actions be implemented, and in what order?

HOW? How will the community fund these projects? How will the community implement these projects? What resources will be needed to implement these projects?

In addition to the prioritized mitigation projects, Table 23, Implementation Plan, includes the responsible party (WHO), how the project will be supported (HOW), and what the timeframe is for implementation of the project (WHEN).

Table 23: Implementation Plan

New Mitigation Project	Type of Hazard	Affected Location	Type of Activity	Responsibility	Funding	Cost Effectiveness	Timeframe
							Ongoing
						Low = < $5,000	*6 months - 1 year*
						Medium = $5,000 - $10,000	*1 - 2 years*
						High = > $10,000	*2 - 5 years*
Implement an action identified in the City's Strategic Plan to develop a community-wide risk reduction plan	Multi-Hazard	City-wide	Planning	Fire & Rescue	Operating Budget (potential grants)	High	4 years
Ensure that all new and proposed CIP projects are required to consider the impacts from climate change, including sea-level rise and increases in extreme precipitation.	Multi-Hazard	City-wide	Planning	Planning Department	Operating Budget	Low	2 years
Review all existing CIP projects that are in design phase to ensure they are considering impacts from climate change, including sea-level rise and increases in extreme precipitation.	Multi-Hazard	City-wide	Planning	Planning Department	Operating Budget	Medium	6 months – 1 year
Develop and complete drainage improvements and shoreland stabilization along Cochecho River in coordination with waterfront development project.	Coastal Flooding	River Street	Structure & Infrastructure	Planning Department & Community Services	TIFF Funded	High	1 – 2 years

Develop a framework for an ongoing public education campaign on all-hazard preparation and self-resiliency for the 3 day - 72 hour event. The campaign will build off efforts currently underway with the elementary students, and may include a series of public service announcements for general and seasonal events.	Multi-Hazard	City-wide	Education & Awareness	Fire & Rescue	Operating Budget (potential grants)	Medium	2 years
Update floodplain management brochure that was completed a few years ago (prior to the 2015 FEMA map adjustments and revisions to the City's floodplain ordinance). The updated brochure may include additional information on flood risk, revised freeboard and building permit requirements, and suggested flood-proofing techniques for homeowner.	Flooding	Areas within the FEMA floodplain	Education & Awareness	Planning Department	Operating Budget	Low	1 year
Review the updated floodplain model ordinance from Office of Strategic Initiatives and update the City's floodplain ordinance, as needed.	Flooding	Areas within the FEMA floodplain	Planning & Regulatory	Planning Department	Operating Budget	Medium	1 year
Determine the appropriate locations for additional warming/cooling stations throughout the city.	Extreme Temperatures	City-wide	Planning	Fire & Rescue	Operating Budget	Low	2 years
Continue to implement the ongoing signalization project to install cameras at all 33 traffic lights locations to alleviate congestion areas and adjust timings as needed. This project will increase capacity to coordinate direction and traffic flow, as well as help during emergency widespread evacuation protocols.	Multi-hazard	City-wide	Structure & Infrastructure	Community Services	Operating Budget (CMAQ grant)	High	3 years

Incorporate changes into the City's Site Plan and/or Subdivision Regulations based on the state's model water efficiency landscaping ordinance.	Drought	City-wide	Planning & Regulatory	Planning Department	NHDES Local Source Water Grant	Low	1 year
*Street Reconstruction at Piscataqua and Rabbit Road – Design and reconstruction of Piscataqua and Rabbit Road.	Flooding	Piscataqua and Rabbit Road	Structure & Infrastructure	Community Services	Debt Financed	HIGH. Piscataqua Rd is a thoroughfare to Rte. 4 and in need of repair. Rabbit Rd is a small road off of Piscataqua that needs improvements and due to its close proximity to the larger project it makes economic sense to combine them. $1 million is projected in the CIP ($500K FY21 and $500K FY22)	2 - 5 years
*Street Reconstruction at Broadway – Design and proposed reconstruction including drainage curb, sidewalk, and road construction.	Flooding	Broadway & Oak, Ham, and Ela	Structure & Infrastructure	Community Services	Debt Financed	HIGH. Broadway is a major artery of the City that receives heavy traffic and is in need of upgrades. $2 million was approved in the FY16 CIP. Work will commence in calendar year 2018.	6 months - 1 year
*Pump Station Equipment Replacement and Maintenance – Equipment upgrades and replacements for several sewer-pumping stations, including backup power to at least 3 or 4 of the stations.	Multi-Hazard	Pump station locations	Equipment Upgrade	Community Services	Operating Budget	HIGH. These stations must continue to be in top operating condition in order to prevent violations. Only 3 pump stations currently do not have generators. The CIP includes $75,000/annually for the next 5 years.	Ongoing
*Purchase 3" & 4" Pump and Hoses – Community Services staff uses these pumps to pump from flooded areas to non-flooded areas during emergency events.	Flooding	City-wide	Equipment Purchase	Community Services	CIP & Grant Funding	LOW. This remains ongoing. This project would be funded through the sewer and drainage budget and would have an estimated cost of about $5,000. Purchases have been made depending on remaining budget at year's end.	Ongoing

*Atlantic Avenue Reconstruction – This road is a main artery in and out of the city. Reconstruction is to replace the major drainage component of the road.	Flooding	Atlantic Ave	Structure & Infrastructure	Community Services	CIP & Grant Funding	HIGH. The water main has been replaced and the remainder of the project is ready for design. An amount of $1.5 million is included in the FY20 CIP.	1 - 2 years
*County Farm Road Bridge Replacement – Would provide additional access in and out of the North End area of the City.	Multi-Hazard	County Farm Road	Structure & Infrastructure	Community Services	CIP & Grant Funding	HIGH. A new bridge in this location would reduce traffic on Tolend Road and provide an additional route to and from Barrington and Rochester. The City submitted a State Aide Application the NHDOT Bridge Program summer 2017. Waiting to receive an official cost estimate from NHDOT.	2 - 5 years
*Message Boards – Used for evacuation plans, flooded areas, street closures and other emergency events.	Multi-Hazard	City-wide	Equipment Purchase	Community Services	CIP & Grant Funding	HIGH. Message boards will be paid for by the operating budget and will cost $30,000 apiece.	Ongoing
*New Bucket Truck – The current truck is 20 yrs. old and a replacement is needed for traffic lights and tree removal during emergency events.	Multi-Hazard	City-wide	Equipment Purchase	Community Services	CIP & Grant Funding	HIGH. The City acquired a new bucket truck in 2013, but it has experienced chronic problems with the lift mechanism. Additionally, it is unstable to reach higher levels to trim trees. As a result the City routinely hires contractors for tree services. Evaluate upgrade/replacement.	Ongoing
*New Wood Chipper – To provide additional resources to assist in clean up after an emergency event.	Multi-Hazard	City-wide	Equipment Purchase	Community Services	CIP & Grant Funding	HIGH. This equipment purchase will be funded through the Public Works heavy equipment budget and will have an estimated cost of $60,000.	1 - 2 years

*Oak Street Railroad Bridge Replacement –Current bridge is only a 6-ton limit and is a major access thruway for both Dover and Rollinsford.	Multi-Hazard	Oak Street RR Bridge	Structure & Infrastructure Project	Community Services	"Reserve Funding & Grant Funding	HIGH. Replace aging, sub-standard wood & iron bridge with new structure. In 2017, the City submitted this project to the NHDOT state aid bridge replacement program. This bridge lies on the boundary with Rollinsford. If approved for funding, unless a funding agreement was executed, under State Law Dover and Rollinsford would be expected to prorate construction costs on the basis of population. Waiting on official cost estimate from NHDOT, but expected to be in excess of $2.5M.	2 - 5 years
*Old Colony Drainage – Two or three home have major flooding during heavy rain events and winter melting. New drainage would resolve this problem.	Flooding	Old Colony	Structure & Infrastructure Project	Community Services	Debt Financed	HIGH. Project would include the installation of drainage on Old Colony Road to prevent homes from flooding. Project would include paving of the street. The estimated cost will be $75,000.	1 - 2 years
*Outer Sixth Street Replace Bridge & Culvert – Major overflows during heavy rain events. Replace bridge and raise the road. Provide additional access in and out of the North End area of the City.	Flooding	Outer Sixth Street	Structure & Infrastructure Project	Community Services	CIP & Grant Funding	HIGH. Public Works/Bridge Improvements estimate this project to cost $1,000,000 with design and maintenance. The City submitted a State Aide Application the NHDOT Bridge Program summer 2017. Waiting to receive an official cost estimate from NHDOT.	2 - 5 years
*Raise County Farm Road – Maintain access to the Strafford County Complex, which includes the rest home, court, hospice care and jail.	Flooding	County Farm Road	Structure & Infrastructure Project	Community Services	Debt Financed	HIGH. This project has not made the projected 5-year CIP. It may hinge on receiving State Aide assistance to replace the County Farm Bridge. Other projects have taken precedent.	2 - 5 years
*River Gauges – Would be installed on the bridges crossing the major rivers to assist emergency personnel during flooding events.	Flooding	Major rivers	Equipment Purchase & Construction	Community Services	CIP & Grant Funding	MEDIUM. This equipment purchase will be funded through the storm water budget and will cost an estimated $15,000 apiece.	1 - 2 years

*Sewer Jet – Equipment would replace the current 15-year-old unit.	Multi-Hazard	City-wide	Equipment Purchase	Community Services	CIP & Grant Funding	HIGH. This equipment purchase will be funded through the Public Works heavy equipment budget. An amount of $281,250 is included in the FY20 CIP.	2 - 2 years
*St. Thomas Street Drainage – Flooding occurs in this area due to the age of the infrastructure. Needs new design/reconstruction.	Flooding	St. Thomas Street	Structure & Infrastructure Project	Community Services	CIP & Grant Funding	HIGH. This project has an estimated cost of $1,800,000. It is not currently in the 5-year CIP due to other competing priorities.	2 - 5 years
*Tree Program – Using the City GPS and GIS program to identify all City trees. Also determine the health and potential hazards.	Multi-Hazard	City-wide	Equipment Purchase	Community Services	CIP & Grant Funding	HIGH This project will be funded through the operating budget in the CIP plan and will have an estimated cost of $20,000.	2 - 5 years
*Purchase generators –To power traffic lights at five critical intersections: Weeks Crossing, Central & Broadway, Central & Washington, NH9, and NH155. There is also consideration for: Glenwood & Central, Sixth and Whittier.	Multi-Hazard	Critical locations	Equipment Purchase	Community Services	Local & Grants	MEDIUM. The City bought two new generators for the traffic lights. The City is currently reviewing the potential for uninterruptable power supplies (UPS) as well as the acquisition and installation of additional backup generators. Portable generators with transfer switches installed might be $5,000 each.	Ongoing
*Central Falls Dam Project – investigate structural integrity of structure of retaining wall.	Flooding & Dam Breach	Cochecho River Headwall	Structure & Infrastructure Project & Prevention	Community Services & Planning	Debt Financed	HIGH. The City has included an estimated cost of $100,000 for design in the FY19 CIP and $1 million for construction in the FY20 CIP.	1 - 2 years
*Interconnection Study – Work off of the completed interconnection study to link municipality's water utilities together to provide emergency aid to each other and create a regional water system.	Multi-Hazard	City-wide	Local Planning	Community Services	Local & Grants	HIGH. Phase II of the interconnection project, which will construct a permanent connection with Somersworth, has an estimated cost of $1.3 million. The City qualified for 100% grant from the NH Groundwater Trust Fund. Design is currently underway.	Ongoing
*Deferred or ongoing actions from the 2013 Plan. Previous implementation notes were reaffirmed. Ongoing actions will be completed throughout the life of the plan.							

Chapter 8: Monitoring, Evaluation, and Updating the Plan

Introduction

A good mitigation plan must allow for updates where and when necessary, particularly since communities may suffer budget cuts or experience personnel turnover during both the planning and implementation states. A good plan will incorporate periodic monitoring and evaluation mechanisms to allow for review of successes and failures or even just simple updates.

Multi-Hazard Plan Monitoring, Evaluation, and Updates

To track programs and update the mitigation strategies identified through this process, the City will review the multi-hazard mitigation plan annually or after a hazard event. Additionally, the Plan will undergo a formal review and update at least every five years and obtain FEMA approval for this update or any other major changes done in the Plan at any time. The Emergency Management Director is responsible for initiating the review and will consult with members of the multi-hazard mitigation planning team identified in this plan. The public will be encouraged to participate in any updates and will be given the opportunity to be engaged and provide feedback through such means as periodic presentations on the plan at city functions, annual questionnaires or surveys, and posting on social media/interactive websites. Public announcements will be made through advertisements in local papers, postings on the City website, and posters disseminated throughout the City. A formal public meeting will be held before reviews and updates are official.

Changes will be made to the Plan to accommodate projects that have failed or are not considered feasible after a review for their consistency with STAPLEE, the timeframe, the community's priorities or funding resources. Priorities that were not ranked high, but identified as potential mitigation strategies, will be reviewed as well during the monitoring and update of the plan to determine feasibility of future implementation. In keeping with the process of adopting this multi-hazard mitigation plan, a public meeting to receive public comment on plan maintenance and updating will be held during the annual review period and before the final product is adopted by the City Council Chapter 9 contains a representation of a draft resolution for Dover to use once a conditional approval is received from FEMA.

Integration with Other Plans

Both the 2006 and 2013 plans were used during periodic updates to the Dover Master Plan. Input on impacts to roads and other critical infrastructure from hazards was included in relevant master plan sections. Both plans were also used during capital improvements planning updates and the C-RiSe vulnerability assessment.

This multi-hazard plan will only enhance mitigation if balanced with all other city plans. Dover will take the necessary steps to incorporate the mitigation strategies and other information contained in this plan with other city activities, plans and mechanisms, such as comprehensive land use planning, capital improvements planning, site plan regulations, and building codes to guide and control development in the City of Dover, when appropriate. The local government will refer to this Plan and the strategies identified when updating the City's Master Plan, Capital

Improvements Program, Zoning Ordinances and Regulations, and Local Emergency Action Plan. The City Council and the Hazard Mitigation Committee will work with City officials to incorporate elements of this Plan into other planning mechanisms, when appropriate. The Emergency Management Director along with other members of the Hazard Mitigation Committee will work with the Planning Board to suggest including information developed for the updated Hazard Mitigation Plan into appropriate City's Master Plan chapters. In addition, the City will review and make note of instances when this has been done and include it as part of their annual review of the Plan.

Chapter 9: Plan Adoption

Conditional Approval Letter from HSEM

Good afternoon!

The Department of Safety, Division of Homeland Security & Emergency Management (HSEM) has completed its review of the Dover, NH Hazard Mitigation Plan and found it approvable pending adoption. Congratulations on a job well done!

With this approval, the jurisdiction meets the local mitigation planning requirements under 44 CFR 201 pending HSEM's receipt of electronic copies of the adoption documentation and the final plan.

Acceptable electronic formats include Word or PDF files and must be submitted to us via email at HazardMitigationPlanning@dos.nh.gov. Upon HSEM's receipt of these documents, notification of formal approval will be issued, along with the final Checklist and Assessment.

The approved plan will be submitted to FEMA on the same day the community receives the formal approval notification from HSEM. FEMA will then issue a Letter of Formal Approval to HSEM for dissemination that will confirm the jurisdiction's eligibility to apply for mitigation grants administered by FEMA and identify related issues affecting eligibility, if any. If the plan is not adopted within one calendar year of HSEM's Approval Pending Adoption, the jurisdiction must update the entire plan and resubmit it for HSEM review. If you have questions or wish to discuss this determination further, please contact me at Kayla.Henderson@dos.nh.gov or 603-223-3650.

Thank you for submitting the Dover, NH Hazard Mitigation Plan and again, congratulations on your successful community planning efforts.

Sincerely,

Kayla J. Henderson
Hazard Mitigation Planning
NH Homeland Security and Emergency Management
33 Hazen Drive
Concord, NH 03301
NEW: 603-223-3650
603-223-3609 (fax)

Signed Certificate of Adoption

CITY OF DOVER

CITY OF DOVER - RESOLUTION

Agenda Item#: 13.B.2.

Resolution Number: **R – 2018.02.28 – 016**
Resolution Re: 2018 Multi Hazard Mitigation Plan Approval

WHEREAS: The City of Dover received funding from the NH Office of Homeland Security and Emergency Management fiscal year 2016 Pre-Disaster Mitigation (PDM) Grant Program and assistance from Strafford Regional Planning Commission in the preparation of the Dover, NH Multi- Hazard Mitigation Plan Update 2018; and

WHEREAS: Several public planning meetings were held between October 31, 2017 and December 27, 2017 regarding the development and review of the Dover, NH Multi-Hazard Mitigation Plan Update 2018; and

WHEREAS: The Dover, NH Multi-Hazard Mitigation Plan Update 2018 identifies several potential future projects to mitigate hazard damage in the City of Dover; and

WHEREAS: A duly noticed public meeting was held by the Dover City Council on February 21, 2018 to review the Dover, NH Multi-Hazard Mitigation Plan Update 2018.

NOW, THEREFORE, BE IT RESOLVED BY THE MAYOR AND DOVER CITY COUNCIL THAT:

The 2018 Update of the Dover, NH Multi-Hazard Mitigation Plan is hereby approved.

AUTHORIZATION

Approved as to Funding:	Daniel R. Lynch Finance Director	Sponsored by:	Mayor Karen Weston By request
Approved as to Legal Form and Compliance:	Anthony Blenkinsop General Legal Counsel		
Recorded by:	Karen Lavertu City Clerk		

CITY OF DOVER - RESOLUTION

Agenda Item#: 13.B.2.

CITY OF DOVER

Resolution Number: **R – 2018.02.28 – 016**
Resolution Re: 2018 Multi Hazard Mitigation Plan Approval

DOCUMENT HISTORY:

First Reading Date:	02/28/2018	Public Hearing Date:	N/A
Approved Date:	02/28/2018	Effective Date:	02/28/2018

DOCUMENT ACTIONS:

Deputy Mayor Carrier moved for its adoption; seconded by Councilor Thibodeaux.
Roll Call Vote: 9/0.

VOTING RECORD Date of Vote: 02/28/2018	YES	NO
Mayor Karen Weston	X	
Deputy Mayor Robert Carrier, At Large	X	
Councilor Michelle Muffett-Lipinski, Ward 1	X	
Councilor Dennis Ciotti, Ward 2	X	
Councilor Deborah Thibodeaux, Ward 3	X	
Councilor Marcia Gasses, Ward 4	X	
Councilor Dennis Shanahan, Ward 5	X	
Councilor Matthew Keane, Ward 6	X	
Councilor Lindsay Williams, At Large	X	
Total Votes:	9	0
Resolution does pass.		

RESOLUTION BACKGROUND MATERIAL:

The attached plan, which is updated every five years, is a planning document identifying specific hazards and approaches to be pursued for mitigating them. This current update to the plan has been approved by FEMA and requires City Council adoption. The community must have a Hazardous Mitigation Plan in order to apply for grants and to be able to seek reimbursement from FEMA. The City Council has reviewed, discussed and approves by passage of this resolution the 2018 Update to the Dover, NH Hazard Mitigation Plan. The vote to approve does not obligate any funds to be expended, it identifies potential needs and strategies to be pursued for planning purposes.

Final Approval Letter from FEMA

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

FEMA

APR 18 2018

Whitney Welch
State Hazard Mitigation Officer
NH Department of Safety
Homeland Security and Emergency Management
33 Hazen Drive
Concord, NH 03303

Dear Ms. Welch:

We would like to acknowledge the City of Dover and the State of New Hampshire for their dedication and commitment to mitigation planning.

As outlined in the FEMA-State Agreement for FEMA-DR-4316 your office has been delegated the authority to review and approve local mitigation plans under the Program Administration by States Pilot Program. On **March 30, 2018** our Agency was notified that your office completed its review of the Dover Hazard Mitigation Plan Update 2018 and determined it meets the requirements of 44 C.F.R. Pt. 201.

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

Approved mitigation plans are eligible for points under the National Flood Insurance Program's Community Rating System (CRS). Complete information regarding the CRS can be found at http://www.fema.gov/national-flood-insurance-program-community-rating-system, or through your local floodplain administrator.

The Dover Hazard Mitigation Plan Update 2018 must be reviewed, revised as appropriate, and resubmitted to New Hampshire Homeland Security and Emergency Management for approval within **five years of the plan approval date of March 30, 2018** in order to maintain eligibility for mitigation grant funding. We encourage the City to continually update the plan's assessment of vulnerability, adhere to its maintenance schedule, and implement, when possible, the mitigation actions proposed in the plan.

Once again, thank you for your continued dedication to public service demonstrated by preparing and adopting a strategy for reducing future disaster losses. Should you have any questions, please do not hesitate to contact Melissa Surette at (617) 956-7559.

Sincerely,

Paul F. Ford
Acting Regional Administrator

PFF: ms

cc: Fallon Reed, Chief of Planning, New Hampshire
Kayla Henderson, Hazard Mitigation Planner, New Hampshire
Jennifer Gilbert, New Hampshire State NFIP Coordinator

Appendices

Appendix A: Bibliography

Appendix B: Planning Process Documentation

Appendix C: Summary of Possible All-Hazard Mitigation Strategies

Appendix D: Technical and Financial Assistance for All-Hazard Mitigation
- Hazard Mitigation Grant Program (HMGP)
- Pre-Disaster Mitigation (PDM)
- Flood Mitigation Assistance (FMA)

Appendix E: Maps

Appendix A: Bibliography

Documents

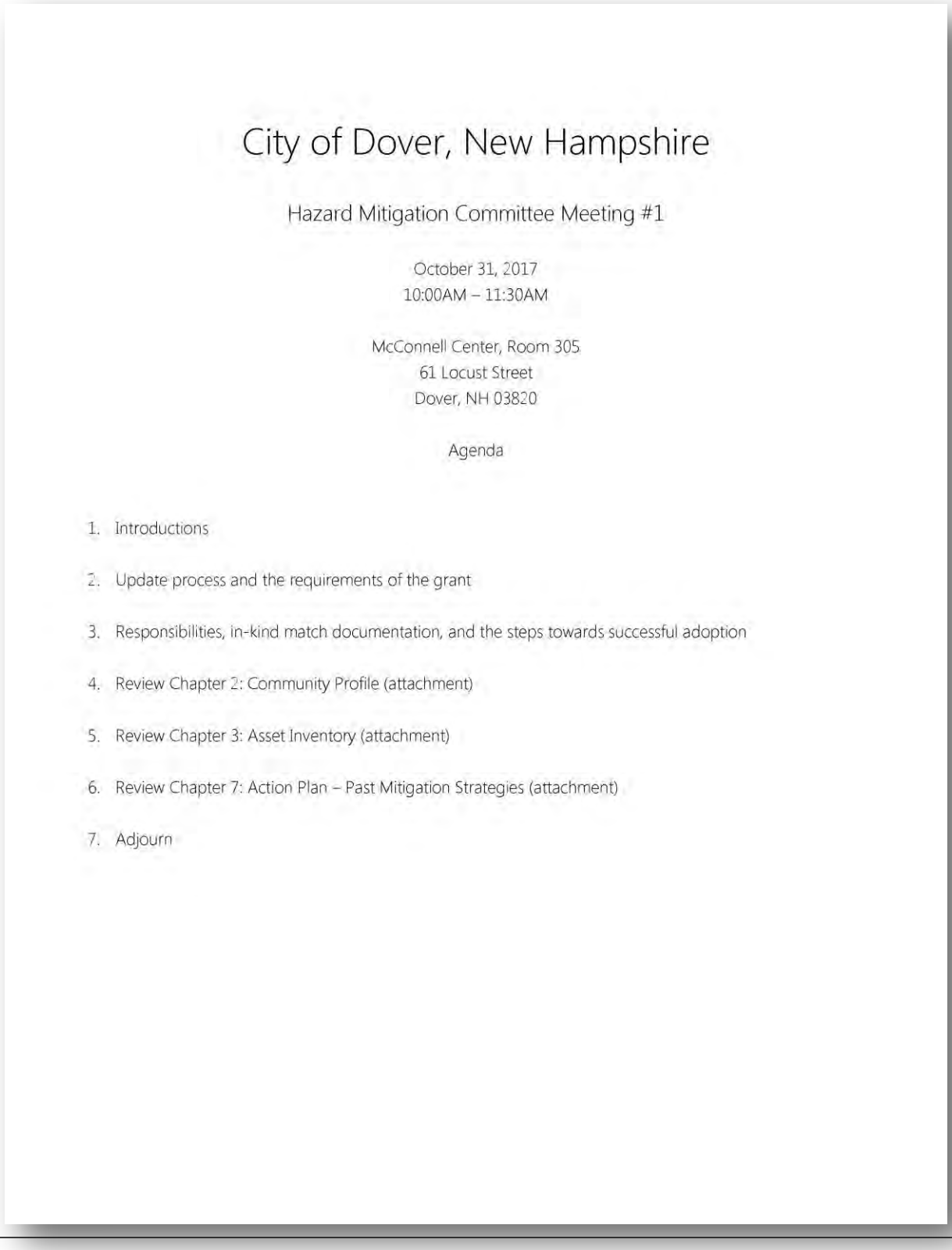
- Local Mitigation Plan Review Guide, FEMA, October 1, 2011
- Multi-Hazard Mitigation Plans
    - Town of Rollinsford, 2016
- State of New Hampshire Multi-Hazard Mitigation Plan (2013) - State Hazard Mitigation Goals
- Disaster Mitigation Act (DMA) of 2000, Section 101, b1 & b2 and Section 322a http://www.fema.gov/library/viewRecord.do?id=1935
- Economic & Labor Market Information Bureau, NH Employment Security, 2015; Census 2010 and Revenue Information
- NCDC [National Climatic Data Center, National Oceanic and Atmospheric Administration]. 2017. Storm Events

Photos

- Richard Driscoll, (former) Assistant Fire Chief, Dover Fire & Rescue
- Kyle Pimental, Principal Regional Planner, Strafford Regional Planning Commission

Appendix B: Planning Process Documentation

Agendas



City of Dover, New Hampshire

Hazard Mitigation Committee Meeting #1

October 31, 2017
10:00AM – 11:30AM

McConnell Center, Room 305
61 Locust Street
Dover, NH 03820

Agenda

1. Introductions
2. Update process and the requirements of the grant
3. Responsibilities, in-kind match documentation, and the steps towards successful adoption
4. Review Chapter 2: Community Profile (attachment)
5. Review Chapter 3: Asset Inventory (attachment)
6. Review Chapter 7: Action Plan – Past Mitigation Strategies (attachment)
7. Adjourn

City of Dover, New Hampshire

Hazard Mitigation Committee Meeting #2

November 14, 2017
10:00AM – 11:30AM

McConnell Center, Room 305
61 Locust Street
Dover, NH 03820

Agenda

1. Introductions

2. Old Business
   a. Review Meeting Notes (*Meeting_Notes_103117.docx*)
   b. Review To Do Lis (*To_Do_List_103117.docx*)

3. New Business
   a. Review Chapter 5: Floodplain Management (*Chapter5_Floodplain_Management.docx*)
   b. Review Chapter 6: Hazard Descriptions (*Chapter6_Hazard_Descriptions.docx*)
   c. Review Chapter 6: Hazard Vulnerability Ranking (*Chapter6_Hazard_Vulnerability_Ranking.docx*)

4. Next meeting date

5. Adjourn

City of Dover, New Hampshire

Hazard Mitigation Committee Meeting #3

December 12, 2017
10:00AM – 11:30AM

McConnell Center, Room 305
61 Locust Street
Dover, NH 03820

Agenda

1. Introductions

2. Old Business
    a. Review Meeting Notes (*Meeting_Notes_111417.docx*)
    b. Review To Do Lis (*To_Do_List_111417.docx*)

3. New Business
    a. Review Chapter 6: Hazard Vulnerability Ranking (*Chapter6_Hazard_Vulnerability_Ranking.pdf*)
    b. Review Table 21: Existing Programs and Policies (*Existing_Strategies.docx*)
    c. Brainstorm new actions and fill in Table 22: Future Mitigation Actions (*Mitigation_Actions.xls*)

4. Steps to adoption

5. Final meeting date

6. Adjourn

City of Dover, New Hampshire

Hazard Mitigation Committee Meeting #4

December 27, 2017
10:00AM – 12:00PM

McConnell Center, Room 305
61 Locust Street
Dover, NH 03820

Agenda

1. Introductions

2. Old Business
    a. Review Meeting Notes (*Meeting_Notes_121217.docx*)

3. New Business
    a. Brainstorm new actions and fill in Table 22: Future Mitigation Actions (*Mitigation_Actions.xls*)
    b. Go through STAPLEE Method to rank each action (*STAPLEE_Method.docx*)
    c. Review GIS maps (not available at this time – will be brought to meeting)

4. Next steps

5. Adjourn

Sign-In Sheets

City of Dover, New Hampshire

Hazard Mitigation Meeting #1

October 31, 2017
10:00AM – 12:00PM

McConnell Center, Room 305
Dover, NH 03820

ATTENDANCE SHEET

Name	Position Title/ Department Affiliation	E-mail	Time spent reviewing materials
Jim MAKFIELD	Bldg OFFICIAL INSPECTION SERVICES / DFR	j.MAKFIELD@Dover.NH.gov	—
Kathleen Meyers	Asset Management Admin / IT	k.meyers@dover.nhgov	—
LENA NICHOLS	DIRECTOR - WELFARE	l.nichols@dover.nh.gov	—
DAN BARUFALDI	DIRECTOR-Economic Development	d.barufaldi@dover.nh.gov	.25
Susan Daudelin	Director of Human Resources / Executive	s.daudelin@dover.nh.gov	—
Anthony Colarusso	police chief	a.colarusso@dover.nh.gov	.20
Cathy Beaudoin	Library Director	c.beaudoin@dover.nh.gov	—
Mike Gillis	Media Services Manager	m.gillis@dover.nh.gov	—
John Stoter	Community Services Director	j.stoter@dover.nh.gov	.25
Gary Bannon	Emergency Shelter Manager Recreation Director	g.bannon@dover.nh.gov	.50
ERIC HAGMAN	FIRE CHIEF / E.M.D.	e.hagman@dover.nh.gov	.50
Dave White	City Engineer / Community Services	d.white@dover.nh.gov	.5
Christopher Parker	Asst. City Mgr. / Planning	c.parker@dover.nh.gov	.50

City of Dover, New Hampshire

Hazard Mitigation Meeting #2

November 14, 2017
10:00AM – 12:00PM

McConnell Center, Room 305
Dover, NH 03820

ATTENDANCE SHEET

Name	Position Title/ Department Affiliation	E-mail	Time spent reviewing materials
John B. Storer	Community Services		0.5 hrs
Gary Bannon	Recreation		.5
ERIC HAGMAN	FIRE/Rescue		.75
Cathy Beaudoin	Library Director		.5
Mike Gillis	Media Services Manager		.5
DAN BARNFALDI	ECONOMIC DEVELOPMENT		0.5hrs
Kathleen Meyers	IT - Asset Manage.		1hr.
Jim MAXFIELD	Building Official / Fire Rescue		1½ hr
Tony COLARUSSO	Police Chief		.5
Chris Parker	Planning		1 hr

City of Dover, New Hampshire

Hazard Mitigation Meeting #3

December 12, 2017
10:00AM – 12:00PM

McConnell Center, Room 305
Dover, NH 03820

ATTENDANCE SHEET

Name	Position Title/ Department Affiliation	E-mail	Time spent reviewing materials
Kathleen Meyers	Asset Management Admin. IT	K.meyers@dover.nh.gov	.25
Tony Colarusso	Police Chief	a.Colarusso@dover.nh.gov	1 hour
ERIC HAGMAN	Fire Chief/EMD	e.hagman@dover.nh.gov	2 hours
Cathy Beaudoin	Library Director	c.beaudoin@dover.nh.gov	1 hr.
Christopher Parker	Asst. CM	c.parker@dover.nh.gov	1 hr
John Stover	Public Works Director	j.stover@dover.nh.gov	2 hrs
LISA C NICHOLS	DOVER WELFARE	l.nichols@dover.nh.gov	1 hr

City of Dover, New Hampshire

Hazard Mitigation Meeting #4

December 27, 2017
10:00AM – 12:00PM

McConnell Center, Room 305
Dover, NH 03820

ATTENDANCE SHEET

Name	Position Title/ Department Affiliation	E-mail	Time spent reviewing materials
Dave White	City Eng	d.white@dover.nh.gov	.25
Tony Colarusso	police chief	a.colarusso@dover.nh.gov	.30
Cathy Beaudoin	Library Director	c.beaudoin@dover.nh.gov	.30
Christopher Parker	Asst. City Mngr	c.parker@dover.nh.gov	.5
LENA NICHOLS	WELFARE DIRECTOR	l.nichols@dover.nh.gov	.5
Mike Gillis	Media Services Manager	M.gillis@dover.nh.gov	.5
ERIC Hagman	Fire Chief	e.hagman@dover.nh.gov	.5

Appendix C: Summary of Possible All-Hazard Mitigation Strategies

I. RIVERINE MITIGATION

A. Prevention

Prevention measures are intended to keep the problem from occurring in the first place, and/or keep it from getting worse. Future development should not increase flood damage. Building, zoning, planning, and/or code enforcement personnel usually administer preventative measures.

1. Planning and Zoning[40] - Land use plans are put in place to guide future development, recommending where - and where not - development should occur and where it should not. Sensitive and vulnerable lands can be designated for uses that would not be incompatible with occasional flood events - such as parks or wildlife refugees. A Capital Improvements Program (CIP) can recommend the setting aside of funds for public acquisition of these designated lands. The zoning ordinance can regulate development in these sensitive areas by limiting or preventing some or all development - for example, by designating floodplain overlay, conservation, or agricultural districts.

2. Open Space Preservation - Preserving open space is the best way to prevent flooding and flood damage. Open space preservation should not, however, be limited to the floodplain, since other areas within the watershed may contribute to controlling the runoff that exacerbates flooding. Land Use and Capital Improvement Plans should identify areas to be preserved by acquisition and other means, such as purchasing easements. Aside from outright purchase, open space can also be protected through maintenance agreements with the landowners, or by requiring developers to dedicate land for flood flow, drainage and storage.

3. Floodplain Development Regulations - Floodplain development regulations typically do not prohibit development in the special flood hazard area, but they do impose construction standards on what is built there. The intent is to protect roads and structures from flood damage and to prevent the development from aggravating the flood potential. Floodplain development regulations are generally incorporated into subdivision regulations, building codes, and floodplain ordinances.
    a. Subdivision Regulations: These regulations govern how land will be divided into separate lots or sites. They should require that any flood hazard areas be shown on the plat, and that every lot has a buildable area that is above the base flood elevation.
    b. Building Codes: Standards can be incorporated into building codes that address flood proofing for all new and improved or repaired buildings.
    c. Floodplain Ordinances: Communities that participate in the National Flood Insurance Program are required to adopt the minimum floodplain management regulations, as developed by FEMA. The regulations set minimum standards for subdivision regulations and building codes. Communities may adopt more stringent standards than those set forth by FEMA.

[40] All zoning should be carefully reviewed on a consistent basis by municipal officials to make sure guidelines are up-to-date and towns are acting in accordance with best management practices.

4. Stormwater Management - Development outside of a floodplain can contribute significantly to flooding by covering impervious surfaces, which increases storm water runoff. Storm water management is usually addressed in subdivision regulations. Developers are typically required to build retention or detention basins to minimize any increase in runoff caused by new or expanded impervious surfaces, or new drainage systems. Generally, there is a prohibition against storm water leaving the site at a rate higher than it did before the development. One technique is to use wet basins as part of the landscaping plan of a development. It might even be possible to site these basins based on a watershed analysis. Since detention only controls the runoff rates and not volumes, other measures must be employed for storm water infiltration - for example, swales, infiltration trenches, vegetative filter strips, and permeable paving blocks.

5. Drainage System Maintenance - Ongoing maintenance of channel and detention basins is necessary if these facilities are to function effectively and efficiently over time. A maintenance program should include regulations that prevent dumping in or altering water courses or storage basins; regrading and filling should also be regulated. Any maintenance program should include a public education component, so that the public becomes aware of the reasons for the regulations. Many people do not realize the consequences of filling in a ditch or wetland, or regrading.

B. Property Protection

Property protection measures are used to modify buildings subject to flood damage, rather than to keep floodwaters away. These may be less expensive to implement, as they are often carried out on a cost-sharing basis. In addition, many of these measures do not affect a building's appearance or use, which makes them particularly suitable for historical sites and landmarks.

1. Relocation - Moving structures out of the floodplain is the surest and safest way to protect against damage. Relocation is expensive, however, so this approach will probably not be used except in extreme circumstances. Communities that have areas subject to severe storm surges, ice jams, etc. might want to consider establishing a relocation program, incorporating available assistance.

2. Acquisition - Acquisition by a governmental entity of land in a floodplain serves two main purposes: 1) it ensures that the problem of structures in the floodplain will be addressed; and 2) it has the potential to convert problem areas into community assets, with accompanying environmental benefits. Acquisition is more cost effective than relocation in those areas that are subject to storm surges, ice jams, or flash flooding. Acquisition, followed by demolition, is the most appropriate strategy for those buildings that are simply too expensive to move, as well as for dilapidated structures that are not worth saving or protecting. Acquisition and subsequent relocation can be expensive, however, there are government grants and loans that can be applied toward such efforts.

3. Building Elevation - Elevating a building above the base flood elevation is the best on-site protection strategy. The building could be raised to allow water to run underneath it, or fill could be brought in to elevate the site on which the building sits. This approach is cheaper than relocation, and tends to be less disruptive to a

neighborhood. Elevation is required by law for new and substantially improved residences in a floodplain, and is commonly practiced in flood hazard areas nationwide.

4. Floodproofing - If a building cannot be relocated or elevated, it may be floodproofed. This approach works well in areas of low flood threat. Floodproofing can be accomplished through barriers to flooding, or by treatment to the structure itself.
    a. Barriers: Levees, floodwalls and berms can keep floodwaters from reaching a building. These are useful, however, only in areas subject to shallow flooding.
    b. Dry Floodproofing: This method seals a building against the water by coating the walls with waterproofing compounds or plastic sheeting. Openings, such as doors, windows, etc. are closed either permanently with removable shields or with sandbags.
    c. Wet Floodproofing: This technique is usually considered a last resort measure, since water is intentionally allowed into the building in order to minimize pressure on the structure. Approaches range from moving valuable items to higher floors to rebuilding the floodable area. An advantage over other approaches is that simply by moving household goods out of the range of floodwaters, thousands of dollars can be saved in damages.

5. Sewer Backup Protection - Storm water overloads can cause backup into basements through sanitary sewer lines. Houses that have any kind of connection to a sanitary sewer system - whether it is downspouts, footing drain tile, and/or sump pumps, can be flooded during a heavy rain event. To prevent this, there should be no such connections to the system, and all rain and ground water should be directed onto the ground, away from the building. Other protections include:
    a. Floor drain plugs and floor drain standpipe, which keep water from flowing out of the lowest opening in the house.
    b. Overhead sewer - keeps water in the sewer line during a backup.
    c. Backup valve - allows sewage to flow out while preventing backups from flowing into the house.

6. Insurance - Above and beyond standard homeowner insurance, there is other coverage a homeowner can purchase to protect against flood hazard. Two of the most common are National Flood Insurance and basement backup insurance.
    a. *National Flood Insurance:* When a community participates in the National Flood Insurance Program, any local insurance agent is able to sell separate flood insurance policies under rules and rates set by FEMA. Rates do not change after claims are paid because they are set on a national basis.
    b. *Basement Backup Insurance:* National Flood Insurance offers an additional deductible for seepage and sewer backup, provided there is a general condition of flooding in the area that was the proximate cause of the basement getting wet. Most exclude damage from surface flooding that would be covered by the NFIP.

C. Natural Resource Protection

Preserving or restoring natural areas or the natural functions of floodplain and watershed areas provide the benefits of eliminating or minimizing losses from floods, as well as improving water quality and wildlife habitats. Parks, recreation, or conservation agencies usually implement such activities. Protection can also be provided through various zoning measures that are specifically designed to protect natural resources.

1. Wetlands Protection - Wetlands are capable of storing large amounts of floodwaters, slowing and reducing downstream flows, and filtering the water. Any development that is proposed in a wetland is regulated by either federal and/or state agencies. Depending on the location, the project might fall under the jurisdiction of the U.S. Army Corps of Engineers, which in turn, calls upon several other agencies to review the proposal. In New Hampshire, the N.H. Wetlands Board must approve any project that impacts a wetland. Many communities in New Hampshire also have local wetland ordinances.

   Generally, the goal is to protect wetlands by preventing development that would adversely affect them. Mitigation techniques are often employed, which might consist of creating a wetland on another site to replace what would be lost through the development. This is not an ideal practice since it takes many years for a new wetland to achieve the same level of quality as an existing one, if it can at all.

2. Erosion and Sedimentation Control - Controlling erosion and sediment runoff during construction and on farmland is important, since eroding soil will typically end up in downstream waterways. Because sediment tends to settle where the water flow is slower, it will gradually fill in channels and lakes, reducing their ability to carry or store floodwaters.

3. Best Management Practices - Best Management Practices (BMPs) are measures that reduce non-point source pollutants that enter waterways. Non-point source pollutants are carried by storm water to waterways, and include such things as lawn fertilizers, pesticides, farm chemicals, and oils from street surfaces and industrial sites. BMPs can be incorporated into many aspects of new developments and ongoing land use practices. In New Hampshire, the Department of Environmental Services has developed Best Management Practices for a range of activities, from farming to earth excavations.

D. Emergency Services

Emergency services protect people during and after a flood. Many communities in New Hampshire have emergency management programs in place, administered by an emergency management director (very often the local police or fire chief).

1. Flood Warning - On large rivers, the National Weather Service handles early recognition. Communities on smaller rivers must develop their own warning systems. Warnings may be disseminated in a variety of ways, such as sirens, radio, television, mobile public address systems, or door-to-door contact. It seems that multiple or redundant systems are the most effective, giving people more than one opportunity to be warned.

2. Flood Response - Flood response refers to actions that are designed to prevent or reduce damage or injury, once a flood threat is recognized. Such actions and the appropriate parties include:
    a. Activating the emergency operations center (emergency director)
    b. Sandbagging designated areas (Highway Department)
    c. Closing streets and bridges (police department)
    d. Shutting off power to threatened areas (public service)
    e. Releasing children from school (school district)
    f. Ordering an evacuation (Board of Selectmen/emergency director)
    g. Opening evacuation shelters (churches, schools, Red Cross, municipal facilities)

These actions should be part of a flood response plan, which should be developed in coordination with the persons and agencies that share the responsibilities. Drills and exercises should be conducted so that the key participants know what they are supposed to do.

3. Critical Facilities Protection - Protecting critical facilities is vital, since expending efforts on these facilities can draw workers and resources away from protecting other parts of the City. Critical facilities fall into two categories:
    a. Buildings or locations vital to the flood response effort:
        i. Emergency operations centers
        ii. Police and fire stations
        iii. Highway garages
        iv. Selected roads and bridges
        v. Evacuation routes
    b. Buildings or locations that, if flooded, would create disasters:
        i. Hazardous materials facilities
        ii. Schools

All such facilities should have their own flood response plan that is coordinated with the community's plan. Schools will typically be required by the state to have emergency response plans in place.

4. Health and Safety Maintenance - The flood response plan should identify appropriate measures to prevent danger to health and safety. Such measures include:
    a. Patrolling evacuated areas to prevent looting
    b. Vaccinating residents for tetanus
    c. Clearing streets
    d. Cleaning up debris

The Plan should also identify which agencies will be responsible for carrying out the identified measures. A public information program can be helpful to educate residents on the benefits of taking health and safety precautions.

E. Structural Projects

Structural projects are used to prevent floodwaters from reaching properties. These are all man-made structures, and can be grouped into the six types discussed below. The shortcomings of structural approaches are:

- Can be very expensive
- Disturb the land, disrupt natural water flows, & destroy natural habitats.
- Are built to an anticipated flood event, and may be exceeded by a greater-than expected flood
- Can create a false sense of security.

1. Diversions - A diversion is simply a new channel that sends floodwater to a different location, thereby reducing flooding along an existing watercourse. Diversions can be surface channels, overflow weirs, or tunnels. During normal flows, the water stays in the old channel. During flood flows, the stream spills over the diversion channel or tunnel, which carries the excess water to the receiving lake or river. Diversions are limited by topography; they won't work everywhere. Unless the receiving water body is relatively close to the flood prone stream and the land in between is low and vacant, the cost of creating a diversion can be prohibitive. Where topography and land use are not favorable, a more expensive tunnel is needed. In either case, care must be taken to ensure that the diversion does not create a flooding problem somewhere else.

2. Levees/Floodwalls - Probably the best known structural flood control measure is either a levee (a barrier of earth) or a floodwall made of steel or concrete erected between the watercourse and the land. If space is a consideration, floodwalls are typically used, since levees need more space. Levees and floodwalls should be set back out of the floodway, so that they will not divert floodwater onto other properties.

3. Reservoirs - Reservoirs control flooding by holding water behind dams or in storage basins. After a flood peaks, water is released or pumped out slowly at a rate the river downstream can handle. Reservoirs are suitable for protecting existing development, and they may be the only flood control measure that can protect development close to a watercourse. They are most efficient in deeper valleys or on smaller rivers where there is less water to store. Reservoirs might consist of man-made holes dug to hold the approximate amount of floodwaters, or even abandoned quarries. As with other structural projects, reservoirs:
    a. are expensive
    b. occupy a lot of land
    c. require periodic maintenance
    d. may fail to prevent damage from floods that exceed their design levels
    e. may eliminate the natural and beneficial functions of the floodplain.

4. Channel Modifications - Channel modifications include making a channel wider, deeper, smoother, or straighter. These techniques will result in more water being carried away, but, as with other techniques mentioned, it is important to ensure that the modifications do not create or increase a flooding problem downstream.

5. Dredging: Dredging is often cost-prohibitive because the dredged material must be disposed of in another location; the stream will usually fill back in with sediment. Dredging is usually undertaken only on larger rivers, and then only to maintain a navigation channel.

6. Drainage Modifications: These include man-made ditches and storm sewers that help drain areas where the surface drainage system is inadequate or where underground drainage ways may be safer or more attractive. These approaches are usually designed to carry the runoff from smaller, more frequent storms.

7. Storm Sewers - Mitigation techniques for storm sewers include installing new sewers, enlarging small pipes, street improvements, and preventing back flow. Because drainage ditches and storm sewers convey water faster to other locations, improvements are only recommended for small local problems where the receiving body of water can absorb the increased flows without increased flooding. In many developments, streets are used as part of the drainage system, to carry or hold water from larger, less frequent storms. The streets collect runoff and convey it to a receiving sewer, ditch, or stream. Allowing water to stand in the streets and then draining it slowly can be a more effective and less expensive measure than enlarging sewers and ditches.

F. Public Information

Public information activities are intended to advise property owners, potential property owners, and visitors about the particular hazards associated with a property, ways to protect people and property from these hazards, and the natural and beneficial functions of a floodplain.

1. Map Information - Flood maps developed by FEMA outline the boundaries of the flood hazard areas. These maps can be used by anyone interested in a particular property to determine if it is flood-prone. These maps are available from FEMA, the NH Homeland Security and Emergency Management (HSEM), the NH Office of Energy and Planning (OEP), or your regional planning commission.

2. Outreach Projects - Outreach projects are proactive; they give the public information even if they have not asked for it. Outreach projects are designed to encourage people to seek out more information and take steps to protect themselves and their properties. Examples of outreach activities include:
    a. Presentations at meetings of neighborhood groups
    b. Mass mailings or newsletters to all residents
    c. Notices directed to floodplain residents
    d. Displays in public buildings, malls, etc.
    e. Newspaper articles and special sections
    f. Radio and TV news releases and interview shows
    g. A local flood proofing video for cable TV programs and to loan to organizations
    h. A detailed property owner handbook tailored for local conditions. Research has shown that outreach programs work, although awareness is not enough. People need to know what they can do about the hazards, so projects should include information on protection measures. Research also shows that locally designed and run programs are much more effective than national advertising.

3. Real Estate Disclosure - Disclosure of information regarding flood-prone properties is important if potential buyers are to be in a position to mitigate damage. Federally regulated lending institutions are required to advise applicants that a property is in the floodplain. However, this requirement needs to be met only five days prior to closing, and by that time, the applicant is typically committed to the purchase. State laws and local real estate practice can help by making this information available to prospective buyers early in the process.

4. Library - Your local library can serve as a repository for pertinent information on flooding and flood protection. Some libraries also maintain their own public information campaigns, augmenting the activities of the various governmental agencies involved in flood mitigation.

5. Technical Assistance - Certain types of technical assistance are available from the NFIP Coordinator, FEMA, and the Natural Resources Conservation District. Community officials can also set up a service delivery program to provide one-on-one sessions with property owners. An example of technical assistance is the *flood audit*, in which a specialist visits a property. Following the visit, the owner is provided with a written report detailing the past and potential flood depths and recommending alternative protection measures.

6. Environmental Education - Education can be a great mitigating tool if people can learn what not to do before damage occurs. The sooner the education begins the better. Environmental education programs for children can be taught in the schools, park and recreation departments, conservation associations, or youth organizations. An activity can be as involved as course curriculum development or as simple as an explanatory sign near a river. Education programs do not have to be limited to children. Adults can benefit from knowledge of flooding and mitigation measures; decision makers, armed with this knowledge, can make a difference in their communities

.

II. EARTHQUAKES

A. Preventive

1. Planning/zoning to keep critical facilities away from fault lines
2. Planning, zoning and building codes to avoid areas below steep slopes or soils subject to liquefaction
3. Building codes to prohibit loose masonry overhangs, etc.

B. Property Protection

1. Acquire and clear hazard areas
2. Retrofitting to add braces, remove overhangs
3. Apply Mylar to windows and glass surfaces to protect from shattering glass
4. Tie down major appliances, provide flexible utility connections
5. Earthquake insurance riders

C. Emergency Services

1. Earthquake response plans to account for secondary problems, such as fires and hazardous material spills

D. Structural Projects

1. Slope stabilization

III. DAM FAILURE

A. Preventive

1. Dam failure inundation maps
2. Planning/zoning/open space preservation to keep area clear
3. Building codes with flood elevation based on dam failure
4. Dam safety inspections
5. Draining the reservoir when conditions appear unsafe

B. Property Protection

1. Acquisition of buildings in the path of a dam breach flood
2. Flood insurance

C. Emergency Services

1. Dam condition monitoring
2. Warning and evacuation plans based on dam failure

D. Structural Projects

1. Dam improvements, spillway enlargements
2. Remove unsafe dams

IV. WILDFIRES

A. Preventive

1. Zoning districts to reflect fire risk zones
2. Planning and zoning to restrict development in areas near fire protection and water resources
3. Requiring new subdivisions to space buildings, provide firebreaks, on-site water storage, wide roads, multiple accesses
4. Building code standards for roof materials and spark arrestors
5. Maintenance programs to clear dead and dry brush, trees
6. Regulation on open fires

B. Property Protection

1. Retrofitting of roofs and adding spark arrestors
2. Landscaping to keep bushes and trees away from structures
3. Insurance rates based on distance from fire protection

C. Natural Resource Protection

1. Prohibit development in high-risk areas

D. Emergency Services

1. Fire Fighting

V. WINTER STORMS

A. Prevention

1. Building code standards for light frame construction, especially for wind-resistant roofs

B. Property Protection

1. Storm shutters and windows
2. Hurricane straps on roofs and overhangs
3. Seal outside and inside of storm windows and check seals in spring and fall
4. Family and/or company severe weather action plan & drills:
    a. include a NOAA Weather Radio
    b. designate a shelter area or location
    c. keep a disaster supply kit, including stored food and water
    d. keep snow removal equipment in good repair; have extra shovels, sand, rock, salt and gas
    e. know how to turn off water, gas, and electricity at home or work

C. Natural Resource Protection

1. Maintenance program for trimming trees and shrubs

D. Emergency Services

1. Early warning systems/NOAA Weather Radio
2. Evacuation plans

Appendix D: Technical & Financial Assistance for All-Hazard Mitigation

FEMA's Hazard Mitigation Assistance (HMA) grant programs provide funding for eligible mitigation activities that reduce disaster losses and protect life and property from future disaster damages. Currently, FEMA administers the following HMA grant programs[41]:

- Hazard Mitigation Grant Program (HMGP)
- Pre-Disaster Mitigation (PDM)
- Flood Mitigation Assistance (FMA)

FEMA's HMA grants are provided to eligible Applicants (States/Tribes/Territories) that, in turn, provide sub-grants to local governments and communities. The Applicant selects and prioritizes subapplications developed and submitted to them by subapplicants. These subapplications are submitted to FEMA for consideration of funding. Prospective subapplicants should consult the office designated as their Applicant for further information regarding specific program and application requirements. Contact information for the FEMA Regional Offices and State Hazard Mitigation Officers is available on the FEMA website, www.fema.gov.

HMA Grant Programs

The HMA grant programs provide funding opportunities for pre- and post-disaster mitigation. While the statutory origins of the programs differ, all share the common goal of reducing the risk of loss of life and property due to Natural Hazards. Brief descriptions of the HMA grant programs can be found below. For more information on the individual programs, or to see information related to a specific Fiscal Year, please click on one of the program links.

A. Hazard Mitigation Grant Program (HMGP)

HMGP assists in implementing long-term hazard mitigation measures following Presidential disaster declarations. Funding is available to implement projects in accordance with State, Tribal, and local priorities.

What is the Hazard Mitigation Grant Program?

The Hazard Mitigation Grant Program (HMGP) provides grants to States and local governments to implement long-term hazard mitigation measures after a major disaster declaration. Authorized under Section 404 of the Stafford Act and administered by FEMA, HMGP was created to reduce the loss of life and property due to natural disasters. The program enables mitigation measures to be implemented during the immediate recovery from a disaster.

Who is eligible to apply?

Hazard Mitigation Grant Program funding is only available to applicants that reside within a presidentially declared disaster area. Eligible applicants are:

- State and local governments
- Indian tribes or other tribal organizations

[41] Information in Appendix E is taken from the following website and links to specific programs unless otherwise noted; http://www.fema.gov/government/grant/hma/index.shtm

- Certain non-profit organizations

Individual homeowners and businesses may not apply directly to the program; however a community may apply on their behalf.

How are potential projects selected and identified?

The State's administrative plan governs how projects are selected for funding. However, proposed projects must meet certain minimum criteria. These criteria are designed to ensure that the most cost-effective and appropriate projects are selected for funding. Both the law and the regulations require that the projects are part of an overall mitigation strategy for the disaster area.

The State prioritizes and selects project applications developed and submitted by local jurisdictions. The State forwards applications consistent with State mitigation planning objectives to FEMA for eligibility review. Funding for this grant program is limited and States and local communities must make difficult decisions as to the most effective use of grant funds.

For more information on the **Hazard Mitigation Grant Program (HMGP),** go to:
http://www.fema.gov/government/grant/hmgp/index.shtm

B. Pre-Disaster Mitigation (PDM)

PDM provides funds on an annual basis for hazard mitigation planning and the implementation of mitigation projects prior to a disaster. The goal of the PDM program is to reduce overall risk to the population and structures, while at the same time, also reducing reliance on Federal funding from actual disaster declarations.

Program Overview

The Pre-Disaster Mitigation (PDM) program provides funds to states, territories, Indian tribal governments, communities, and universities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event.

Funding these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations. PDM grants are to be awarded on a competitive basis and without reference to state allocations, quotas, or other formula-based allocation of funds.

C. Flood Mitigation Assistance (FMA)

FMA provides funds on an annual basis so that measures can be taken to reduce or eliminate risk of flood damage to buildings insured under the National Flood Insurance Program.

Program Overview

The FMA program was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP).

FEMA provides FMA funds to assist States and communities implement measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the National Flood Insurance Program.

Types of FMA Grants

Three types of FMA grants are available to States and communities:

- Planning Grants to prepare Flood Mitigation Plans. Only NFIP-participating communities with approved Flood Mitigation Plans can apply for FMA Project grants
- Project Grants to implement measures to reduce flood losses, such as elevation, acquisition, or relocation of NFIP-insured structures. States are encouraged to prioritize FMA funds for applications that include repetitive loss properties; these include structures with 2 or more losses each with a claim of at least $1,000 within any ten-year period since 1978.
- Technical Assistance Grants for the State to help administer the FMA program and activities. Up to ten percent (10%) of Project grants may be awarded to States for Technical Assistance Grants

Appendix E: Maps

Maps

- Emergency Response Facilities
- Non-Emergency Response Facilities
- Critical Facilities
- Vulnerable Populations to Protect
- Water Resources

Emergency Response Facilities & Past and Potential Hazards

2018
Hazard Mitigation Plan

DOVER, NH

Emergency Response Facilities Legend

Facility Type

- Administrative (Information Technology)
- Back-Up Emergency Shelter
- Back-up Emergency Operations Center
- Emergency Fuel
- Emergency Fuel (diesel only)
- Emergency Medical Evacuation
- Fire
- Medical Facility
- Primary Back-Up Emergency Shelter
- Primary Emergency Operations Center
- Primary Emergency Shelter
- Radioactive Reception Center
- Evacuation Routes

Past and Potential Hazards

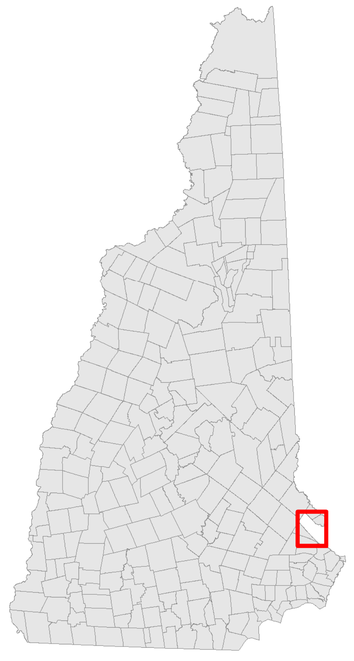
- Past Flooding
- Dam Inundation Areas
- FEMA 100-year Floodplain
- Extent of Sea-Level Rise of 1.7' with Storm Surge
- Extent of Sea-Level Rise of 4.0' with Storm Surge
- Extent of Sea-Level Rise of 6.3' with Storm Surge

Base Features

- Municipal Boundary
- Rivers, Brooks, Streams
- Lakes and Ponds

Roads [NHDOT, 2017]

- State
- Local
- Private



Grid North
NH State Plane Coordinates
NAD 1983 (feet)

0 0.75 1.5 3 Miles

Prepared by: Strafford Regional Planning Commission
150 Wakefield St, Suite 12, Rochester, NH 03867
T: (603) 994-3500 F: (603) 994-3504 Em: srpc@strafford.org
Emergency Response Facilities & Past and Potential Hazards
Date: December 2017
Path: M:\Region\OEM_haz_mit\2017_2018_Updates\Dover\Maps\Final_Maps\ERF_Final

DATA SOURCES

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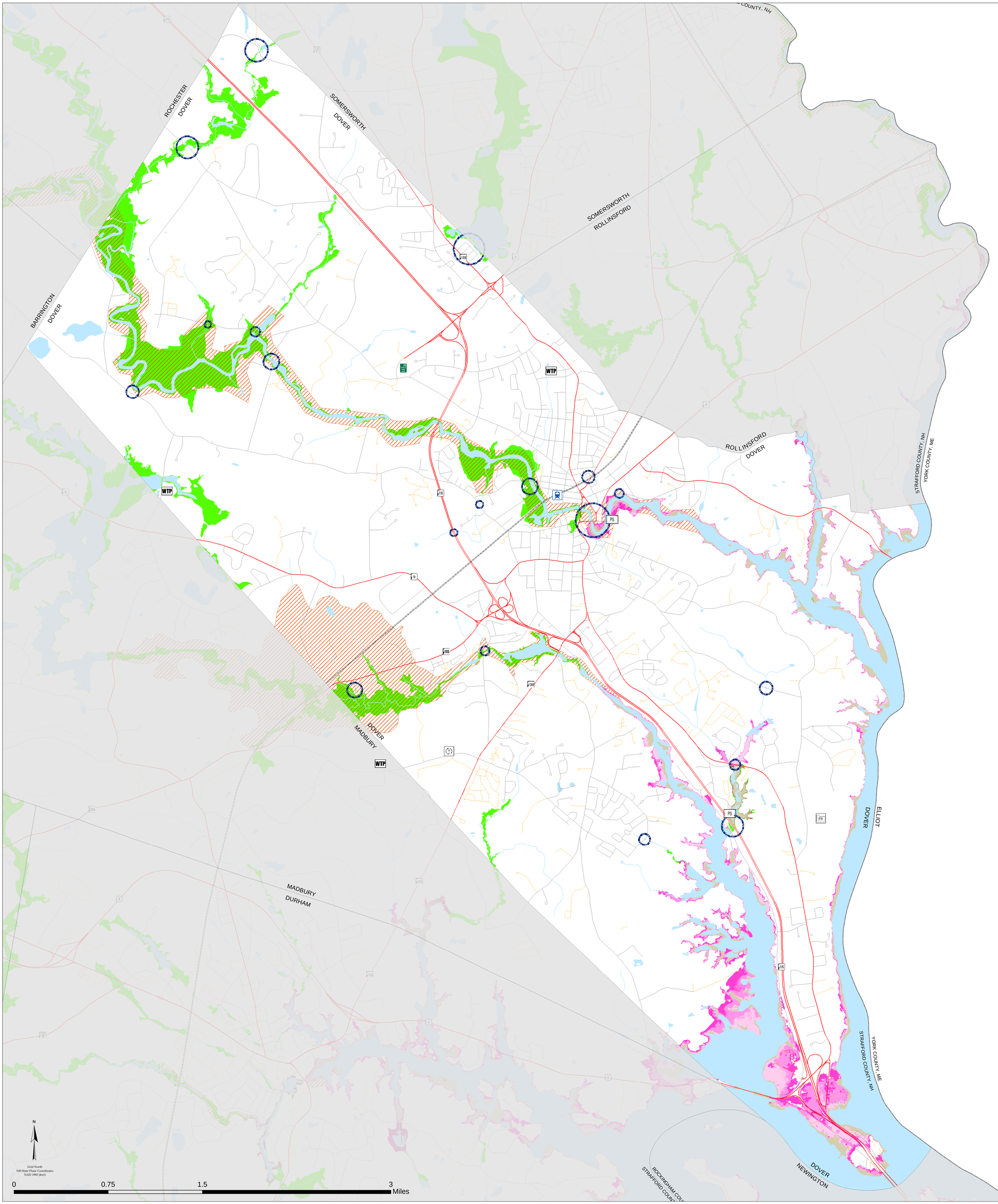
Non-Emergency Response Facilities & Past and Potential Hazards

2018
Hazard Mitigation Plan

DOVER, NH



Non-Emergency Response Facilities

Facility Type

- Potential Logistics and Staging Area
- Pump Station
- Residential Waste
- Transportation Center
- Wastewater Plant
- Water Plant

Past and Potential Hazards

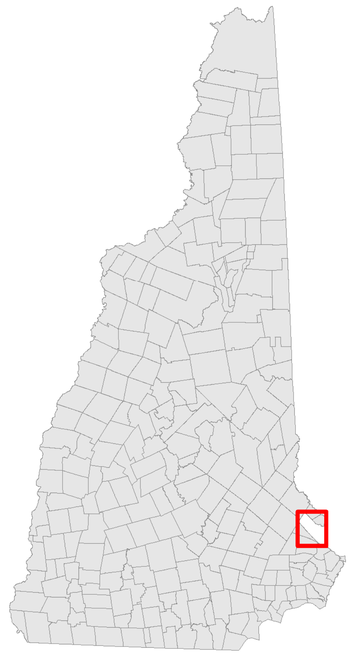
- Past Flooding
- Dam Inundation Areas
- FEMA 100-year Floodplain
- Extent of Sea-Level Rise of 1.7' with Storm Surge
- Extent of Sea-Level Rise of 4.0' with Storm Surge
- Extent of Sea-Level Rise of 6.3' with Storm Surge

Base Features

- Municipal Boundary
- Rivers, Brooks, Streams
- Lakes and Ponds

Roads [NHDOT, 2017]

- State
- Local
- Private



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Critical Infrastructure & Past and Potential Hazards

2018 Hazard Mitigation Plan

DOVER, NH

Critical Infrastructure Legend

Facility Type

- Critical Transportation
- Low Hazard Dam
- High Hazard Dam
- Significant Hazard Dam
- Pump Station
- Transportation (City Owned)
- Transportation (State)
- Transportation (Turnpike Bureau)
- Water Reservoir

Past and Potential Hazards

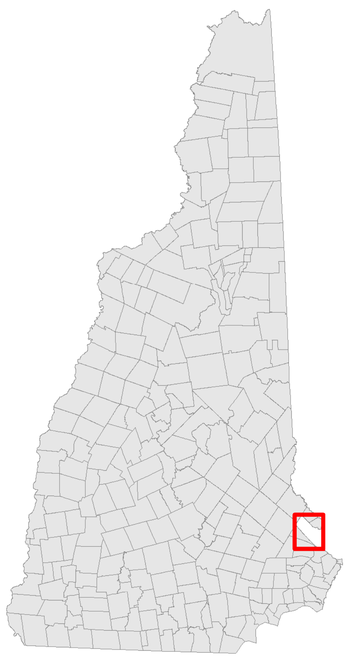
- Past Flooding
- Dam Inundation Areas
- FEMA 100-year Floodplain
- Extent of Sea-Level Rise of 1.7' with Storm Surge
- Extent of Sea-Level Rise of 4.0' with Storm Surge
- Extent of Sea-Level Rise of 6.3' with Storm Surge

Base Features

- Municipal Boundary
- Rivers, Brooks, Streams
- Lakes and Ponds

Roads [NHDOT, 2017]

- State
- Local
- Private



Grid North
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Strafford REGIONAL PLANNING COMMISSION

Vulnerable Populations to Protect & Past and Potential Hazards

2018
Hazard Mitigation Plan

DOVER, NH

Vulnerable Populations to Protect

Facility Type

- Assisted Living
- Catholic School (private)
- College-Prepatory School
- Elementary School
- Homeless Shelter
- Middle School
- Nursing Home
- Preschool/Daycare
- Senior High School
- Special Education Program

Past and Potential Hazards

- Past Flooding
- Dam Inundation Areas
- FEMA 100-year Floodplain
- Extent of Sea-Level Rise of 1.7' with Storm Surge
- Extent of Sea-Level Rise of 4.0' with Storm Surge
- Extent of Sea-Level Rise of 6.3' with Storm Surge

Base Features

- Municipal Boundary
- Rivers, Brooks, Streams
- Lakes and Ponds

Roads [NHDOT, 2017]

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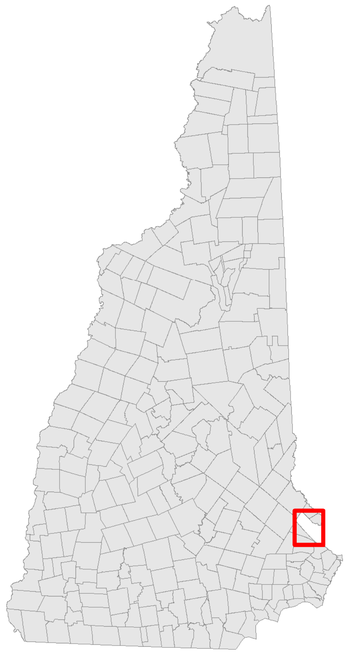
- Local
- Private



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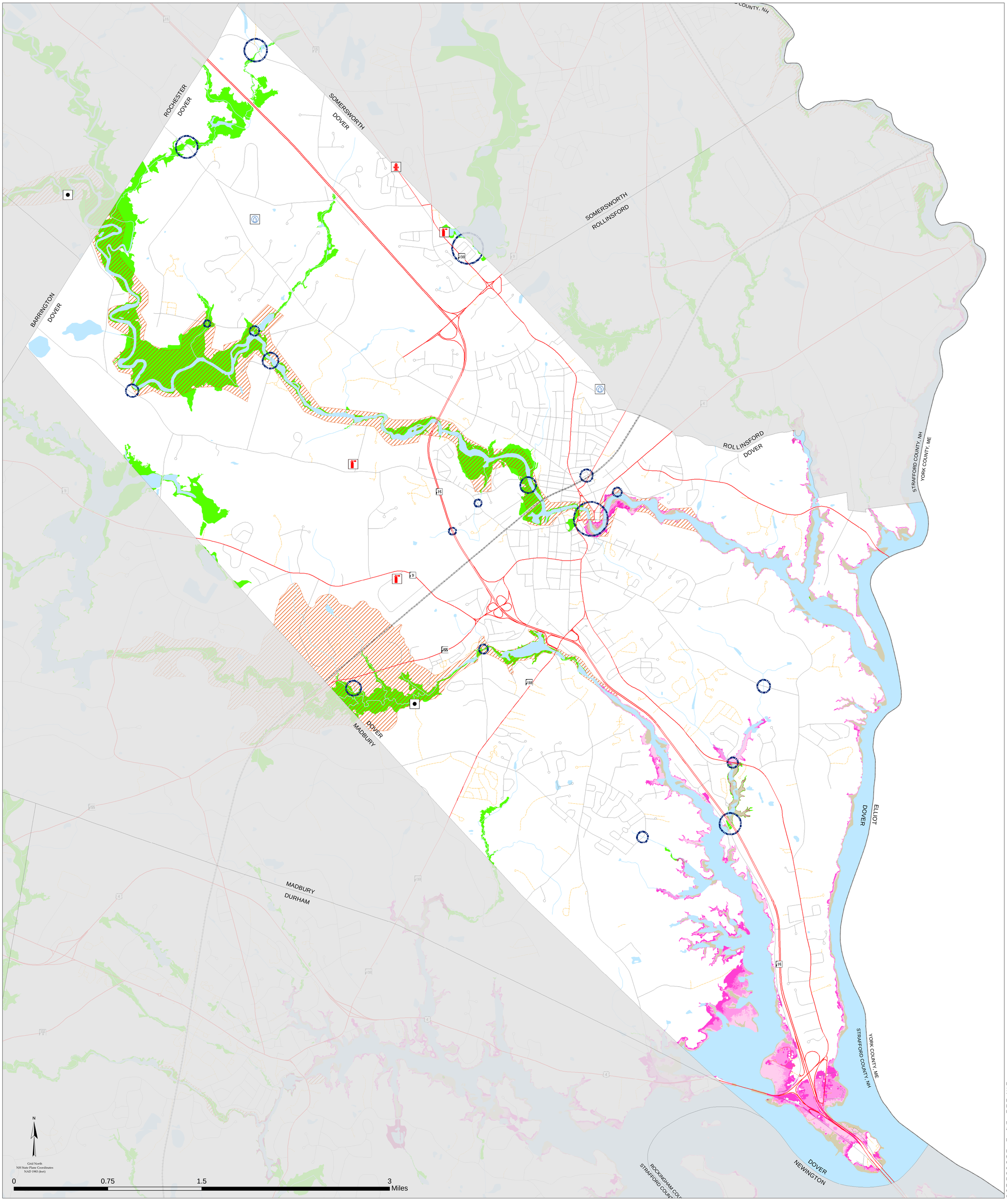
Water Resources & Past and Potential Hazards

2018 Hazard Mitigation Plan

DOVER, NH



Water Resources Legend

Facility Type

- Aquifer Recharge Station
- Auxiliary Fire Aid
- Hydrant to Hydrant Emergency Water Interconnection
- Water Reservoir

Past and Potential Hazards

- Past Flooding
- Dam Inundation Areas
- FEMA 100-year Floodplain
- Extent of Sea-Level Rise of 1.7' with Storm Surge
- Extent of Sea-Level Rise of 4.0' with Storm Surge
- Extent of Sea-Level Rise of 6.3' with Storm Surge

Base Features

- Municipal Boundary
- Rivers, Brooks, Streams
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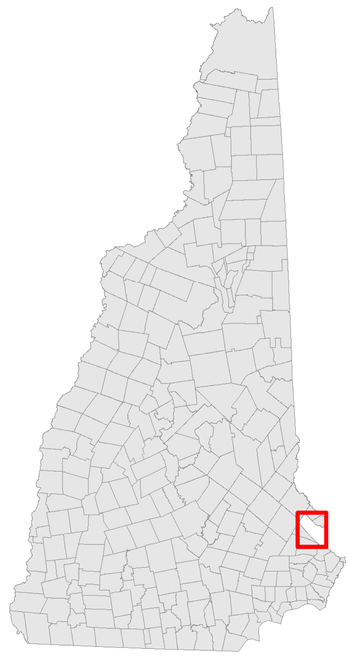
Roads [NHDOT, 2017]

- State
- Local
- Private



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