

Town of Bow

New Hampshire

Plan Lapses December 17, 2023

Hazard Mitigation Plan

Update 2018



2010 Feb-Mar: Knox Road Winter Storm

Photo: Eric Anderson

2011 Mar: River Road Flood

Photo: Tim Sweeney

2014 Nov: Garvins Falls Thanksgiving Day Snow Storm

Photo: Eric Anderson

Adopted by the Bow Board of Selectmen

December 11, 2018

NHHSEM/FEMA Approved December 17, 2018

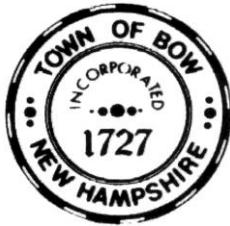
Town of Bow

New Hampshire

Hazard Mitigation Plan Update 2018

Selectmen Adopted December 11, 2018

NHHSEM/FEMA Approved December 17, 2018



Town of Bow
Safety Center and
Emergency Management Department
7 Knox Road
Bow, NH 03304
(603) 223-3940 | www.bownh.gov



Central NH Regional Planning Commission (CNHRPC)
28 Commercial Street, Suite 3
Concord, NH 03301
(603) 226-6020 | www.cnhrpc.org



NH Department of Safety (NHDOS)
NH Homeland Security and Emergency Management (NHHSEM)
33 Hazen Drive
Concord, NH 03305 (*Mailing Address*)



Incident Planning and Operations Center (IPOC)
110 Smokey Bear Blvd
Concord, NH 03301 (*Physical Address*)
(800) 852-3792 or (603) 271-2231
www.nh.gov/safety/divisions/hsem
<https://apps.nh.gov/blogs/hsem>



US Department of Homeland Security
Federal Emergency Management Agency (FEMA)
99 High Street, Sixth Floor
Boston, Massachusetts 02110
(617) 223-9540 | www.fema.gov

From: [Hazard Mitigation Planning](#)
To: ["cnicolopoulos@bownh.gov"](#); ["dstack@bownh.gov"](#); ["lkimball@bownh.gov"](#)
Cc: [Stephanie Alexander](#); [Chase, Julia](#)
Subject: Bow, NH - Local Hazard Mitigation Plan - Formal Approval
Date: Monday, December 17, 2018 12:42:45 PM
Attachments: [image001.png](#)
[image004.png](#)
[Bow NH Final Hazard Mitigation Plan Review Tool.pdf](#)
Importance: High

Good afternoon,

Congratulations! The Town of Bow's Local Hazard Mitigation Plan has received **Formal Approval** as of today, **December 17, 2018**. This State Formal Approval is based upon the New Hampshire Department of Safety, Division of Homeland Security & Emergency Management's (HSEM) determination that the community's Local Hazard Mitigation Plan successfully met the requirements of 44 C.F.R Pt. 201. A copy of the adopted plan has been submitted to the Federal Emergency Management Agency (FEMA) for their records.

Please find the Final Local Mitigation Plan Review Tool attached. The Town of Bow will receive a copy of FEMA's Formal Approval Letter reflecting the approval date identified above within the next few weeks.

Thank you for your continued dedication to hazard mitigation!

Sincerely,

Whitney Welch

Hazard Mitigation Planning
NH Homeland Security and Emergency Management
33 Hazen Drive
Concord, NH 03301
NEW: 603-223-3650
603-223-3609 (fax)
ReadyNH.gov   
TAKE ACTION. BE SAFE.



FEMA

JAN 07 2019

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 Town of Bow 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 **December 17, 2018** our Agency was notified that your office completed its review of the Town of Bow, New Hampshire Hazard Mitigation Plan Update 2018 and determined it meets the requirements of 44 C.F.R. Pt. 201.

With this plan approval, the Town of Bow 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 Town of Bow, New Hampshire 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 December 17, 2018** in order to maintain eligibility for mitigation grant funding. We encourage the Town 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.

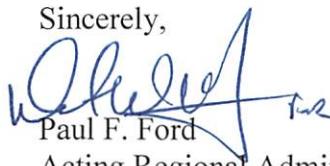
JAN 07 2019

Whitney Welch

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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 or Melissa.Surette@fema.dhs.gov.

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

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Town of Bow, NH Hazard Mitigation Plan Update 2018

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1 PLANNING PROCESS

The Town's Hazard Mitigation Committee was appointed to rewrite the Plan into a more concise format and to incorporate the newest material required by FEMA in addition to updating the Town's newest information since 2013. This Planning Process Chapter contains information previously available in the Introduction Chapter of the **Plan Update 2013**. Expanded public participation steps were taken and a new plan development procedure was used as documented in the Methodology section.

Certificate of Adoption, 2018

Town of Bow, NH
Board of Selectmen
10 Grandview Road
Bow, NH 03304

A Resolution Adopting the Bow Hazard Mitigation Plan Update 2018

WHEREAS, the Town of Bow has historically experienced severe damage from natural hazards and it continues to be vulnerable to the effects of the hazards profiled in the **Hazard Mitigation Plan Update 2018** including but not limited to flooding, high wind events, severe winter weather, and fire, resulting in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the Town of Bow has developed and received conditional approval from the NH Homeland Security and Emergency Management (NHHSEM) for its **Hazard Mitigation Plan Update 2018** under the requirements of 44 CFR 201.6; and

WHEREAS, public and Committee meetings were held between **January 2018** through **October 2018** regarding the development and review of the **Hazard Mitigation Plan Update 2018**; and

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

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

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

Town of Bow, NH Hazard Mitigation Plan Update 2018

1 PLANNING PROCESS

RESOLVED by Town of Bow Board of Selectmen:

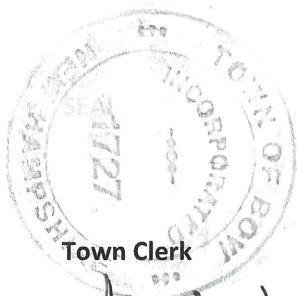
The **Hazard Mitigation Plan Update 2018** is hereby adopted as an official plan of the Town of Bow;
The respective officials identified in the mitigation action plan of the Plan are hereby directed to pursue implementation of the recommended actions assigned to them;

Future revisions and Plan maintenance required by 44 CFR 201.6 and FEMA are hereby adopted as a part of this resolution for a period of five (5) years from the date of this resolution; and

An annual report on the progress of the implementation elements of the Plan shall be presented to the Board of Selectmen by the Emergency Management Director or designee.

IN WITNESS WHEREOF, the undersigned have affixed their signature and the corporate seal of the Town of Bow this 11th day of December, 2018.

ATTEST



Town Clerk

Mridula Naik

Mridula Naik, Town Clerk

Board of Selectmen

Christopher Nicolopoulos 12/11/18
Christopher Nicolopoulos, Chairman date

Colleen Hunter 12/11/18
Colleen Hunter, Vice Chair date

Harold Judd 12/11/18
Harold Judd, Member date

Matthew Poulin 12/11/18
Matthew Poulin, Member date

Mike Wayne 12/11/18
Mike Wayne, Member date

Plan Process Acknowledgments

The Board of Selectmen-appointed Hazard Mitigation Committee was comprised of these individuals on behalf of their respective Departments, Boards or Committees who met between **January 2018** through **October 2018** to develop the **Bow Hazard Mitigation Plan Update 2018**:

- **Michael Carpenter**, Bow Police Department School Resource Officer
- **Thomas Ferguson**, Bow Health Officer
- **Noel Gourley**, Bow Public Works Supervisor
- **Leland Kimball**, Bow Emergency Management Director and Staff Coordinator
- **Margaret Lougee**, Bow Police Department Chief
- **Timothy Sweeney**, Bow Public Works Director
- **Bryan Westover**, Bow Community Development Assistant Planner

The following Central NH Regional Planning Commission (CNHRPC) staff contributed to the development of the Hazard Mitigation Plan Update:

- **Stephanie Alexander**, CNHRPC Senior Planner
- **Craig Tufts**, CNHRPC Principal Planner (GIS mapping)
- **Joseph Spalding**, CNHRPC Summer Intern (GIS mapping)

Members of the public* (2) and other individuals attended one or more Hazard Mitigation Committee meetings and/or contributed information to the content of the Plan:

* member of the public

- **Mike Conroy**, Bow Citizen, Emergency Operations Center Volunteer*
- **Mitchell Harrington**, Bow Fire Chief, Deputy Emergency Management Director
- **Gale Kenison**, Bow Police Department Administrator
- **Kara Hinck**, Bow School District 504 Coordinator
- **Judy Klotz**, Bow Citizen*
- **Shawna-Leigh Morton**, NH Homeland Security and Emergency Management (NHHSEM) Field Representative
- **Kayla Henderson**, NH Homeland Security and Emergency Management (NHHSEM) State Hazard Mitigation Planner
- **Stacey Elliott**, Capital Area Public Health Network Public Health Emergency Preparedness Coordinator

* "Member of the public" means a person who is not a Town, School, state, or federal government staff member or other staff person paid for by local tax dollars, and who is not a current Town volunteer.

Authority

In 2000, the President enacted the Disaster Mitigation Act 2000 (DMA) which requires states and municipalities to have local adopted and FEMA approved natural hazard mitigation plans in place to be eligible for disaster and mitigation funding programs such as the Federal Emergency Management Agency's (FEMA) Hazard Mitigation Assistance (HMA) programs, including Hazard Mitigation Grant Program, Flood Mitigation Assistance Program, and Pre-Disaster Mitigation Program. New Hampshire is awarded funds based upon the completeness of its State Plan and the number of local plans.

As a result of the DMA, funding was provided to state offices of emergency management, including the New Hampshire Homeland Security and Emergency Management, to produce local (municipal) hazard mitigation plans. To remain in compliance with the DMA, the Town of Bow is required to submit for FEMA approval a revised **Hazard Mitigation Plan Update** every five years.

The New Hampshire Homeland Security and Emergency Management (NH HSEM) produced its latest *[State of New Hampshire Hazard Mitigation Plan 2013](#)* in **2013**. The development of the State's Plan allows for New Hampshire to receive funding programs to provide to communities in the event of disasters or for mitigation. An updated *[Draft State of New Hampshire Hazard Mitigation Plan 2018](#)* will be considered for adoption by FEMA in **2018**.

Prior versions of the Town's Hazard Mitigation Plan are noted in the **Final Plan Dates** section. A 2016 Pre-Disaster Mitigation (PDM) grant provided 75%/25% funding for the Town to update its prior Plan through the Central NH Regional Planning Commission. The 25% match required by the Town was provided by in-kind staff and volunteer time and labor.

This **Bow Hazard Mitigation Plan Update 2018** has been developed in accordance with the Disaster Mitigation Act of 2000 and the *[FEMA Local Mitigation Plan Review Guide Effective October 2012](#)* and effective one year later. The most recent Plan development standards provided by FEMA Region I have also been incorporated. The planning effort of the Town is a regular process and this Plan is considered to be a "living document."

The **2018** Bow Hazard Mitigation Committee was established by the Board of Selectmen in fall 2017 and guided the development of the Plan. The Committee consisted of personnel from the Town's Emergency Management Department and Emergency Operations Center, Police Department, Fire Department, Public Works Department, and Community Development Department.

The attendees of the meeting process are noted in the **Acknowledgements**. The Central NH Regional Planning Commission, of which Bow is a member in good standing, contributed to the development of this Plan by facilitating the meeting and technical processes, working with the Committee and its members to obtain information, preparing the document, and handling the submissions to NH Homeland Security and Emergency Management and FEMA.

Methodology

The **Bow Hazard Mitigation Plan Update 2018** was developed over a nine-month period, with a group of Town staff members and volunteers and the CNHRPC comprising the majority of the Hazard Mitigation Committee. The **2018** methodology for Plan development is summarized in this section. The Hazard Mitigation Plan is designed differently from the **2013 Plan** with the intent to organize the Plan for utility purposes, with easier updating ability and implementation while meeting FEMA's requirements. The Plan roughly follows the *FEMA Local Mitigation Planning Handbook, 2013* by using its terminology and some of its tasks, ensuring **Bow's Plan Update 2018** begins to follow a standardized approach to Plan construction and content endorsed by FEMA. Many of the vital sections of the **2018 Plan Update** will be contained in the **10 APPENDICES** for easier display, usage, sharing, and update.

Meetings and Duties

The meetings and tasks of the Hazard Mitigation Committee were dictated by Agendas and how much the Committee was able to complete for each Agenda is displayed in **Table 1**. Work Sessions were designed to accomplish what could not be completed at meetings due to time constraints.

Table 1
Meeting Schedule and Agenda Activities

Meeting	Date	Agenda Activities – See APPENDIX C Meeting Information
Meeting 1	01-08-18	Discuss Process and Schedule, Identify Newest Hazard Events, Develop Hazard Risk Assessment, Review Maps 1-2-3 for revision, Schedule Meetings
Work Session 1	01-29-18	Identify Recent (2012-) and Potential Future Hazard Events in Bow, Begin Critical and Community Facilities Vulnerability Assessment (CCFVA)
Meeting 2	02-26-18	Finalize Critical and Community Facilities Vulnerability Assessment, Review & Update Goals and Objectives
Work Session 2	03-12-18	Review & Update Former Existing Measures -> Now Capability Assessment, Develop List of Existing Mitigation Plans and Documents, Complete Map 3
Meeting 3	03-26-18	Finalize CCFVA Problem Statements, Begin Review and Identify Status of 2013 Actions
Work Session 3	04-09-18	Finalize Status of 2013 Mitigation Actions (Completed, Deleted, Deferred), Begin to Develop New Actions from Problem Statements (Community Vulnerability Assessment) and Capability Assessment's Future Improvements
Work Session 3.2	05-07-18	Finalize Mitigation Action Plan, New Actions & Determine Action Timeframe, Cost, Responsibility, Prioritize Actions using Enhanced STAPLE
Meeting 4	09-17-18	Review Draft Hazard Mitigation Plan Components (onscreen), Review Sections in Need of Information, Review Outstanding Data and Assignments, Prep for WS4

Meeting	Date	Agenda Activities – See APPENDIX C Meeting Information
Work Session 4	09-24-18	Review Entire Draft Hazard Mitigation Plan, Appendices and Maps, Prepare for Public Information Meeting, Review Plan Approval Process
Public Information Meeting	10-09-18	HMC members present sections of the Plan to members of the public in a question and answer format. Describe hazards and mitigation Actions. Maps will be available.

Source: Bow Hazard Mitigation Committee Agendas, 2018

For each meeting, all meeting attendees signed attendance sheets and meeting match timesheets, documenting their time at the meetings. The Committee members worked to complete the Agendas, including developing the **Hazard Risk Assessment**, **Critical and Community Facilities Vulnerability Assessment**, **Capability Assessment**, and **Mitigation Action Plan**, completing the **STAPLEE Action Prioritization**, etc. along with input from members of the public and guests. The agendas and attendance sheets are included in **APPENDIX C** of the Plan.

The specific meeting tasks are described in detail on the Agendas in **APPENDIX C**. CNHRC staff facilitated the Committee meetings and Work Sessions. Information needed on the Agenda Tasks indicated above was collected from any attendees present, including any members of the public, by CNHRC, during discussions among attendees. The new and updated information was described in each Chapter under the **2018 Plan Update** section. Maps were reviewed and updated by the Committee and guests and revised in a Geographic Information System (GIS) by CNHRC.

In between meetings, Town staff and volunteers and CNHRC staff researched and collected information for the Chapters. CNHRC updated and rewrote Chapters, tables, and sections as appropriate. The Chapters were also updated by revising the document to the current FEMA standards.

Who is a Member of the Public?

For the purposes of this Plan, “**a member of the public**” or “**the public**” means:

Anyone who is not a Town of Bow, School District, County, State, or federal government employee; anyone who is not paid for services by Town tax dollars; and anyone who is not a current Town volunteer.

Opportunity for Public Participation

Public Input from the Hazard Mitigation Committee Meetings

The public notification is described in the Public Outreach Strategy sidebar. Two (2) members of the public periodically attended the Committee meetings as indicated in the **Acknowledgements** and the Attendance Sheets in **APPENDIX C Meeting Information**.

Members of the public assisted with completing the Agendas, including developing the **Hazard Risk Assessment, Critical and Community Facilities Vulnerability Assessment, Capability Assessment, and Mitigation Action Plan**, completing the **STAPLEE Action Prioritization**, etc. along with the Committee members. The general public had the opportunity to attend and participate in the **10** posted meetings or to contact the Staff Coordinator for more information.

Public Input from the Public Information Meeting

The **Public Information Meeting (PIM)** was held on October 9, 2018. The Hazard Mitigation Committee members presented portions of the Plan and had the Maps available for display. The agenda and attendance sheet are included in **APPENDIX C**. Held during the semi-monthly Board of Selectmen's meeting, the PIM involved **several** members of the public who listened to presentations, asked questions and had the opportunity to review the final draft Plan document, Appendices and Maps.

Public Input from the Board of Selectmen Adoption Meeting

The Board of Selectmen meeting to adopt the **Hazard Mitigation Plan** was held on December 11, 2018. Although the Plan's APA had been received, the Board permitted public comment prior to adoption although Plan changes could not be made at this time. Discussion was held prior to the unanimous adoption of the Plan by the Board.

Public Outreach Strategy

Many individuals were personally invited to attend and participate in the Bow Hazard Mitigation Committee meetings. They included Town Boards and Committees, Department heads, neighboring community Emergency Management Directors, Baker Free Library, Heritage Commission, Bow School District, Bow utilities, and several engaged citizens. These invitations were emailed for each Committee meeting. The NH Homeland Security and Emergency Management (NHHSEM) Field Representative and State Hazard Mitigation Planner were also invited.

The Hazard Mitigation Committee itself was comprised of most primary Town Departments, including the Emergency Management, Police, Fire, Public Works, and Community Development Departments.

The public process for this Plan included advertising the meetings on the Town's online Public Meetings calendar and website at www.bownh.gov and posting some materials on the Emergency Management's Hazard Mitigation webpage. Press releases were emailed for each meeting to the Bow Times, Concord Monitor, Hooksett Banner, Union Leader, The Citizen, The Messenger, Hippo Press, Bow School District SAU #67, and the Bow Baker Free Library. Notices were physically posted at the Municipal Building, Library, and Recreation Department. Local and regional interests had multiple opportunities to attend and participate in the Committee meetings. Copies of publicity for the Plan are included in **APPENDIX C**.

The Central NH Regional Planning Commission, a quasi-governmental regional organization of which Bow is a member, contributed to the development of this Plan by facilitating the meetings, guiding the planning process, and preparing the Plan documents, Appendices, and Maps.

As a final attempt to obtain additional public input, a specially noticed Public Information Meeting was held on October 9, 2018 at a Board of Selectmen's meeting at which many members of the public had the opportunity to learn about and discuss the Plan contents. This meeting was publicly noticed at the Municipal Building, Library, via news outlets mentioned above, other locations, and online with the draft Plan available for review on the Town's website in advance of the meeting.

The attendees and publicity of the public planning process are noted in the **Acknowledgements**.

Completion of the Plan Steps and Dates

On October 9, 2018, the Committee held a **Public Information Meeting**. The same extensive public notification described in the Public Outreach Strategy sidebar occurred to obtain review and comment from the public for the Plan.

On October 12, 2018, this Plan, Appendices and Maps were submitted to the NH Homeland Security and Emergency Management (NHHSEM) for compliance review and revision to apply for Approved Pending Adoption (APA) status, also known as conditional approval.

On November 8, 2018, Bow received an **Approved Pending Adoption (APA)** notification from NHHSEM. The APA states the Plan will be approved by FEMA after proof of adoption by the local governing body, a Certificate of Adoption from the Board of Selectmen, is submitted.

On December 11, 2018, the Board of Selectmen **adopted the Hazard Mitigation Plan Update** for the Town at a duly noticed public meeting. Copies had been made available at the Municipal Building and on the Town Website for public review. Copies of the public notice and flyers are included in **APPENDIX C**. The signed Certificate of Adoption was sent to NHHSEM/FEMA.

On December 17, 2018, Bow received a **Notification of Formal Approval** from NHHSEM, with the Plan approval granted effective that day. A **Letter of Formal Approval** from FEMA confirming the notification will be forthcoming. The next Hazard Mitigation Plan update is due five (**5**) years from this date of approval, on **December 17, 2023**.

Final Plan Dates

The following is a summary of the required dates which guide the adoption and update of the **Bow Hazard Mitigation Plan**. Included is the history of the Plan approvals and expiration dates as shown in **Table 2**.

Table 2
Plan Adoption History

Year of FEMA-Approved Hazard Mitigation Plan	Adoption by Bow Board of Selectmen	NHHSEM-FEMA's Formal Approval	Plan 5-Year Lapse/ Expiration
Original 2007	08/22/07	10/17/07	10/17/12
Update 2013	04/23/13	06/03/13	06/03/18
Update 2018	12/11/18	12/17/18	12/17/23

Source: CNHRPC Records

2 COMMUNITY PROFILE

It has been over five years since the last Plan was written, in between the decennial 2010 and 2020 Census. The best available new data has been used in this Chapter to portray the population, housing, and overall demographic picture of present day Bow. The former Relation to Natural Hazards section has been updated within **4 HAZARD RISK ASSESSMENT** as Built Environment Changes. The tables clearly identify the facilities in Town and which natural, human, and technological hazard events could most likely occur in those areas, as described in **5 COMMUNITY VULNERABILITY ASSESSMENT AND LOSS ESTIMATION**.

A simplified description of how the Town's population and housing have grown within the last four decades follows. Relationships of the locations of people and buildings to natural hazard events are generally explored. Examination of this information will allow the Town to better understand the land use and demographic trends within its borders and how emergency and preventative services can best serve the growing and changing population and landscape.

Geographic Context

The Town of Bow is located in Central New Hampshire within Merrimack County. The Town is bordered by the Town of Hopkinton and City of Concord to the north, the Town of Pembroke and Allenstown to the east, the Town of Hooksett to the south, and the Town Dunbarton to the west. The State's capital of Concord is about 4 miles from the Bow Municipal Building on Grandview Road, just off Exit 1 Interstate 89 (I-89) in the northeastern section of Town. Where I-89 ends and branches off to Interstate 93 (I-93) north and south, this area is known as Bow Junction where many industries and retail sales are located. The historic Bow Center is located further south along White Rock Hill Road and Branch Londonderry Turnpike West. Following precisely parallel to I-93 south is highly traveled NH 3A, which begins at Bow Junction and travels south to Hooksett and beyond. An active freight railroad carries railcars of materials and gases north to the Merrimack Station on the **Merrimack River**, one of the last coal-fired plants in New England.

The community hosts rural areas, dozens of cul-de-sac subdivision neighborhoods, Town Forests with recreational trails, direct access to **2** Interstate highways, and **2** significant rivers, the Central NH region Turkey River and the New England Merrimack River. Bow's easy accessibility, excellent school system, rural character, forests, the **Turkey River** and **Merrimack River**, Merrimack Station (formerly Public Service of NH and Eversource, now owned by Granite Shore) and existing industries have made the Town a prime location for residences and businesses alike.

The **Turkey River** begins at Turkey Pond in Concord and flows in a southeasterly direction into Bow, under I-89 and I-93, and empties into the Merrimack River. This short section of river flows through very important areas of the Region in terms of commute patterns and transportation access and has flooded Bow Junction in past hazard events. The stretch of **Turkey River** in Bow was evaluated as the **Turkey River Fluvial Geomorphic Features Addendum 2015** to the **2013 Hazard Mitigation Plan**.

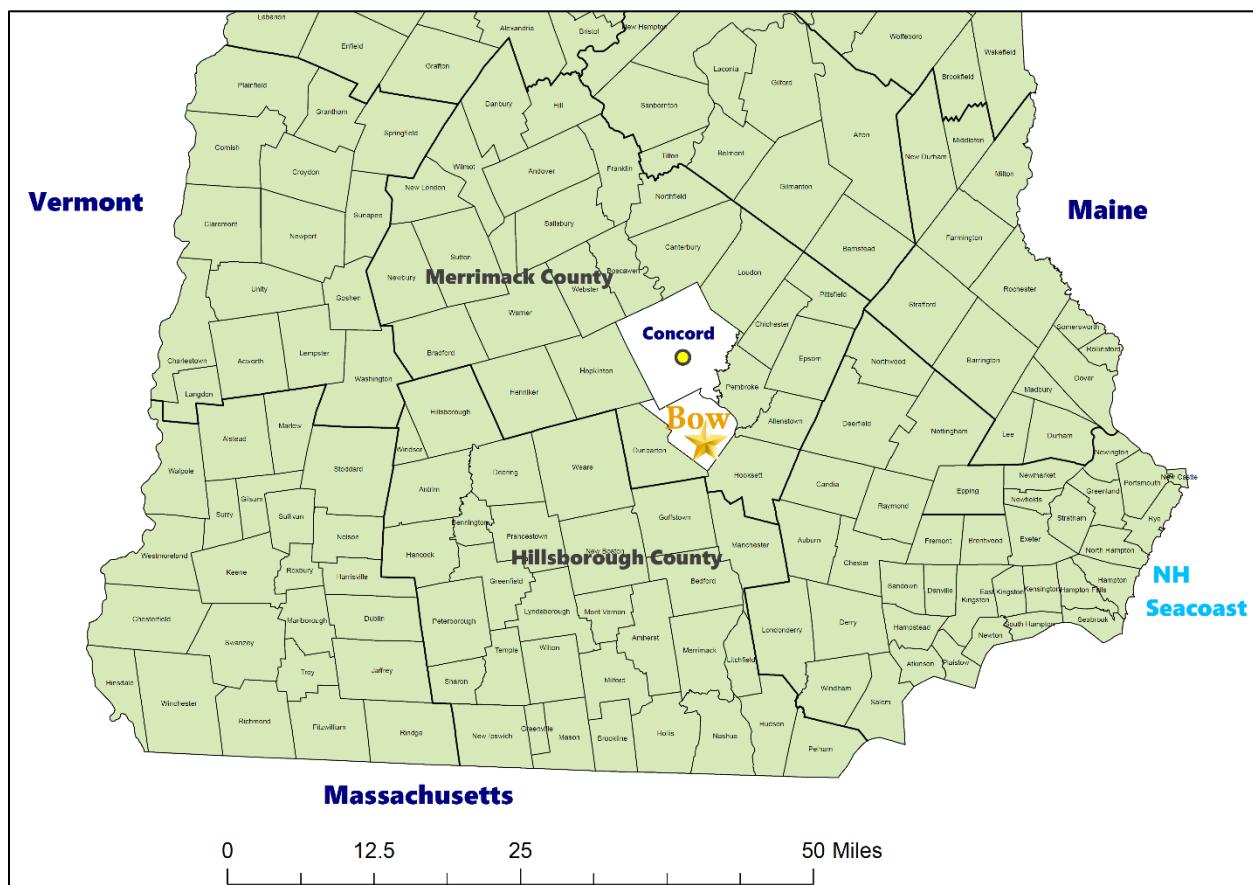
The swooping meanders of the **Merrimack River** flows south from Concord into Bow and forms the Town's eastern boundary with flat, vast floodplain areas. The **Merrimack River** continues south through Bow into Hooksett.

Central NH Region Profile with Bow

Merrimack County in which Bow resides is often referred to as a valley as its borders are higher in elevation than its middle communities. Concord and Franklin are the **2** Cities in the County. Merrimack County is surrounded on all sides by other NH Counties, including Hillsborough, Sullivan, Belknap, Rockingham, Strafford, and Grafton. Most, but not all, communities in Merrimack County comprise the majority of the Central NH Planning Region joined by two communities from Hillsborough County. Hillsborough County borders Massachusetts and includes the cities of Manchester and Nashua.

Concord is about **50** miles from the Massachusetts state border, the Vermont state border, the Maine state border, and the seacoast traveling along New Hampshire's Interstates, US Routes, NH Routes, and local roadways. Bow is located centrally with the Capital City. The Town's context within Merrimack County and the State of New Hampshire shown in **Figure 1**.

Figure 1
Bow in the State



Source: Central NH Regional Planning Commission

Bow is closely associated with the Central NH Region, one of the nine legislatively-boundaried planning regions in the State. The Town is a voluntary, good-standing member of the Central New Hampshire Regional Planning Commission. The Central NH planning region comprised of **19** Towns and **1** City contains several major rivers and important highways.

The **Blackwater River** (Salisbury, Webster, Warner) and the **Warner River** (Bradford, Sutton, Warner, Hopkinton) flow south into the **Contoocook River**. The **Contoocook River** flows in a north-easterly direction through Hillsborough, Henniker, Hopkinton, Concord, and Webster until its confluence with the **Merrimack River** in Boscawen/Penacook (Concord). The **Contoocook** and **Merrimack Rivers** effectively bisect the region into three sections. The **Soucook River** flows south through Loudon along the Concord/Pembroke border and enters the **Merrimack River**. The **Suncook River** originates in Belknap County, flowing south through Pittsfield, Chichester, Bow, Pembroke, and Allenstown until it also converges into the **Merrimack River** in Bow/Hooksett. The large **Merrimack River**, originating in Merrimack County in Franklin at the confluence of the Pemigewasset and Winnipesaukee Rivers, is the Central NH Region's largest watercourse and contributes to wide, sandy floodplain areas often utilized

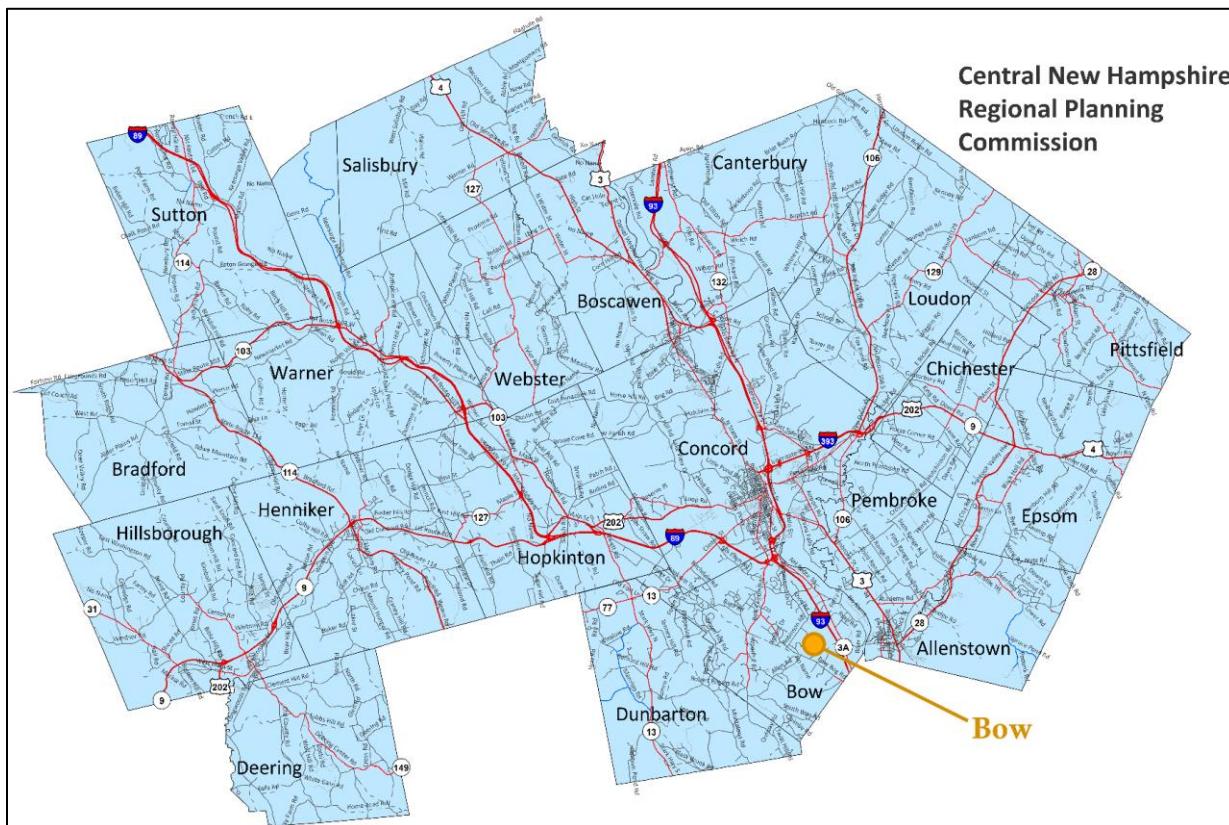
Town of Bow, NH Hazard Mitigation Plan Update 2018

2 COMMUNITY PROFILE

for agriculture. The **Merrimack** flows through southern New Hampshire and northern Massachusetts and empties into the Atlantic Ocean at Newburyport, MA.

In the Central NH Region, Interstates 89, 93 and 393 stretch in north, northwest, east, and south directions, meeting in Concord and Bow. Major traffic routes of US 3 travels north-south and US 4/202 traverses in an east-west direction. Bow hosts NH 3A, a very busy local highway used by large trucks and commuters, which begins at Bow Junction and travels south through Hooksett as it parallels I-93. Dozens of State highways crisscross the entire region. A map of the Central NH Region and its major highways is displayed in **Figure 2**.

Figure 2
Bow in the Region



Source: Central NH Regional Planning Commission

Population and Housing Growth

The latest **Bow Master Plan** was adopted in **2017**, developed by the Planning Board with assistance from the CNHRPC. The Master Plan is being updated again in **2018**, with the goal of rotating Chapter review and revision annually. Chapters updated include past and present housing and demographics, Existing and Future Land Use, Historical and Cultural Resources, Natural Resources, Transportation, Economic Development, Community Facilities, Regional Concerns, and Implementation. The Master Plan influences the Zoning Ordinance and the Subdivision and Site Plan Review Regulations along with the Capital Improvements Program.

The following tables contain the newest available data on housing and population growth which depict development trends over time. Shown in **Table 3**, Bow's population and housing increases were substantial between the **1980-2000** decades, averaging **+33%** population and **+35%** housing units for each **10**-year span, **1980-1990** and **1990-2000**. The most recent estimated **2017** population and **2016** housing units approximates **7,790** people and **2,946** housing units in Bow.

Table 3
Overall Population and Housing Growth Trends in Bow, 1970-2017

Growth	Population	Net Change # %		Housing Units	Net Change # %	
1970 Census	2,419	N/A	0	731	N/A	0
1980 Census	4,015	1,596	66.0%	1,282	551	75.4%
1990 Census	5,500	1,485	37.0%	1,860	578	45.1%
2000 Census	7,138	1,638	29.8%	2,330	470	25.3%
2010 Census	7,519	381	5.3%	2,807	477	20.5%
Total Change from 1970 – 2010 Census	---	5,100	210.8%	---	2,076	284.0%
2017 Population & Housing Estimates*	7,790	271	3.6%	2,946	139	5.0%
47 years of Increase		+ 5,371 People			+ 2,215 Housing Units	

Sources: 1970-1990 US Census CPH-2-31 Table 9 Population and Housing Unit Counts; US Census 2000 & 2010 Data *includes all housing units, including vacant and seasonal and 2017 Group Quarters (81). NH Office of Strategic Initiatives (NHOSI) Population Estimates 2017, Aug 2018; NHOSI Current Estimates and Housing Trends 2010-2016, Dec 2017

In **Table 3**, Bow's confirmed **2010** Census population of **7,519** shows an overall increase of about **+211%** (**+5,100**) in population over the previous **4** decades, up from **2,419** people in **1970**. Between **2000-2010**, the Town's population increased by **+5%** (**+381** people). The overall population growth numbers and percentages in Bow since **1970** are larger than other medium-sized communities in the Central NH region. Significant growth trends slowed during the last **2000-2010** decade.

The growth rate of housing units in Bow each decade is usually similar to its respective population growth rates with the exception of **2000-2010**, when new housing units topped population increase by

15%. The Town grew from **731** housing units in **1970** to quadruple that number in **2010**, totaling **2,807** units, an overall growth rate of **+284% (+2,076)**. During this same time period, population increased **+211% (+5,100)**.

The slowing trend continues during the current **2010-2020** decade with less development and smaller population increases levels, with an estimated **+4% (+271)** population and **+5% (+139)** housing increases as of **2017** in Bow, with **3** more years' data forthcoming. This decade's housing increases are the lowest by far over the **50**-year period of **1970-2020**. These slowing trends are found across the Central NH region for communities of any size.

The number of people per housing unit in Bow has continued to decline from its high of **3.3** people in **1970** to **2.7** people per housing unit in **2010**. Although the **1970** figure is high, the lower **2010** figure demonstrates a similar trend, as found throughout the Central NH Region, of an overall decline of the number of people in a home.

Another good measurement of community population and housing change is population density, or how many people live in a square mile of land area. As displayed in **Table 4**, the overall population density between **1970** and **2017** tripled at **+222% (+191)**, from **86** people per square mile in **1970** to **196** people in **1990** and to an estimated **277** people per square mile in **2017**. Bow is geographically a small-sized community in the Central NH region at **28.1** square land miles (not including water acreage).

Table 4
Population Density in Bow, 1970-2017

Municipality Size		Persons per Square Mile					
Land Acreage	Land Area in Square Miles	1970	1980	1990	2000	2010	2017
18,030	28.1	86	143	196	254	268	277

Sources: **Table 3**, Office of Strategic Initiatives GIS acreage calculations, 2013

Table 5 displays Bow's new home and new building construction permits issued by the Code Enforcement Officer between **2012-2017**. During this **6**-year period, a grand total of **141** new construction permits for homes and non-residential buildings were issued. Most of these permits (**109**) were for new Single Family Homes, averaging more than **18** permits per year. During this time, **16** permits were issued for new multi-family home construction, **0** permits for new manufactured homes were issued because there are none in Bow, and **16** permits were issued for the construction of new non-residential buildings. Compared to most Central NH region communities, Bow was quite busy between **2012-2017**. The most active year was **2016** when a total of **28** new construction were issued, but 2017 quickly followed with **26** new permits.

Table 5
New Construction Permits Issued by Building Type, 2012 – 2017

Building Type	2012	2013	2014	2015	2016	2017	6-Year Totals
Single Family Homes	19	17	9	17	26	21	109
Multi-family Homes	0	0	16	0	0	0	16
Manufactured Homes	0	0	0	0	0	0	0
Non-Residential Buildings	1	3	2	3	2	5	16
Totals	20	20	27	20	28	26	141

Source: Bow Community Development Department, Sept 2018

Building data seems to indicate Bow is experiencing higher housing growth trends. The result of this upward trend may result in either the number persons per household (**2.7** per home in **2010**) increasing or the population itself may increase.

Land Use and Zoning

According to NH Office of Strategic Initiative's **2013** geographic information system (GIS) calculations, Bow has a total land area of **18,030** acres, or **28.1** square land miles. An additional **240** acres (about **0.37** square miles) is water area. The acreage figure is not comparable to the most recent **2018** MS-1 reporting calculation of **16,766** land and water acres for the Town. Certain acreages are often posted in more than one land use category for taxation purposes. Alternatively, certain dual-use acreages are placed into only one category when they fit into more than one. Reviewing the assessing information closely should clarify the answer as to why this large discrepancy exists. Small differences between the actual taxable land calculations from the assessing records and the acreage from the basic GIS calculations are not unusual.

For New Hampshire and specifically the Central NH Region, Bow is considered a small- sized community in terms of land area. Bow's proportion of residential land and commercial land are similar to many Towns in the region, but the community is much more built out and is becoming suburbanized. The Town has many large forests and conservation easements. Because not all of the classified residential land has been built upon, land use categorization often does not accurately reflect the acreage situation on the ground.

Table 6 provides a snapshot of the Town's **2018** land use acreage from the Town's assessing data. Residential land use is the most extensive land use type, comprising **37%** of the Town's land area. Exempt land has a high amount of acreage, at **23%** of the Town's area and does not generate taxation. Forested land (22%) in categories of stewardship, recreation, or forest also comprises a high area. Some forested land would be reflected within some of the residential land use and the unproductive land (**2%**). Commercial/ industrial land (**6%**), utilities (**3%**) and farmland (**<2%**), illustrate lower acreages. As categorized, wet areas characterize **<1%** of the Town's land use.

Table 6
Land Use Acreage, 2018

Land Use Category	Acres	% of Town
Residential Improved	6,203	37.0%
Residential Vacant	619	3.7%
Residential Mobile Home	0	0.0%
Residential Apartments	0	0.0%
Commercial Improved	290	1.7%
Commercial Vacant	215	1.3%
Industrial Improved	457	2.7%
Utilities	506	3.0%
Exempt	3,786	22.6%
Farm Land	162	1.0%
Farm Land Recreation	86	0.5%
Forest Land	1,599	9.5%
Forest Land with Stewardship	146	0.9%
Forest Land Recreation	1,582	9.4%
Forest Land Rec & Stewardship	278	1.7%
Unproductive	286	1.7%
Unproductive Recreation	413	2.5%
Wet	138	0.8%
Total Acres	16,766	100.0%

Source: MS-1 2018 Assessing, Community Development

The perspective of the Town's Zoning Districts offers another way to view how the land is utilized within Bow in **Table 7**. A full table of uses is available within the Zoning Ordinance which states which uses are allowed within each district. The ordinance does not include a table of dimensional and density regulations pertaining to water and sewer, lot frontages and lot sizes, and minimum pervious surfaces.

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Table 7

Zoning District	Abbreviation	Acreage
Rural District	RU	12,816
Residential District	R	1,592
Residential One Family District	R-1	356
Commercial District	C	264
Limited Industrial District	I-1	73
General Industrial District	I-2	745
Civic District	CV	222
Bow Mills Mixed Use	BMMU	90
Business Development District	BD	775
	Total	16,933
Zoning Overlay District	Abbreviation	Acreage
Floodplain	F	1,015
Wetlands Conservation District	WC	N/A*
Aquifer Protection District	AP	6,040
	Total	7,055

**No set district, determination for each lot, site plan subdivision, etc.*

Source: Community Development Department, Sept 2018

The overlay districts are superimposed upon the zoning districts so additional regulations shall apply. For any conflicting regulation, the more restrictive shall apply. The Zoning Ordinance has sections amended every year at the annual March Town Meeting and is used and applied by the Community Development Department, Code Enforcement Officer and Planning Board.

The community's **Built Environment Changes** describe how and where the community has grown, to which hazards vulnerable areas are susceptible, and states the overall change in hazard vulnerability in **4 HAZARD RISK ASSESSMENT**.



Bow Municipal Building, 10 Grandview Road; Photo courtesy of Eric Anderson



Bow Safety Center, 7 Knox Road; Photo courtesy of Eric Anderson

3 GOALS AND OBJECTIVES

The overall purpose of this Plan is to reduce future life and property losses caused by hazard events before they occur by the identification of appropriate **Actions** that are implemented during the five-year duration of this Plan.

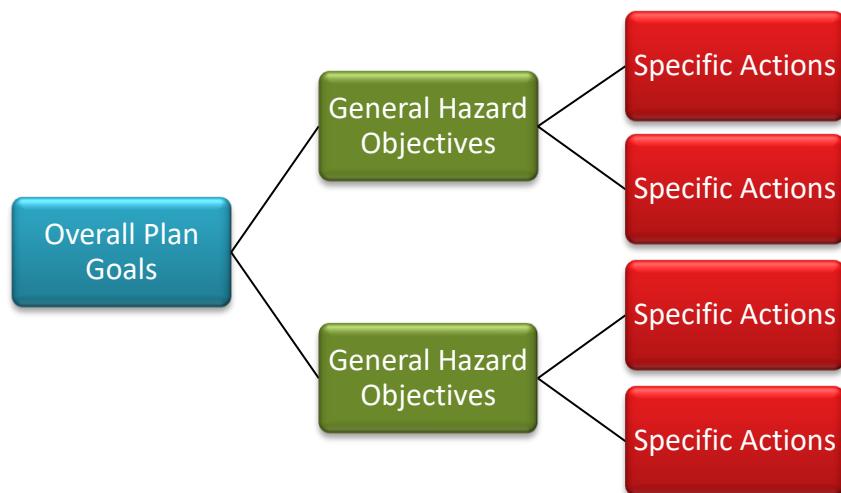
Inspired by the *State of New Hampshire Hazard Mitigation Plan*, the following **Goals** were initially developed in a previous Plan version and thus were reviewed and updated as applicable by the Hazard Mitigation Committee during a public meeting. While the hazard incidents have remained essentially the same as from the **2013 Plan** with a few disaster additions over the course of the last five years, it was important to reassess the continued relevancy of **Goals** and **Objectives** to influence the development of the best and most relevant hazard mitigation Actions.

What Are Goals, Objectives and Actions

Goals, Objectives and Actions are used in the Hazard Mitigation Plan to define different levels of meaning. Their relationship is displayed in **Figure 3**.

The overall **Goals** of this Hazard Mitigation Plan provide a macro-level view of what emergency managers want to accomplish to keep the Town's life, property and infrastructure safer from natural disasters. Statements of overall **Goals**, beginning with "To", describe the desired vision of mitigation and safety for the community. **Goals** enable the development of thoughtful hazard **Objectives** designed to generally fulfill those **Goals**.

Figure 3
Relationship of Goals, Objectives and Actions



Objectives begin to narrow down the focus of the overall **Goals** into hazard minimization statements. Main hazard categories of **Flood, Fire, Severe Wind, Extreme Temperature (Cold-Hot), Human, and Technological** guide the direction of mitigation efforts. These hazard **Objective** statements, beginning with “Minimize”, state Town’s desired outcome for each hazard category. The **Objectives** support the overall **Goals** by placing a focus on hazard mitigation or minimization.

Finally, **Actions** are the specific activities or projects which can be undertaken to accomplish an **Objective**. **Actions** begin with a verb to portray a direction for accomplishment. The **Action** is the target to reach to help mitigate hazards in the community. The completed **Action** fulfills the associated **Objectives**. The Actions will be listed and reviewed later in the **Mitigation Action Plan** tables.

Overall Hazard Mitigation Plan Goals

The following **3 Goals** for the **Hazard Mitigation Plan 2018** were developed by the Hazard Mitigation Committee as the vision for the community with respect to the declared disaster declarations, general hazard events, seasonal weather events and changing climate patterns resulting in unexpected events. Collectively, the **Goals** guided the formulation of **Objectives** for each of the main hazard categories. These **Goals** were revised from the **2013 Plan** to emphasize hazard mitigation instead of preparedness, response and recovery which are covered in the **Emergency Operations Plan**. Mitigation **Goals** more closely aligned with sustained risk prevention or reduction of long-term risk to people, property and infrastructure.

Bow Hazard Mitigation Plan Goals

- 1. To reduce the risk of injury and the loss of life in the Town from all natural hazards and disasters and impacts from secondary, technological and human hazards.**
- 2. To reduce the risk of potential damages in Town to public and private property, critical facilities, infrastructure, historic resources and the natural environment from all natural hazards and disasters.**
- 3. To promote public awareness of hazard mitigation planning and activities to the Town’s residents, visitors and businesses.**

General Hazard Mitigation Objectives

Bow Hazard Mitigation Objectives

FLOOD HAZARDS

1. Minimize the damages from floodwaters of the Merrimack and Turkey Rivers, Bela Brook, Bow Bog Brook, White Brook, Putney Meadow Pond, other Brooks and Ponds, wetlands, and other water bodies to life, property, and infrastructure.
2. Minimize the damages caused by flash-flooded, washed out, and overtopped roads and erosion, culvert washouts, dam failures or debris (tree limbs, leafy material/ sediment) to life, property, and infrastructure.

FIRE HAZARDS

3. Minimize the damages from fire, lightning, and wildfire to life, property, and infrastructure, including the Nottingcook, Knox and School Town Forests, Hammond Nature Preserve, other Town Forests, conservation lands, or Town-owned property and all telecommunications towers.

WIND HAZARDS

4. Minimize the damages from severe wind events, including thunderstorms, downbursts, hurricanes and tropical storms, tornadoes and their debris, to life, properties, historic properties, and infrastructure.

EXTREME TEMPERATURE (COLD-HOT) HAZARDS

5. Minimize the damages from both severe winter weather, including storms, snow, ice, and wind chill events and from excessive heat events such as heat waves, drought, energy consumption, air and water quality, and climate change to life, property and infrastructure.

Primary hazard event categories such as **Flood, Fire, Wind** and **Extreme**

Temperature hazards are intended to encompass their respective full sub-hazards range described in this Plan. The general Objectives are developed by addressing the primary hazard events that could impact Bow. They focus on minimizing or mitigating the hazard events to support the overall Goals while driving the direction of Action development later in the Plan. Because the Hazard Mitigation Committee did not believe much could be reasonably done to mitigate **Earth** hazards, there was no respective **Objective** written. However, some Actions in the and **Mitigation Action Plan** tables may address these hazards.

Although human and technological hazards are not natural disasters, many technological hazards are secondary to (caused by) natural hazards such as **Storms, Flooding or Winter Weather** causing **Power Failure or Debris Impacted Infrastructure**. Eleven (11) General Hazard Mitigation

Objectives were crafted for the main natural hazard groups to direct Action development in later Chapters.

Bow Hazard Mitigation Objectives

6. Minimize the impact of cold and warm weather public health hazards, such as influenza, norovirus, arboviral diseases, tick-borne diseases, and the threat of communicable diseases, by enhancing public awareness with the focus on vulnerable populations.

HUMAN HAZARDS

7. Minimize the damages from human threats such as sabotage, vandalism, terrorism, hostage situations and civil disturbance to life, property and infrastructure.

TECHNOLOGICAL HAZARDS (INFRASTRUCTURE AND SECONDARY)

8. Minimize the impact to travelers through blocked transportation systems, including I-89, I-93, highway on/off ramps, NH 3A and other local roads.
9. Minimize the damages from multiple hazards to the operational efficiency of all communications systems, dams, underground water, gas, and sewer utilities, bridges, and transportation roadways.
10. Minimize the damages from electrical power failure to life, property, and infrastructure, in both rural, urban, and industrial/commercial environments.
11. Minimize the damages from hazardous materials exposure, chemical spills, radiological materials incidents, or biological incidents to life, property, and infrastructure.

4 HAZARD RISK ASSESSMENT

Natural disasters and technological, and human hazards that have occurred in Bow or have the potential to occur in the Town were assessed in a **Hazard Risk Assessment** to determine their **Overall Risk** to the community. The major disasters declarations covering the Central NH Region (Merrimack County and Hillsborough County) have been inventoried and additional hazard events occurring in Bow and the area have been described. FEMA Public Assistance funding to the Town is detailed for each disaster declaration. A review of climate changes is provided for region to provide perspective on how the weather may change over time.

The *State of New Hampshire Hazard Mitigation Plan, 2013* recommends that municipalities examine multiple natural hazards. Two hazards, coastal flooding and snow avalanche, are not discussed in Bow's Plan because they have no relevance. Within the **Hazard Mitigation Plan 2018**, natural hazards under these basic categories have been incorporated:

- ➡ **Flood Hazards**
- ➡ **Wind Hazards**
- ➡ **Fire Hazards**
- ➡ **Extreme Temperature (Cold-Hot) Hazards**
- ➡ **Earth Hazards**
- ➡ **Technological (Secondary) Hazards**
- ➡ **Human Hazards**

Within these basic hazard categories are numerous related subcategories, all of which are detailed in a **Hazard Risk Assessment**. This Assessment provides a measure of **Frequency, Location Area, Impact to the Town, Hazard Magnitude**, and **Overall Risk** for each hazard in a numerical format as determined by the Hazard Mitigation Committee. Scale definitions and the process to define hazards are discussed.

Many of these examined hazards discussed may pose little threat to the Town. The Hazard Mitigation Committee wanted to acknowledge their possibility as opposed to simply focusing on a handful of top hazards which will certainly occur in the community. Using this broad vision allows Bow to contemplate the impact of a variety of hazards and to develop mitigation actions and design emergency planning programs as appropriate. Only the most predominant hazards, or even multiple hazards, will have mitigation actions developed to try to reduce the hazards' impact. These are later discussed in **Potential Mitigation Actions** and prioritized in the **Mitigation Action Plan**.

Hazard Risk Assessment Rankings

Twenty-seven (**27**) natural, technological, and human hazards are evaluated within this Plan. The **16** natural hazards (including the technological hazard **Dam Failure or Release** because of its close association with flooding) are ranked within in a **Hazard Risk Assessment**. Some hazards may be more likely to occur in the community than others based on past events and current conditions, and some hazards may have a greater impact than other hazards. How vulnerable Bow could be to natural hazards can be measured in terms of **Overall Risk**.

The location of where each hazard has occurred either in the past or may be prone to future hazard occurrences is noted in the **Hazard Locations in Town** column.

Knowing where events may be likely to occur, the 2018 Hazard Mitigation Committee examined each potential hazard for its **Probability of Occurrence** and its potential **Impact to the Town** affecting people, services/infrastructure and property based on past personal recollections and community hazard trends to determine the **Overall Risk** to the community.

The Committee identified each hazard's **Probability of Occurrence** score on a **1-2-3-4** scale from **Unlikely/1** (0-25% chance of occurring in 10 years, which is **2** Hazard Mitigation Plan cycles) to **Highly Likely/4** (76-100% chance in 10 years) as shown below.

Probability of Occurrence

1	Unlikely=	0 - 25% chance	in 10 years
2	Possible=	25 - 50% chance	in 10 years
3	Likely=	51 - 75% chance	in 10 years
4	Highly Likely=	76 - 100% chance	in 10 years

The Committee determined the likely **Impact to the Town** of an event based on a **1-2-3-4** scale for **3 Impact** characteristics – Human injuries, the length of time Critical Services/Infrastructure are shut down, and Property damage. Not all of these characteristics have to be expected because each hazard differs. The scale runs from **Limited/1** to **Catastrophic/4** and the more specific definitions are described below.

The **Probability of Occurrence** score was multiplied by the average of each **Impact to the Town** (Human, Critical Services/Infrastructure and Property) score to obtain the **Overall Risk** score.

The technological and human hazards were not scored to ensure the natural hazards retained the focus of the **Hazard Mitigation Plan Update 2018**. However, **Dam Failure** was rated because of its close correlation to **Flooding**.

Severity of Impact to the Town: Human, Critical Facilities/Infrastructure/Services, Property

1	Limited=	Human: Injuries treatable with first aid. Critical Facilities/Infrastructure/Services: Minor inconvenience; Shutdown for 3 days or less. Property: Damaged less than 10%.
2	Significant=	Human: Significant injuries or illnesses result in no permanent disability. Critical Facilities/Infrastructure/Services: Shutdown for up to 2 weeks. Property: Damaged 10% to 25%.
3	Critical=	Human: Significant injuries or illnesses result in permanent disability. Critical Facilities/Infrastructure/Services: Complete shutdown for at least 2 weeks. Property: Damaged 25% to 50%.
4	Catastrophic=	Human: At least 1 to multiple deaths. Critical Facilities/Infrastructure/Services: Complete shutdown for 30 days or more. Property: Damaged greater than 50%.

OVERALL RISK ASSESSMENT SCORES

The highest possible **Overall Risk** score a natural hazard could be ranked using this **Hazard Risk Assessment** system is **16** while the lowest score a hazard could be ranked is **1**. The **Overall Risk** numeric score is one which can help the community weigh the hazards against one another to determine which hazards are most detrimental to the community and which hazards should have the most Actions developed to try to mitigate those hazards. The **Overall Risk** is calculated simply by adding the two scores of **Probability of Occurrence** and **Impact to the Town**. The full results of the **Hazard Risk Assessment** are displayed in **Table 8**.

Out of the **16** ranked natural hazards, Bow's highest-ranking hazards scored an **Overall Risk** between **7 - 12** (out of a possible score of **16**), rounded to whole numbers:

Highest Overall Risk Hazards Scored 7- 12:

- **Floods and Flash Floods 12**
- **Severe Winter Weather, Wind Chill and Ice Storms 11**
- **Excessive Heat 11**
- **Hurricanes and Tropical Storms 7**
- **Severe Winds, Rain Storms and Thunder Storms 7**
- **Lightning 7**
- **Earthquake 7**

Table 8
Hazard Risk Assessment

Natural, Technological, Human Hazard Events	Susceptible (Existing) Hazard Locations in the Town <i>See also Appendix A. Community and Critical Facility Vulnerability Assessment (CCFVA)</i>	Probability of Occurrence	Human Injury Impact	Critical Services and Infrastructure Impact	Property Damage Impact	Severity of Impact	OVERALL RISK (1-16)
Flood	<p>◆ Entire Town, Floodplains of Merrimack River and Turkey River. Brooks such as Bow Bog Brook, Bela Brook, White Brook, Morgan Brook, Black Brook, and Russell Brook and Sage Meadow result in expanded flooding. Garvins Fall Dam is a High Hazard (H) dam on the Merrimack. Other recreation ponds and several dams can flood, leaving businesses and motorists along NH 3A, I-89 or I-93 at risk.</p> <p>◆ Runoff from roadways or heavy rain can cause floods over the Entire Town.</p> <p>◆ Roads, bridges, drainage systems and areas of past, repaired, or existing potential for road washout:</p> <ul style="list-style-type: none"> • Allen Road • Birchdale Road at White Brook • Bow Bog Brook (undersized culverts to be replaced) • Bow Bog Road (by Dean Avenue) • Branch Londonderry Turnpike • Buckingham Road at Putney Road • Clinton Street (Bela Brook) • Dunklee Road Bridge, Bow Bog Brook (improperly constructed box culvert to be repaired or replaced) • Hall Street • I-89 highway ramp (State owned, Turkey River) • Page Road, Bela Brook (undersized culverts to be replaced) • River Road at Ferry Road, Merrimack River (undersized culverts to be replaced) • NH 3A at Bow Junction (Turkey River) • South Street (Turkey River) 	4	3	3	3	3.0	12.0
Flood	<p>◆ Melt runoff from impervious surfaces and roadways or from tree cover into waterbodies such as the Turkey River or Merrimack River can cause floods over the Entire Town.</p> <p>◆ Particularly susceptible areas to rapid snow melt include Bow Junction area (NH 3A and I-89/ I-93) and along any of the Town's fast moving brooks (Bela Brook, Bow Bog Brook, etc). Damage to roads is expected. Other areas include the regular road washouts (see Flooding), as well as the dam and bridge vulnerabilities.</p>	2	2	2	1	1.7	3.3

Town of Bow, NH Hazard Mitigation Plan Update 2018

4 HAZARD RISK ASSESSMENT

Natural, Technological, Human Hazard Events		Susceptible (Existing) Hazard Locations in the Town <i>See also Appendix A. Community and Critical Facility Vulnerability Assessment (CCFVA)</i>	Probability of Occurrence	Human Injury Impact	Critical Services and Infrastructure Impact	Property Damage Impact	Severity of Impact	OVERALL RISK (1-16)
Flood	River Ice Jams	♦ Merrimack & Turkey River ice jams could endanger the dams and nearby facilities, especially near the Garvins Falls Dam on the Merrimack and the Chen Yang Li Restaurant on the Turkey River.	1	1	1	1	1.0	1.0
Flood	Riverine Scouring, Erosion, Channel Movement	♦ Merrimack & Turkey Rivers and their Floodplains, Brooks. Because of the high volumes and swift moving Merrimack River and Turkey River, bank erosion, scouring and channel movement are hazards of potential concern. ♦ Erosion of Hall Street banks is presently occurring. River Road is regularly threatened and has growing cracks in the pavement; mitigation is necessary to stop the road from collapsing into the Merrimack. West Meadow Road.	2	1	2	2	1.7	3.3
Wind	Tornadoes	♦ Entire Town. Most Tornado - vulnerable areas include populated buildings and high-density locations: Merrimack Station electric plant and the Utili/ Eversource powerlines, communications equipment at the crest of Woodhill Hooksett Road; high density or vulnerable populations such the Bow Elementary, Middle and High Schools, White Rock Senior Living Community; historic buildings in the old Town Center; and the 6 telecomm towers [NH 3A (2 by Peterbilt), Robinson Road, South Bow Road, Knox Road @ Safety Center, Woodhill Road]. ♦ Much of the Town is wooded and forested and sections would be difficult to access with trees and power lines down on the residential roads; most of the over 2 dozen housing developments are situated on cul-de-sacs. ♦ Most remote roads/areas of Town include: South Bow Dunbarton Road, Ferry Road, Woodhill Hooksett Road off Bow Bog Road, Branch Londonderry Turnpike (East & West), and the South Bow area. They could be difficult to access with treefall and power lines down from Tornadoes.	1	3	2	3	2.7	2.7

Town of Bow, NH Hazard Mitigation Plan Update 2018

4 HAZARD RISK ASSESSMENT

Natural, Technological, Human Hazard Events		Susceptible (Existing) Hazard Locations in the Town <i>See also Appendix A. Community and Critical Facility Vulnerability Assessment (CCFVA)</i>	Probability of Occurrence	Human Injury Impact	Critical Services and Infrastructure Impact	Property Damage Impact	Severity of Impact	OVERALL RISK (1-16)
Wind	Downbursts	<ul style="list-style-type: none"> ♦ Entire Town. Most areas vulnerable to downbursts include populated buildings and high-density locations: Merrimack Station electric plant and the Utili/Eversource powerlines, communications equipment at the crest of Woodhill Hooksett Road; high density or vulnerable populations such as the Bow Elementary, Middle and High Schools, White Rock Senior Living Community; historic buildings in the old Town Center; and the 6 telecomm towers [NH 3A (2 by Peterbilt), Robinson Road, South Bow Road, Knox Road @ Safety Center, Woodhill Road]. ♦ Local government operations are susceptible to damage by debris impacted infrastructure. See also previously listed Wind and Flood vulnerability sites. ♦ Much of the Town is wooded and forested and sections would be difficult to access with trees and power lines down on the residential roads; most of the over 2 dozen housing developments are situated on cul-de-sacs. ♦ Most remote roads/areas of Town include: South Bow Dunbarton Road, Ferry Road, Woodhill Hooksett Road off Bow Bog Road, Branch Londonderry Turnpike (East & West), and the South Bow area. They could be difficult to access with treefall and downed power lines. ♦ Agricultural areas are vulnerable to damage: Alexander Dairy Farm and Millican Tree Nursery. 	3	2	2	1	1.7	5.0
Wind	Hurricanes and Tropical Storms	<ul style="list-style-type: none"> ♦ Entire Town. ♦ See Floods and Flash Floods, Downbursts for specific locations that are most susceptible to hurricane events. 	4	1	2	2	1.7	6.7
Wind	Severe Winds, Rainstorms and Thunderstorms	<ul style="list-style-type: none"> ♦ Entire Town. ♦ See Floods and Flash Floods, Downbursts for specific locations that are most susceptible to severe wind/rain/storm events. 	4	1	2	2	1.7	6.7

Town of Bow, NH Hazard Mitigation Plan Update 2018

4 HAZARD RISK ASSESSMENT

Natural, Technological, Human Hazard Events		Susceptible (Existing) Hazard Locations in the Town <i>See also Appendix A. Community and Critical Facility Vulnerability Assessment (CCFVA)</i>	Probability of Occurrence	Human Injury Impact	Critical Services and Infrastructure Impact	Property Damage Impact	Severity of Impact	OVERALL RISK (1-16)
Fire	Lightning	<ul style="list-style-type: none"> ◆ Entire Town. Areas of particular concern to lightning include critical facilities such as the Merrimack Station electric plant and their powerlines, communications equipment at the crest of Woodhill Hooksett Road and the 6 telecomm towers [NH 3A (2 by Peterbilt), Robinson Road, South Bow Road, Knox Road @ Safety Center, Woodhill Road]. Locations of concern are remote areas which could not be easily accessed by emergency vehicles (Woodhill Hooksett Road). ◆ Old, historic or wooden structures (Town Center). Those structures without lightning rods would be more susceptible to damage from a strike than those buildings with the rods. ◆ Remote, forested areas, parks, conservation areas can be dangerous to people and property: Public Town forests and conservation areas (Nottingcook Forest), open recreation fields, points of higher elevation than surrounding area. ◆ Other aboveground utilities transformers, water towers are vulnerable to lightning. 	4	1	2	2	1.7	6.7
Fire	Wildfire	<ul style="list-style-type: none"> ◆ Entire Town. Locations most susceptible include vulnerable populations and buildings as identified in Lightning. ◆ Much of the Town is wooded and forested and sections would be difficult to access in case of wildfire; most of the over 2 dozen housing developments are situated on cul-de-sacs. ◆ Most remote roads/areas of Town include: South Bow Dunbarton Road, Ferry Road, Woodhill Hooksett Road off Bow Bog Road, Branch Londonderry Turnpike (East & West), and the South Bow area. Inaccessible locations are more vulnerable to wildfire impacts because fire crews and emergency personnel have greater difficulty responding quickly to fires in these locations. 	4	1	1	2	1.3	5.3

4 HAZARD RISK ASSESSMENT

Natural, Technological, Human Hazard Events	Susceptible (Existing) Hazard Locations in the Town <i>See also Appendix A. Community and Critical Facility Vulnerability Assessment (CCFVA)</i>	Probability of Occurrence	Human Injury Impact	Critical Services and Infrastructure Impact	Property Damage Impact	Severity of Impact	OVERALL RISK (1-16)
Severe Winter Weather, Cold, Wind Chill and Ice Storms Extreme Temp	<p>♦ Entire Town. Particular areas of concern during winter weather include: critical facilities such as the Merrimack Station electric plant and their powerlines, communications equipment at the crest of Woodhill Hooksett Road and the 6 telecomm towers [NH 3A (2 by Peterbilt), Robinson Road, South Bow Road, Knox Road @ Safety Center, Woodhill Road]. Locations of concern are remote areas which could not be easily accessed by emergency vehicles (Woodhill Hooksett Road), and elderly homes/housing (chill and snow load).</p> <p>♦ Failure of the PSNH substation on Bog Road over the Concord line on NH 3A would affect Bow residents.</p> <p>♦ Logging Hill Road is a sharp incline/decline and cars have trouble traveling the road during winter conditions. NH 3A is a major travel way for residents and commuters while I-89 runs through the Town.</p> <p>♦ Wooded and forested sections of Town are vulnerable to snow and ice effects.</p> <p>♦ Local government operations are susceptible to winter weather. See also previously listed Wind and Flood vulnerability sites.</p> <p>♦ Much of the Town is wooded and forested and sections would be difficult to access with excessive snowfall, tree fall or power outage. There are over 2 dozen housing developments are situated on cul-de-sacs.</p> <p>♦ Most remote roads/ areas of Town include: South Bow Dunbarton Road, Ferry Road, Woodhill Hooksett Road off Bow Bog Road, Branch Londonderry Turnpike (East & West), and the South Bow area.</p> <p>♦ The entire road network is susceptible to winter conditions, including the state and interstate roads (I-89, I-93, NH 3A).</p> <p>♦ People may be subject to cold temperature, snow isolation, transportation accidents, power failure and communications failure during winter storm events.</p>	4	4	2	2	2.7	10.7

Town of Bow, NH Hazard Mitigation Plan Update 2018

4 HAZARD RISK ASSESSMENT

Natural, Technological, Human Hazard Events		Susceptible (Existing) Hazard Locations in the Town <i>See also Appendix A. Community and Critical Facility Vulnerability Assessment (CCFVA)</i>	Probability of Occurrence	Human Injury Impact	Critical Services and Infrastructure Impact	Property Damage Impact	Severity of Impact	OVERALL RISK (1-16)
Extreme Temp	Drought	<ul style="list-style-type: none"> ◆ Entire Town / Region. Areas susceptible to drought and dry conditions include farms and nurseries: Alexander Dairy Farm and Millican Tree Nursery. ◆ Water Supplies: residences with private dug wells and Town water supplies. Drought means increased risk of brush fire with dry vegetation (see Wildfire for areas). Gravel roads affected because can't grade them when water is low. Higher elevations and ledgy locations tend to run dry first. ◆ All fire ponds will be low or dry during drought times: 6 Dry Hydrants at Fire Ponds- Putney Road Pond, Rising Wood Pond, Higgins Pit Pond, South Bow Dunbarton Marsh, McNichols Pond, Knox Road Town Pond. 	4	1	1	2	1.3	5.3
Extreme Temp	Excessive Heat	<ul style="list-style-type: none"> ◆ Entire Town / Region. Groups most susceptible to excessive heat include: Elementary, Middle and High Schools, Montessori School and Casa Dei Bambini, White Rock Senior Living Community, and high-density housing. ◆ Vulnerable areas most susceptible to extreme heat include the farms and nurseries (see Drought). ◆ The Safety Center (and possibly Library) can be opened as a cooling center during extended heat conditions. ◆ See APPENDIX A for the list of vulnerable facilities or groups. 	4	4	2	2	2.7	10.7
Earth	Earthquake	<ul style="list-style-type: none"> ◆ Entire Town. The Central NH Region is seismically active and earthquakes are regularly felt from area epicenters. Locations with high density population or potential gathering sites to evacuate include: Schools, White Rock Senior Living Community. ◆ Earthquake damage to Merrimack (coal-fired) Station, utility poles and wires, roadways and infrastructure (dams, water lines, bridges) could be significant. ◆ Areas with underground utilities, community water systems, Water District, and the old, historic buildings (such as the Old Town Center) are more vulnerable to earthquake damage. ◆ See APPENDIX A for the list of vulnerable facilities or groups. 	4	1	2	2	1.7	6.7

Town of Bow, NH Hazard Mitigation Plan Update 2018

4 HAZARD RISK ASSESSMENT

Natural, Technological, Human Hazard Events		Susceptible (Existing) Hazard Locations in the Town <i>See also Appendix A. Community and Critical Facility Vulnerability Assessment (CCFVA)</i>	Probability of Occurrence	Human Injury Impact	Critical Services and Infrastructure Impact	Property Damage Impact	Severity of Impact	OVERALL RISK (1-16)
Earth	Landslide	<ul style="list-style-type: none"> ◆ Slopes greater than 25%, including roads with steep ditching or embankments are most vulnerable to landslide. Roads with steep ditching or embankments are most vulnerable to landslide include NH 3A by St. Germain's (668 NH 3A). Landslide is a fairly uncommon hazard but one that can have devastating effects, including property damage and in some cases, loss of life. ◆ The excavation sites in Town are potential sites of landslide. 	2	1	1	2	1.3	2.7
Technological	Dam Failure or Release	<ul style="list-style-type: none"> ◆ High Hazard (H) dam is the Garvins Falls Dam (H) on the Merrimack River, could be vulnerable to dam failure although very unlikely to occur. Two Low Hazard (L) dams are Bow Fire Pond Dam and Putney Meadow Pond Dam. Other active Non-Menace (NM) dams are in Town are more likely to experience dam failure. ◆ Beaver dams have a high probability of flooding and potential to break. Turkey River beaver dam at St Paul's in Concord would be catastrophic for downstream Bow if it breaches. 	2	1	3	2	2.0	4.0

Town of Bow, NH Hazard Mitigation Plan Update 2018

4 HAZARD RISK ASSESSMENT

Natural, Technological, Human Hazard Events		Susceptible (Existing) Hazard Locations in the Town <i>See also Appendix A. Community and Critical Facility Vulnerability Assessment (CCFVA)</i>	Probability of Occurrence	Human Injury Impact	Critical Services and Infrastructure Impact	Property Damage Impact	Severity of Impact	OVERALL RISK (1-16)
Technological	Power/Utility Failure	<ul style="list-style-type: none"> ◆ Entire Town, including Vulnerable Populations (see APPENDIX A) and Areas of particular concern during power failures. Critical facilities such as the Merrimack Station electric plant and the Eversource/Utilit powerlines, communications equipment at the crest of Woodhill Hooksett Road; high density or vulnerable populations such the Bow Elementary, Middle and High Schools, White Rock Senior Living Community; historic buildings in the old Town Center; and the 6 telecomm towers [NH 3A (2 by Peterbilt), Robinson Road, South Bow Road, Knox Road @ Safety Center, Woodhill Road]. ◆ Much of the Town is wooded and forested and sections would be difficult to access with excessive tree fall or power lines down. There are over 2 dozen housing developments are situated on cul-de-sacs. ◆ Most remote roads/ areas of Town include: South Bow Dunbarton Road, Ferry Road, Woodhill Hooksett Road off Bow Bog Road, Branch Londonderry Turnpike (East & West), and the South Bow area. ◆ The agricultural farms (feeding or dairy animals) should be monitored. ◆ Power outages may last for several days before service is restored from a large event. 	not rated	not rated	not rated	not rated	not rated	not rated

Town of Bow, NH Hazard Mitigation Plan Update 2018

4 HAZARD RISK ASSESSMENT

Natural, Technological, Human Hazard Events		Susceptible (Existing) Hazard Locations in the Town <i>See also Appendix A. Community and Critical Facility Vulnerability Assessment (CCFVA)</i>	Probability of Occurrence	Human Injury Impact	Critical Services and Infrastructure Impact	Property Damage Impact	Severity of Impact	OVERALL RISK (1-16)
Technological	Communications Systems Failure	<ul style="list-style-type: none"> ◆ Entire Town. Communications systems are detailed in the APPENDIX A Facility Vulnerability Assessment tables. Systems failures could affect Town businesses and local government on an isolated scale. The internet enables alternative communication options. ◆ The 6 telecomm towers [NH 3A (2 by Peterbilt), Robinson Road, South Bow Road, Knox Road @ Safety Center, Woodhill Road] are the primary towers in Town. The Fire Department has a repeater on site. ◆ Communications failure would be worse if it occurred during a holiday or inhibited emergency dispatch and EOC operations. Most Town radios are interoperable, and they are used in more than one location. ◆ The Town is serviced by the Capital Area Mutual Aid Compact, which does all the emergency medical service and Fire dispatching. They have redundant capabilities and are currently upgrading their systems. 	not rated	not rated	not rated	not rated	not rated	not rated
Technological	Debris Impacted Infrastructure	<ul style="list-style-type: none"> ◆ Most dams, culverts, and bridges could experience debris impacted infrastructure. The Turkey River, Bela Brook or Bow Bog Brook or the Garvins Falls Dam (High) on the Merrimack. ◆ Roads with culverts that regularly washout are listed above under Flooding. ◆ Many of these facilities would be high impact in the event of debris impacted infrastructure because of the highway system of I-89, I-93 and NH 3A. Box culverts as replacements for failing culverts have been recently installed in many Bow roads as a result of recurring flooding events. ◆ Debris impacted infrastructure can also refer to roadways blocked by downed trees and power lines during storms (see Tornadoes and Downbursts lists above). 	not rated	not rated	not rated	not rated	not rated	not rated

Town of Bow, NH Hazard Mitigation Plan Update 2018

4 HAZARD RISK ASSESSMENT

Natural, Technological, Human Hazard Events		Susceptible (Existing) Hazard Locations in the Town <i>See also Appendix A. Community and Critical Facility Vulnerability Assessment (CCFVA)</i>	Probability of Occurrence	Human Injury Impact	Critical Services and Infrastructure Impact	Property Damage Impact	Severity of Impact	OVERALL RISK (1-16)
Tech	Transportation Accidents	<ul style="list-style-type: none"> ◆ Interstate 89, Interstate 93 and NH 3A are the main highways through Town. Interstate on/off ramps are dangerous, especially Exit 1 Logging Hill Road. Bow Junction intersections and traffic access can be dangerous with potentially severe transportation accidents. ◆ In addition to accidents at these locations, transportation accidents occur throughout the community at rural intersections, along hills and s-curves as shown on Maps 1-4. ◆ Accidents increase during hazard events, winter weather and wind storms. 	not rated	not rated	not rated	not rated	not rated	not rated
Technological	Hazardous/Radiological Materials Spills	<ul style="list-style-type: none"> ◆ Railroad to Merrimack Station, Interstate 89, Interstate 93 and NH 3A, Bow Junction, and some local roads are the most realistic routes taken where vehicular and railcar traffic transport hazardous waste. Serious transportation accidents involving hazardous materials have the greatest possibility here. ◆ Vulnerable areas for targeted evacuation include the Schools and White Rock Senior Living Community. ◆ The largest or most dangerous stationary sites that store and/or handle haz mat on site (fertilizer, pesticides, fuel, etc) are listed in APPENDIX A. Occupational haz mat sites where spills could occur include schools, manufacturing, industry, of which there are many in Bow. 	not rated	not rated	not rated	not rated	not rated	not rated
Technological	Fire (Vehicle, Structure, Arson)	<ul style="list-style-type: none"> ◆ Several locations around Town are potential sites for explosions and serious fires and numerous other sites that have the potential for prolonged burning. They include above ground fuel tanks on farms, Merrimack Station electrical plant, Eversource/ Utilil high tension power lines, manufacturing and industrial businesses, areas away from fire ponds; vacant buildings, foreclosed homes or seasonal buildings; or buildings in densely populated areas. ◆ Vehicle fires could occur anywhere, parking lots, driveways, roadways. See also APPENDIX A. ◆ Human-started fires could occur in Nottingcook Forest and other wooded or popular conservation areas. 	not rated	not rated	not rated	not rated	not rated	not rated

Town of Bow, NH Hazard Mitigation Plan Update 2018

4 HAZARD RISK ASSESSMENT

Natural, Technological, Human Hazard Events		Susceptible (Existing) Hazard Locations in the Town <i>See also Appendix A. Community and Critical Facility Vulnerability Assessment (CCFVA)</i>	Probability of Occurrence	Human Injury Impact	Critical Services and Infrastructure Impact	Property Damage Impact	Severity of Impact	OVERALL RISK (1-16)
Technological	Public Health Issues	<ul style="list-style-type: none"> ◆ Congregate populations. Bow Elementary, Middle and High Schools, White Rock Senior Living Community, populated areas, large employers, restaurants, stores, Blue Seal Feeds store, and public assembly venues listed in APPENDIX A - all of these locations increase the risk of exposure to and transfer of illness, causing potential public health concerns. ◆ The many forests, conservation areas, agriculture, wooded areas, and ponds can host ticks (Lyme, Anaplasmosis, etc) and mosquitos (arboviral- West Nile, EEE, Equine Infectious Anemia, etc) which carry diseases. ◆ Wheelabrator in Penacook and the Merrimack Power Station are considered the largest source of local air pollution in addition to vehicular traffic of Concord and the highways. 	not rated	not rated	not rated	not rated	not rated	not rated
Human	Terrorism	<ul style="list-style-type: none"> ◆ Unlikely, but terrorism could possibly occur anywhere in Entire Town. Most susceptible sites could include: High School, Elementary and Middle Schools (bomb threats), Merrimack Power Station, Municipal Water and Wastewater System, Town Office, Safety Building, churches, Baker Free Library, Eversource high tension power lines, banks, Blue Seal. ◆ All other governmental or state facilities, political offices or rallies, churches, 6 telecomm towers, manufacturing or industrial businesses with large quantities of hazardous materials, grocery or convenience stores, restaurants, or other public places could be possible terrorism targets. ◆ Cyberterrorism is a more likely scenario, with the Town records or website targeted via internet hacking. 	not rated	not rated	not rated	not rated	not rated	

Town of Bow, NH Hazard Mitigation Plan Update 2018

4 HAZARD RISK ASSESSMENT

Natural, Technological, Human Hazard Events		Susceptible (Existing) Hazard Locations in the Town <i>See also Appendix A. Community and Critical Facility Vulnerability Assessment (CCFVA)</i>	Probability of Occurrence	Human Injury Impact	Critical Services and Infrastructure Impact	Property Damage Impact	Severity of Impact	OVERALL RISK (1-16)
Human	Sabotage/Vandalism	<ul style="list-style-type: none"> ♦ Town or Governmental Facilities. Sabotage would be most likely to occur at Municipal Water or Waste Water systems, Merrimack Station, Town Offices (computer systems & website), Safety Building, other Town buildings. ♦ Vandalism could occur at dams, under bridges, other public water supplies or towers, cemeteries, vacant buildings, beaver dams, recreation areas, etc. 	not rated	not rated	not rated	not rated	not rated	not rated
Human	Hostage Situation	<ul style="list-style-type: none"> ♦ Unlikely, Isolated events. Locations where hostages could be taken include: Town Offices and other public buildings, 3 Schools, White Rock Senior Living Community, workplaces, grocery and convenience stores, restaurants, high density population areas, public events, and domestic home situations. ♦ See vulnerable populations listed in APPENDIX A. 	not rated	not rated	not rated	not rated	not rated	not rated
Human	Civil Disturbance/Public Unrest	<ul style="list-style-type: none"> ♦ Unlikely, Limited locations. Locations where civil disturbance could occur: High School, Elementary and Middle Schools (including bomb threats), Merrimack Power Station, Municipal Water and Wastewater System, Town Office, Safety Building, churches, Baker Free Library, banks, Blue Seal, all other governmental facilities or state facilities, establishments serving alcohol, high density population areas. ♦ Occasions of potential public unrest include: Town & School Meetings, voting day, local board meetings, during visits from political candidates, large events such as Old Home Day, Veteran's Parade, School sports events or graduations. 	not rated	not rated	not rated	not rated	not rated	not rated

Source: Bow Hazard Mitigation Committee 2018

Central NH Region Major Disaster Declarations, 1973-2018

The Central NH region, which encompasses parts of Merrimack County (**18** communities) and Hillsborough County (**2** communities), has been damaged by **21** presidentially-declared major disasters in the last **45** years, between **1973-2018**.

Although a natural disaster typically befalls multiple counties in New Hampshire, only those damaging either Merrimack County or Hillsborough County were identified in this section. Over the last **13** years (**2005-2018**), the Central NH region of Merrimack and Hillsborough Counties experienced **12** presidentially- declared natural major disasters [DR-] and **2** presidentially- declared emergency declarations [EM-], totaling **14** disasters in the last **13** years. The first grouping of Central NH region declarations spanned **1973 to 2004** (**32** years) and yielded **9** presidentially-declared natural major disasters and **4** presidentially-declared emergency declarations, a total of **13** disasters in **32** years.

Between **2005-2018**, the most recent round of major disasters afflicting the Central NH Region, of the **14** natural disasters [DR-], **5** were floods, **5** were snow/ice storms, **2** were wind/rain/lightning storms and **2** were wind/flooding storms. The disasters [DR-] experienced between **1973-2004** were **4** floods, **5** snowstorms, **1** wind/rain/lightning storm and **3** wind/flooding storms. While disaster declarations within a county open up the ability to receive Public Assistance (PA) funding and Individual Assistance (IA) funding, Hazard Mitigation Grant Program (HMGP) *plan* funding is typically made available to all communities statewide, and for those towns with an active, approved Hazard Mitigation Plan, HMGP *project* funding is available.

Emergency declarations [EM-] are often proclaimed for counties in New Hampshire to help communities receive funding for less serious hazard events that may have caused more damage in nearby declared declaration [DR-] counties or states. The **2001-2005** group of **4** Snow emergency declarations [EM-] and the **2011-2012** Tropical Storm Irene and Hurricane Sandy emergency declarations [EM-] significantly impacted communities such as Bow but not enough to be classified as a declared disaster [DR-] for many counties. Nonetheless, Public Assistance Protective Measures funding was available in the Central NH region to those who needed the financial help.

The last declared disaster in Merrimack County, in which Bow is located, was the severe wind storm and flooding event in **October 2017** for which Bow requested federal Public Assistance funding (**\$14,600**). Details of Central NH region declared disasters and emergency declarations since **1973** and federal funding provided to the Town of Bow are displayed in **Table 9**. Most of these disasters will be described within the following [Recent Disaster Events Summary](#) section.

Town of Bow, NH Hazard Mitigation Plan Update 2018

4 HAZARD RISK ASSESSMENT

Table 9

Central NH Region Major Disaster Declarations, 1973 to 2018

FEMA DR-	Local Disaster Name	Incident Period	FEMA Disaster Name	Includes County*		FEMA Public Assistance Funding to Bow**
				Merr	Hill	
4355	2017 October Wind Storm	Oct 28-20, 2017	Severe Storm and Flooding	M	---	\$14,600
4209	2015 January Blizzard	Jan 26-28, 2015	Severe Winter Storm and Snowstorm	---	H	N/A
4105	2013 Snowstorm NEMO	Feb 8-10, 2013	Severe Winter Storm and Snowstorm	M	H	\$36,421
4095 EM-3360	2012 Hurricane Sandy Emergency	Oct 26-Nov 8, 2012	Hurricane Sandy	EM- M	EM- H	\$4,909
4049 EM-3344	2012 Halloween Snow Storm Emergency	Oct 29-30, 2012	Severe Storm and Snowstorm	EM- M	H	\$0
4026	2012 Tropical Storm Irene	Aug 26-Sep 6, 2012	Tropical Storm Irene	M	---	\$7,577
1913	2010 March Flooding & Winds	Mar 14-31, 2010	Severe Storms and Flooding	M	H	\$0
1892	2010 Winter Storm	Feb 23-Mar 3, 2010	High Winds, Rain, Snow	M	H	\$37,203
1812	2008 December Ice Storm	Dec 11-23, 2008	Severe Winter Storm	M	H	\$50,564
1799	2008 September Flood	Sep 6-7, 2008	Heavy Rains and Floods	M	H	\$0
1782	2008 July Tornado	Jul 24, 2008	Tornado, Severe Winds, Heavy Rains	M	---	\$0
1695	2007 April Spring Flood	Apr 15-23, 2007	Severe Storms and Flooding	M	H	\$19,474
1643	2006 Mother's Day Flood	May 12-23, 2006	Severe Storms and Flooding	M	H	\$254,293
1610	2005 Columbus Day Flood	Oct 7-18, 2005	Severe Storms and Flooding	M	H	\$5,145
EM-3207	2005 Snow Emergency	Jan 22-23, 2005	Snowstorm	M	H	\$31,258
EM-3193	2003 Snow Emergency	Dec 6-7, 2003	Snowstorm	M	H	\$25,006
EM-3177	2003 Snow Emergency	Feb 17-18, 2003	Snowstorm	M	H	\$16,292
EM-3166	2001 Snow Emergency	Mar 5-7, 2001	Snowstorm	M	H	\$18,924
1231	1998 Flooding	Jun 12-Jul 2, 1998	Severe Storms and Flooding	M	H	\$0
1199	1998 December Ice Storm	Jan 7-25, 1998	Ice Storms	M	H	\$0
1144	1996 Storms and Flooding	Oct 20-23, 1996	Severe Storms and Flooding	M	H	\$0
1077	1995 Flood	Oct 20-Nov 15, 1995	Storms and Floods	M	---	\$0
917	1991 Hurricane Bob	Aug 18-20, 1991	Severe Storm	---	H	N/A
876	1990 Flooding and Severe Storm	Aug 7-11, 1990	Flooding and Severe Storm	M	H	No data
789	1987 Storms and Flooding	Mar 30-Apr 11, 1987	Severe Storms and Flooding	M	H	No data
771	1986 Storms and Flooding	Jul 29-Aug 10, 1986	Severe Storms and Flooding	---	H	N/A
399	1973 Storms and Flooding	Jul 11, 1973	Severe Storms and Flooding	M	H	No data
Total Public Assistance (PA) FEMA Funding to Bow, 1993-2018**				\$521,667		

Source: http://www.fema.gov/disasters/grid/state/33?field_disaster_type_term_tid_1>All

*M = Merrimack County (18 towns in CNH region) H = Hillsborough County (2 towns in CNH region)

** Dollar figures are rounded to the nearest \$100 and does not yet include DR-4355 (TBD)

Recent Disaster Events Summary

The Town of Bow has been affected by several significant natural disasters within the last decade and applied for and received Public Assistance (PA) funding for many of these events. Severe natural hazard events have been occurring more frequently in Merrimack County than in the past. While these events on occasion disrupted the flow of the community and isolated residents for days, the disaster impacts were relatively mild as few injuries were reported. FEMA provided Public Assistance funding to the Town for tasks such as cleanup, road repairs, tree and brush cutting, and culvert replacement.

The Hazard Mitigation Committee helped provide anecdotal descriptions of how the recently declared natural disasters or emergency declarations for the Central NH Region affected Bow and its residents. Public Assistance disaster funding opportunities open to communities when a disaster is declared within a county. The Town of Bow applied for and received this funding for several recently declared disasters. Also identified were numerous hazard events that occurred locally in the community and within the area. The disaster event listing dates from the 1936 floods to present day.

PUBLIC ASSISTANCE GRANT FUNDING

To help reclaim some of the costs these disasters wrought on town property and infrastructure, Bow applied for and received FEMA Public Assistance (PA) funds, Categories A-G, a 75% grant and 25% match program for several declared Merrimack County disasters. These PA funds have been used for overtime wages for Town employees, equipment rentals, snow removal, washout repair, road reconstruction, bridge repair, debris removal, and more.

The database where the Public Assistance funding information resides is available from **1993** to present (**2018**). The Public Assistance disaster funding was sought for and received by Bow for **8** of the **15** eligible *declared disasters* [DR-] in Merrimack County during this timeframe. *Emergency declaration* [EM-] funding was sought and received by Bow for **5** of the **6** eligible storms during this time period. Bow was eligible for funding from **21** total storms during this **25**-year time period. This data is available through FEMA at <https://www.fema.gov/openfema-dataset-public-assistance-funded-projects-details-v1>.

The most expensive disaster for Bow, in terms of FEMA Public Assistance (PA) funds received for recovery, was the **May 2006 Mother's Day Floods** after which Bow received **\$254k** for **10** small projects and **1** large project to help repair the roads and bridges, repair washed out shoulders and roads, and rehabilitate damaged bridges, and for emergency services. The last time the Town was awarded PA funding was the nearly **\$15k** for the wind storm and flooding from the **October 2017 Wind Storm**. All Public Assistance funding to date from **1993** to **October 2017**, totals **\$522k**. This detail is rounded to the nearest \$100/\$1,000 in **Table 10** for each disaster and is summarized previously in **Table 9**.

Town of Bow, NH Hazard Mitigation Plan Update 2018

4 HAZARD RISK ASSESSMENT

COLOR KEY for Table 10:

Declared Disasters in Merrimack County or Hillsborough County (Central NH Region)	PA Funding \$ Received by Bow	Other Bow Local Hazard Event	Regional Hazard Event with Bow Impacts
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Table 10
Local and Area Hazard Event and Disaster History

Event	Declared Disaster DR-	Year	Date	FEMA Public Assistance	Area Effects Surrounding Bow	Local Effects Occurring in Bow	Hazard Category	Source
TOWN TO ADD NEW EVENT ROWS HERE								Bow Hazard Mitigation Committee
Bow Lightning Strike Jul 2017	No	2018	Jul 17	N/A	N/A, but lightning strikes were reported throughout the State	Bow FD was dispatched to (6 Branch Londonderry Tpk) Crossroads Community Church for lightning strike fire coming from the steeple and spreading to the roof structure. Building was not occupied at the time of the fire. 2nd alarm assigned. Bow and other mutual aid crews worked in the interior. One minor injury reported.	Lightning	Bow Hazard Mitigation Committee, Bow Times, CNHRPC
Regional Thunderstorm, Severe Winds, Tornado and Debris May 2018	No	2018	May 4	N/A	All across the northern Central NH region, the evening of May 4 experienced heavy downpours along with strong wind gusts, straight line winds (microbursts) and possible tornadic activity. Many communities suffered significant tree and structure damage. The National Weather Service determined an EF-1 tornado blew 36 miles, about 300 yards across, through Warner, Bradford and Webster in the CNHRPC Region after originating in Charlestown (Sullivan County). About 41,000 customers lost power as a result of the storm.	In Bow, the storm knocked down trees, blocked roads, caused short power outages. Was not as severe as the western section of the region.	Wind, Downburst Storms, Tornado, Debris	Bow Hazard Mitigation Committee, CNHRPC, wmur.com , NH1.com
Contoocook Earthquake 2.4M Mar 2018	No	2018	Mar 7	N/A	A significant 2.4M earthquake was recorded by the USGS in March 2018. Its epicenter was around the Blackwater River in Hopkinton at a depth of 3.4km. Weak to light shaking was reported by a great number of people in Henniker,	Bow residents may have experienced slight shaking or a loud noise, often reported to local Police and Fire Depts or the USGS. Contoocook (Hopkinton) is abuts Bow	Earthquake, Earth	Earthquake.rack.com , Earthquake.usgs.gov , CNHRPC

Town of Bow, NH Hazard Mitigation Plan Update 2018

4 HAZARD RISK ASSESSMENT

Event	Declared Disaster DR-	Year	Date	FEMA Public Assistance	Area Effects Surrounding Bow	Local Effects Occurring in Bow	Hazard Category	Source
					Hopkinton, Webster, Salisbury (felt the greatest intensity), Bow and Concord. The Concord area has experienced 9 earthquakes in the past 365 days (earthquaketrack)			
Bow Traffic Accident/ Potential Haz Mat Spill Nov 2017	No	2017	Nov	N/A	N/A	A motor vehicle collision occurred on Woodhill Road where a Rymes Heating Oil truck overturned, but there was fortunately no spillage.	Traffic Accident, Haz Mat Spill	Bow Hazard Mitigation Committee, Bow Police Dept, CNHRPC
Severe Wind Storm and Flood Oct 2017	4355	2017	Oct 28-30	\$14,600	Merrimack and Hillsborough Counties experienced downed trees on powerlines, debris to clean up, and some flooding of drainage catch basins and culverts. The storm impacted northern NH, with 6 counties declared disasters. Power was out for an estimated 270,000 customers.	Bow received \$14,600 in FEMA Public Assistance funding for protective measures. Although power lines and trees were down on roads, the Town Public Works crew plowed debris aside and street drainage issues. No significant damages. White Rock Hill Road, Bow Center Road, Shore View Road, Knox Road lost power for 3-4 days.	Wind, Storms, Debris, Flood, Rainstorm	Bow Hazard Mitigation Committee
Severe Storms and Flooding Jul 2017	4329	2017	Jul 1-2	N/A for Bow	The entire State, North Country and Central NH region experienced severe storms with rain, wind, lightning, thunder and flooding. Not a declared disaster in Merrimack or Hillsborough counties.	Bow did not apply for or receive federal funds. Bow conducted debris clean up along roads but noted the storm was not out of the ordinary in Town.	Severe Winds Rain Storm, Thunder Storm, Lightning, Downburst	Bow Hazard Mitigation Committee, FEMA CNHRPC, WMUR, NOAA
Severe Snowstorm-Town Meeting Blizzard Mar 2017	4316	2017	Mar	N/A for Bow	Many other NH towns had to choose whether to close or not to accommodate the blizzard, which became a legal issue to sort out. Not a declared disaster in Merrimack or Hillsborough counties.	Bow did not apply for or receive federal funds. A state-wide blizzard occurred during Town Meeting, (Election Day Storm). This was the second year in a row a snowstorm disrupted NH Town Meetings.	Winter Weather, Extreme Temp, Snow Storm	Bow Hazard Mitigation Committee, CNHRPC, Concord Monitor
Bow Elementary School Bomb Threat Feb 2017	No	2017	Feb 2	N/A	N/A, although parents from other communities send their children to school in Bow	An automated prank robocall about a bomb threat was made to the Bow Elementary School (grades K-4). Several schools and daycares in NH, Mass and Maine were also called.	Human, Cyberterrorism, Fire/Explosion	Bow Hazard Mitigation Committee, Bow Police Dept
Webster Pillsbury Lake Earthquake 1.9M Feb 2017	No	2017	Feb 27	N/A	Residents of Contoocook, Webster and Warner in Central NH communities felt this earthquake most strongly. Since it occurred overnight, there were fewer reports. Its epicenter was at Pillsbury Lake.	Bow residents may have experienced slight shaking or a loud noise, often reported to local Police and Fire Depts or the USGS. Pillsbury Lake in Webster is about 10-15 miles to the north of Bow, only 2 towns away.	Earthquake, Earth	Webster Hazard Mitigation Committee, Earthquaketrack.com, Earthquake.usgs.gov

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Event	Declared Disaster DR-	Year	Date	FEMA Public Assistance	Area Effects Surrounding Bow	Local Effects Occurring in Bow	Hazard Category	Source
Central NH Region and Bow Excessive Heat 2016-2017	No	2016	-2017	N/A	NH and the Central NH region experienced high heat records throughout 2016 and 2017.	Many people don't have AC, lots of 90 degree days, humid. Elderly residents in White Rock Senior Living Community or in individual homes and other vulnerable populations such as the Schools and day care facilities required extra attention to help reduce the chance of heat exhaustion.	Extreme Temperature, Excessive Heat	Bow Hazard Mitigation Committee, CNHRPC
Merrimack County Drought Severe Emergency 2015-2016	No	2015	-2016	N/A	Severe Drought (D2), Moderate Drought (D1) and Abnormally Dry (D0) intensities were found in communities of Merrimack County and Hillsborough in 2016. The State's counties had been experiencing levels of drought for over a year. The NH DES issued a series of statements and tips for homeowner water conservation. Residents and municipalities had been requested to voluntarily conserve water. Some communities or water precincts enacted water restrictions or bans for certain water usage.	The Severe Drought (D2) conditions as of 09/16 caused some problems in Bow. Dug wells reportedly dried up. During this time, fire pond & dry hydrants ponds went dry. Dangerous fire conditions	Drought, Extreme Temperature, Increased Wildfire Risk	Bow Hazard Mitigation Committee, US Drought Monitor NH, NH DES
NH Severe Wind Rain & Thunder Storm Jul 2016	No	2016	Jul 23	N/A	The entire region and the State experienced a severe storms with rain, wind, lightning and thunder. A possible microburst was reported. As many as 72,000 customers lost electricity. A similar storm earlier in the week brought several confirmed microbursts and also downed trees.	Bow likely experienced the same effects, such as high winds, trees down on roads, power loss, heavy rains.	Severe Winds Rain Storm, Thunder Storm, Lightning, Downburst, Wildfire	Bow Hazard Mitigation Committee Concord Patch, CNHRPC, WMUR, NOAA
Earthquake 1.8M Andover Epicenter Oct 2016	No	2016	Oct 31	N/A	Epicenter in Andover/ Salisbury 1.8M with a depth of 6.1 km. Two other earthquakes occurred within 10 minutes on this day in the same area.	Bow residents may have experienced slight shaking or a loud noise, often reported to local Police and Fire Depts or the USGS. Andover is about 20-25 miles to the north west of Bow, still in Merrimack County.	Earth, Earthquake	Earthquaketrack.com, Earthquake.usgs.gov, CNHRPC
Earthquake 2.8M Warner Epicenter Mar 2016	No	2017	21-Mar	N/A	Epicenter in Warner/ Hopkinton area, 2.8 magnitude. Felt in the Central NH Region/most of Merrimack County, light in Hillsborough County. Felt most strongly in Hopkinton, Henniker,	Bow residents may have experienced slight shaking or a loud noise, often reported to local Police and Fire Depts or the USGS. Warner is about 20 miles to the northwest of Bow, only 2 towns away.	Earth, Earthquake	Earthquaketrack.com, Earthquake.usgs.gov, CNHRPC

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Event	Declared Disaster DR-	Year	Date	FEMA Public Assistance	Area Effects Surrounding Bow	Local Effects Occurring in Bow	Hazard Category	Source
					Warner, Webster, Salisbury, Franklin, Webster, Concord, and Hillsborough			
Earthquake 2.2M Epsom Epicenter Aug 2015	No	2015	2-Aug	N/A	Epicenter around Epsom in the Central NH Region in Merrimack County, felt in nearby locations including Concord, Hopkinton, Allenstown, Loudon Chichester and Epsom	A 2.2M earthquake occurred near Bow, 2 towns to the east in Epsom. A little shaking but no sounds reported.	Earth, Earthquake	Epsom Hazard Mitigation Committee, Earthquaketrack.com, Earthquake.usgs.gov, CNHRPC
Earthquake 2.3M Boscawen Epicenter May 2015	No	2015	May 24	N/A	Epicenter in lower Boscawen around Queen Street with 2.3M at a depth of 5km. A lot of reports were made at the USGS.	Bow residents may have experienced slight shaking or a loud noise, often reported to local Police and Fire Depts or the USGS. Boscawen is about 10-15 miles to the north of Bow, only 2 towns away.	Earth, Earthquake	Earthquaketrack.com, Earthquake.usgs.gov, CNHRPC
Tornado, Severe Thunderstorms Jul 2015	No	2015	31-Jul	N/A	In Warner, NWS confirmed an EF-0 tornado touched down in the evening. It had a maximum wind speed of 75 mph and was 100 yards wide. Town officials said the tornado ripped the roof off a barn, but there were no injuries reported.	Bow had high winds and some limbs down but no major damage. Warner is located in the Central NH Region, 2 towns to the north west of Bow.	Severe Wind, Tornado, Thunderstorm	Bow Hazard Mitigation Committee, WMUR, CNHRPC
Severe Winter Storm and Snowstorm - January Blizzard 2015	4209	2015	Jan 26-28	N/A for Bow	Predicted at near blizzard conditions, the end of January, 2015 snowstorm's major declaration ended up having a Hillsborough County wide per capita impact of \$3.88, making the storm a fairly expensive one at \$3.3 million dollars in Public Assistance over three southern NH counties. Snow approached 30" in some areas with heavy snow and 50 mph whiteout wind conditions. The closest reporting weather station, Concord Airport (CON), had accumulated 29" of heavy snow, 50 mph whiteout wind conditions in the region. <u>Not declared in Merrimack County.</u>	Bow could not apply for/receive funding. The storm was not particularly notable by the Town. Emergency service were provided, including snow removal, debris pickup, and response monitoring.	Severe Winter Weather, Extreme Temp, Snow, Ice, Power Failure, Severe Winds, Debris Impacted Infrastructure	Bow Hazard Mitigation Committee, fema.gov, Boston Globe, CNHRPC
Thanksgiving Day Snowstorm Nov 2014	No	2014	27-Nov	N/A	Large amount of snowfall fell in a very short period of time ahead of typical seasonal expectations. Power outages were prolific, with a peak of	This storm caused power outages and road closures. At the peak of the storm 95.4% of the Town was without power. Town-wide communication (all forms) -	Extreme Temp, Snow, Power Failure,	Bow Hazard Mitigation Committee, Concord Monitor, CNHRPC

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Event	Declared Disaster DR-	Year	Date	FEMA Public Assistance	Area Effects Surrounding Bow	Local Effects Occurring in Bow	Hazard Category	Source
					about 200,000 outages, from the Public Service of New Hampshire, Utilil (Concord area), and NH Electric Co-op. Nearby Concord and the towns on the eastern side of the Central NH region accumulated only 6-12" of snow according to PSNH, far less snow than southern and western NH. This was not a presidentially declared disaster in NH.	heavy snow and antiquated systems was lost – landline, phone, internet & electrical , cellular. The Town Public Works road crew out was out working for 4 days straight, most on little sleep.	Severe Wind	
Regional Communications Failure by Lightning 2014	No	2014	Summer	N/A	Regional event- Plausawa Hill (Pembroke) Lightning strike – disabled the Capital Area Fire Compact Dispatch. Fairpoint communications went down due to equipment failure, so the redundant system Merrimack County dispatch was also disrupted	This regional emergency response communications failure affected Bow as the Town uses the Capital Area dispatch. Life Alerts fail quickly because of failure, have to do the person checks as a result. All Emergency responders have hardlines.	Lightning, Communications Failure (Region-wide emergency response)	Bow Hazard Mitigation Committee, CNHRPC
Earthquake 2.6M Warner Epicenter Oct 2013	No	2013	11-Oct	N/A	Epicenter in Warner, 2.6 magnitude. Felt in the Central NH Region/ northern Merrimack County, most strongly in Hopkinton, Henniker, Warner, Bow, Concord, Salisbury, Franklin.	Bow residents may have experienced slight shaking or a loud noise, often reported to local Police and Fire Depts or the USGS. Warner is about 20 miles to the northwest of Bow, only 2 towns away.	Earthquake, Earth	Earthquaketrack.com, Earthquake.usgs.gov, USGS, CNHRPC
NH Severe Storms, Flooding and Landslide Jun-Jul 2013	4139	2013	Jun 26 – Jul 3	N/A for Bow	This declared disaster for Grafton, Sullivan and Cheshire Counties included landslides from the heavy rain. Public Assistance (PA) was available for these 3 Counties and Hazard Mitigation Assistance (HMA) became available statewide. Damage per capita was high – Grafton (\$39.58), Sullivan (\$24.48), and Cheshire (\$21.46). <u>Not declared in Merrimack or Hillsborough Counties.</u>	Bow was not within the declared disaster area and did not apply for HMA funding. There were no specific issues in Town noted. Any flooding or other problems were handled as normal business.	Landslide, Severe Storms, Flood, Wind, Rain, Debris Impacted Infrastructure	FEMA, CNHRPC
Severe Winter Storm and Snowstorm - Winter Storm NEMO 2013	4105	2013	Feb 8-10	\$36,421	Winter Storm "Nemo". FEMA-3360-DR. Blizzard conditions with winds gust of 50-60 MPH and over 20 inches snow hit New Hampshire and the New England area. Disaster declaration received for emergency protective measures in eight counties of the State.	Bow received \$36,421 in FEMA Public Assistance funding for protective measures. Emergency services were provided, including snow removal, debris pickup, response monitoring, and road maintenance. The Police and Fire Depts worked overtime. No damage to building or equipment, utility	Severe Winter Weather, Extreme Temp, Snow, Ice, Wind	FEMA, Bow Hazard Mitigation Committee, CNHRPC

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Event	Declared Disaster DR-	Year	Date	FEMA Public Assistance	Area Effects Surrounding Bow	Local Effects Occurring in Bow	Hazard Category	Source
						systems, or water systems. Total for town about \$100k. Power failure for several days.		
Hurricane Sandy Oct 2012	4095 EM-3360	2012	Oct 26-Nov 8	\$4,909	Merrimack County and Hillsborough County received a disaster declaration for Emergency Protective Measures. Five counties experienced severe damage from heavy winds and moderate flooding, 218,000 customers without power. Fallen trees and debris closed roads, building and vehicle damage.	Bow received \$4,909 in FEMA Public Assistance funding. One month of local highway tree and debris clean-up was needed, with two crews of 4 each. Power outages 3 days. At the peak of the storm, 3,200 customers had no electricity in Bow. Wires fell down at 13 different locations which involved road closures. The Town Shelter was not opened.	Wind, Flood, Severe Storm, Hurricane, Debris Impacted Infrastructure	Bow Hazard Mitigation Committee, FEMA, Nashua Telegraph, CNHRPC
Earthquake 4.0M Hollis ME Epicenter Oct 2012	No	2012	16-Oct	N/A	With the epicenter near Hollis Center, Maine, a 4.0 earthquake was measured and felt not only in Central NH, but throughout New England. Reportedly sounding like a jumbo jet and lasting for 10 seconds, calls came in to local Fire Departments inquiring about the event. By two hours later, no calls reporting damages or injuries had been received.	Reports may have been made to the USGS from Bow with an earthquake of this magnitude as it was felt around the Central NH Region. Hollis is about 40 miles to the southwest of Bow	Earthquake, Earth	Concord Monitor, Earthquake-track.com, CNHRPC
NH Severe Storm and Flooding May 2012	4065	2012	May 29-31	N/A for Bow	This declared disaster for Cheshire County. Public Assistance (PA) was available and Hazard Mitigation Assistance (HMA) became available statewide. Damage per capita was high – Cheshire (\$26.04). <u>Not declared in Merrimack or Hillsborough Counties.</u>	Bow was not within the declared disaster area and did not apply for HMA funding. There were no specific issues in Town noted. Any flooding, tree fall or other problems were handled as normal business.	Flood, Severe Storms, Wind, Rain	FEMA, CNHRPC
Halloween Snow Storm Oct 2011	4049	2011	Oct 29-30	N/A for Bow	FEMA-4049-DR. Towns in Central NH were impacted by this shocking, early severe snowstorm, although a major disaster declaration was <u>not declared in Merrimack County</u> . Halloween festivities were cancelled in most communities, to the heartbreak of young children. In Hillsborough County, damages were at the equivalent of \$5.11 per capita (400,721 people in 2010). The storm was also	Bow could not apply for/receive funding. At the end of October 2011, a heavy, wet unexpected snow storm impacted the state. Trees and power went down. The snow storm resulted in down power and utility lines causing disruptions in communications. All PSNH residents in south Bow lost power: Cardinal Drive, Ordway Lane, and Merrill Crossing, Chelsey Drive, South Bow Dunbarton Road, Crescent Drive, and Quimby Road were all out of	Extreme Temp, Snow, Communications Failure, Power Failure	FEMA, Bow Hazard Mitigation Committee, CNHRPC

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Event	Declared Disaster DR-	Year	Date	FEMA Public Assistance	Area Effects Surrounding Bow	Local Effects Occurring in Bow	Hazard Category	Source
					declared in Rockingham County.	electricity for a week. The Town emergency services identified special needs folks and performed safety checks, held a carbon monoxide and fire safety awareness program with each resident, and set up a hotline for power updates and shelter information. The lines were underground and their primary feeders were taken down. Only about 100 residents total were affected to this greatest extent.		
Tropical Storm- Irene Aug-Sep 2011	4026	2011	Aug 26- Sep 6	\$7,577	Carroll, Coos, Grafton, and Merrimack Counties suffered severe impacts to roads and bridges as a result of flooding from Tropical Storm Irene, which also caused power outages. Merrimack County reimbursement to towns was \$4.29 per capita (146,455 people in 2010), a total of \$11m was allocated. Disaster was not declared for Hillsborough County.	Bow received \$7,577 in FEMA Public Assistance funding for protective measures, debris removal and roads and bridges. Tree blowdowns and limbs falling. Bow had street flooding from Tropical Storm Irene, but only one road closure occurred, on North Bow Dunbarton Road, and this was due to downed trees. Power was restored quickly to most homes, with all power restored within 24 hours. The emergency officials prepared for the necessary emergency services by holding senior staff briefings three days before the storm. In advance, each Department checked their equipment, and the EOC was staffed at level 3. Prior to and throughout the storm, the shelter (Bow High School) opened as a regional shelter. The Town obtained FEMA reimbursements for the storm, including for the night of Sunday September 6 when a severe storm 60 mph microburst hit NH 3A, damaging or destroying over a dozen recreational vehicles at a dealership between Grandview and Down Road. Multiple camper vehicles were picked up and tossed, causing immense vehicular damage, although no injuries were reported. The damage also included closed roads and extensive power outage on NH 3A. The Police Dept's	Wind, Flood, Severe Storm, Rainstorm, Tropical Storm, Debris Impacted Infrastructure, Microburst, Communications Failure, Power Failure,	FEMA, Bow Hazard Mitigation Committee, CNHRPC

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Event	Declared Disaster DR-	Year	Date	FEMA Public Assistance	Area Effects Surrounding Bow	Local Effects Occurring in Bow	Hazard Category	Source
						dispatch center was disrupted		
Bow Arboviral Positive Summer 2011	No	2011	Summer	N/A	N/A, although nearby Central NH region communities were likely affected by arboviral diseases.	Birds were tested positively for West Nile and EEE in Bow.	Public Health, Biological	Bow Hazard Mitigation Committee, CNHRPC
Bow Lightning Strikes Summer 2011	No	2011	Aug - Sep	N/A	N/A, although it is likely other region communities were impacted as well, including the power outages	The Fire Department has responded to lightning strikes at buildings on Laurel Drive and Garvins Falls Road, but no fire was found.	Lightning, Thunderstorm	Bow Hazard Mitigation Committee, CNHRPC
NH/Regional April Fool's Snowstorm Apr 2011	No	2011	1-Apr	N/A	A Nor'easter snowstorm impacted the State, causing over 30,000 power outages, most by PSNH. Snow fell in depths of up to 8", but stopped by noon. Although dozens of accidents were reported, no serious injuries were reported. Trucks from Quebec Hydro were staged at various Fire Depts ready for deployment to fix downed wires.	An unexpected severe weather event occurred with little warning causing many trees to fall in Bow. The heavy snow also caused loss of power and transportation disruptions.	Extreme Temp, Snow, Wind Chill, Power Failure, Debris Impacted Infrastructure	Bow Hazard Mitigation Committee, wmur.com , CNHRPC
Bow Structure Fires 2011-2012	No	2011	2012	N/A	N/A, although with Capital Area Mutual Aid, neighboring communities likely responded	Fire Department reports responding to building fires on Oak Ridge Drive (Mar 2011), Bow Bog Road (Sep 2011), Hollow Road (Oct 2011), Woodhill Road (Dec 2011) and Hunter Drive (Mar 2012). Responded to an explosion in an apartment at 6 Bow Center Road caused by a chemical reaction (Aug 2011).	Fire, Explosion	Bow Hazard Mitigation Committee, CNHRPC
Bow Building Collapse Potential Jan 2011	No	2011	Jan	N/A	N/A, although regional snow conditions should have been similar to Bow's	Severe winter storms created extensive snow loading on business and residential properties; however, there were no significant incidents reported. There is however the potential for collapses to occur.	Extreme Temps, Winter Snow, Storm, Snow Melt	Bow Hazard Mitigation Committee, CNHRPC
Earthquake 3.4M Webster/Boscawen Epicenter Sep 2010	No	2010	26-Sep	N/A	"A magnitude 3.4 earthquake rattled buildings and nerves across much of New Hampshire Saturday night. The quake occurred at 11:28 p.m. and was centered about 10 miles north of Concord, according to the U.S. Geological Survey. State police said they received reports from residents across the state who	Boscawen is about 10-15 miles to Bow north, 2 towns away. Bow residents likely felt this tremor	Earth, Earthquake	Bow Hazard Mitigation Committee, Union Leader, USGS, CNHRPC

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Event	Declared Disaster DR-	Year	Date	FEMA Public Assistance	Area Effects Surrounding Bow	Local Effects Occurring in Bow	Hazard Category	Source
					reported what they thought was an explosion. The quake was felt in places like Fremont, Derry, Durham, Henniker, Penacook and Raymond. There were no reports of damage." The quake was in fact felt all over the state, Southern ME and MA, but most reports were received from the Central NH region.			
Quebec-Ottawa Earthquake 5.0M Jun 2010	No	2010	Jun	23	Earthquake lasted about 30 seconds, epicenter near Buckingham, Quebec 35 north of Ottawa. Ottawa declared this earthquake the most powerful in 65 years. Tremors felt in Central NH.	No known impacts to Bow specifically, but this large quake was felt regionwide	Earthquake, Earth	Bow Hazard Mitigation Committee, CNHRPC
Canadian Wildfire Air Quality May 2010	No	2010	May	31	On Memorial Day weekend, brush fires from Canada impacted the air quality of New Hampshire. Residents from more than 50 wildfires that are burning out of control in Quebec. Over 150,000 acres in central Quebec, north of Montreal and Quebec City, about 500 miles north of Manchester, reduced visibility to 1.75 miles in Concord. No air quality alert was issued, although people with respiratory issues were urged to remain indoors.	Bow residents likely experienced the effects and viewed & smelled the smoke in the air.	Air Quality, Public Health	Bow Hazard Mitigation Committee, CNHRPC, Union Leader
Bow Middle School Bomb Threat Mar 2010	No	2010	Mar 15	N/A	N/A, although parents from other communities send their children to school in Bow	A Bomb scare occurred at Bow Memorial School (grades 5-8). The school was evacuated, but no device was found. A subject was arrested for the threat.	Human, Cyberterrorism, Fire/Explosion	Bow Hazard Mitigation Committee, Bow Police
Severe Storms and Flooding Mar 2010	1913	2010	Mar 14-31	\$0	Severe storms and flooding occurred over two weeks and damaged roads and bridges. Merrimack County reimbursement to towns for repair was \$0.28 per capita (146,455 people in 2010), and in Hillsborough County reimbursements were \$1.80 per capita (400,721 people in 2010)	Bow did not apply for/receive funding. Much of the damage from the previous storm was still being cleaned up and repaired. The Town did not experience much additional flooding and high winds during this event.	Severe Winds, Flooding, Power Failure, Debris Impacted Infrastructure	Bow Hazard Mitigation Committee, FEMA
Severe Winter Storm Feb-March Storm and	1892	2010	Feb 23-Mar 3	\$37,203	This severe weather event included high winds, rain, and snow over a week-long period. The primary impact	Bow received \$37,203 in FEMA Public Assistance funding for roads & bridges, debris removal, protective	Extreme Temp, Snow, Wind,	Bow Hazard Mitigation Committee, FEMA,

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Event	Declared Disaster DR-	Year	Date	FEMA Public Assistance	Area Effects Surrounding Bow	Local Effects Occurring in Bow	Hazard Category	Source
Flooding 2010					was debris removal and repair reimbursement for fallen trees and powerlines. In Merrimack County, the reimbursement to communities was the equivalent of \$10.39 per capita (146,455 people in 2010), with Hillsborough County at \$3.68 per capita (400,721 people in 2010). In the Concord area, 21,000 Utilil customers were out of power at the peak outage period.	measures and recreational/other. This multi-hazard storm which included a snowstorm and high wind event in February and subsequent flooding in March. This severe winter storm felled trees and powerlines, causing debris on roads, homes, and surfaces which resulted in scattered power outages. Individual structure damages occurred. All roads suffered downed limbs. At least 10 roads were closed, but the Town was able to open them quickly. The Town Shelter was opened in the Community Building/ Fire Station.	Flood, Wind Chill,	Utilil, CNHRPC
Bow Fire Dept Response-Transportation Accidents with Injuries 2009-2012	No	2009	2012	N/A	N/A, although Capital Area Mutual Aid and NH State Police likely assisted at some accident scenes	The Bow Fire Department responded to one-hundred ten (110) transportation accidents and motor vehicle accidents with injury between 2009 and 2012.	Transportation Accident	Bow Hazard Mitigation Committee, CNHRPC
Bow Hazardous Materials Spills 2009-2011	No	2009	2011	N/A	N/A, although Capital Area mutual Aid and Haz Mat Team likely assisted	Community has experienced numerous small spills that have resulted from car accidents involving petroleum products as well as incidents involving household cleaning products and improper mixing and storage of pool chemicals. In addition, the town has experienced gas line disruptions and LP tank venting problems. The potential for complex and catastrophic events exists with three major highways that are susceptible to transportation related incidents involving hazardous materials of all kinds.	Hazardous Materials Spills	Bow Hazard Mitigation Committee, CNHRPC
Pandemic Swine Influenza 2009-2011	No	2009	2011	N/A	The swine flu (H1N1) pandemic was experienced across the globe and was closely monitored by NH doctors. H1N1 was included in the seasonal vaccine strains for 2009-10, 2010-11 and 2011-12 vaccines. Public service announcements about proper hygiene, staying isolated when sick, and	Bow began preparing for this potential swine influenza pandemic to occur in Town	Public Health, Biological	Bow Hazard Mitigation Committee, CNHRPC, www.nh.gov/safety/divisions/hsem/ , www.dhhs.state.nh.us/dphs/cdcs/influenza/ ,

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					fact sheets were prominent. There 722 state-reported confirmed cases to date, as well as 10 confirmed NH deaths related to flu complications.			www.cdc.gov , www.en.wikipedia.org
Bow Structure Fires 2009-2010	No	2009	2010	N/A	N/A, although with Capital Area Mutual Aid, neighboring communities likely responded	Fire Department reports responding to building fires on Grandview Road (May 2009), River Road (Apr 2011), Bow Center Road roof fire (May 2010), and Branch Londonderry Turnpike West (Dec 2010) Responded to an explosion in an apartment at 6 Bow Center Road caused by a chemical reaction (Sep 2010) and an explosion on Hooksett Turnpike caused by over pressurization of LP tank (Feb 2010).	Fire, Explosion	Bow Hazard Mitigation Committee, CNHRPC
Severe Winter Storm - Dec 2008 Ice Storm	1812	2008	Dec 11-23	\$50,564	Accumulating ice, snow, rain, and strong winds caused downed trees and power lines, with power outages and traffic accidents resulting. In Merrimack County, debris removal and repair cost reimbursement FEMA the equivalent of \$10.07 per capita (146,455 people in 2010). In Hillsborough County, debris removal costs were \$6.35 per capita (400,721 people in 2010). The major disaster was declared in all 10 counties. New England was blanketed with ice and snow during the winter storm. Weight of ice caused branches to snap, and trees to either snap or uproot, bringing 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. Event was the largest power outage in NH history.	Bow received \$50,564 in FEMA Public Assistance funding for debris removal and protective measures. The December 2008 ice storm had a significant impact on Bow. Town-wide power outages occurred for up to 10 days in most of the Town. Road debris caused numerous road closings, and lots of removal had to occur. Many houses were damaged from falling trees and limbs. The weather was cold right after the event and people had no heat. Putney Road/Buckingham Road at the top of Brown Hill Road was the last location in Bow to have power reconnected. Much of the damage was elevation-driven. The Ice Storm took down power lines which resulted in communications disruptions; including phones and cellphones	Extreme Temp, Ice, Wind, Technological, Power Failure, Debris Impacted Infrastructure, Communications Failure	Bow Hazard Mitigation Committee, FEMA, CNHRPC

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Event	Declared Disaster DR-	Year	Date	FEMA Public Assistance	Area Effects Surrounding Bow	Local Effects Occurring in Bow	Hazard Category	Source
Severe Storms and Flooding (Hurricane Hannah) - Sep Flood 2008	1799	2008	Sep 6-7	\$0	Heavy rain from the remnants of tropical storm Hanna resulted in flooding on small rivers and streams in the Central NH area. The remains of tropical storm Hanna moved through eastern New England dumping 3 to 6 inches of rain in New Hampshire in about 8 hours causing rapid rises on area streams. In Merrimack County, damage to road systems totaled the equivalent of \$1.48 per capita (146,455 people in 2010) for town reimbursement. Hillsborough County's damage was much higher at \$6.90 per capita (400,721 people in 2010)	Bow did not apply for/receive funding for roads & bridges or protective measures. Town Departments cleaned up tree debris and repaired damages Utility companies restored electricity.	Flood, Debris Impacted Infrastructure	Bow Hazard Mitigation Committee, FEMA, CNHRPC
Severe Winds, Heavy Rains July Tornado 2008	1782	2008	Jul 24	\$0	An EF3 tornado touched down in Rockingham County then proceeded into another county. Then in Merrimack County, the tornado was rated up to an F-3 and killed a woman in Deerfield trapped in a collapsed house. In the county, there was substantial damage totaled the equivalent of \$1.12 per capita (146,455 people in 2010) for the towns' debris removal reimbursement costs. A total of 123 residences statewide were affected, with 17 destroyed and another 37 suffering major damage. Damage was estimated to exceed \$10 million. Hillsborough County	Bow did not apply for/receive funding for roads & bridges or protective measures Town Departments cleaned up tree debris and repaired damages Utility companies restored electricity.	Wind, Tornado, Downburst, Severe Storm, Debris Impacted Infrastructure, Power Failure	FEMA, Bow Hazard Mitigation Committee, CNHRPC
Bow Utility Failure Feb 2008	No	2008	Feb 18	No	About 80,00 homes and businesses in the state reportedly lost power. Utilil had outages in every town it serves. A reported 25,000 customers in the Concord area lost power.	55 mph wind gusts, resulting from a cold front in the region, felled trees which blocked roads and downed power lines in Bow.	Power Failure, Extreme Temps Winter Storm, High Winds, Debris Impacted Infrastructure	Bow Hazard Mitigation Committee, CNHRPC, Concord Monitor

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Event	Declared Disaster DR-	Year	Date	FEMA Public Assistance	Area Effects Surrounding Bow	Local Effects Occurring in Bow	Hazard Category	Source
Severe Storms and Flooding - April Spring Flood 2007	1695	2007	Apr 15-23	\$19,474	Extensive flooding caused by severe storms impacted seven counties. Indirect peak discharge measurements on stream gages on the Merrimack River at Short Falls Road in Webster were 14,100 ft ³ , which was determined to be greater than 100-year flood discharge levels. The heavy rain combined with snow melt to cause small rivers and streams in much of New Hampshire to flood. Over land, the strong winds downed numerous trees. The downed trees caused widespread power outages, especially near the coast, and numerous road closures. The storm also brought heavy rain to the region which, when combined with snow melt, produced widespread flooding across much of the region.	Bow received \$19,474 in FEMA Public Assistance funding for roads & bridges, protective measures and recreational/other. The snow pack melt of April 2007 created a direct impact for flooding. Areas that were still damaged from the previous year's flood sustained further damage. Although problems were identified when the Dunklee Road box culvert bridge was rebuilt in 2006 after the Mother's Day Flood, the bridge had been open for six months when it was impacted by the 2007 flood.	Flood, Wind, Debris Impacted Infrastructure, Rapid Snow Pack Melt	FEMA, USGS Flood of 2007, Bow Hazard Mitigation Committee, CNHRPC
Bow Lightning Strikes Summer 2006	No	2006	Summer	N/A	N/A, although it is likely other region communities were impacted as well, including the power outages	The Fire Department has responded to three lightning-related fires this year. Lightning hit wells and dog fences and back traveled to the homes. In addition, lightning struck a transformer on NH 3A, splitting the line in half, affecting Concord, Bow, and NH 3A.	Lightning, Thunderstorm, Fire, Wildfire Power Failure	Bow Hazard Mitigation Committee, CNHRPC
Epsom Suncook River Avulsion-Mother's Day Flood 2006	1643	2006	May 12-23	Yes, see below	N/A, although this unusual avulsion event on the Suncook River in Epsom still has far-reaching effects in downstream communities (Pembroke, Allenstown) and sedimentation of the Merrimack River to its exit at Newburyport, MA.	Avulsion not experienced in Bow. However the Suncook empties into the Merrimack River at the south of Bow. Sediment has been backing up the confluence in the 2006 avulsion and has been raising the profile of the Merrimack River along much of Bow. Bank eroding is occurring. Future flooding conditions may be more dangerous as a result.	Flood, Channel Movement, Erosion, Landslide, Mass Failure, Sedimentation	Bow Hazard Mitigation Committee, CNHRPC
Severe Storms and Flooding – Mother's Day Flood 2006	1643	2006	May 12-23	\$254,293	Extensive flooding caused by severe storms impacted seven counties including Merrimack and Hillsborough Counties. The USGS recorded the highest flows on record for several	Bow received \$254,293 in FEMA Public Assistance funding for roads and bridges, debris removal, protective measures, and recreational/other. The Dunklee Road box culvert	Flood, Wind, Debris Impacted Infrastructure, Erosion,	Bow Hazard Mitigation Committee, FEMA, USGS, CNHRPC

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Event	Declared Disaster DR-	Year	Date	FEMA Public Assistance	Area Effects Surrounding Bow	Local Effects Occurring in Bow	Hazard Category	Source
					rivers including the Contoocook River in Davisville village, Soucook in Concord, and Piscataquog in Goffstown.	bridge where a brand new gas line had just been installed was impacted by the flooding of Bow Bog Brook. The box culvert was rebuilt as a result. In 2012, the rebuilt box culvert bridge is now falling apart. The "Mother's Day" flood caused more than one million dollars in damage to public property in Bow, and an as-yet undetermined amount of damage to private property, mostly in flooded basements of residences. Public property damage included widespread high water on roadways, undermining of pavement in many areas, particularly on Allen Road, and the closing of Dunklee Road and Page Road due to washed out culverts. Dunklee Road remained closed for more than three months while repairs were designed and built. The Merrimack River continues to pose an erosion threat to private homes on the riverbank on Hall Street in Bow. Merrimack River erosion is also threatening River Road in Bow. The extent of damage was far more widespread than any other flooding in the memory of current residents. The Turkey River threatened to flood, including the State South Street bridge and I-89 ramps. The heavy rainstorm threatened to breach the St. Paul's School dam in Concord. The school complex was heavily flooded and damaged. NH 3A was closed for three days as a result of the floods, which affected businesses, restaurants, and truck stops in Bow	Landslide, Dam Failure or Release, Inundation	
Bow and Regional Wildfire Apr 2006	No	2006	Apr 29	N/A	The railroad tracks run from Concord, Bow, Hooksett and into Manchester. The fire occurred in many locations anywhere along the line through these communities	A freight train sparked brush fires along tracks in Bow, Hooksett and Manchester. In Bow, a 50' by 350' fire was spreading toward the woods when officials arrived on the scene. Concord Fire Chief said that fires sparked by	Wildfire, Fire	Bow Hazard Mitigation Committee, CNHRPC, WMUR News, Concord Hazard

Town of Bow, NH Hazard Mitigation Plan Update 2018

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Event	Declared Disaster DR-	Year	Date	FEMA Public Assistance	Area Effects Surrounding Bow	Local Effects Occurring in Bow	Hazard Category	Source
						trains are not unusual and they are typically caused by exhaust coming out of the stack.		Mitigation Committee
Bow Cyberterrorism/ Information Breach Spring 2006	No	2006	Spring	N/A	N/A	At Bow Mills Bank, there was a chance of access to banking information and a suspected information breach.	Cyberterrorism, Human	Bow Hazard Mitigation Committee, CNHRPC
Severe Storms and Flooding - Columbus Day Flood 2005	1610	2005	Oct 7-18	\$5,145	Extensive flooding caused by severe storms impacted five counties, including Merrimack and Hillsborough. Alstead experienced several fatalities as the result of dam failure.	Bow received \$5,145 in FEMA Public Assistance funding for roads & bridges. Many roads were washed out.	Flood, Wind, Debris Impacted Infrastructure, Erosion, Scouring, Mass Failure	Bow Hazard Mitigation Committee, FEMA
Bow Storms and Power Failure Sep 2005	No	2005	Sep 30	N/A	N/A, although storms are often regional and have similar damages region- or state- wide. About 13,000 PSNH customers lost power. At least 1,400 of the 13,000 customers were located in Concord and Canterbury	High winds and heavy rains downed trees, causing power outages in the area. In Town, the radio station WTPL 107.7 F.M. lost power for 2 hours.	Wind storm, Power Failure, Debris Impacted Infrastructure, Communications Failure	Bow Hazard Mitigation Committee, CNHRPC, Concord Monitor
State and Bow Arboviral Positive Summer 2005	No	2005	Summer	N/A	Seven people were tested in New Hampshire for EEE, Eastern Equine Encephalitis and two died. Forty-six (46) birds and a mosquito pool were tested for West Nile Virus.	Birds were tested positively for West Nile and EEE in Bow.	Public Health, Biological	Bow Hazard Mitigation Committee, CNHRPC, NH Center for Disease Control
Regional Thunderstorms and Lightning Jun 2005	No	2005	12-Jun	N/A	During a thunderstorm, lightning struck and severely damaged the historic Loudon Town Hall on Clough Hill Road. Winds from severe thunderstorm knocked down trees and power lines down in the towns of Warner, Hopkinton, Concord, Boscawen, Loudon, and Webster in Merrimack County.	Bow likely experienced the thunderstorm and lightning event, but none notable by the Haz Mit Committee.	Thunderstorm, Lightning, Severe Winds	Bow Hazard Mitigation Committee, CNHRPC, Area Hazard Mitigation Committees
Bow Storms and Power Failure Mar 2005	No	2005	Mar 9	N/A	N/A, although storms are often regional and have similar damages region- or state- wide. Customers in Hopkinton and Chichester all lost power temporarily.	Cold air, blizzard-like conditions and fierce winds in excess of 40 mph, were the cause of power outages to 550 Utilit customers on Stickney Hill Road and Hopkinton Road.	Wind Storm, Power Failure, Debris Impacted Infrastructure	Bow Hazard Mitigation Committee, CNHRPC, Concord Monitor

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Event	Declared Disaster DR-	Year	Date	FEMA Public Assistance	Area Effects Surrounding Bow	Local Effects Occurring in Bow	Hazard Category	Source
Snow Emergency Jan 2005	EM-3207	2005	Jan 22-23	\$31,258	Record and near record snowstorm for 8 NH counties including Merrimack and Hillsborough. Emergency protective measures declared for reimbursement.	Bow received \$31,258 in FEMA Public Assistance funding for protective measures, including snow removal.	Extreme Temp, Snow	FEMA, CNHRPC
Bow High School Bomb Threats 2005	No	2005	---	N/A	N/A, although parents from other communities send their children to school in Bow	The High School received 2 bomb threats that year. Police Department had to search all bags	Human, Cyberterrorism, Fire/Explosion	Bow Hazard Mitigation Committee, Bow Police
Bow Civil Disturbance 2005	No	2005	---	N/A	N/A, although the issues raised were regional	The Zoning Board of Adjustment and Planning Board held a meeting regarding the proposed ash landfill in Canterbury along the Merrimack River. The Oxbow Initiative held a peaceful demonstration, and Bow Police Department was called to ensure that it remained peaceful.	Human, Civil Disturbance	Bow Hazard Mitigation Committee, Bow Police Dept
Pandemic Avian Influenza Preparation 2005-2006	No	2005	2006	N/A	The State was preparing for the Avian flu pandemic, which did not end up impacting the country. Using over \$800,000 in federal funds, Town emergency officials trained for the possible pandemic. Ten portable trailers were dispersed across the State, containing medical supplies. Articles and public service announcements served to educate the public.	Bow began preparing for this potential avian influenza pandemic to occur in Town.	Public Health, Biological	Bow Hazard Mitigation Committee, CNHRPC, www.dhhs.state.nh.us/dphs/cdcs/avian , www.nhphn.org/news , www.wildlife.state.nh.us/Wildlife
Bow Storms and Power Failure Nov 2004	No	2004	Nov 6	N/A	N/A, although storms are often regional and have similar damages region- or state- wide. High winds left thousands in New Hampshire without power.	Utilil Energy Systems, the local energy provider, reported 550 customers without power in Concord and Bow. Outages were caused by limbs or entire trees falling on lines or equipment.	Wind Storm, Power Failure, Debris Impacted Infrastructure	Bow Hazard Mitigation Committee, CNHRPC, Concord Monitor
Earthquake 2.2M Henniker-Hopkinton Epicenter Jan 2004	No	2004	20-Jan	N/A	An earthquake measuring 2.2 on the Richter Scale was centered in the Henniker- Hopkinton area. Shaking and noise were reported, but no damage occurred.	Bow residents may have experienced slight shaking or a loud noise, often reported to local Police and Fire Depts or the USGS. Hopkinton abuts Bow and Henniker is 1 town away	Earth, Earthquake	Concord Monitor, January 2004, USGS, Earthquake Monitor, CNHRPC
Snow Emergency Dec 2003	EM-3193	2003	Dec 6-7	\$25,006	Record snow fall event impacting much of New England. In NH, 8 counties received emergency protective measures,	Bow received \$25,006 in FEMA Public Assistance funding for protective measures, including snow removal.	Extreme Temp, Snow	FEMA, CNHRPC

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Event	Declared Disaster DR-	Year	Date	FEMA Public Assistance	Area Effects Surrounding Bow	Local Effects Occurring in Bow	Hazard Category	Source
					including Merrimack and Hillsborough.			
Snow Emergency Feb 2003	EM-3177	2003	Feb 17-18	\$16,292	Record and near record snowstorm for 5 NH counties including Merrimack and Hillsborough. Emergency protective measures declared for reimbursement.	Bow received \$16,292 in FEMA Public Assistance funding for protective measures, including snow removal.	Extreme Temp, Snow	FEMA, CNHRPC
Bow Computer Sabotage 2002	No	2002	---	N/A	N/A	Volunteers were able to track a hacking attempt of the Town's server, giving access to all Town files, from Germany	Cyberterrorism	Bow Hazard Mitigation Committee, CNHRPC
NH Drought Emergency 2002	No	2002	Aug	N/A	All counties in the State of NH except Coos County. One of the hottest Augusts on record in Concord along with drought conditions since March made for a high fire danger in New Hampshire. Numerous forest fires were reported, including a 30-acre blaze in New Durham.	N/A, although Bow was likely affected by dug wells going dry and fire ponds receding	Drought, Extreme Temperatures, Earth, Fire	Concord Monitor 8/20/02, NHDES, CNHRPC
Bow September 11 Terrorism Response Sep 2001	No	2001	Sep 11	N/A	The effects of 9/11 were, and continue to be, felt across the country	Terrorist attacks on the World Trade Center in New York City caused concerns of a terrorist threat against the Public Service of New Hampshire's Merrimack Station power generation plant in Bow. The Bow Police Department was seriously impacted by providing 24-hour security for the plant for more than a month until PSNH was able to provide for its own security at the plant.	Terrorism	Bow Hazard Mitigation Committee, CNHRPC
Bow Thunderstorms Jun 2001	No	2001	Jun	N/A	N/A, although thunderstorms likely impacted other Central NH region communities	Thunderstorms produced hail up to 1" (one inch) in diameter and strong winds that downed many trees.	Wind, Hurricane, Flood, Debris Impacted Infrastructure, Lightning	National Climatic Data Center, CNHRPC
Snow Emergency Mar 2001	EM-3166	2001	Mar 5-7	\$18,924	Record and near-record snowfall from late winter storm, emergency declaration was issued for protective measures. Merrimack, Hillsborough and 5 other counties declared eligible.	Bow received \$18,924 in FEMA Public Assistance funding for protective measures, including snow removal.	Extreme Temp, Snow	FEMA, CNHRPC
Regional	No	1999	6-Jul	N/A	Severe storms in July 1999 bring strong damaging winds and 3 downbursts.	Bow likely experienced some heavy winds, trees down on roads and power outages as	Severe Wind, Downburst	Concord Monitor, NH

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Event	Declared Disaster DR-	Year	Date	FEMA Public Assistance	Area Effects Surrounding Bow	Local Effects Occurring in Bow	Hazard Category	Source
Downbursts and Severe Winds Jul 1999					Two deaths occurred. The roof of the Pill building in Concord is blown off during a storm. The downburst was designated a macroburst (at least 2.5 miles in diameter). Other communities in the Central NH Region experienced damages	well during this severe wind storm		HSEM, CNHRPC
Severe Storms and Flooding Summer 1998	1231	1998	Jun 12-Jul 2	No	Heavy flooding in six counties, including Merrimack and Hillsborough Counties. Damages of \$3.4m for all counties.	Bow did not apply for/receive funding. As Bow is within Merrimack County, it is likely experienced heavy rains and possibly some flooding. A Canadian man attempting to repair phone lines suffered temporary paralysis after nearby phone equipment was struck by lightning and damaged.	Flood, Wind, Debris Impacted Infrastructure	FEMA, CNHRPC, National Climatic Data Center
Ice Storm of Jan 1998	1199	1998	Jan 7-25	\$0	This ice storm was the first to test our statewide and local emergency management systems and utility providers. Tree and infrastructure damage was extensive and power failures lasted up to two weeks in some parts of the state. In The Central NH Region, many lost power for over a week. This ice storm had severe impacts throughout most of the State, with 52 communities impacted. FEMA Disaster Declaration #1199, Six injuries and one death resulted. Damage totaled \$12,446,202. In addition, there were 20 major road closures, 67,586 people left without electricity, and 2,310 people without phone service.	Bow did not apply for/receive funding. The Town reported Putney Hill and Brown Hill were affected.	Extreme Temp, Ice Storm, Power Failure, Communications Failure	FEMA, US Army Corps of Engineers NH Storms database, Bow Hazard Mitigation Committee, CNHRPC
Severe Storms and Flooding Oct 1996	1144	1996	Oct 20-23	\$0	Heavy rains caused flooding in six counties, including Merrimack and Hillsborough Counties. Damage totaled \$2.3m for all counties.	Bow did not apply for/receive funding. As Bow is within Merrimack County, it is likely experienced heavy rains and possibly some flooding.	Flood	FEMA, NH HSEM, CNHRPC
Storms and Floods Oct-Nov 1995	1077	1995	Oct 20-Nov 15	\$0	Four NH counties were damaged by excessive rain, high winds and flooding, including Merrimack (not Hillsborough).	Bow did not apply for/receive funding. As Bow is within Merrimack County, it is likely experienced heavy rains, trees down and power outages.	Flood, Severe Winds	FEMA, Federal Register, CNHRPC

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Event	Declared Disaster DR-	Year	Date	FEMA Public Assistance	Area Effects Surrounding Bow	Local Effects Occurring in Bow	Hazard Category	Source
Severe Storm-Hurricane Bob Aug 1991	917	1991	Aug 18-20	N/A for Bow	Public assistance was available for Hillsborough County and 2 other counties (not declared in Merrimack County) as a result of damages caused by Hurricane Bob. The 2 seacoast counties fared the worst.	As Bow is within Merrimack County, it likely experienced heavy rains, wind gusts, tree debris, power outages and possibly some flooding.	Severe Winds, Hurricane	FEMA, CNHRPC
Flooding and Severe Storm Aug 1990	876	1990	Aug 7-11	No data available	Moderate to heavy rains caused flooding in eight counties, including Merrimack and Hillsborough Counties. Damage totaled \$2.3m for all counties	As Bow is within Merrimack County, it likely experienced heavy rains, tree debris, power outages and possibly some flooding.	Flood, Severe Winds	FEMA, NH HSEM
Bow Hazardous Materials Fire Aug 1990	No	1990	Aug	N/A	N/A	The Bow Fire Department responded to a 5th alarm fire at the PSNH's Bow Power Plant, on River Road, in Bow, encountering a large "working fire" in one of the four silos at this location. It took approximately 72 hours, 18 different fire departments and over 100 fire fighters to extinguish this situation. This situation could happen again. It has not happened to this magnitude in the past 16 years, however, we have had smaller type situations there during this time period. We utilized a "foam system" and had the help of PSNH personnel to acquire a successful ending to a bad incident. This incident took place at the 12th story level	Haz Mat, Fire	Bow Hazard Mitigation Committee, CNHRPC
Bow Potential Active Shooter Early 1990s	No	1990	Circa	N/A	N/A, although response likely came from nearby communities	A teenager with a high powered rifle in Bow was apprehended, but Police officers were injured. No hostages known, just his parents could not leave due to gunfire.	Potential Terrorism, Active Shooter, Hostage Situation	Bow Hazard Mitigation Committee, CNHRPC
Severe Storms and Flooding Mar-Apr 1987	789	1987	Mar 30-Apr 11	No data available	Flooding caused by snowmelt and intense rain was felt in seven counties, including Merrimack and Hillsborough Counties. Nearly \$5m in damages.	As Bow is within Merrimack County, it likely experienced heavy rains, tree debris, power outages and possibly some flooding.	Flood, Rapid Snow Pack Melt, Debris Impacted Infrastructure	FEMA, NH HSEM, US Army Corps of Engineers
Severe Storms and Flooding Jul-Aug 1986	771	1986	Jul 29-Aug 10	N/A for Bow	Severe summer storms with heavy rains, tornadoes, flash floods, and severe winds, damaged the road network statewide. Disaster	Bow likely experienced heavy rains and possibly some flooding along the tree fall	Flood, Wind, Debris Impacted Infrastructure	FEMA, NH HSEM, CNHRPC

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Event	Declared Disaster DR-	Year	Date	FEMA Public Assistance	Area Effects Surrounding Bow	Local Effects Occurring in Bow	Hazard Category	Source
					declared in Cheshire, Sullivan and Hillsborough Counties (not declared in Merrimack County).			
Earthquake 4.5M Sanbornton Jan 1982	No	1982	18-Jan-82	N/A	An earthquake originating near in Sanbornton in Belknap County measured 4.5M and was felt in various locations throughout the State. The area it was felt includes all of northern Merrimack County including the Concord area communities in Central NH.	A Sanbornton-centered earthquake caused little physical damage in Merrimack County. Sanbornton is about 25 miles to the north of Bow. The quake shook the table during a Selectmen's meeting.	Earth, Earthquake	CNHRPC, Earthquake-track.com, Bow Hazard Mitigation Committee
Concord Beaver Meadow Tornado Jul 1979	No	1979	Jul 27	N/A	In Concord, a small twister was sighted at Beaver Meadow, where 13 trees were toppled, including a 100-foot tall pine. The duration was about 15-20 seconds.	N/A, although Concord abuts Bow to the north	Wind, Tornado	Concord Monitor, CNHRPC
NH Blizzard of Feb 1978	No	1978	Feb 5-7	N/A	RSI Index of Category 5 (Extreme). This snowstorm is described as "a natural disaster of major proportions" and stunned all of New England. The storm was caused by an intense coastal Nor'easter that produced winds in excess of hurricane force and very high snow totals. Most of southern New England received more than three feet of snow, 25-33" in NH and higher throughout New England. Abandoned cars along roadways immobilized infrastructure and blocked major interstates. For over a week, New England remained paralyzed by the storm. All of New Hampshire was impacted. Governor Meldrim Thomson Jr. declared a state of emergency.	During this severe snowstorm, Bow residents survived three days without electricity, water, light, or heat in weather that was 30 degrees.	Extreme Temperatures, Severe Snow Storms, Windchill, Power Failure	American Meteorological Society, Northeast States Emergency Consortium, Bow Hazard Mitigation Committee, CNHRPC
Quebec Earthquake 4.8M Jun 1973	No	1973	15-Jun	N/A	An earthquake originating near the Quebec border at a scale of 4.8 was felt in various locations throughout NH.	N/A, although some Bow residents may have felt the effects.	Earth, Earthquake	Northeast States Emergency Consortium, CNHRPC
Severe Storms and Flooding Jul 1973	399	1973	Jul 11	No data available	All counties in the State of NH experienced storm damage and were declared disaster areas, including Merrimack and Hillsborough Counties.	No information available for Bow.	Flood, Wind	FEMA, CNHRPC

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Event	Declared Disaster DR-	Year	Date	FEMA Public Assistance	Area Effects Surrounding Bow	Local Effects Occurring in Bow	Hazard Category	Source
Bow Pressure Explosion 1964	No	1964	---	N/A	N/A, although Concord City line is near the building and Concord may have assisted	An explosion occurred at Blue Seal Feeds which blew the roof off the building. Staff were milling alfalfa which exploded	Explosion	Bow Hazard Mitigation Committee, CNHRPC
Older Hurricanes 1954-1991	No	1954	to 1991	N/A	Many older hurricanes have impacted New Hampshire including the 1954 – 1991 Hurricanes: Carol on August 31, 1954 (tree and crop damage), Edna on September 11, 1954, Donna on April 12, 1960 (heavy flooding), Dora on August 28, 1971, Bell on August 10, 1976, Gloria on September 27, 1985, and Bob in 1991.	Downd trees, wind damage, and flooding were likely experienced in Bow during many of these hurricanes.	Wind, Flood, Hurricane, Tropical Storm, Debris Impacted Infrastructure	NH Homeland Security and Emergency Management, CNHRPC
10 Severe Snowstorms 1940-1978	No	1940	to 1978	N/A	Ten severe snowstorms are documented in south-central NH during this time span, Feb 14-15, 1940 (depths over 30" and high winds), Feb 14-17, 1958 (20-33"), Mar 18-21, 1958 (22-24"), Mar 2-5, 1960 (up to 25"), Jan 18-20, 1961 (up to 25", blizzard conditions), Jan 11-14, 1964 (up to 12"), Jan 29-31, 1966 (up to 10"), Feb 22-28, 1969 (24-98", slow-moving storm), Dec 25-28, 1969 (12-18"), Jan 19-21, 1978 (up to 16").	Although it is unknown what Bow experienced, it is likely many of the same snow depths occurred.	Extreme Temperatures, Severe Snow Storms, Ice, Windchill, Power Failure	American Meteorological Society, CNHRPC
Regional Snow Storm and Rapid Snow Pack Melt Mar 1953	No	1953	Mar	N/A	N/A, although similar rain or snow storms and rapid snow pack melt likely impacted the region. The highest level of water in the Blackwater Dam was measured, with the capacity at 93%. No flooding was reported. Uncertain as to exactly what type of storm caused this effect. A total of nearly 8" of precipitation in March 1953.	The storm was not particularly notable by the Town, although the rapid snow pack melt probably caused flooding effects in Bow along the roads, Merrimack River, Turkey River, and main brooks.	Flood, Rapid Snow Pack Melt, Debris Impacted Infrastructure	FEMA, NH HSEM, US Army Corps of Engineers, CNHRPC
Bow Thunderstorms Sep 1948	No	1948	Sep	N/A	N/A, although thunderstorms likely impacted other Central NH region communities	Thunderstorms produced damaging winds that downed trees and power lines, subsequently causing widespread power outages.	Wind, Hurricane, Flood, Debris Impacted Infrastructure, Lightning	National Climatic Data Center, CNHRPC

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Event	Declared Disaster DR-	Year	Date	FEMA Public Assistance	Area Effects Surrounding Bow	Local Effects Occurring in Bow	Hazard Category	Source
Regional & Bow Hurricane of Sep 1938	No	1938	Sep 21	N/A	Hurricane made landfall as a 3 on the Saffir-Simpson Scale, killed about 682 people and damaged or destroyed over 57,000 homes. Most deadly New England hurricane. Central New Hampshire was inundated with water. Downed trees caused extensive damage to homes, businesses and community infrastructure. President Roosevelt ordered emergency aid be sent to NH, including Merrimack County.	Hurricane leaves Bow Mill in complete disrepair. Recent reports suggest cleanup errors may have greatly contributed to mercury pollution in state's water supplies. In the same storm a Bow farmhand was killed. The Putney Farm Pond Dam breached and was completely destroyed	Wind, Hurricane, Flood, Debris Impacted Infrastructure	Bow Hazard Mitigation Committee, Concord Monitor, Bow 100 Acres More or Less: The History of the Land and People of Bow, NH, USGS, CNHRPC
Regional & Bow Flood of Mar 1936	No	1936	Mar 11-21	N/A	Simultaneous high snowfall totals, heavy rains, and warm weather combined to hit all of New England. Floods killed 24 people, caused \$133,000,000 in damage, and made 77,000 people homeless in New England. The great flooding of 1936 resulted from heavy rains and rapid snow pack melt. Snow north of Concord contributed to the higher waters in the Winnipesaukee, Contoocook and Pemigewasset Rivers that were largely responsible for the destruction in Concord and the surrounding area. NH issued boil water warnings to everyone.	At the Garvins Falls Dam on the Merrimack River, three courses of capstones were carried off the crest for its entire length. These blocks of stone, up to 6 tons, were scattered over a distance of 300' below the dam. Two of the old horizontal generators in the powerhouse were completely submerged but the new vertical generators remained dry. The gage height of the water at Garvins Falls Dam on the Merrimack River (drainage area 2,427 square miles) was 14.2 feet. Water flowed over the dam beginning March 13 by 2.8-3.6 feet and through wheels and gates. Maximum discharge 122,000 feet per second on March 20. The flood runoff from the dam, with regional effect, was said to have been increased by artificial and natural storage in Winnipesaukee, Squam and Newfound Lakes.	Flood, Ice Jams, Rapid Snow Pack Melt, Dam Failure	Concord Monitor, Union Leader, Army Corps of Engineers Ice Jam Database, Bow Hazard Mitigation Committee, CNHRPC, US Department of the Interior 1936
Pandemic Spanish Flu 1918	No	1918	---	N/A	2,000 people in NH died of flu (Spanish flu) in 1918 compared to just 145 people the year prior. This disaster killed an estimated 20-50 million people around the globe, 1/5 of the world's population, including claiming 600,000 Americans. By the end of October, in NH the flu was over.	Some Bow residents may have experienced this rapid, contagious illness. In abutting Concord: In mid-September 1918, the Union newspaper catalogued the casualties of flu and reported "The influenza situation in Concord remains practically unchanged. Many new cases are reported daily, but it is believed the number of recoveries offset the new	Public Health, Biological	CNHRPC, Dept of Commerce 1918, NH Public Radio

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Event	Declared Disaster DR-	Year	Date	FEMA Public Assistance	Area Effects Surrounding Bow	Local Effects Occurring in Bow	Hazard Category	Source
						ones. The City is practically closed up tight, except for the stores on main St. Soda and ice cream are taboo in the drug stores but there continues a brisk trade in cough and cold remedies. All meeting have been called off, most of these scheduled having been voluntarily abandoned before the orders issued yesterday afternoon by the city board of health. The emergency hospital in the old Elks home was opened this afternoon and five patients were moved in immediately with others in prospect. Mayor French was in charge of the installation of the beds and improved hospital equipment, and assisted personally in the arrangement of things." Surrounding Concord, daily newspapers reported calls for nurses and new regulations that forbade church services and limited the number of mourners at funerals.		
New England & Central NH Region Blizzard 1888	No	1888	Mar 11-14	N/A	N/A, All of New England experienced a major snowstorm with snow accumulations of 30-50 inches, one of the most severe winter storms to ever hit New England	Bow likely extreme experienced difficulties with this storm.	Extreme Temperatures, Severe Snow Storms, Windchill	States Emergency Consortium, CNHRPC

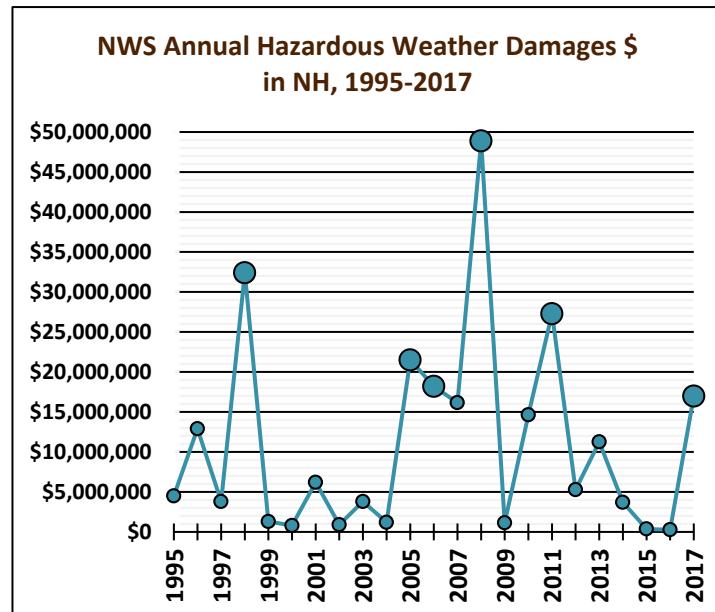
Source: Compilation of Events by Bow Hazard Mitigation Committee; CNHRPC

Local Climate Changes and Extreme Weather

In the State and the Central NH Region, like any other areas, exist our own “micro-climate” areas that can be analyzed for future susceptibility to disasters and hazard events. New Hampshire has obtained high costs of damage over time due to hazardous weather and declared disasters. A review of the state and area history can provide a perspective on what Bow can expect to see in terms of extreme weather in the future.

Table 11
Summary of Hazardous Weather Damage Costs in NH, 1995-2017

Year	Total Damages \$	\$ Rank
2017	\$16,970,000	6
2016	\$270,000	23
2015	\$370,000	22
2014	\$3,700,000	16
2013	\$11,250,000	10
2012	\$5,280,000	12
2012	\$27,280,000	3
2010	\$14,630,000	8
2009	\$1,130,000	19
2008	\$48,890,000	1
2007	\$16,150,000	7
2006	\$18,200,000	5
2005	\$21,500,000	4
2004	\$1,200,000	18
2003	\$3,800,000	14.5
2002	\$900,000	20
2001	\$6,200,000	11
2000	\$800,000	21
1999	\$1,300,000	17
1998	\$32,400,000	2



Source: National Weather Service (NWS) National Oceanic and Atmospheric Administration, last accessed 0/18
<http://www.nws.noaa.gov/om/hazstats.shtml>

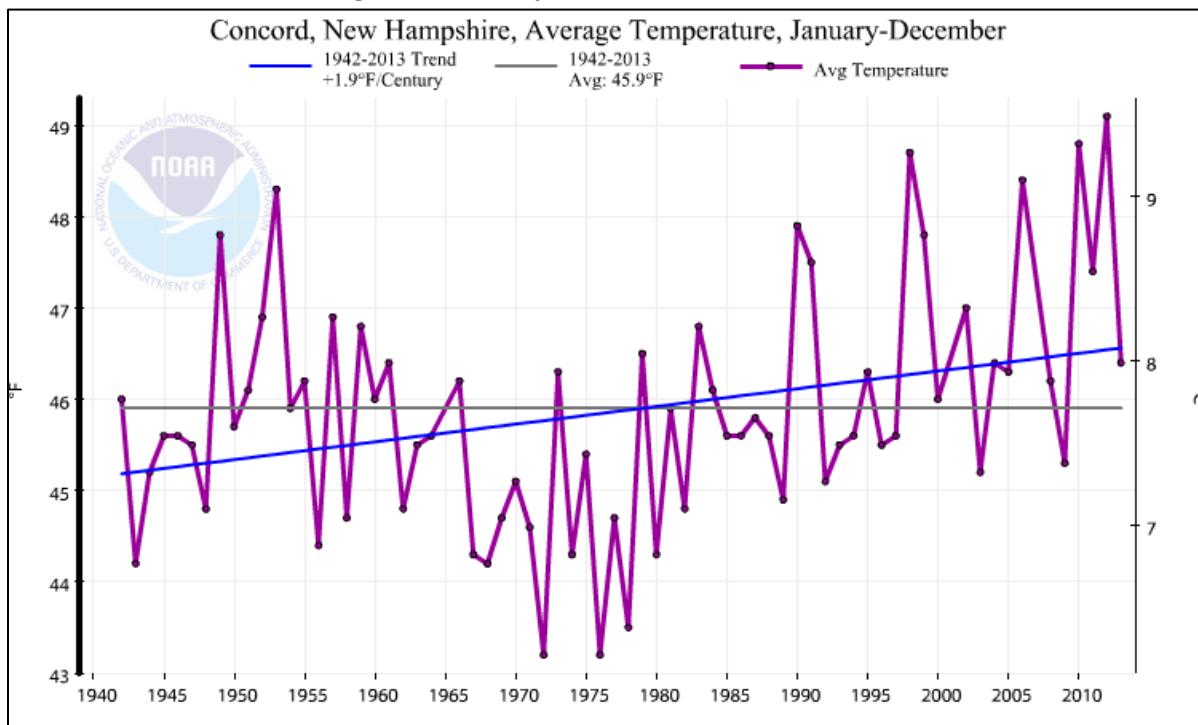
These statistics are compiled by the Office of Services and the National Climatic Data Center from information contained in Storm Data, a report comprising data from NWS forecast offices

Hazardous weather damages in New Hampshire are expensive and are beginning to illustrate trends over time. These dollar damages can be generally applied to the major disasters declared in the State. As displayed in **Table 11**, the highest numbers of damage costs correlate to the **2008 (\$49m)** and **1998 (\$32m)** ice storms, **2012 Hurricane Sandy (\$28m)**, **2005 Columbus Day flood (\$22m)**, and **2006 Mother's Day flood (\$18m)**.

Much of the rest of the discussion in this section has been directly excerpted or paraphrased from the [Central NH Regional Plan 2015](#). The Central NH Region's weather history is summarized to provide a view of the trends around the Concord area where the weather measurements have taken since **1939** at the Concord Airport. For CNHRPC region continuity, the Concord measurements will be used for Bow.

Figure 4 displays Concord's average annual temperature between **1942 (46.0°F)** and **2013 (46.4°F)**. Earlier data was not available. As with typical New Hampshire weather, the seasonal temperatures can vary year after year and without obtaining an average, changes are difficult to see. The displayed trend line allows a definitive way of averaging all of the temperatures and illustrates a **+2.8°F** increase in average annual temperature during this **70**-year time period.

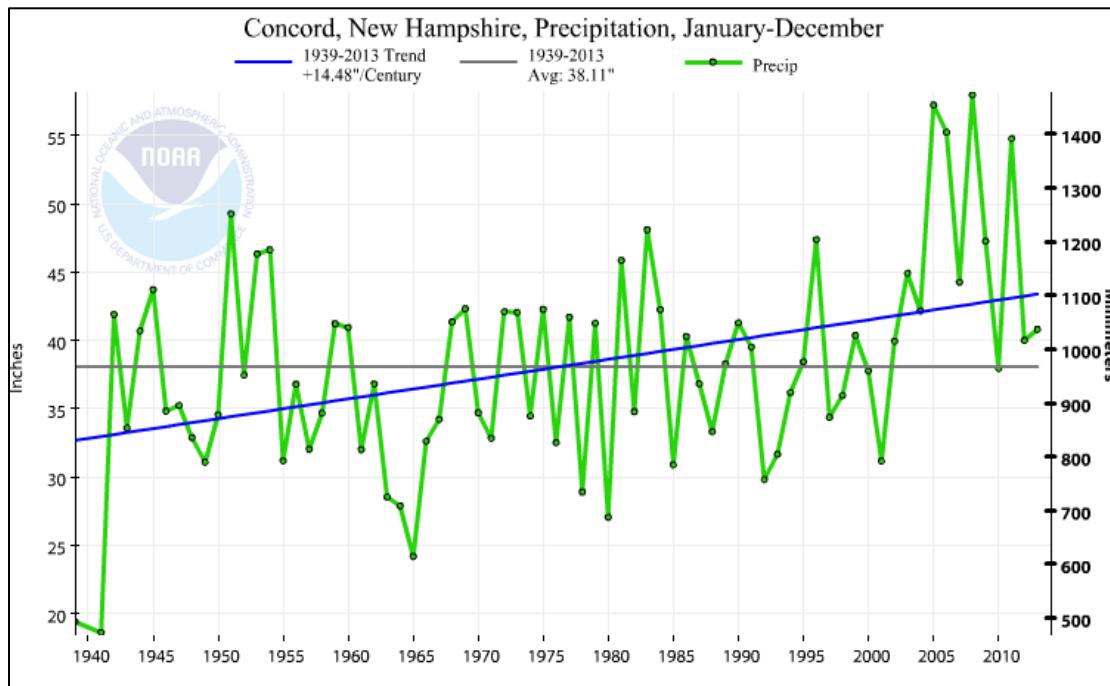
Figure 4
Average Annual Temperature for Concord, 1942-2013



Source: National Oceanic and Atmospheric Administration

For precipitation changes, **Figure 5** displays Concord's average annual precipitation rates between **1939** and **2013**. Varying seasonal rainfall amounts continue over the decades. The trend line serves the same purpose to illustrate an overall increase of **+14.48"** in precipitation over the **74**-year time period from **1939** to **2013**.

Figure 5
Average Annual Precipitation for Concord, 1939-2013

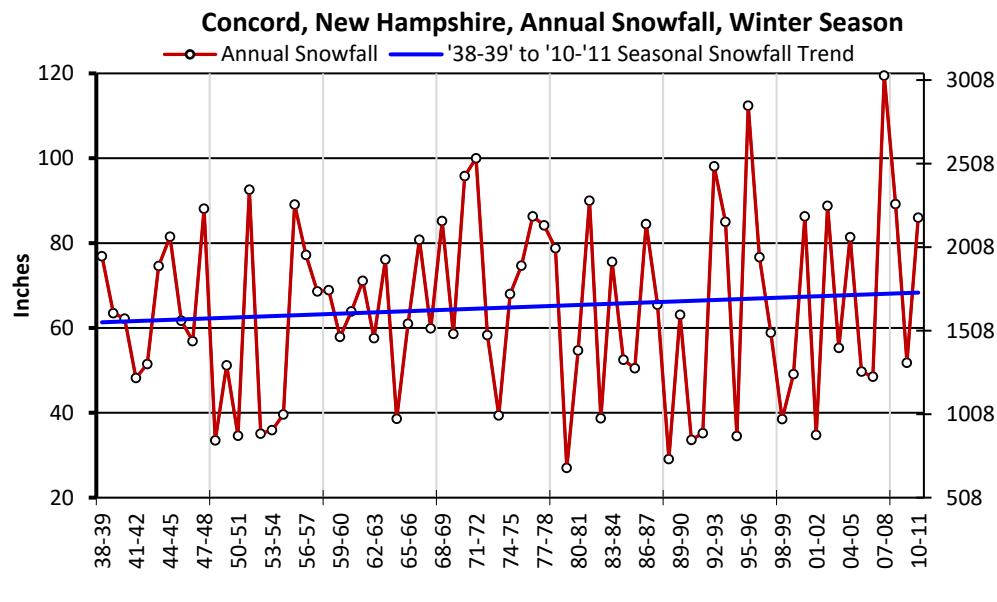


Source: National Oceanic and Atmospheric Administration

Similar to temperature and precipitation, annual snowfall amounts as reported by NOAA were observed for Concord starting in the **1938-1939** winter season through the **2010-2012** winter season. Snowfall data from **2012-2013** was not available. As displayed in **Figure 6**, the amount of annual snowfall has varied greatly over the past century. Overall, the trend line indicates a slight increase in annual snowfall inches, from about **60"** in the **1938-1939** season to about **68"** in **2010-2011**, totaling an increase of **+8"** of snowfall over the **72**-year time span.

Figure 6

Average Annual Snowfall for Concord, Winter Seasons 1938/39 - 2010/11



This climate data may certainly be relevant to the entire Central NH Region which includes the Town. The Central NH region climate summation is that the temperature is getting warmer, the precipitation is increasing, and the snowfall is slightly increasing according to the National Oceanic and Atmospheric Administration's data collection at the Concord airport. There are no indications to see these trend lines reverse although the snowfall varies greatly from one season to the next, almost in an alternating pattern.

The Southern NH Climate Change Assessment, formally entitled [Climate Change in Southern New Hampshire: Past, Present, and Future, 2014](#) by the University of New Hampshire, reviewed current climate conditions and projected future conditions of Southern New Hampshire under potential low and high emission scenarios. Their past and future climate overview is illustrated in **Figure 7**.

Figure 7

Southern NH Climate Assessment Projections

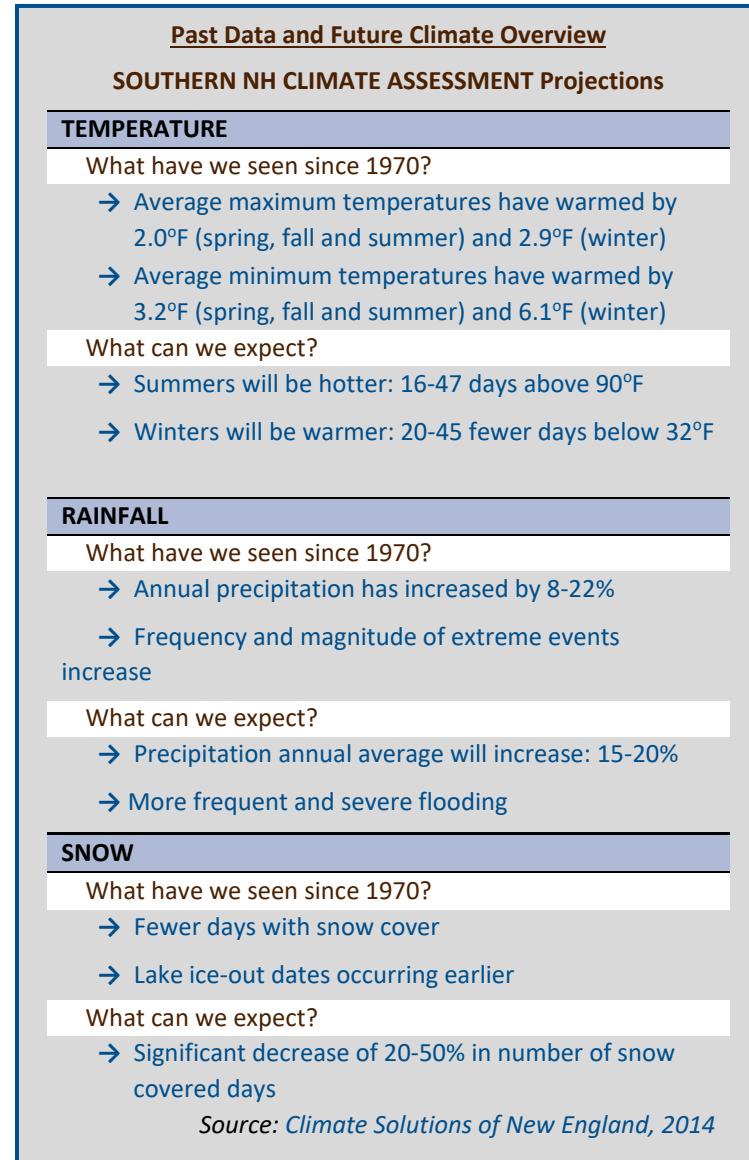
As a result of anticipated extreme weather continuing and climate changes in Central NH and Bow, consideration should be given for potential impacts to the community. A few new issues are considered, although the list is not detailed. For more information on these topics, refer to the [**Central NH Regional Plan 2015**](#).

More Human Health Emergency Events

- ☞ Illnesses such as heatstroke, fainting, and heat exhaustion.
- ☞ Excess heat especially dangerous for the aging population and residents without air conditioning.
- ☞ Increase in greenhouse gas emission, energy demand, and air conditioning use and cost.
- ☞ More favorable conditions for insects carrying viruses and diseases, such as West Nile Virus.
- ☞ Increases risk of waterborne illnesses caused by pollutants entering the town's water supply, commonly through stormwater runoff and sewage overflow.
- ☞ Infrastructure failure by adding additional stress, leading to potential injury or loss of life.
- ☞ More air pollution, leading to asthma and breathing disorders.
- ☞ Vulnerable populations require more assistance.

Natural Environment Disruption

- ☞ Too much water and/or lack of water can disrupt trees and plants natural growing cycle, potential leading the tree, plant, and surrounding area to die.
- ☞ Additional water and drought conditions affect wetland discharge, stream flow, and water quality, affecting the habitat's quality of life and species' health within the area.



- ☛ Debris will be a result of harsh flooding, including trash and downed trees, polluting waters, harming habitats, and damaging property and infrastructure.

Declining Forest Health

- ☛ Large weather events such as heat stress, drought, and periods of winter thaw followed by intense cold can lead to loss of trees.
- ☛ Become susceptible to invasive species and diseases, such as the Hemlock Wooly Adelgid.
- ☛ Loss of trees can have a direct impact on portions of the region's economic components, including declining tourism.

Fewer Recreation Opportunities

- ☛ Weather Impacts on Recreational Trails such as debris, flooding and erosion.
- ☛ Snowmobiling, ice fishing, snow shoeing, skiing and snowboarding provide numerous sources of winter recreation and winter tourism, enhancing the quality of life and economy, will be affected with shorter seasons.

Risks to the Built Environment

- ☛ Critical infrastructure such as roads, bridges, culverts, stormwater drainage systems, water and wastewater treatment facilities, natural gas lines, electric lines and poles might be at risk of severe damage or failure if the anticipated extreme weather events occur.
- ☛ Damaged infrastructure cannot provide services to homes and businesses, disrupting the economy and may endanger public health.
- ☛ Culverts are at risk to extreme precipitation events, including rain, snow, and ice.
- ☛ Residents who experience damage with flooding to their homes and personal belonging may lack proper flooding insurance, placing the resident in financial hardship.
- ☛ Dams with High Hazard and Significant Hazard classifications are the most likely to cause the largest amount of damage or loss of life.

Increasing Municipal Transportation Systems Maintenance Needs

- ☛ Volume of flooding is expected to increase, potentially closing roads and increasing the travel time for drivers and increasing the cost and energy use.
- ☛ Flooding can also cause damage to pavement and embankments, increasing maintenance, repair, and replacement costs to municipalities.
- ☛ Extreme precipitation will also increase erosion, decreasing certain infrastructure components design life span.

Aging and Inadequate Stormwater Infrastructure

- ☛ Stormwater infrastructure such as catch basins, pipes, discharge points, and culverts that redirect stormwater runoff can be impacted by flooding and cannot perform their function.

- ☛ Blocking of water can lead to flooding of the area and roadways, potential leading to the closure of nearby roads.
- ☛ Components of stormwater infrastructure are outdated, and increased flows are added stress to the system, more money to maintain and higher replacement costs.
- ☛ Increased development with increased amounts of impervious surface adds the volume of stormwater runoff within more urban area.

Decreasing Water Resources

- ☛ Water quality and quantity are both threatened by projected changing weather events, with threats of flooding, drought, erosion and stormwater runoff.
- ☛ By preventing groundwater from replenishing, additional runoff and sediments can lead to intensify flows in rivers and streams with higher contamination levels of unwanted nutrients and pathogens.
- ☛ Additional water treatment may be necessary, potentially overloading treatment systems.
- ☛ Contamination can pollute sewage, threatening the performance of wastewater treatment facilities.
- ☛ Increased occurrences in flooding can also intensify flows, causing overloading of treatment system.
- ☛ When the ground is frozen, rapid snow melt from warm days or intense rain is not able to infiltrate the ground, leading to drought conditions.

Changing Food and Agriculture Production

- ☛ Merrimack County is the top county in the State for agriculture sales of higher temperatures will promote a longer growing season for most crops, benefiting a larger number of local crops.
- ☛ Negative impacts can potentially alter the region to a climate not suitable for growing valuable local crops such as apples and blueberries.
- ☛ Temperature are expected to slow weight gain and lower the volume of milk produced by dairy cows.
- ☛ Higher overnight temperatures are anticipated to prevent the dairy cows and cattle from recovering from heat stress.
- ☛ Warmer temperatures and increase in carbon dioxide in the air creates a more ideal environment for pests and weeds, potentially increasing the use of herbicides and pesticides on crop.

This is a sampling of how changing climate and severe weather impacts can affect communities in New Hampshire, in the Central NH Region and in Bow. Consideration should be given to applicable items during the development and update of the **Hazard Mitigation Plan**.

Detailed Hazard Events in Bow

A compilation of hazards that have occurred in Bow and the Central NH Region area is provided in the prior Table of **Local and Area Hazard Events**. **Hazard Locations in Town** are areas to watch, areas of particular susceptibility and may be vulnerable to future events. **Potential Future Hazards** are determined based on the past hazard events, possibilities, and existing issues in Town to provide focus to future potential problem areas and to help with mitigation action development.

Each hazard is generally described and then is noted how and where it could occur in Bow. For all hazards examined in this Plan, a table of the **Hazard Locations in Town** and the **Potential Future Hazards** is provided at the end of this Plan Chapter.

Hazard events were researched using a wide variety of sources for the **original Bow Hazard Mitigation Plan 2007** which were the basis for many of the past disaster events and updated to the present. The **Hazard Mitigation Plan Update 2013** provided recent information on many of the extreme disasters experienced between **2005-2008**. Sources and techniques included interviewing local townspeople, researching Town Histories and related documents, and collecting information from governmental or non-profit websites. Presidentially declared disasters or other significant hazard events are described for the surrounding area or Merrimack County for the **Hazard Mitigation Plan Update 2018** and some of them may have affected the community. These disasters were also considered by the Committee when determining the risk evaluation.

Committee member experiences, knowledge, and recollections generally comprise the **Local and Area Hazard Events** and **Hazard Locations in Town**. While additional hazards might have occurred in Town, those events in the Plan are what the Committee chose to list, or were familiar with to list, to comprise the hazard events within the in Tables. The same is true for the **Potential Future Hazards** section.

FLOODING

Floods are defined as a temporary overflow of water onto lands that are not normally covered by water. Flooding results from the overflow of major rivers and tributaries, storm surges, and/or inadequate local drainage. Floods can cause loss of life, property damage, crop/livestock damage, and water supply contamination. Floods can also disrupt travel routes on roads and bridges. However, floods can be beneficial to the low lying agricultural areas which are used for active farm lands by enriching the soil.

Floodplains are usually located in lowlands near rivers, and flood on a regular basis. The term **100-year flood** does not mean that a flood will occur once every **100** years. It is a statement of probability that scientists and engineers use to describe how one flood compares to others that are likely to occur. It is more accurate to use the phrase **1% annual chance flood**. This phrase means that there is a **1%** chance of a flood of that size happening in any single year.

Inland floods are most likely to occur in the spring due to the increase in rainfall and melting of snow; however, floods can occur at any time of year. A sudden thaw during the winter or a major downpour in the summer can cause flooding because there is suddenly a lot of water in one place with nowhere to drain. Flooding is the most common natural disaster to affect New Hampshire, a common and costly hazard.

There are several types of **Flooding** hazards examined in the **Hazard Risk Assessment**:

- **Floods and Flash Floods**
- **Rapid Snow Pack Melt**
- **Ice Jams**
- **Riverine Fluvial Hazard Flooding, Erosion, Channel Movement**

Magnitude of Flooding

Flooding magnitude, or how bad flooding could get in Bow, can be measured by the following SFHA Flood Zone scale in **Table 12**. “Flooding” encompasses all types of flooding including **Floods and Flash Floods**, **Rapid Snow Pack Melt**, **River Ice Jams** and **Fluvial Hazard Erosion and Channel Movement**.

Table 12
Special Flood Hazard Area (SFHA) Zones on 2010 DFIRMS

Special Flood Hazard Areas on Bow DFIRMs	
Zone A	<u>1% annual chance of flooding</u> <ul style="list-style-type: none">• 100-year floodplains <i>without</i> Base Flood Elevations (BFE)
Zone AE (<i>with or without floodways</i>)	<u>1% annual chance of flooding</u> <ul style="list-style-type: none">• 100-year floodplains <i>with</i> Base Flood Elevations (BFE)• some identified as floodways with stream channel and/or adjacent floodplain areas• areas must be kept free of encroachment so 1% annual chance of flood will not substantially increase flood height
Zone X	<u>0.2% annual chance of flooding</u> <ul style="list-style-type: none">• 500-year floodplain <i>without</i> Base Flood Elevations (BFE)• sheet flow flooding less than 1-foot deep• stream flooding where the contributing drainage area is less than 1 square mile• areas protected from 100-year floodplains by levees• OR areas determined to be outside the 0.2% annual chance of flood (see DFIRMs)

Sources: FEMA and NH Geographically Referenced Analysis and Transfer System (NH GRANIT) websites

Bow DFIRMs can be viewed online at and downloaded from the [NH Geographically Referenced Analysis and Transfer System \(NH GRANIT\)](#) website. Alternatively, the DFIRMs’ respective paper **FEMA 2010** Floodplain Maps in the Town Office could be consulted. Should the **Zone A** or **Zone X** or **Zone AE** flood to

either the **100**-year (**1%** annual) or **500**-year (**0.2%** annual) level, the DFIRM areas will help **measure the location of the floodplain and potential magnitude of the flood**.

Flooding in Bow

Bow has many areas particularly susceptible to flooding. Rapid pack snow melt affecting roadways and drainage, old waterline infrastructure breaking and washing out roads, culvert debris, Merrimack River flooding and inundation of local roads, hilly roads, Bow Junction, Turkey River, NH 3A. There are many hilly roads in Town that could washout during flash flooding and heavy rain events. Some key culverts need to be up-sized to address the increased water load and these are listed as Actions in **8 MITIGATION**

ACTION PLAN. The Town has been communicating with the State to upgrade some of their culverts and bridges, such as South Street Bridge. **Dam Failures** are discussed in a forthcoming section.

These small brooks, ponds and wetlands in Bow contribute to flooding these and other areas in Town:

- ☞ **Watercourses:** Merrimack River, Turkey River; Bela Brook (West Branch Bela Brook, East Branch Bela Brook), Black Brook, Boutwell Mill Brook, Brickyard Brook, Bow Bog Brook, Bow Brook, Horse Brook, Steer Brook, Morgan Brook, Russell Brook, White Brook, Turee Brook, One Stack Brook, and several unnamed brooks.
- ☞ **Waterbodies:** Greylord Farm Pond, Knight Pond, Lewis Putney Pond, Putney Meadow Pond, and Turee Pond; Great Meadow, Hornbeam Swamp, Putney Meadow, Sage Meadow, Six Acre Swamp; The Meadow; several other farm ponds, recreational ponds and fire ponds (Putney Road Pond, Rising Wood Pond, Higgins Pit Pond, South Bow Dunbarton Marsh, McNichols Pond, Knox Road Town Pond); and several unnamed ponds and wetlands.

Road and Drainage System Washouts

Roads in Bow are vulnerable to washouts and floods and may washout during flash flooding and heavy rain events. A listing of past and future potential road washouts is shown on **Map 1 Potential Hazards** and **Map 2 Past Hazards**. A **Table** of undersized Town-owned culverts to be upgraded to ensure their carrying capacity can be found in **5 COMMUNITY VULNERABILITY ASSESSMENT**. These roads are either most common, regular locations of **road washouts** or water flooding over the roadways, are locations which could be washed out during a flood event, or have been flooded and repaired:

» Continuing Susceptibility to Flooding, Washout, Overtop

- Allen Road
- Bow Bog Road by Dean Avenue
- Bow Junction
- Brown Hill Road
- Branch Londonderry Turnpike

- Buckingham Road at Putney Road
- Hall Street (also Concord)
- Page Road
- River Road by railroad tracks (formerly Johnson Road)

» State Bridges or Box Culverts to be Upgraded:

- I-89 Highway Exit 1 Ramps @ Turkey River
- NH 3A at Bow Junction @ Turkey River
- South Street @ Turkey River
- Clinton Street @ Bela Brook

» Town Undersized Culverts or Bridges to be Upgraded:

- Bow Bog Road @ Bow Bog Brook
- Dunklee Road Bridge @ Bow Bog Brook (improperly constructed box culvert, planned replacement June 2019/2020)
- Page Road @ Bela Brook
- River Road at Ferry Road @ Bow Bog Brook
- Robinson Road @ multiple stream crossings
- White Rock Hill Road @ Turee Brook



Excerpted From Bow Times August 2018

Birchdale Road
Bridge Rebuilt and
Reopened

Photos: Eric Anderson

Special Flood Hazard Areas (SFHAs)

Base Flood Elevations (BFEs) are abundant within Central NH along the Merrimack River, Contoocook River, Blackwater River, Warner River, Soucook River, and Merrimack River on the DFIRMs of **2010**. In Bow (**330107**) New Hampshire (**D33013C**), there are multiple DFIRMs identifying floodplains. DFIRM panels are not printed when floodplains are not present in an area.

There are **13** DFIRMs in Bow, of which **5** panels contain floodplains of the **Merrimack River**: **#0542, #0561, #0563, #0564, and #0677**. These DFIRMs include **Zone AE** floodways (1% annual risk of flooding), **Zone AE** floodplains with **BFEs** (1% annual risk of flooding) or **Zone X** (0.2% annual risk of flooding) locations in Town. A total of **5** DFIRMs out of the **13** in Bow contain **Base Flood Elevations**. These are highlighted gray in **Table 13**.

The **Turkey River** floodplains, which are **Zone A**, are displayed in **#0540** and **#0541** as the river flows southeast to join the **Merrimack** in panel **#0542**. Other brooks, ponds, wetlands, and swamps are included in **Zone A** or **Zone X** floodplains (SFHAs) on panel **#0545, #0520, #0655, #0660, #0676, and #0678**. These are the white rows in **Table 13**. An additional **5** DFIRMs, **#0393, #0394, #0558, #0579, and #0595** do not have printed panels. This situation occurs when there are no available floodplains to display in the DFIRM area.

Table 13
Locations of Bow Special Flood Hazard Areas (SFHA) on 2010 DFIRMS

Panel NH (D33013C)	Flood Zones in Bow (330107)	Base Flood Elevations (BFEs)	Water Body Areas in Floodplains	Community of Bow Geographic Location
#0542	AE with floodway, AE, A, X	Merrimack: 227, 226, 225, 224, (Garvins Falls Dam), 208, 204, 204	Merrimack River, Turkey River, Bow Bog Brook, Bow Brook	Northeastern corner of Bow. Bow Junction (NH 3A, I-89, I-93), railroad corridor, Grandview Road, Betty Lane, Poor Richards Drive, Heidi Lane, Old Hill Road, Garvins Falls Road, River Road.
#0561	AE with floodway, AE, X	Merrimack: 204, 203	Merrimack River	Eastern edge of Merrimack River abutting Pembroke, Railroad corridor
#0563	AE with floodway, AE, A, X	Merrimack: 202, 201, 201, 200, 200	Merrimack River, Bow Bog Brook, Unnamed Wetlands, Unnamed Streams	Eastern section of Bow with Merrimack River boundary at Pembroke. Contains I-93, NH 3A, railroad corridor, River Road, Dunklee Road, Tallwood Drive, Robinson Road, Johnson Road, Old Ferry Road, Vaughn Road.
#0564	AE with floodway, AE, X	Merrimack: 200, 199, 198, 198, 198, 198	Merrimack River, engineered Oxbow	Eastern most section of Bow at Merrimack River oxbow, abuts Pembroke and Allenstown. Contains railroad corridor
#0677	AE with floodway, AE, X	Merrimack: 198	Merrimack River	Southeastern edge abutting Hooksett to the south and Allenstown across the Merrimack. Contains River Road.

Town of Bow, NH Hazard Mitigation Plan Update 2018

4 HAZARD RISK ASSESSMENT

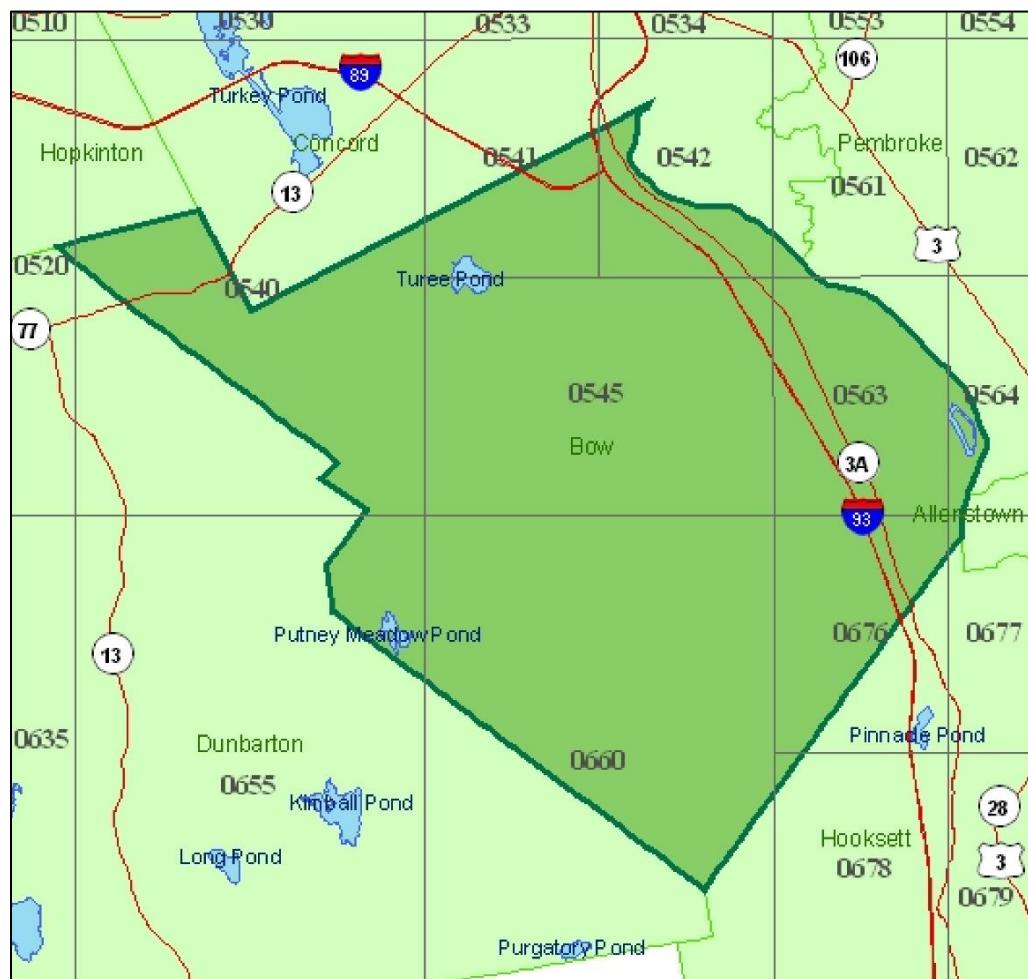
Panel NH (D33013C)	Flood Zones in Bow (330107)	Base Flood Elevations (BFEs)	Water Body Areas in Floodplains	Community of Bow Geographic Location
#0545	A, X	N/A	Turee Pond, Unnamed Wetlands	Geographic center of Bow. Contains NH 3A, Branch Londonderry Turnpike, utility corridor, Knox Road, Page Road, Woodhill Road, Bow Bog Road and numerous subdivision roads: Dow Road, Saltmarsh Circle, Timmins Road, Tree Pond Road, Wheeler Road, Shore View Drive, Surrey Coach Lane, Erin Drive, Brockett Drive, and more. Also White Brook out of SFHA.
#0541	A	N/A	Turkey River, Turee Brook, Turee Pond	Northern boundary with Concord. Interstate 89, Logging Hill Road, Albin Road, Woodland Circle, Turee View Drive, Cilley State Forest
#0540	A, X	N/A	Turkey River, One Stack Brook, Boutwell Mill Brook, Bela Brook, Turee Brook, White Brook, Unnamed wetlands	Northwestern edge abutting Hopkinton to the northwest, Concord to the north and Dunbarton to the west. Essex Drive, Bela View Drive, One Stack Drive, Longview Drive, Page Road, Tonga Drive, Hooksett Turnpike, Branch Londonderry Turnpike, Birchdale Road, Hampshire Hills Drive, Brown Hill Road
#0520	A	N/A	One Stack Brook	Northwestern corner of Town, abutting Dunbarton to the west and Hopkinton to the northwest.
#0655	X	N/A	Putney Meadow Pond	Brown Hill Road, Buckingham Drive, Dunbarton Center Road, Audley Divide, Sterling Place
#0660	A, X	N/A	Bow Bog Brook, Horse Brook, The Meadow, Steer Brook	Large southern central area of Town abutting Dunbarton and Hooksett. Contains utility corridor, Bow Bog Road, Stoney Brook Road, Hope Lane, Woodhill Hooksett Road, South Bow Road, South Dunbarton Road, Quimby Road. Also includes Brickyard Brook, Hornbeam Swamp, Greyllore Farm Pond, Bow Bog Brook not in SFHA
#0676	X, AE	N/A	Merrimack River, Unnamed Wetlands	Southeastern edge abutting Hooksett. Contains I-93, NH 3A, utility corridor, Morgan Drive, Johnson Road, Bow Bog Road, Rosewood Drive, Woodhill Hooksett, railroad corridor, Johnson Road.
#0678	N/A	N/A	N/A	Southeastern edge abutting Hooksett. Contains part of Brickyard Brook not in SFHA.

Sources: FEMA and NH Geographically Referenced Analysis and Transfer System (NH GRANIT) websites

Figure 8 displays the relative location of each of the DFIRM panels in the community used in **Table 13**. This set of DFIRMs is excerpted from the [Merrimack County Flood Insurance Study \(FIS\) of 2010](#). The graphic illustrates the numbering system of the DFIRMs, how they are not always consecutive.

Figure 8

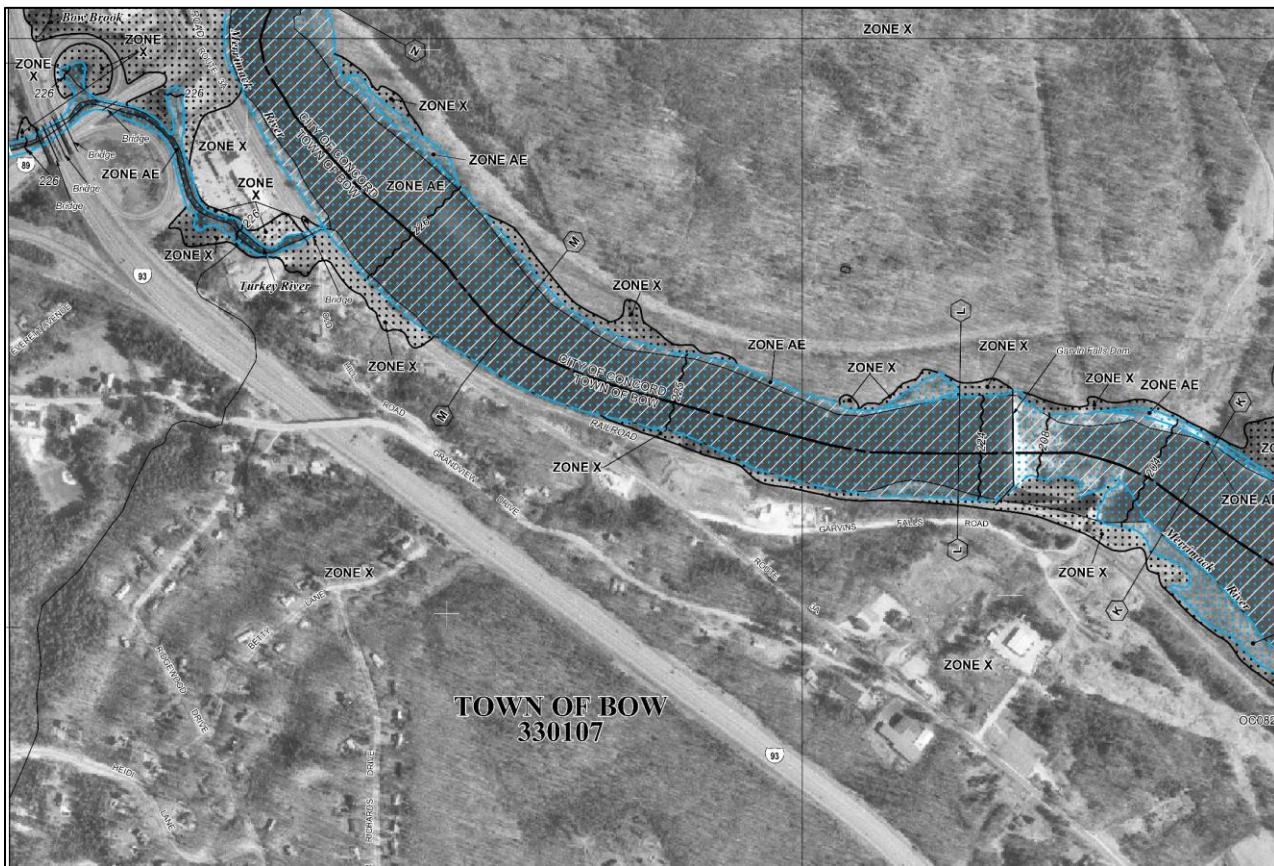
DFIRM Panel Locations (330107), 2010



Source: Bow DFIRMS can be downloaded at <http://www.granit.unh.edu/dfirms/d-townhtmls/bow.html>, last accessed 09-11-18

Figure 9 displays an example of a DFIRM's zoomed-in view of the Merrimack River and Turkey River's confluence at Bow Junction along NH 3A. The **Turkey River** travels from Concord to I-89 Exit 1, crossing South Street and paralleling I-89 to the highway's end in Bow Junction. The panel #0542 SFHAs, including the **Zone X 0.2%** annual chance inundation area for much of Bow Junction and the **Zone A 1%** annual chance flood area along the **Turkey River**, are displayed in **Figure 9**.

Figure 9
Zoom View of Bow DFIRM Panel Location #0542



Source: FEMA DFIRM 2010 for Bow NH #0542

DFIRMs illustrate the location of floodplains as a significant upgrade from the previous series of outdated paper maps, known as FIRMs. These new **2010** maps are now set on an aerial photography background that displays roads, buildings, forested areas, waterbodies and watercourses. Bow's Zoning Ordinance references the new maps as the official Special Hazard Flood Areas (SFHAs).

Rapid Snow Pack Melt

Warm temperatures and heavy rains cause rapid snowmelt. The water cannot seep into the frozen ground in early spring and so it runs off into streets and waterways. Quickly melting snow coupled with moderate to heavy rains are prime conditions for flooding.

There is the possibility of damages from the rapid snow pack melt because of the flooding from the **Merrimack River**, **Turkey River** and the various brooks along the roads, roadside wetlands, and from the culverts of the watercourses. Locations in Bow that may be vulnerable to rapid snow pack melt include undersized or unmaintained culverts, roads, driveways, slopes, yards or fields, or any of the Town's fast moving brooks or drainage areas. Damage to roads is expected.

Magnitude of Rapid Snow Pack Melt

Rapid snow pack melt is a type of flooding. On its own, it has no known magnitude measurement. However, the hazard can share **Flooding's** Special Flood Hazard Areas (SFHAs) table.

Rapid Snow Pack Melt in Bow

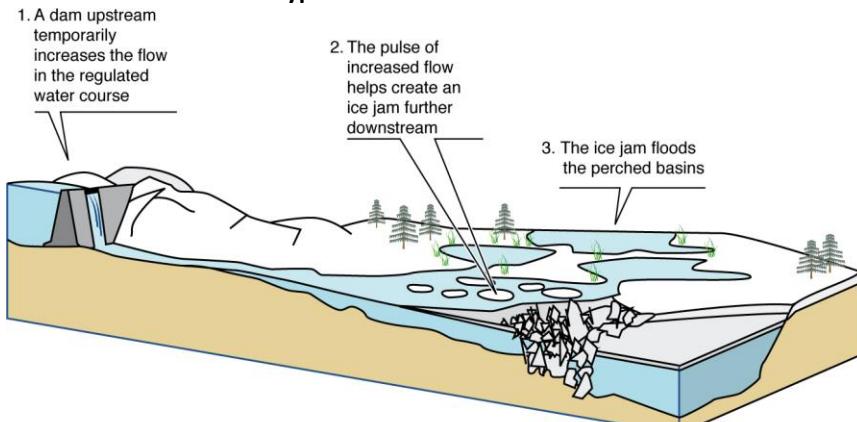
Melt runoff from impervious surfaces and roadways or from tree cover and fields can cause floods over the Entire Town. Road washouts and/or culvert failure locations or other areas flooded from rapid snow melt over the years have included the Bow Junction area, (NH 3A, 1-89/ I-93) and I-89 ramps, and along any of the Town's fast moving brooks (Bela Brook, Bow Bog Brook, White Brook, etc) and down roadways (see **Flooding** for specific lists). Potential channel movement of the **Turkey River** and further sedimentation of the **Merrimack River** (from the **Suncook River**) means a greater likelihood for further rapid snow pack melt damages.

On the local Town roads and private roads (such as cul-de-sac roads), the road beds may be washed away, preventing traffic from passing. All areas of Town could be susceptible to rapid snow pack melt, particularly those near wetlands and brooks and within the floodplains.

River Ice Jams

Rising waters in early spring often break ice into chunks, which float downstream, pile up and cause flooding. Small rivers and streams pose special flooding risks because they are easily blocked by jams. Ice in riverbeds and against structures presents significant flooding threats to bridges, roads, and the surrounding lands. A visual of how ice jams often form is displayed in **Figure 10**.

Figure 10
Typical Ice Jam Commencement



Source: USGS, Internet Accessed May 2014

Magnitude of River Ice Jams

There is no known widely-used magnitude scale for **river ice jams**. River ice jams can cause debris impacted infrastructure when they apply pressure to bridges and dams.

River Ice Jams in Bow

The **Merrimack River** has hosted **ice jams** in the far past. The **Turkey River** at the I-89 ramps could also **flood** in the case of river **ice jams**. The historic grist mill, the Chen Yang Li restaurant, along the **Turkey River** is very susceptible to any disturbance on the **Turkey River** and the Garvins Falls Dam is a critical site on the **Merrimack River**. Roads in general are always susceptible to the effects of winter ice conditions, and this could include the **Merrimack River** that runs along River Road or along the major brooks in Town (see **Flooding** for specific lists).

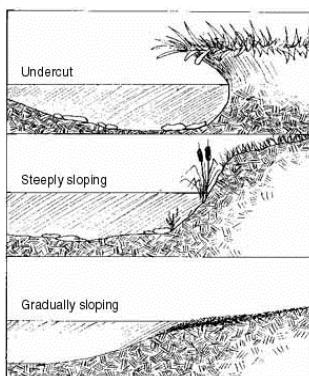
River **ice jams** could occur in these locations or along other bends in the Merrimack River during high water and heavy **rain/snow melt** conditions. Bridges and dams are identified in **APPENDIX A Critical and Community Facility Vulnerability Assessment**.

Riverine Fluvial Erosion, Bed Scouring and Channel Movement

Fluvial erosion is the wearing away of the river/stream bank and floodway. Bed scouring is the wearing away of the bed of the river or stream, typically shown as a pool type formation at downstream culvert outflows. Watercourses with high elevation change (stream gradient) are particularly prone to flash-flooding conditions and most vulnerable to erosion and scouring. During flooding or even high flow events, rivers can erode their banks and migrate into their floodplains. A migrating river, when channel movement is occurring, has the potential to impact nearby structures (berms, dams, buildings, etc.) or infrastructure such as river or stream crossings (culverts and bridges) or transportation features (roads, drainage structures, rail, etc.) in its migration path.

Fluvial geomorphology is the study of how processes of flowing water in rivers work to shape river channels and the land around them. Fluvial assessments are a collection of field data undertaken within designated river reaches. A **river reach** is a length of stream that has characteristics similar enough that condition data collected within that length is representative of the entire reach. **Figure 11** displays visual bank erosion characteristics.

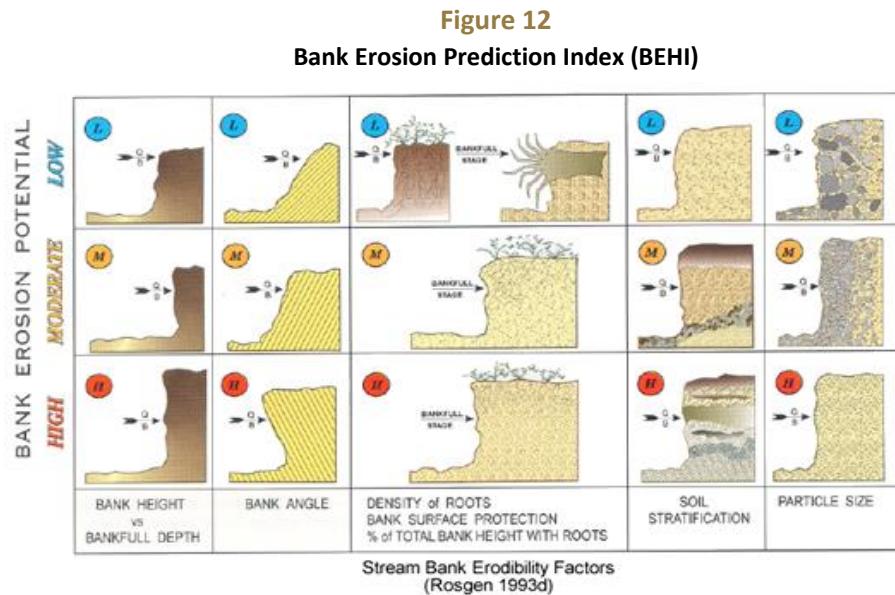
Figure 11
Bank Erosion Characteristics



Source: US Geological Survey (USGS)

Magnitude of (Fluvial) River Bank Erosion

River and streambank erosion magnitude can be measured by the US EPA Bank Erosion Prediction Index (BEPI), which is used with the Near Bank Stress (NBS) quantification. Taken into consideration for the BEPI are the bank height versus bankfull depth, bank angle, density of roots, soil stratification, and particle size at a river reach. **Figure 12** displays the visual version of the index.



Source: US Environmental Protection Agency (US EPA)

Riverine Fluvial Erosion, Bed Scouring and Channel Movement in Bow

To identify areas of river and stream erosion that could impact public health and safety in the **Merrimack River** watershed, the New Hampshire Geological Survey (NHGS) at the NH Department of Environmental Services (NHDES) coordinated a **fluvial geomorphology assessment** (FGA) conducted by Field Geology Services who collected field data along the **Turkey River** in 2013. The **Merrimack River**, as a wide, meandering River, forms Bow's eastern political boundary and erodes many areas of shoreland. Because the Merrimack is so large, no **fluvial geomorphology assessment** (FGA) has been conducted to date.

Turkey River

Data collection included line geomorphic features (artificially straightened channel, encroachments, riverside development, vegetated buffer less than 25' in length, bank erosion, bank armoring, and mass failure). Data collection also included point geomorphology features such as channel migration areas, beaver dams, bridges/culverts, large woody material jams, flood chutes, steep riffles, etc.). New **Maps of Fluvial Geomorphic Features** and **Fluvial Erosion Hazard Meander Belts** were developed to display this important river data and were incorporated into the **Turkey River Fluvial Geomorphic Features 2015 Addendum to the 2013 Bow Hazard Mitigation Plan.**

Floodplains of **Turkey River** and **Merrimack River** have the greatest potential for flooding, erosion, scouring or channel movement. The smaller water course begins in Concord and ends in Bow at Bow Junction where the **Turkey River** converges with the **Merrimack River**. Concerns about the **Turkey River** overtopping the State bridge and flooding the I-89 Exit 1 ramps are not unfounded – this almost occurred during the **2006** Mother's Day Flood. Scouring and erosion were detected. As of **2018**, the Town and the

State of New Hampshire Department of Transportation are working together to find a mutually beneficial solution to this potentially large problem.

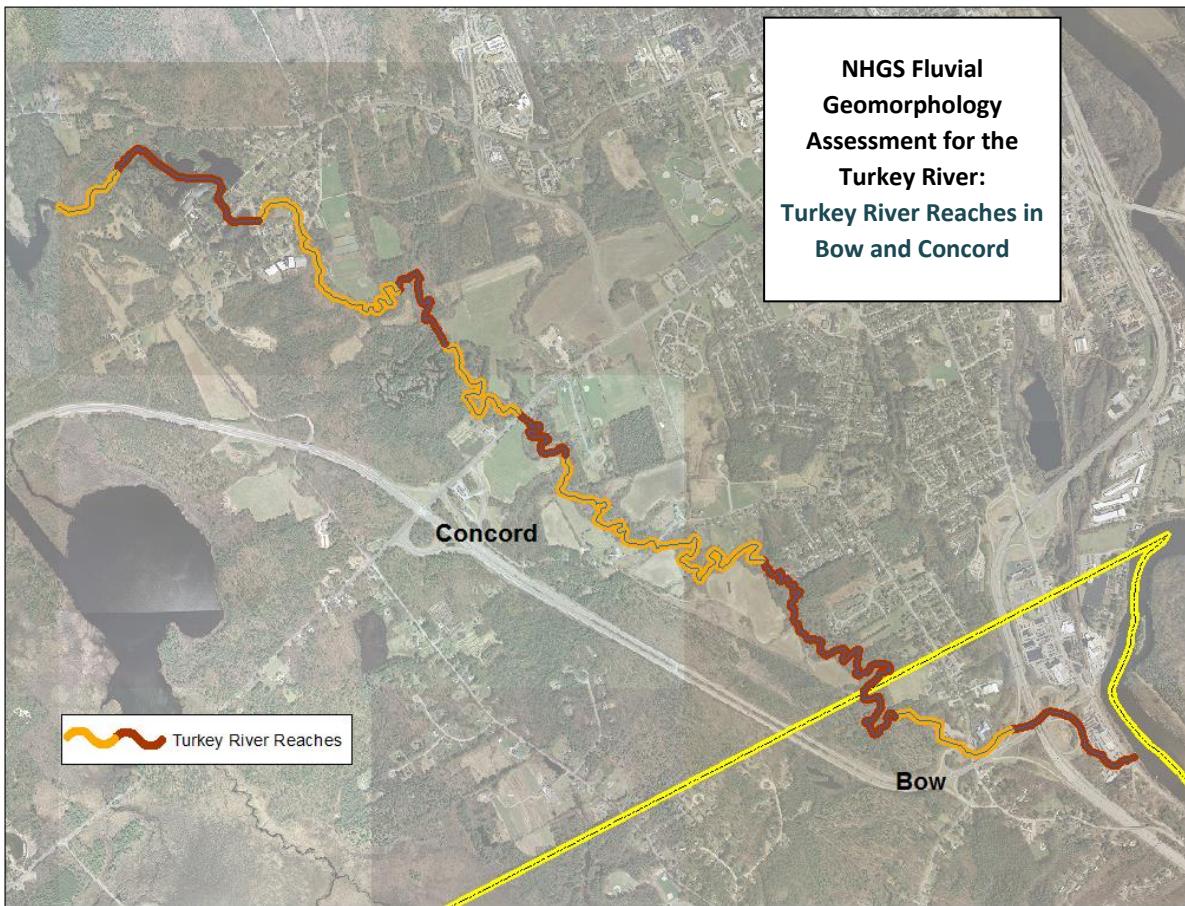


2006 May: Turkey River at South Street under Exit 1 in Bow

The aforementioned **Fluvial Geomorphic Feature Addendum 2015** enabled data collection and study along many sections of the **Turkey River** in 2013. The data features collected during the fluvial geomorphology assessment are displayed on **Map 5 Fluvial Geomorphic Features** and **Map 6 Fluvial Erosion Hazard Meander Belt**.

The entire Turkey River channel is **6.7** miles, with **5.4** miles in Concord and **1.3** miles (**6,723** feet) in Bow. Data were collected along the **1.3** miles of Bow's river channel span of the **Turkey River**. **Figure 13** displays the locations of the river reaches, sections of river predetermined as geomorphically similar, which are described within the assessment.

Figure 13
Turkey River Reaches Location in Concord and Bow



Source: Map developed by Central NH Regional Planning Commission (CNHRPC), 2015, from data provided by the NH Geological Survey (NHGS)

Of Bow's **1.3** miles (**6,723'**) of **Turkey River** channel and **13,456'** of left and right (L/R) banks:

- **53%** (**3,840'**) of Bow's **Turkey River** channel had been artificially straightened;
- **4%** (**510'**) of **Turkey River** banks were actively eroding;
- **39%** (**5,176'**) of the banks had < **25'** of protective vegetative buffers;
- **45%** (**6,006'**) of banks had encroachments;
- **15%** (**2,029'**) of the banks had riverside development; and
- **43%** (**5,799'**) of the banks were stabilized/armored.

This evaluation was conducted in **2013**, so at present time, these figures have likely changed. These areas were mapped on **Map 5**.

Geomorphic features such as flood chutes (1), stormwater inputs (14), bridges (10), culverts (3), grade control areas (3) and beaver dams (1) were identified and mapped on [Map 5](#).

The full [2015 Addendum](#) with its data and findings discussed in detail is included as **APPENDIX E** to the **Bow Hazard Mitigation Plan 2018** and its maps have been incorporated as well.

Turkey River Fluvial Erosion Hazard (FEH) Meander Belts

Fluvial erosion hazard areas, or *meander belt*, data is derived from assessed river reaches. A *meander belt* is that area of land on either side of a river or stream channel that a river can potentially access over time as a river naturally migrates across its floodplain

For identified river reaches, including those for the **Turkey River**, the suite of river geomorphology (condition) data was collected to provide an understanding of the river channel's sensitivity to future change (inclusive of bed and bank erosion) within the meander belt (or fluvial erosion hazard zone) as a result of high flow events. **Sensitivity for a reach can be in any one of six categories, based on its condition, ranging from Very Low to Extreme, with the categories of Low, Moderate, High and Very High in between.**

The 3 assessed **Turkey River** reaches in Bow were delineated by the NH Geological Survey (NHGS) using scientific techniques to define fluvial erosion hazard (FEH) meander belt locations and their relative sensitivity to future change. Future reach change could include channel migration, bank erosion, and other fluvial geomorphic changes during high flow or flooding conditions.

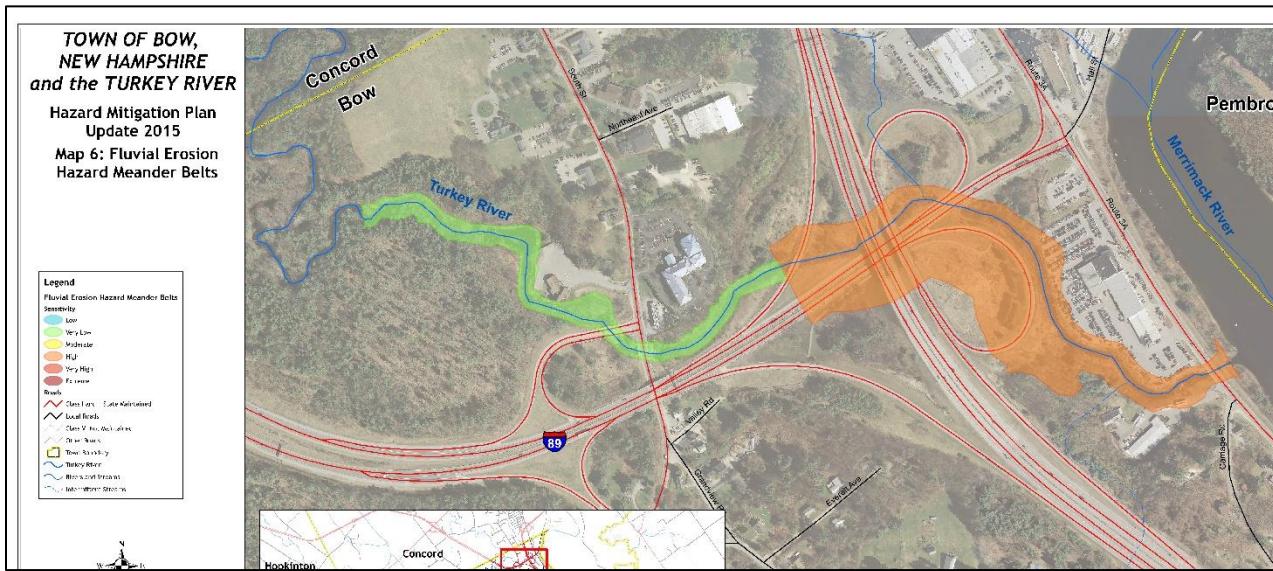
The fluvial geomorphology data collected about the river allows for delineation of meander belts, also known as fluvial erosion hazard areas. Fluvial erosion hazard mapping can display these reach sensitivities to channel changes, ranging from the highest **Extreme** to the lowest **Very Low** sensitivity rankings. Broadly, assignment of an **Extreme** category means a reach that is experiencing considerable erosion of its beds and banks, and typically has flood chutes and meander cutoffs that increase the potential for changing flow paths and further erosion during a large flood. Conversely, a rating of **Very Low** is typically found in a bedrock gorge, where the flow path will not change on time scales of concern to people.

Fluvial Erosion Hazard (FEH) Meander Belt Sensitivity
Very Low
Low
Moderate
High
Very High
Extreme

On the relative scale of the six FEH sensitivity categories ranging from **Very Low to Extreme**, the **Turkey River** has some dangerous potential because of the identified high transportation and populated area and artificially straightened channel through the Interstate area. The meander belt sensitivity for Bow's **Turkey River** segments are displayed on [Map 6 Turkey River Fluvial Erosion Hazard \(FEH\) Meander Belt](#) (see **APPENDIX E** for the **Fluvial Geomorphic Addendum 2015**

for more information). A section of [Map 6](#) is provided here in [Figure 14](#) as a visual representation of [Reach 1 \(High\)](#), [Reach 2 \(Very Low\)](#), [Reach 3](#) (not rated) for fluvial erosion hazard meander belt sensitivity.

Figure 14
Segment of Map 6 River Fluvial Erosion Hazard (FEH) at Bow Junction



Source: Map developed by Central NH Regional Planning Commission, 2015, from data provided by the NH Geological Survey (NHGS)

Erosion occurs at some of the more rural locations along the **Turkey River** banks according to [Map 5](#), which can be used as a tool to help understand and respond to erosion and scouring situations. The Town should remain alert for the progress of existing erosion sites and locations of new bank erosion.

From discussions with the Hazard Mitigation Committee and the [Map 5](#) series, existing or potential future hazard locations of **Turkey River bank erosion and scouring** could include:

- Floodplains of the Turkey River
- Historic Grist Mill (Chen Yan Li Restaurant) @ South Street and I-89 Exit 1
- Bow Junction
- Grappone Dealership buildings @ NH 3A and Bow Junction

Merrimack River

As discussed in the [2013 Plan](#), on Hall Street one home had a portion of the foundation sagging toward to the Merrimack River. An engineering study conducted by the Town showed that any potential preventative measures, if approved by the Environmental Protection Agency and US Army Corps of Engineers, would cost approximately three million dollars. The Board of Selectmen at that time concluded the issue was a private property matter, as the erosion is a natural occurrence years in the making.

On River Road, at some time in the future, either bank erosion mitigation will be necessary or else River Road will ultimately collapse into the River. Currently, cracks can be seen developing immediately adjacent to the pavement edge in some locations along River Road. Areas that are vulnerable at this time are at Old Ferry Crossing and some buildings on new Granite Shore Power (formerly PSNH) property. All of Johnson Road were renamed as River Road, and erosion is dealt with by the Public Works Department.

WIND HAZARDS

Hurricane season begins on June 1 and continues through the end of November. August and September are the most active hurricane months. It is not uncommon for New England to be impacted by a hurricane more than once in a season. River and flooding due to heavy rains is a risk to Bow during hurricanes. Numerous hurricane events in recent history have occurred in the State, region, and the local area surrounding Bow that may have also had an impact on the Town.

Wind is also found in severe winter snow and ice storms, making this hazard likely to occur during the entire year. Significantly high winds occur especially during hurricanes, tornadoes, winter storms, and thunderstorms any time of the year. Falling objects and downed power lines are dangerous risks associated with high winds. Property damage and downed trees are common during high wind occurrences. All utilities, including power lines, are at risk and their damage or destruction would create a hazard to the Town. A communications interruption or failure resulting from damage to telecommunications towers could affect the capabilities of emergency personnel to respond to the hazard event.

There are several types of **Wind** hazards examined in the **Hazard Risk Assessment**:

-  **Tornadoes**
-  **Downbursts**
-  **Hurricanes and Tropical Storms**
-  **Severe Wind, Rain Storms and Thunderstorms**

Tornadoes

Significantly high winds that occur especially during hurricanes, winter storms, and thunderstorms, but can also exist independent of other storms. Falling objects and downed power lines are dangerous risks associated with high winds. In addition, property damage and downed trees are common during high wind occurrences.

A tornado is a violent windstorm characterized by a twisting, funnel shaped cloud. They 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.

Magnitude of Tornadoes

A tornado occurring in Bow would cause considerable damage. Roofs could be torn off frame houses; dams could be damaged; large trees snapped or uprooted; and light object missiles would be generated by an EF-2 Tornado. Tornado magnitude is measured by the [Enhanced Fujita \(EF\) Scale](#), a 2007 update from the original F-scale (Fujita Scale), which are provided in **Table 14**.

Table 14
Enhanced Fujita (EF) Scale

Enhanced Fujita (EF) Scale 2007 – Present	Old Fujita (F) Scale replaced
F Number with 3-Second Gust mph	F Number with 3-Second Gust mph
EF0 65-85 mph	F0 45-78 mph
EF1 86-110 mph	F1 79-117 mph
EF2 111-135 mph	F2 118-161 mph
EF3 136-165 mph	F3 162-209 mph
EF4 166-200 mph	F4 210-261 mph
EF5 over 200 mph	F5 262-317 mph

Source: National Oceanic and Atmospheric Administration (NOAA) Storm Prediction Center

Tornadoes in Bow

The entire area of Town is vulnerable to a **tornado**, but this event would do more damage in highly populated or large business areas. The Merrimack Power Station (coal-fired) off of River Road along the **Merrimack River** is a vulnerable site for any hazard event. Most of Bow's major businesses and industries are located in its vicinity, off NH 3A and River Road next to the **Merrimack River**. This area is vulnerable to **high wind** events because of the sheer concentration of industry here.

Interstate 89, Interstate 93, I-89 ramps, NH 3A commuter route, NH 13 and Bow Junction are very heavily traveled via passenger vehicle and trailer trucks through Bow and can be subject to great damage and personal injury from **tornadoes**.

High density populated sites include the Baker Free Library (Warming/Cooling Center) [~50 capacity], Bow Elementary School [~460 students + ~100 staff], Bow High School [~600 students + ~100 staff] as Town Shelter [~200 shelter capacity], Bow Memorial (Middle) School [~475 students + ~100 staff], Community Building (Warming/ Cooling Center) [~50 capacity], Bow Youth Center [~100 children + 13 staff], Casa Dei Bambini Children Center [~87 students + 12 staff], Celebrating Children @ Bow Municipal Building [~32 students + 12 staff], Joyful Noise Learning Center / Crossroads Community Church [~20 students + 4 staff], Little Sprouts Day Care [~20 students + 6 staff], Meeting House Montessori School (24 students + 2 staff), Rockwood Acres Learning Center [~20 students + 6 staff], White Rock Senior Living Community [~200 residents + 4 staff]. All of these are vulnerable to **tornadoes** and other **high wind events** because of population concentrations in one building or multiple close-packed buildings.

The over **2** dozen one-egress residential developments in Bow can experience evacuation issues or delayed or unavailable emergency services during disasters due to trees down on roadways, powerlines down on roadways, **power failure**, or stream crossing (culvert/bridge) **flooding** because of **debris impacted infrastructure** from **tornadoes**. These residential, dead-end and/or cul-de-sac developments include: Abbey Road Subdivision [~12 homes], Audley Divide Subdivision [~16 homes], Beaver Brook Drive Subdivision [~10 homes], Chandler Circle Subdivision [~13 homes], Clearview Drive Subdivision [~27 homes], Clough Street Subdivision [~30 homes], Colby Lane Subdivision [~8 homes], Dicandra Drive Condominiums [~42 homes], Fox Meadow Drive Subdivision [~10 homes], Hampshire Hills Subdivision [~34 homes], Heather Lane Subdivision [~14 homes], Hope Lane Subdivision [~12 homes], McNichol Lane Subdivision [~6 homes], Meadow Lane Subdivision [~25 homes], Peaselee Road Subdivision [~34 homes], Rosewood Drive Subdivision [~22 homes], Sterling Place Subdivision [~8 homes], Stone Sled Farm 55+ Adult Community [~32 homes], Sundance Lane Subdivision [~13 homes], The Pines of Bow 55+ Adult Community [~27 homes], Tower Hill Road Subdivision [~14 homes], Whittier Drive Subdivision [~15 homes], Wilson Meadow Road [~9 homes], and Wind Chimes 55+ Adult Community, [~25 homes]. These **24** subdivisions are listed because homeowners lack secondary access to main Town streets should these cul-de-sac roads be damaged or blocked by weather events such as **flooding, high winds or debris impacted infrastructure**. At least **478** homes are represented in these **1**-egress residential developments, and these are only a representative sample of the cul-de-sac or dead-end residential roads; many more are not identified here.

A secondary effect of quick, severe hazard events with **power failure** include alarms in the elderly resident homes. Alarms turn on, scaring residents, and can cause medical emergencies due to shock and heart problems. Emergency responders report it is impossible to move the residents during these circumstances. All of these populated areas carry greater risk because of higher density (see **APPENDIX A Critical and Community Facility Vulnerability Assessment** for a complete list of sites).

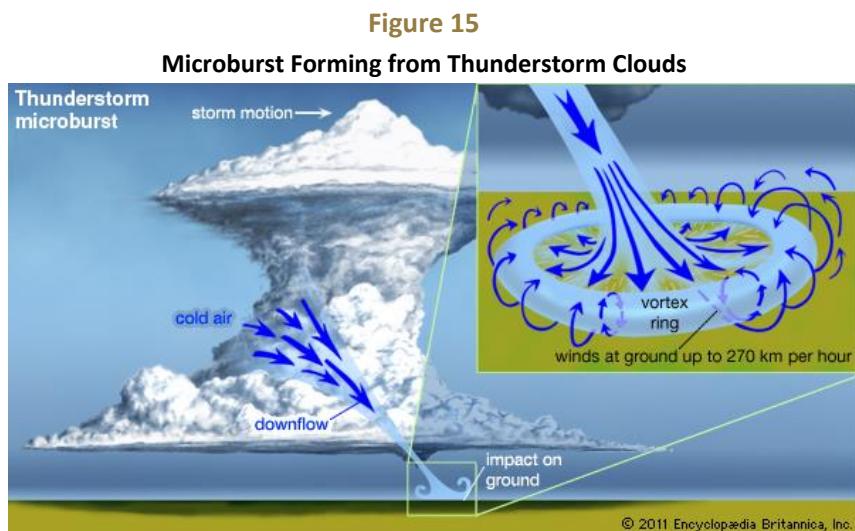
Wooded forested sections of Town similarly run a risk of isolation through debris impacted infrastructure (trees down on roads and powerlines) resulting in power failure with little emergency access until the way is cleared. Many of these locations are recreational lands where people may be hiking or bicycling during an unexpected high wind event such as a tornado. These locations include the Town Forests and conservation lands: Nottingcook Town Forest (**771** acres, trails – access trailheads South Bow Road and Woodhill Hooksett Road off Bow Bog Road), Boucher Forest Easement (**42** acres, no formal trails yet but used for hiking/biking- access Bow Center Road), Hammond Nature Preserve (**144** acres, old sawmill site, Paul's Falls and hiking trails- access Dunbarton Center Road and Brown Hill Road) & Walker Forest; Knox Town Forest (**318** acres, hiking trails, vernal pools and wetlands- access at Robinson Road and Knox Road) & School Forest (**105** acres, see Knox – trailhead on Bow Center Road).

A **tornado** occurring in Bow would cause considerable damage to this rural community, perhaps similar to the EF-3 **tornado** in July 2008 which moved across Northwood Lake. Roofs could be torn off frame houses; mobile homes can be demolished; large trees are snapped or uprooted; and light object missiles would be generated as a result of an EF-2 **Tornado**. The **6** telecommunications towers [NH 3A (**2** by Peterbilt), Robinson Road, South Bow Road, Knox Road @ Safety Center, and Woodhill Road], telephone lines, power lines, broadband internet service, the various waterlines with pump station and the water tower, and other utilities could also be affected by **tornadoes**.

Downbursts

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 are capable of producing winds of up to 175 mph and are life threatening. Downbursts are quite common during Central NH's hot weather months. Microbursts and macrobursts have been known to occur here in the region.

Downbursts of both sizes can produce strong wind shear - or large changes in wind speed and direction over a short distance. Trees are regularly snapped off in a singular direction by a macroburst or microburst. Downbursts typically originate from thunderstorm clouds, with air moving in a downward motion until it hits the ground level and then spreads outward in all directions. In fact, the wind pattern of a downburst is the opposite of a tornado's wind pattern, shown in **Figure 15**.



Source: Internet (Encyclopedia Britannica)

Magnitude of Downbursts

Downburst magnitude is rated on the same NOAA Enhanced Fujita (EF) scale as tornadoes. In addition, downbursts fall into two categories:

- microburst, which covers an area less than 2.5 miles in diameter and
- macroburst, which covers an area equal to or greater than 2.5 miles in diameter.

Downbursts in Bow

Downbursts are considered a strong threat in Bow, more likely than **tornadoes**, with an overall trend of more future wind events in Town. **High winds** are unpredictable, and are often more prevalent at higher elevations. Interstates 93, 89, I-89 ramps, NH 3A and NH 13 are heavily travel and lined with businesses and homes. The Interstates are a regular commuter route for thousands of cars during each morning and evening commute block.

Like a **tornado**, the highest populated locations could have the greatest potential for injury and property damage from **downbursts**. These include the Town facilities, vulnerable populations, 3 Bow School District Schools, White Rock Senior Living Community and the other senior housing developments, Stone Sled Farm, Wind Chimes, and The Pines of Bow; the single-egress subdivisions; the Merrimack Station, business and industry area along NH 3A, and forested lands. The most remote roads or areas of Town include: Putney Road, Buckingham Road, Brown Hill Road, North Bow Dunbarton Road, South Bow Dunbarton Road, Ferry Road, Woodhill Hooksett Road off Bow Bog Road, Branch Londonderry Turnpike (East & West), and the South Bow area. **Power outages** may last for several days before service is restored in a large event. A secondary effect of quick, severe hazard events with **power failure** include alarms in the elderly resident homes. Alarms turn on, scaring residents, and can cause medical emergencies due to

shock and heart problems. All of these populated areas carry greater risk of **downbursts** because of higher density (see [Tornado](#) section). See also **APPENDIX A Critical and Community Facility Vulnerability Assessment** for a complete list of sites.

Agricultural operations run the risk of high damage from **downbursts** which creates economic consequences, but there are few in Bow, including Alexander Dairy Farm and Millican Tree Nursery. The old, historic Bow Center carries much of the history of Bow, and any loss of old buildings and historic homes, Bow Bog Meetinghouse, Community Building, and more, would be a detriment to the community.

Hurricanes and Tropical Storms

A hurricane is a tropical cyclone in which winds reach speeds of 74 miles per hour or more and blow in a large spiral around a relatively calm center. Flooding is often caused from the coastal storm surge of the ocean and torrential rains, both of which accompany the storm. The floods and high winds can result in loss of life and property. Hurricanes, high wind and rain events, and thunderstorms can damage Bow just like any other community in Central New Hampshire. Forested lands and trees along the transportation infrastructure can be blown down across roads; the above-ground powerlines along the sides of the road can be snapped either by trees or high winds and fall onto the roads or nearby objects; and runoff flooding and stream/brook and river flooding can occur because of hurricanes and severe storms.

Magnitude of Hurricanes and Tropical Storms

The [Saffir-Simpson Hurricane Wind Scale](#) measures the magnitude of wind event on a **1** through **5** rating basis. The definitions of Category 1 through 5 sustained wind miles per hour and their respective threats to people, different types of homes, shopping centers, trees, power lines, water, and more are displayed in **Table 15**.

Table 15
Saffir-Simpson Hurricane Wind Scale

Category	Sustained Winds	Types of Damage Due to Hurricane Winds
1	74-95 mph	Very dangerous winds will produce some damage: Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110 mph	Extremely dangerous winds will cause extensive damage: Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3 major	111-129 mph	Devastating damage will occur: Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.

Category	Sustained Winds	Types of Damage Due to Hurricane Winds
4 major	130-156 mph	Catastrophic damage will occur: Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5 major	157 mph or higher	Catastrophic damage will occur: A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Source: National Oceanic and Atmospheric Administration (NOAA)

Hurricanes and Tropical Storms in Bow

Hurricane Sandy, which was not a declared disaster in Bow, caused many roads to temporarily close while the Public Works Department cleared them of debris. Trees and limbs fell onto the roadways and onto powerlines. If vehicles had been traveling on these roads while the hurricane was in progress, they would have been in danger. Many of the same sites vulnerable to high wind events in previous sections are also vulnerable to **hurricanes and tropical storms**.

When **hurricanes or tropical storms** occur in Bow, multiple hazard events occur: **Flooding** of the Merrimack River, Turkey River, Bela Brook, and other major brooks; **High Wind** effects to the Town's utilities, forests, trees, power lines and buildings all across Town; **Debris Impacted Infrastructure** on roads, stream crossings, bridges, dams and powerlines which exacerbate the effects of storms; and **Power Failure** from the inevitable trees down on powerlines along roadways.

The areas and sites previously listed in detail in the **Tornado** section provide a good synopsis of the potential risks and future vulnerabilities of the Town from **hurricanes and tropical storms**. Additional sites are provided in **APPENDIX A Critical and Community Facility Vulnerability Assessment** for a complete list of sites and appear on the **Maps 1-4** series.

Severe Wind, Rainstorms and Thunder Storms

More commonly experienced are **severe wind storms**, **rainstorms** and **thunderstorms**. The severe wind storms occur during all months of the year while the thunder storms tend to erupt during periods of humidity. On occasion, precipitation in the form of rain or hail is experienced during these storms. Rainstorms can bring flooding and high winds. **Thunderstorms** can also bring lightning hazards in addition to high winds and flooding.

Magnitude of Severe Wind and Thunder Storms

Many of the severe wind storms Bow experiences are not hurricanes but are severe wind storms or thunderstorms. Thunderstorms are common in New Hampshire, particularly during the hot weather months. The [Thunderstorm Category Criteria](#) scale in **Table 16** measures the magnitude of thunderstorms with their various weather components, including rain, wind, hail, tornado, and lightning.

Table 16
Thunderstorm Criteria Scale

Thunderstorm Categories	Rainfall Inches per hour	Wind Gust max mph	Hail Size in	Tornado Potential Highest Category	Lightning Frequency per 5 minutes	Darkness Aspect	Overall Thunderstorm Impact
T-1 Weak Thunderstorms or Thundershowers	0.03" to 0.10"	< 25 mph	None	None	Few strikes during entire storm	Slightly Dark Sunlight may be seen after storm	1. No damage. 2. Gusty winds at times.
T-2 Moderate Thunderstorms	0.10" to 0.25"	25-40 mph	None	None	Occasional 1 to 10	Moderately Dark Heavy downpours might cause the need for car headlights	1. Heavy downpours. 2. Occasional lightning. 3. Gusty winds. 4. Very little damage. 5. Small tree branches might break. 6. Lawn furniture moved around. 7. Power outages are possible.
T-3 Heavy Thunderstorms 1. Singular or lines of storms	0.25" to 0.55"	40-57 mph	1/4" to 3/4"	EFO	Occasional to Frequent 10 to 20	Dark Car headlights used. Visibility low in heavy rains. Cars might pull off the road.	1. Minor damage. 2. Downpours produce some flooding on streets. 3. Frequent lightning could cause house fires. 4. Hail occurs with the downpours. 5. Small tree branches are broken. 6. Shingles are blown off roofs. 7. Power outages are likely.

Town of Bow, NH Hazard Mitigation Plan Update 2018

4 HAZARD RISK ASSESSMENT

Thunderstorm Categories	Rainfall Inches per hour	Wind Gust max mph	Hail Size in	Tornado Potential Highest Category	Lightning Frequency per 5 minutes	Darkness Aspect	Overall Thunderstorm Impact
T-4 Intense Thunderstorms 1. Weaker supercells 2. Bow echoes or lines of storms	0.55" to 1.25"	58-70 mph	1" to 1.5"	EF0 to EF2	Frequent 20 to 30	Very Dark Car headlights used. Some streetlights come on.	1. Moderate damage. 2. Heavy rains can cause flooding to streams and roadway flooding occurs. 3. Hail can cause dents on cars and cause crop damage. 4. Tornado damage. 5. Power outages will occur.
T-5 Extreme Thunderstorms 1. Supercells with family of tornadoes 2. Derecho Windstorms	1.25" to 4"	> 70 mph	1.5" to 4"	EF3 to EF5	Frequent to Continuously > 30	Pitch Black Street lights come on. House lights might be used.	1. Severe damage to trees and property. Damage is widespread. 2. Flooding rains. 3. Damaging hail. 4. Damaging wind gusts to trees and buildings. 5. Tornadoes EF3 to EF5 or family of tornadoes can occur. Tornadoes cause total devastation. 6. Widespread power outages.

Source: Adapted from Accuweather.com, Henry Margusity, Senior Meteorologist

Incidentally, hail can accompany thunderstorms, hurricanes, or severe wind events. The [Hail Size Description Chart](#) describes the potential size of hail during a hurricane or severe storm event, which could occur anywhere in Bow. The chart is shown below along with a [Hail Size Comparison Chart](#) which is a visual representation of some of the relative sizes of hail (note this chart image is not shown to scale). The [Table 17](#) hail size description and [Figure 16](#) size comparison scales measure the magnitude of hailstones that could fall on Bow during severe storm events.

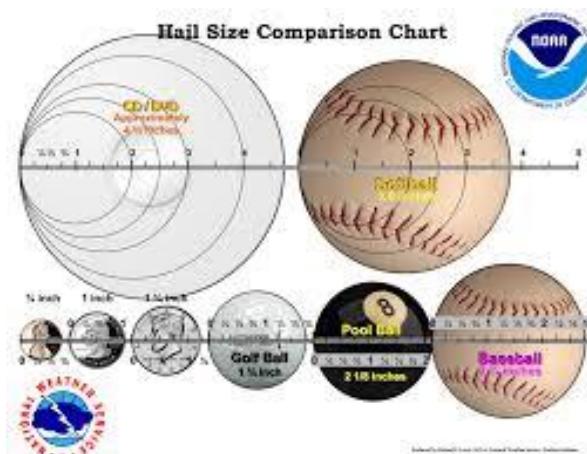
Table 17

Hail Size Description

Hailstone Diameter (inches)	Size Description
< 1/4	bb
1/4	Pea Size
1/2	Mothball Size
3/4	Penny Size
7/8	Nickel Size
Severe Criteria 1	Quarter Size
1 1/4	Half Dollar Size
1 1/2	Walnut or Ping Pong Ball
1 3/4	Golf Ball Size
2	Hen Egg Size
2 1/2	Tennis Ball Size
2 3/4	Baseball Size
3	Teacup Size
3 4/5	Softball Size
4	Grapefruit Size

Figure 16

Hail Size Comparison



Sources: National Oceanic and Atmospheric Administration (NOAA), National Weather Service (NWS)

Severe Wind, Rainstorms and Thunder Storms in Bow

All of Bow has experienced the natural disaster combination of **severe winds, rain and thunderstorms**. The most severe in recent history was the **October Wind Storm 2017**. Power failures nearly always occur because of tree fall; the reconnection time could be minutes, hours or several days in the more remote or densely populated areas of Town, depending on where debris has fallen onto roads and the extent of local and regional powerline damage. In addition, **hail** can occur with these **severe storms**, damaging homes, vehicles, property or crops as well as **lightning** which can cause localized **building fires**, building electronics damage (computer circuitry), or **wildfires**. These storms are very common, with regular **severe storms** experienced yearly in the Central NH region. Town Departments respond as needed and provide or receive mutual aid when necessary under the Capital Area Mutual Aid Compact, the NH Public Works Mutual Aid, local Police Department mutual aid, and under other local agreements.

Like the **Hurricanes and Tropical Storms** previously, when **severe wind, rain and thunderstorms** occur in Bow, multiple hazard events are the result: **Flooding** of the Merrimack River, Turkey River, Bela Brook, and other major brooks; **High Wind** effects to the Town's utilities, forests, trees, power lines and buildings all across Town; **Debris Impacted Infrastructure** on roads, stream crossings, bridges, dams and powerlines which exacerbate the effects of storms; and **Power Failure** from the inevitable trees down on powerlines along roadways.

The areas and sites previously listed in detail in the [**Tornado**](#) section provide a good synopsis of the potential risks and future vulnerabilities of the Town from **severe wind, rain and thunderstorms**.

Additional sites are provided in **APPENDIX A Critical and Community Facility Vulnerability Assessment** and appear on the [**Maps 1-4**](#) series.

FIRE HAZARDS

Fire can be caused by several agents and can spread rapidly to consume property and endanger lives. This **2018 Plan** examines **lightning**, and **wildfire** (natural) fire sources and places other **fires (vehicles, structure, arson, explosions)** with **Technological Hazards**.

Wildfire is a significant concern and can quickly get out of control without good infrastructure, easily accessible forested backlots and practiced procedures. Lightning or human folly can cause wildfire. Locations of older narrow graveled roads or densely packed residential areas and other sections of Town or roads with only **1** access/egress are among the most vulnerable locations for fire and wildfire hazards. Rural, forested areas of the community or recreation and conservation areas are often the most vulnerable to both wildfire and lightning.

There are two types of natural **Fire** hazards examined in the **Hazard Risk Assessment**:

- Lightning**
- Wildfire**

Lightning

All thunderstorms contain lightning. During a lightning discharge, the sudden heating of the air causes it to expand rapidly. After the discharge, the air contracts quickly as it cools back to ambient temperatures. This rapid expansion and contraction of the air causes a shock wave that we hear as thunder, a shock wave that can damage building walls and break glass. Lightning strikes can cause death, injury, and property damage. Lightning is often referred to as the “underrated killer”.

Magnitude of Lightning

Lightning can be measured to determine how likely it may be for starting fires. Using a Level system of **1** to **6** corresponding with storm development and the number of lightning strikes, the [**Lightning Activity Level \(LAL\)**](#) measures the magnitude of lightning strikes as displayed in [**Table 18**](#).

Table 18
Lightning Activity Level (LAL)

Level	LAL Cloud and Storm Development	Cloud to Ground Strikes per 5 Minutes	Cloud to Ground Strikes per 15 Minutes
LAL 1	No thunderstorms	n/a	n/a
LAL 2	Isolated thunderstorms. Light rain will occasionally reach the ground. Lightning is very infrequent, 1 to 5 cloud to ground strikes in a 5- minute period.	1 to 5	1 to 8
LAL 3	Widely scattered thunderstorms. Light to moderate rain will reach the ground. Lightning is infrequent, 6 to 10 cloud to ground strikes in a 5-minute period.	6 to 10	9 to 15
LAL 4	Scattered thunderstorms. Moderate rain is commonly produced. Lightning is frequent, 11 to 15 cloud to ground strikes in a 5- minute period.	11 to 15	16 to 25
LAL 5	Numerous thunderstorms. Rainfall is moderate to heavy. Lightning is frequent and intense, greater than 15 cloud to ground strikes in a 5-minute period.	> 15	> 25
LAL 6	Dry lightning (same as LAL 3 but without rain). This type of lightning has the potential for extreme fire activity and is normally highlighted in fire weather forecasts with a Red Flag Warning.	6 to 10	9 to 15

Source: National Weather Service

Lightning in Bow

Lightning regularly strikes in Town and can strike at any time at any given location, including Bow's tall utilities: the **6** communications towers, telephone lines, power lines, broadband cable internet service, Merrimack Power Station, Garvins Falls Substation, Bow Precinct water pump station, Water Tower (Dunklee Road), municipal sewer pump stations (Grandview Road, White Rock Hill Road).

The vulnerable populations and sites listed previously, including the 3 Bow Schools; White Rock Senior Living Community and the other senior housing developments, Stone Sled Farm, Wind Chimes, and The Pines of Bow; Bow Center buildings, or other wooden or historical buildings; the single-egress subdivisions; business and industry area along NH 3A; and forested lands. The most remote roads or areas of Town include Putney Road, Buckingham Road, Brown Hill Road, North Bow Dunbarton Road, South Bow Dunbarton Road, Ferry Road, Woodhill Hooksett Road off Bow Bog Road, Branch Londonderry Turnpike (East & West), and the South Bow area and could be particularly vulnerable to **lightning** and resulting **wildfires**. These sections of Town would be difficult to access with trees and power lines down on the residential roads. There is a lot of wood slash remaining in the woodland interior due to the **July 2008 Tornado** and the **December 2008 Ice Storm** which, with **drought** conditions, contributes to an increased overall hazard potential for **wildfires**.

Forested areas, parks, conservation areas or open recreation fields can be dangerous to people and property during **thunderstorms** and **lightning strikes**. These include recreational lands where people may be hiking or bicycling during **storms**, such as Town Forests and conservation lands, Nottingcook Town Forest (**771** acres, trails – access trailheads South Bow Road and Woodhill Hooksett Road off Bow Bog

Road), Boucher Forest Easement (**42** acres, no formal trails yet but used for hiking/biking- access Bow Center Road), Hammond Nature Preserve (**144** acres, old sawmill site, Paul's Falls and hiking trails- access Dunbarton Center Road and Brown Hill Road) & Walker Forest; Knox Town Forest (**318** acres, hiking trails, vernal pools and wetlands- access at Robinson Road and Knox Road) & School Forest (**105** acres, see Knox – trailhead on Bow Center Road). The highest areas or cleared areas are especially vulnerable to **lightning strike**.

Wildfire

Wildfire is defined as any unwanted and unplanned fire burning in forest, shrub or grass. Wildfires are frequently referred to as forest fires, brush fires, shrub fires or grass fires, depending on their location and size. They often occur during drought and when woody debris on the forest floor is readily available to fuel the fire. The threat of wildfires is greatest where vegetation patterns have been altered by past land-use practices, fire suppression and fire exclusion. Because fire is a natural process, fire suppression can lead to more severe wildfires due to vegetation buildup.

Increased severity over recent years has decreased capability to extinguish wildfires. Wildfires are unpredictable and usually destructive, causing both personal property damage and damage to community infrastructure and cultural and economic resources.

Magnitude of Wildfire

The standard of measuring wildfire magnitude is by the National Wildfire Coordinating Group (NWCG)'s wildfire classification scale. **Table 19** displays the wildfire classification size per the number of acres burned.

Table 19
National Wildfire Coordinating Group Wildfire Classification Scale

Fire Class	Sizes in Acres
Class A	1/4 acre or less
Class B	> 1/4 acre to < 10 acres
Class C	10 acres to < 100 acres
Class D	100 acres to < 300 acres
Class E	300 acres to < 1,000 acres
Class F	1,000 acres to < 5,000 acres
Class G	5,000 acres or more

Source: National Wildfire Coordinating Group

Wildfire in Bow

Although **wildfire** damage has been kept to a minimum to date, the potential for losing an immense acreage of Bow to this natural hazard is possible, particularly with the abnormal, severe **drought** conditions currently occurring in **2015-2016, and 2018**. The heavily forested woodlands of Town are often remote locations and difficult to access by emergency vehicles. The forested, dead-end residential neighborhoods would be difficult to evacuate. Any **debris** left over from **flooding, winter storms, or wind events** are a **wildfire hazard**. When **droughts** or drier conditions occur, the dry vegetation becomes a significant hazard to the Town Fire Department. See the [**Lightning**](#) section for site details.

The Fire Department has several fire ponds and dry hydrants throughout Town (Putney Road Pond, Rising Wood Pond, Higgins Pit Pond, South Bow Dunbarton Marsh, McNichols Pond, Knox Road Town Pond). Many of the neighborhoods have residential or commercial sprinkler systems. All of these water systems can help reduce the impact of **wildfire**.

All areas of Bow could be impacted by wildfire. Some neighborhoods are more vulnerable than others because of high density, one-egress roads, multi-family developments identified in **APPENDIX A Critical and Community Facility Vulnerability Assessment**. Unmaintained Class VI roads, private roads, and the transmission line corridors, and Bow's mountains and backcountry are challenging to access because of the potential lack of emergency vehicle access and the number of people who use these areas for recreational purposes. **Wildfires** can also be caused by campfires and other human activity.

EXTREME TEMPERATURE (COLD-HOT) HAZARDS

Extreme temperature hazards include diverse hazards such as severe cold and snowstorms, excessive heat, drought, and public health. The snow and ice component often results in communications & power failure for a large segment of the Town. This category is meant to encompass all the hazards which can be influenced by the extreme weather temperatures and climate changes that New England, New Hampshire, the Central NH Region, and Bow are experiencing.

There are several types of **Extreme Temperature (cold-hot)** hazards examined in the [**Hazard Risk Assessment**](#):

- █ **Severe Winter Weather, Cold, and Ice Storms**
- █ **Drought**
- █ **Excessive Heat**
- █ **Public Health (Epidemics)**

The National Weather Service (NWS) in Gray, Maine which covers New Hampshire collects and reports climate data in addition to issuing warning and advisories. Winter **2015-2016** was one of the warmest and one of the least snowy on record in Concord, their most local reporting station. The average temperature this season since **1868** was **30.9** degrees, topping the previous record of **30.4** degrees in the season of

1879-1880. Precipitation was **2.01** inches above normal this winter, totaling **10.53** inches. Total snowfall was **24.7** inches, **20.2** inches below normal. Warmest temperature records were also set during **2015**.

Severe Winter Weather, Cold, and Ice Storms

Ice and snow events typically occur during the winter months and can cause loss of life, property damage, and tree damage. Severe winter storms, including Nor'easters, typically occur during January and February. However, winter storms can occur from late September through late May.

A winter storm can range from moderate snow to blizzard conditions. Blizzard conditions are considered blinding, wind-driven snow over 35 mph that lasts several days. A severe winter storm deposits four or more inches of snow during a 12-hour period or six inches of snow during a 24-hour period.

An ice storm involves rain, which freezes upon impact. Ice coating at least one-fourth inch in thickness is heavy enough to damage trees, overhead wires, and similar objects. Ice storms also often produce widespread power outages.

A Nor'easter is a large weather system traveling from South to North, passing along or near the seacoast. As the storm approaches New England and its intensity becomes increasingly apparent, the resulting counterclockwise cyclonic winds impact the coast and inland areas from a Northeasterly direction. In the winter months, oftentimes blizzard conditions accompany these events. The added impact of the masses of snow and/or ice upon infrastructure often affects transportation and the delivery of goods and services for extended periods.

Extreme cold temperatures are associated with continental Arctic air masses. The actual temperatures reached depend specifically on the nature of the cold air mass and where it originated. In general, those from the Arctic regions are the coldest. Though cold temperatures are dangerous, they become more so in conjunction with strong winds. The combination produces a wind-chill factor – heat loss measured in Watts per meter squared (Wm-2). A wind-chill factor of 1400 Wm-2 is equivalent to a temperature of -40 degrees F. At 2700 Wm-2, exposed flesh freezes within a half-minute.

Numerous severe winter events in recent history have occurred in the State, region, and the local area surrounding Bow that may have also had an impact on the Town. Unlike the relatively infrequent hurricane, New Hampshire generally experiences at least several Nor'easters each year with varying degrees of severity. They form along the East coast as warm air from the Atlantic Ocean collides with cold arctic winds to the north and west. A hurricane, the nor'easter's warm-weather counterpart, differs in that it has a narrow range of strong winds around a warm, low-pressure core—nor'easter winds are more dispersed around a cold, low-pressure center.

Recent Severe Winter Weather in New Hampshire

In March **2018**, New Hampshire was hit by **4** cyclonic Nor'easters in a row over a **2**- week period because of the changing climate, in a recurring snow-and-melt cycle. These storms have the potential to inflict more damage than many hurricanes because the high storm surge and high winds can last from 12 hours to 3 days, while the duration of hurricanes ranges from 6 to 12 hours.

- March 2-3, 2018 (Winter Storm Riley) – Seacoast flooding, Concord wind gusts 36mph, about 1"
- March 7-8, 2018 (Winter Storm Quinn) – Concord 11"
- March 12-14, 2018 (Winter Storm Skylar) – Concord 11", Bow 23"
- March 22, 2018 (Winter Storm Toby) – Concord 3"

All winter storms make walking and driving extremely dangerous. The elderly and very young are at high risk during winter storms and may be affected by hypothermia and isolation. During winter storms, there is an increased risk of **fire** because people experience **power failure** and use candles, portable gas stoves, generators, and flammable sources of heat and light.

Magnitude of Severe Winter Weather

Severe Winter Weather magnitude in can be measured for windchill, ice accumulation and snowfall using several different scales and indices including the NWS Windchill Chart, Sperry-Piltz Ice Accumulation Index (SPIA) and NCDC Regional Snowfall Index (RSI) for the Northeast. **Figure 17** displays the [Windchill Temperature Index](#) which measures the wind and temperature leading to how quickly frostbite can occur.

Figure 17
Windchill Temperature Index

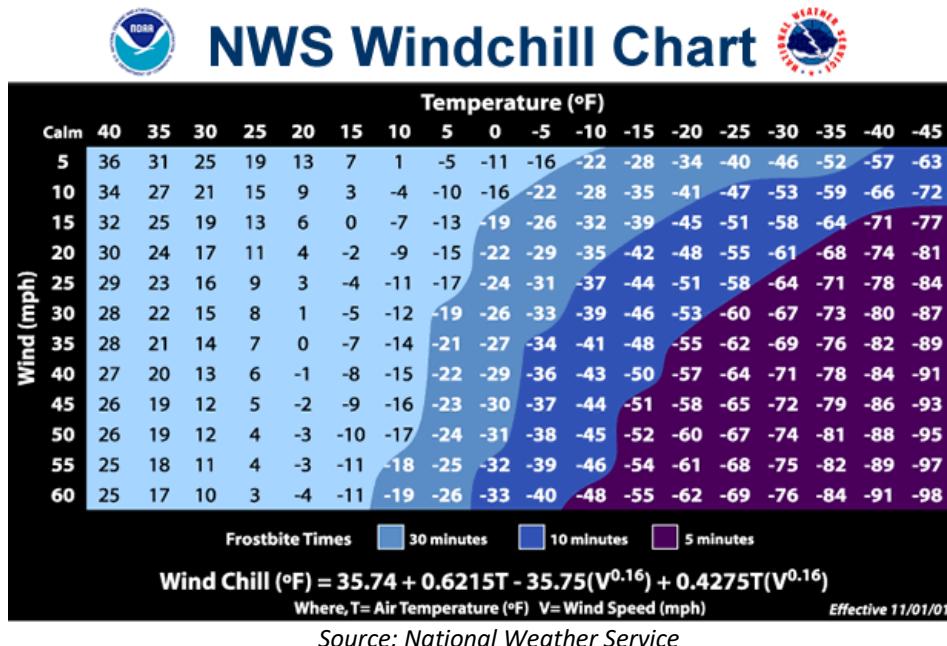


Table 20 displays the [Sperry-Piltz Ice Accumulation Index \(SPIA\)](#) which measure the magnitude of ice damage from severe winter weather. The index is compared to the tornado and hurricane scales note above. Storm total rainfall converted to ice accumulation, wind, and temperatures during the storm period are used to develop SPIA.

Table 20
Sperry-Piltz Ice Accumulation Index (SPIA)

Ice Damage Index	Average NWS Ice Amount in Inches	Wind Speed mph	Ice 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 to 0.25	15 to 25	Some isolated or localized utility interruptions are possible, typically lasting only a few hours.
	0.25 to 0.50	> 15	Roads and bridges might become slick and hazardous.
2	0.10 to 0.25	25-35	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions might be extremely hazardous due to ice accumulation.
	0.25 to 0.50	15-25	
	0.50 to 0.75	< 15	
3	0.10 to 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. Warming sites needed.
	0.25 to 0.50	25 - 35	
	0.50 to 0.75	15 - 25	
	0.75 to 1.00	< 15	
4	0.25 to 0.50	> = 35	Prolonged and widespread utility interruptions with extensive damage to main distribution feeder lines and some high voltage transmission lines/structures. Outages lasting 5-10 days. Shelters or warming sites needed.
	0.50 to 0.75	25 - 35	
	0.75 to 1.00	15 - 25	
	1.00 to 1.50	< 15	
5	0.50 to 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 to 1.00	> = 25	
	1.00 to 1.50	> = 15	
	> 1.50	Any	

Source: www.spia-index.com (adapted by CNHRPC)

The [Regional Snowfall Index \(RSI\) for the Northeast](#) is used to categorize significant snowstorms. The RSI ranks snowstorm effects on a scale from **1** to **5**, similar to the Enhanced Fujita Scale for tornadoes or the Saffir-Simpson Hurricane Wind Scale for hurricanes. The RSI differs from these other indices because it includes population, a social component. The RSI is based on the spatial extent of the storm, the amount of snowfall, and the juxtaposition of these elements with population. The Regional Snowfall Index (RSI) displayed in **Table 21** is a measurement of the magnitude of a snowstorm in the Northeast, which includes New Hampshire.

Table 21
Regional Snowfall Index (RSI) for the Northeast

Storm Category	RSI Value	Snow Description
1	1–3	Notable
2	3–6	Significant
3	6–10	Major
4	10–18	Crippling
5	18.0+	Extreme

Source: www.ncdc.noaa.gov/snow-and-ice/rsi/ (adapted by CNHRPC)

Severe Winter Weather in Bow

Winter weather events are as common in Bow as they are in the other areas of Central New Hampshire. The most recent worst winter storm on record was the **December 2008 Ice Storm** with wide-spread power outages lasting from **1 week (7 days)** up to **3 weeks (21 days)** in the most remote areas. Since then, Unitil, Eversource and NH Cooperative have adopted **5-year** hazardous road tree trimming policies. Road icing (**transportation accidents**) can occur when **ice and snow storm** events hit. **Communications failure, power failure, extreme cold** and local road impassibility (trees and/or power lines down) occur as well. Areas above **800'** in elevation are particularly vulnerable to the effects of severe winter weather.

Areas of particular concern during **severe winter weather** include Interstate 89, Interstate 93, I-89 ramps, NH 3A, NH 13, Bow Junction, and River Road. The majority of commercial development is located in the southeast of Bow between NH 3A, River Road, and the **Merrimack River**.

Bow's dispersed residential population, located in wooded and forested sections of Town within one-egress roads or cul-de-sacs, is vulnerable to loss of power and debris on roads. These sections of Town may be difficult to access for many days, with trees and power lines down on the residential roads. People may be subject to **cold temperature, snow isolation, transportation accidents, power failure** and **communications failure** during **winter storm events**. All residential developments and businesses are vulnerable to the **winter weather** impacts noted above. During winters, the Public Works Department is now deploying more frequently to respond to events than in past years, reacting quickly and minimizing losses.

The Town Shelter at Bow High School and warming Shelters at Baker Free Library, Community Building, Old Town Hall can be opened by Bow Emergency Management to help both Bow residents and to help accommodate people from nearby smaller communities as space is available.

The utilities of Bow need to be protected from freezing or collapsible conditions. Older or historic buildings subject to roof collapse are at risk from **severe winter weather conditions**. See the list of vulnerable sites in **APPENDIX A Critical and Community Facility Vulnerability Assessment**.

Drought

A drought is defined as a long period of abnormally low precipitation, especially one that adversely affects growing or living conditions. Droughts are becoming less rare in New Hampshire than they have been in the past. They have different, widespread damages compared with floods and are more difficult to define. The effect of droughts is indicated through measurements of soil moisture, groundwater levels, and streamflow. However, not all of these indicators will be minimal during a drought. For example, frequent minor rainstorms can replenish the soil moisture without raising ground-water levels or increasing streamflow. Low streamflow also correlates with low ground-water levels and commonly cause diminished water supply because ground water discharge to streams and rivers maintains streamflow during extended dry periods.

In the case of drought, residential (dug wells especially) and Town water supplies would be threatened. Most homes in Town rely on well water which is not easily replenished during periods of drought. During the **2015-2016** drought, many residences notified the Town of their dug wells going dry. The residents either made private arrangements for potable water or they dug new bedrock wells. Any agricultural enterprises, Town Forests, wetlands, brooks and conservation areas in Town would be affected by **drought**. Additionally, **wildfires** have the potential of being more severe and commonplace during periods of **drought**, more difficult to contain.

Magnitude of Drought

Table 22 displays overall drought magnitude, measured by the [Palmer Hydrological Drought Index \(PHDI\)](#) the extent of hydrological drought in the form of long-term, cumulative monthly moisture conditions. The indices are developed by algorithms taking into consideration precipitation, temperature data, and the local Available Water Content (AWC) of the soil.

Table 22
Palmer Drought Conditions

Hydrological Drought Classification	
Extremely Moist	+4 and above
Very Moist	+3 to +3.99
Moderately Moist	+2 to +2.99
Mid-Range	-1.99 to +1.99
Moderate Drought	-2 to -2.99
Severe Drought	-3 to -3.99
Extreme Drought	-4 and below

Source: www.ncdc.noaa.gov/sotc/drought (as compiled by CNHRPC)

Drought in Bow

Periods of **drought** in Bow would occur Town-wide and could cause property damage and economic losses. The lack of water would become a community problem to keep people hydrated, to keep utilities running, and to maintain healthy forests and aquifers. Failure of tree farms to thrive can result in economic losses. Increased likelihood of wide-spread **brush fire** and **wildfire** will occur with drier vegetation. **Lightning** strikes could contribute to wildfire risk during droughts. Dug wells can dry up during droughts and interrupt personal water supplies, so few homes remain with dug wells in Town. Property damage and personal injuries or death could occur from drought-related fires or dry wells. The Town's municipal water supplies, even with its small number of customers, could enact water saving measures for their customers to assist with keeping the groundwater table higher. Overall, Bow residents should be encouraged to voluntarily undertake water conservation.

There are many woodlands, Town Forests and conservation lands susceptible to loss during **drought** conditions. A large aquifer runs beneath Bow but is not refilled during **drought** conditions, a particularly concerning issue. The Town water bodies (Turee Pond, Putney Road Pond, Rising Wood Pond, Greylure Farm Pond, Knight Pond, Lewis Putney Pond, Putney Meadow Pond, Great Meadow, Hornbeam Swamp, Putney Meadow, Sage Meadow, Six Acre Swamp, The Meadow, unnamed wetlands, and more), and water courses (**Merrimack River**, **Turkey River**, Bela Brook, White Brook, Bow Bog Brook, Morgan Brook, Black Brook, Turee Brook, unnamed streams, more) are critical to Bow's rural identity and to the natural resources of future generations. Waterbodies help keep drought levels in check and reduce the chance of **wildfire** or **fire** spreading, whether in the Town's commercial developments or residential subdivisions.

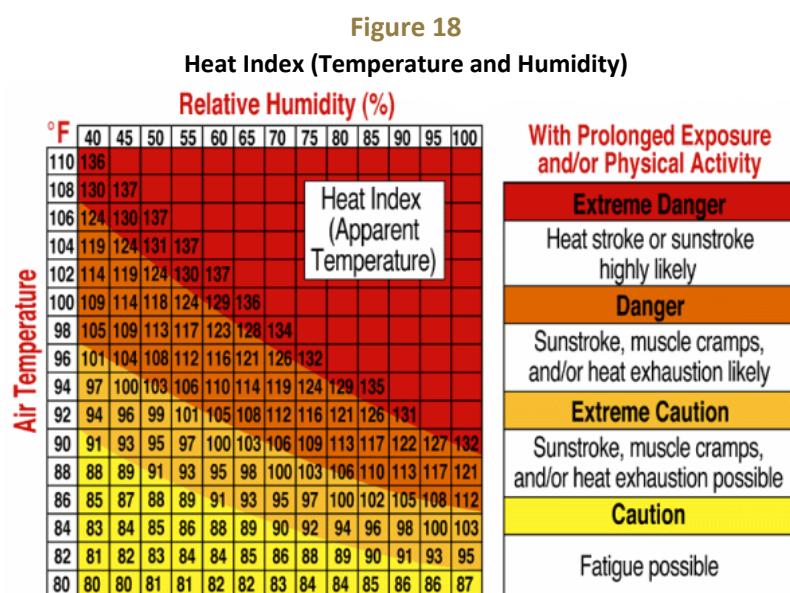
There are few agricultural operations in Bow, unlike most communities, so has few livestock to protect during weather events, including **drought**. During emergencies, with agreements in place the Town could provide informational assistance to people for getting their large animals (horses) to shelter at alternative locations such as the Hopkinton Fairgrounds and to enable small animals or pets to be brought to a nearby boarding facility or veterinary clinic.

Excessive Heat

A heat wave is a period of abnormally and uncomfortably hot and unusually humid weather that typically lasts two or more days. The National Weather Services' (NWS) Heat Index is used to measure humidity against temperature to develop a "real feel" temperature. Heat disorders on the body are quick and can be deadly. These now normal hot temperatures in the summer are commonly known as **excessive heat**.

Magnitude of Excessive Heat

Excessive heat is measured by the [NWS Heat Index and the NWS Excessive Heat Warning Classifications](#). As both the air temperature and the humidity rise, so will the danger level to people. Heat disorders will become more likely with prolonged exposure or strenuous activity as shown in **Figure 18**.



Source: [NWS weather.gov](#)

Excessive Heat in Bow

Bow has experienced **heat waves** where temperatures exceeded 90 degrees for several days. During these times, the groups of children and elderly residents in Town are particularly susceptible to excessive heat, including the White Rock Senior Living Community and the other senior housing developments, Stone Sled Farm, Wind Chimes, and The Pines of Bow; Bow Elementary School, Bow Memorial School and Bow High School; and the Casa Dei Bambini, Bow Youth Center, Rockwood Acres Learning Center, Meetinghouse Montessori School, Celebrating Children, Little Sprouts Day Care, and Joyful Noise Learning Center child care facilities.

The aged 55+ residences and schools, child care centers should have access to either air conditioning or cooling facilities. Older, individual homes may lack air conditioning. **Excessive heat** can cause dehydration, heat exhaustion and more serious illnesses. The Baker Free Public Library [capacity **~50**], Old Bow Town Hall [capacity **~85**], Community Building [capacity **~50**], or Safety Center could open during these times as

a Cooling Center. Other vulnerable facilities are indicated in **APPENDIX A Critical and Community Facilities Vulnerability Assessment**.

EARTH HAZARDS

Earth hazards include geologic events such as the small earthquake NH residents experience. The Central NH area is seismically active and small earthquakes (less than 2.5 magnitude on the Richter Scale) occur about 1-2 times per year. Landslides can occur as a result of earthquakes, rain, flooding and result in erosion along roadways and watercourses.

Radon is a naturally occurring radioactive gas with carcinogenic properties. The gas is a common problem in many states, including New Hampshire, seeping into homes from basements. Radon may also enter homes dissolved in drinking water from drilled wells. High levels of radon in water from individual drilled wells is a common occurrence in New Hampshire. Radon is no longer being addressed by the [**State of New Hampshire Hazard Mitigation Plan**](#) as no new studies have made specific data available. It is generally known that radon exists throughout in the State and in communities, including the Central NH Region. Arsenic is a new concern that often co-occurs with radon. Radon is known to be present throughout New Hampshire and is addressed on an individual basis, no longer addressed in the **Hazard Mitigation Plan** because of the lack of State monitoring and available action.

There are two types of **Earth** hazards examined in the **Hazard Risk Assessment**:

- Earthquake**
- Landslide**

Earthquake

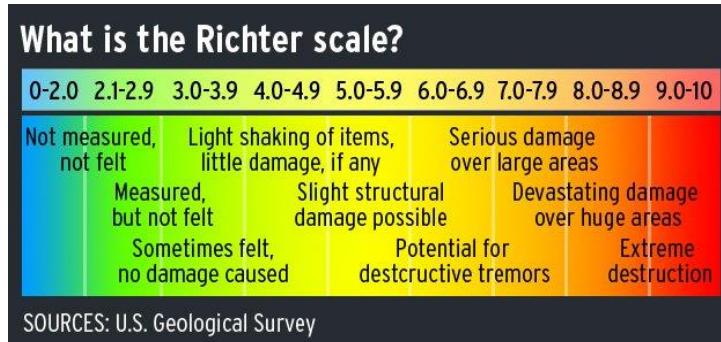
An earthquake is a rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface. **Earthquakes** can cause buildings and bridges to collapse, disrupt gas, electric and phone lines, and often cause **landslides**, **flash floods**, **fires**, and avalanches. Larger earthquakes usually begin with slight tremors but rapidly take the form of one or more violent shocks, and end in vibrations of gradually diminishing force called aftershocks. The underground point of origin of an earthquake is called its focus; the point on the surface directly above the focus is the epicenter. The magnitude and intensity of an earthquake is determined by the use of scales such as the [**Richter scale**](#) and [**Mercalli scale**](#). Geologic events are often associated with California, but New England is considered a moderate risk earthquake zone.

Magnitude of Earthquake Hazards

Earthquake hazard magnitude can be measured by the Richter Scale as shown in **Figure 19**. To better place the Richter Scale magnitude in perspective, the Mercalli Scale describes the *intensity* felt at different magnitudes in **Figure 20**. The **M** refers to magnitude of the earthquake.

Figure 19

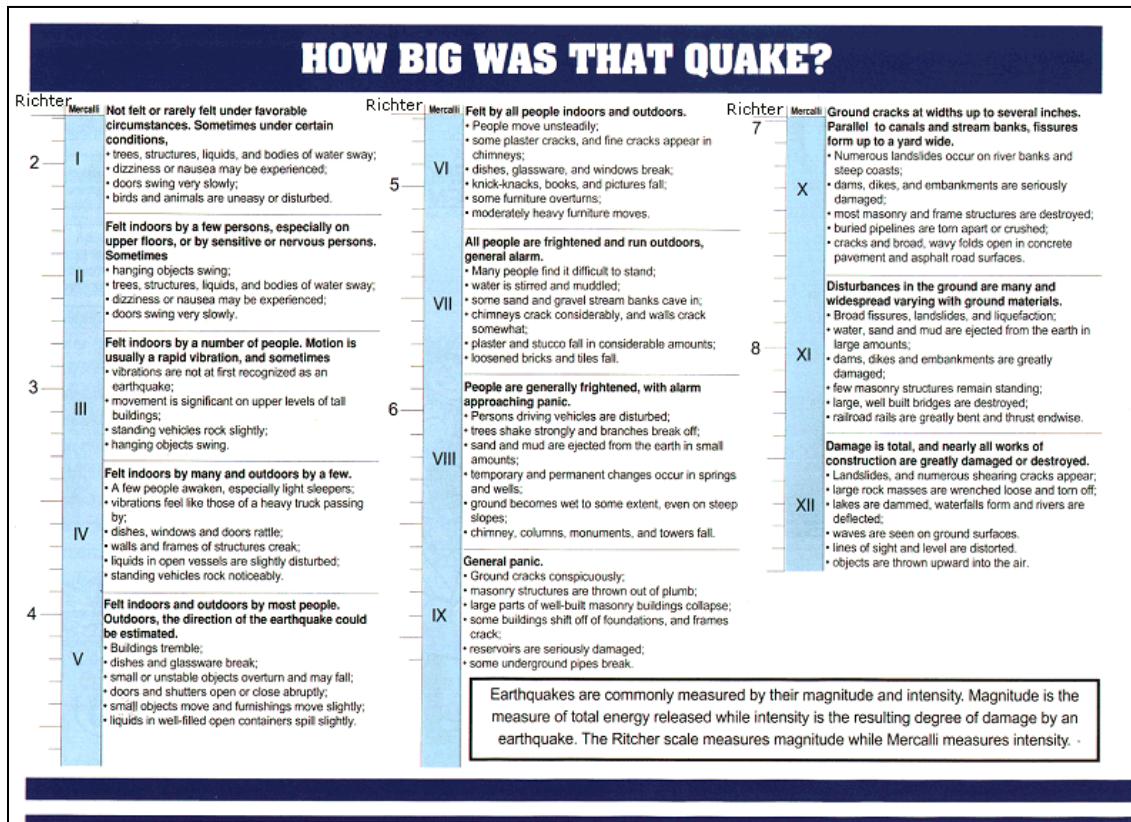
Descriptive Richter Scale



Source: US Geological Survey (USGS)

Figure 20

Earthquake Impacts on the Richter and Modified Mercalli Scales



Source: National Oceanic and Atmospheric Administration (NOAA)

Earthquakes in Bow

Multiple small-scale **earthquakes**, about **1-2** quakes every year, have been felt by Bow residents, with their epicenters occurring within the Bow, Webster, Hopkinton (Contoocook), Hillsborough, Henniker, Warner or Franklin or Sanbornton area in Central NH or otherwise within **25** miles of Bow since **2002** to present day. The Central NH Region is an active seismic area with mild earthquakes. No significant damages or injuries have been reported from these events, mainly because they are so deep underground in bedrock, from 3-6 kilometers from the surface. Nearby earthquakes with a magnitude greater than **2.5M**, or that are closer to the earth's surface, would be more concerning to the Town.

While It is likely Bow residents will continue to feel **earthquakes** in the future, it continues to be likely that no major damage will result from these small earthquakes. Damage to utility poles and wires, roadways, the Merrimack Station and any of the **6** telecomm towers NH 3A (2 by Peterbilt), Robinson Road, South Bow Road, Knox Road @ Safety Center, Woodhill Road could be significant should a large earthquake (**>3M**) occur.

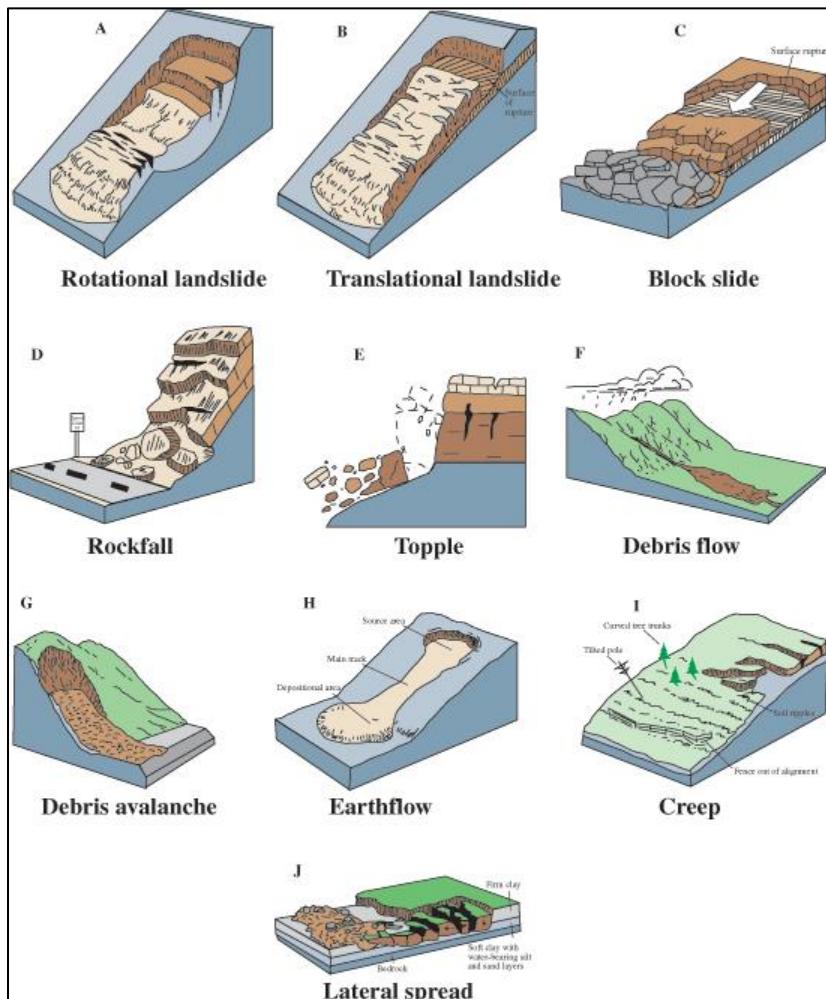
Areas with underground utilities, community water systems, and the old/historic buildings, Old Town Center, and large facilities such as White Rock Senior Living Community and the **3** Bow Schools are particularly at risk because of building size and/or large population concentrations.

Older buildings (stone foundations) in Town could be susceptible to earthquake damage. Stone walls, other dams, bridges, cemeteries, and telecommunications towers could also be susceptible to damage.

Landslide

A landslide is the downward or outward movement of slope-forming materials reacting under the force of gravity including: mudflows, mudslides, debris flows, rockslides, debris avalanches, debris slides, and earth flows. Erosion of soil may also contribute to landslides. **Landslides** have damaged or destroyed roads, electrical and telephone lines, buildings, sewers, bridges, dams, forests, parks, and farms. A display of different types of landslides is shown in **Figure 21**.

Figure 22
Basic Types of Landslides



Source: US Geological Survey (USGS)

Magnitude of Landslide Hazards

There is no known standardized measurement of landslide magnitude available.

Landslides in Bow

Landslide is a possibility in limited areas of Bow where certain topological conditions are met, although it has not occurred since the **2013 Plan**. Development in proximity to areas of steep slopes (greater than 15% or 25%) could present a risk to residents. Most potential **landslides** will be in conjunction with another hazard event, such as **flooding**, a severe rain event, **earthquake**, or from the construction of buildings or infrastructure in a topologically vulnerable area. Most roads are gravel roads which already experience washout during heavy rain events, flooding, or rapid snow pack melt. Some of the steeper roads could experience landslide or rockslide erosion during heavy rain events. Although a large-scale road landslide would damage few structures, road (infrastructure) closures are costly and can last for months.

The **Merrimack River's** river banks and brook banks could **erode** or **scour** be subject to **mass failure**, which is the water version of **landslide**.

Generally, vegetation in Bow is good at preventing **landslides**, except for the gravel pits in Town. Roads with steep ditching or embankments are most vulnerable to **landslide**. Areas of concern for potential **landslide** include NH 3A by St. Germain's. Road washouts and flash-flooding could cause **landslides**, but the Town is not particularly susceptible.

TECHNOLOGICAL HAZARD EVENTS

Many technological hazards could be construed as secondary hazards, as they often occur as the result of a primary (natural) hazard. For example, **power failure** or **transportation accidents** (technological) can result from severe winter weather (natural). Scientific measures of magnitude are generally not available for individual technological hazards, but they are provided for **debris impacted infrastructure** and **dam failure** which are closely related to **flooding** and for **hazardous materials spills** and **radiological incident**.

There are several types of **Technological** hazards examined in the **Hazard Risk Assessment**:

- Dam Failure**
- Power/Utility Failure**
- Communications Systems Failure**
- Debris Impacted Infrastructure**
- Transportation Accidents**
- Fire (Vehicle, Structure, Arson)**
- Hazardous Materials Spills**
- Public Health Issues**

Magnitude of Technological Events

Magnitude of most technological hazards are not addressed in this Plan. The only exception is **Dam Failure** because of its close relationship with flooding using the NH DES Dam Hazard Classifications.

Dam Failure

Dam breach and the resulting failure cause rapid loss of water that is normally impounded by the dam. These kinds of floods are extremely dangerous and pose a significant threat to both life and property as they are quick, unexpected, and if they occur during a flooding event, dam failures can overload an already burdened water channel.

Magnitude of Dam Failures

Although dam failure is considered a **Technological Hazard**, it is often a secondary hazard caused by flooding conditions. Classifications of dams and their magnitude of failure can be measured by the [NH DES Dam Hazard Classifications](#) shown in [Table 23](#).

Table 23
New Hampshire Dam Hazard Classifications

NON-MENACE Structure		Inspection
NM	Means a dam that is not a menace because it is in a location and of a size that failure or misoperation of the dam would not result in probable loss of life or loss to property, provided the dam is:	Every 6 years if criteria
	<ul style="list-style-type: none"> <input type="radio"/> Less than six feet in height if it has a storage capacity greater than 50 acre-feet; <input type="radio"/> Less than 25 feet in height if it has a storage capacity of 15 to 50 acre-feet. 	
LOW Hazard Structure		Inspection
LH	Means a 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 any of the following:	Every 6 years
	<ul style="list-style-type: none"> <input type="radio"/> No possible loss of life. <input type="radio"/> Low economic loss to structures or property. <input type="radio"/> Structural damage to a town or city road or private road accessing property other than the dam owner's that could render the road impassable or otherwise interrupt public safety services. <input type="radio"/> The release of liquid industrial, agricultural, or commercial wastes, septic, or contaminated sediment if the storage capacity is less than two-acre-feet and is located more than 250 feet from a water body or water course. <input type="radio"/> Reversible environmental losses to environmentally-sensitive sites. 	
SIGNIFICANT Hazard Structure		Inspection
SH	Means a 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 any of the following:	Every 4 years
	<ul style="list-style-type: none"> <input type="radio"/> No probable loss of lives. <input type="radio"/> Major economic loss to structures or property. <input type="radio"/> Structural damage to a Class I or Class II road that could render the road impassable or otherwise interrupt public safety services. <input type="radio"/> Major environmental or public health losses, including one or more of the following: <ul style="list-style-type: none"> ◆ Damage to a public water system, as defined by RSA 485:1-a, XV, which will take longer than 48 hours to repair. ◆ The release of liquid industrial, agricultural, or commercial wastes, septic, sewage, or contaminated sediments if the storage capacity is 2 acre-feet or more. ◆ Damage to an environmentally-sensitive site that does not meet the definition of reversible environmental losses. 	
HIGH Hazard Structure		Inspection
HH	Means a 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 as a result of:	Every 2 years
	<ul style="list-style-type: none"> <input type="radio"/> Water levels and velocities causing the structural failure of a foundation of a habitable residential structure or commercial or industrial structure, which is occupied under normal conditions. <input type="radio"/> Water levels rising above the first floor elevation of a habitable residential structure or a commercial or industrial structure, which is occupied under normal conditions when the rise due to dam failure is greater than one foot. <input type="radio"/> Structural damage to an interstate highway, which could render the roadway impassable or otherwise interrupt public safety services. <input type="radio"/> The release of a quantity and concentration of material, which qualify as "hazardous waste" as defined by RSA 147-A:2 VII. <input type="radio"/> Any other circumstance that would more likely than not cause one or more deaths. 	

Source: NH Department of Environmental Services (NHDES) Dams Bureau, 2012

Dam Failures in Bow

Dam failures, or breaches, are a potential danger to people and property within the dam failure inundation area(s). There are **6** active dams in Bow, all listed in **APPENDIX A**.

There are only a few dams in Bow with the potential for immense flooding damage *if* breached. One (**1**) **High Hazard (H)** dam, the Garvins Falls Dam @ **Merrimack River**, could have severe consequences if a failure occurs. The dam is located in the Merrimack River which forms the eastern edge of the community and parallels I-93 and NH 3A. The Turkey River empties into the Merrimack River just north of the Garvins Falls Dam, which is **33'** high, **550'** long dam is situated across the entire span of Merrimack River with Concord to the north and east.

Two (**2**) **Low Hazard (L)** dams are situated in Bow, the Bow Fire Pond Dam @ **Morgan Brook** and the **Putney Meadow Pond** Dam @ **Black Brook** Tributary, which was reportedly located in Dunbarton and removed 5-6 years ago. Three (**3**) **Non-Menace** dams are located throughout the community, the McKay Fish Pond Dam @ natural swale, Martin Pond Dam @ **Greyllore Farm Pond**, and **Knight Pond** Dam @ Unnamed wetlands. Most of these dams are privately owned and maintained, following the NH Department of Environmental Services' (NHDES) regulations for Dam Emergency Action Plans.

Also of significance to Bow is the High Hazard (H) **Turkey Pond** Dam in Concord at St. Paul's School @ **Turkey Pond**. This dam, presently **15'** high, **100'** long and impounding **360** acres of water, was in danger of failing during the **2006 Mother's Day Flood** when the I-89 ramps and South Street Bridge were nearly overtopped. Should the **Turkey Pond** dam fail, an immense amount of water would be released into the **Turkey River** and in their current condition, these two locations are expected to flood. Floodwaters would continue downstream to Bow Junction, which was heavily flooded during this **2006** event, likely causing inundation, before reaching the **Merrimack River** and possibly breaching the Garvins Falls Dam. This event is considered one of the greatest potential disasters that could occur in Bow.

The following is a summary listing of these dams, downstream of which would be immediately susceptible to the impacts of dam failure or release **flooding**.

- ↪ Garvins Falls Dam, **High Hazard (H)**
- ↪ Turkey River Dam (Concord), **High Hazard (H)**
- ↪ Bow Fire Pond Dam, **Low Hazard (L)**
- ↪ Putney Meadow Pond Dam (reportedly removed), **Low Hazard (L)**

All dams have a high probability of flooding and potential to breach or fail over time.

Figure 23 displays the relationship of the Garvins Falls Dam on the **Merrimack River** to the location of the Interstates, I-89 and I-93, as well as the populated Bow Junction (NH 3A, Hall Street) and the **Turkey River**.

Figure 23

Aerial View of Garvin's Falls Dam on the Merrimack River



Source: Google Maps, Accessed 09-13-18; CNHRPC

Power/Utility Failure

Utilities systems exist everywhere and are subject to damage from construction work, accidents and extreme weather. Many utilities are protected by back-up generators to prevent failure, whatever the cause may be. Nuclear power plants produce roughly 20% of the nation's power, they exist in nearly all states and 3 million Americans live within 10 miles of a nuclear power plant. The greatest risk to life resulting from a nuclear power plant failure is radiation contamination resulting from radiation release into the environment. People in the immediate vicinity are at greatest risk of radiation contamination. Another common source of energy, coal, can be potentially hazardous because coal power plants emit chemicals such as mercury and sulfur dioxide.

New Hampshire contains nuclear, coal and natural gas power plants. There is only one **(1)** coal power plant in New Hampshire, the Merrimack Station in Bow. The Merrimack Station is the largest coal-fired electrical generating station, currently owned by Granite Shore Power, formerly owned by Eversource and Public Service of New Hampshire, and supplies power to 190,000 households. Coal fuel generated only **7%** of the State's electricity in **2016**. The Merrimack Plant may be decommissioned in the future in favor of other sources. Much of the State's electricity (**56% in 2016**) is provided by the Seabrook nuclear power reactor.

In the harsh environment that New Hampshire residents are subjected to, power and utility failures on an isolated level are commonplace. During nearly every heavy snow storm, ice storm, or other severe weather event, someone, somewhere, loses power and/or other utilities.

Power Failure in Bow

Power is disrupted on a regular basis during all seasons, a result of the primary natural hazards occurring. Bow depends on Unitil, as the only electric provider, for its power needs. **Power outages** may last for hours to several days near the Municipal Building (Town Offices) on Grandview Road and other critical facilities locations to up to **2 weeks** on Brown Hill Road and cul-de-sac neighborhoods in the higher elevation regions before service is restored to residents after a large event. Power outages in the more rural or isolated areas of Town regularly occur during **severe wind events, storms, winter weather** or hazard events that cause debris impacted infrastructure. The Unitil response to power failure is fairly quick and prioritized.

The most remote roads/ areas of Town include South Bow Dunbarton Road, Ferry Road, Woodhill Hooksett Road off Bow Bog Road, Branch Londonderry Turnpike (East & West), and the South Bow area. Over **2** dozen cul-de-sacs are susceptible to power failure and the often-related tree fall on roadways that accompany it.

The Bow High School can serve as the Town Shelter available to Bow and area residents once opened. The multiple businesses in Town rely on electricity provided by powerlines, and in most cases the Town's busy enterprise comes to a standstill during severe weather events.

Specific vulnerable locations to power outage include communications equipment at the crest of Woodhill Hooksett Road; high density or vulnerable populations such the Bow Elementary, Middle and High Schools; historic buildings in the old Town Center; and the **6** telecomm towers [NH 3A (2 by Peterbilt), Robinson Road, South Bow Road, Knox Road @ Safety Center, Woodhill Road], and the water and sewer utilities.

Vulnerable populations are at greatest risk in rural Bow for the effects of **power/utility failure**. A few individuals in Town require oxygen and power failure and the likely accompanying communications systems failure would comprise the most vulnerable populations, including the White Rock Senior Living Community and the other senior housing developments, Stone Sled Farm, Wind Chimes, and The Pines of Bow. The Fire Department has a voluntary registration program for people who want to be reached during emergencies, and the Police Department also conducts welfare checks. (See **APPENDIX A** for a list of vulnerable populations and utilities.)

As a rule of thumb, all residents should be able to shelter in place in their homes for up to three days, gathering needed supplies and water ahead of time. **Power failure** can cause inconvenience, loss of economy, extra Town expenditures and staffing, and could restrict emergency response because the typical power failure is a secondary hazard caused by natural weather event. This problem is applicable to the **Hurricanes and Tropical Storms, Downbursts, Tornadoes, and Severe Winter Weather, Cold, and Ice Storms** hazard events described earlier as well as **Debris Impacted Infrastructure and Transportation Accident** hazard events in the following sections.

Communications Systems Failure

Communications systems, like utilities, are found everywhere and are subject to damage by construction work, severe weather and traffic accidents. Because communications systems depend on electricity, any power outage may cause an interruption in a communications system. In addition, many communications systems have buried cables which are particularly vulnerable to being cut. Communications systems interruptions can negatively impact a region, town, neighborhood or household in the case of a natural disaster, catastrophe or other emergency. Power lines often share cables and poles with communications systems. When power fails, cable, telephone and radio services frequently fail as well.

Communications Systems Failure in Bow

Any **communications failure** can mean lack of emergency services or delayed emergency services. Police/Fire use digital service and are members of the effective Capital Area Fire Compact Mutual Aid (CAFCMA) Dispatch service, which has upgraded its equipment for greater effectiveness after region-wide

communications were lost in a **2014** event (see **Table 10**). Bow has several telecommunications towers which provide cellular coverage to most sections the Town. Bow emergency communication capabilities have been upgraded significantly since the last Plan, including obtaining a new radio frequency, underway as of **September 2018**, and the construction of a new Safety Center in **2017** on Knox Road where all emergency response departments are located.

Communications failure usually occur as a secondary effect of a natural disaster such as a severe storm or severe winter weather. However, Town radios are interoperable and they are used in more than one location, and repeaters are used to minimize future emergency communications failures. Vulnerable areas and populations previously identified are at highest risk of danger from personal communications failure, including the **3** Bow Schools, the senior housing developments, and childcare facilities and more detailed in the **Tornadoes** section.

Debris Impacted Infrastructure

Debris impacted infrastructure regularly occurs along the Central NH Region's rivers and streams and also along roadways. Rivers or brooks flowing under bridges or through culverts could get clogged or damaged by woody material or leaves in the watercourse. Culvert maintenance is particularly important before and during heavy rainfall and floods. Tree limbs falling onto power lines and onto roadways, disrupting both electricity and the roadway, occur during wind or winter storms.

Debris Impacted Infrastructure in Bow

Bow's watercourses, including the **Merrimack and Turkey Rivers**, its large brooks, and stationary water ponds and wetlands can **flood** their banks, **overflow culverts**, **overtop roads** or **washout roads** during certain conditions. Trees and limbs falling on roads and power lines cause **power failure** or **road blockage**. Infrastructure in Bow can refer to roadways, powerlines, utility lines, culverts, water towers, bridges or dams. These features inventoried in **APPENDIX A Critical and Community Vulnerability**

Assessment are those which should be watched carefully before and after storms and should be checked and maintained regularly to reduce the risk of significant **debris impacted infrastructure** events. **Erosion** along the **Merrimack River**, and potentially the **Turkey River** in places, causes sediment and debris to flow downstream and is a hazard to the landowners who have shoreland frontage, significantly raising flood risks. Sedimentation from the **Suncook River** flowing downstream into the **Merrimack River** is a form of debris and could accumulate at the Garvins Falls Dam, creating a larger ponding effect and raising risks of inundation **flooding**.

Most dams and bridges could experience debris impacted infrastructure. Public Works Department staff have upgraded failing culverts with box culverts along many Bow roads as a result of potentially recurring, damaging **flood** events. These upgrades are particularly expensive, requiring engineering, permitting, State support and special voter approval.

Debris in the form of trees is a possibility during any storm event, whether trees fall onto roadways, into waterways or onto powerlines. The Town could call the NH Department of Environmental Services for emergency removal from waterbodies or remove the trees themselves and obtain a “retroactive permit” during emergency situations. Bridges are vulnerable to debris dislodged during storm events, including State bridges. The Town has **2** redlisted bridges that are structurally deficient as of **September 2018**, Page Road over Bela Brook and Dunklee Road over Bow Bog Brook. The Town is working hard to upgrade these bridges over the next couple of years with NH Bridge Aid funding. The formerly redlisted Town bridge, the Birchdale Road bridge over White Brook, was upgraded in **July 2018**. The Town is also working with the State to negotiate improvements to the South Street Bridge and the I-89 ramps along the **Turkey River** which are susceptible to **flooding** and **debris**.

All outlying State and local roads are susceptible to **tree fall** and **downed powerlines**, such as NH 3A, NH 13, Putney Road, Buckingham Road, Brown Hill Road, North Bow Dunbarton Road, South Bow Dunbarton Road, Ferry Road, Woodhill Hooksett Road off Bow Bog Road, Branch Londonderry Turnpike (East & West), and the South Bow area as well as the cul-de-sac roads listed in the **Tornadoes** section.

Transportation Accidents

Automobile accidents could occur on any roadway in the Central NH region. A major accident would have the greatest impact for travelers on Interstates 93, 393 or 89; on US 3, US 4, US 202, or US 4/202 highways; on NH 3A, NH 9, NH 13, NH 28, NH 31, NH 49, NH 77, NH 103, NH 106, NH 107, NH 114, NH 127, NH 129, and NH 132 highways; or on highway bypasses, interchanges, Exits and on/off ramps. These are high speed corridors with high traffic volumes channeling visitors, recreationalists, workers, commuters and residents. Many local roads in the region allow for residential and commuter vehicles at low speeds.

The railroad lines along the **Merrimack River** create the potential for a (railcar) transportation accident, which have occurred within the past decade in Bow and Concord. Trains could potentially spark fires or derail, causing injuries or fatalities and hazardous materials spills. In the Central NH Region, the Concord-Lincoln Line runs 73 miles between Concord and Lincoln. The New Hampshire Maine Line runs between Concord, Nashua and Lowell, MA. Several communities through which these lines travel have expressed the concern about hazardous material spills due to transportation accidents or sabotage. Concord Municipal Airport is the major airport in the Central NH Region but Manchester-Boston Regional Airport (MHT) can be accessed via NH 28 in about 45 minutes. Air traffic can also be hazardous to the region's citizens. Helicopter travel is often seen, both private helicopters and the military helos from the NH Air National Guard stationed in Concord next to the Concord Municipal Airport.

Transportation Accidents in Bow

Traffic accidents may be the most likely future transportation hazard in Bow on I-89, I-93, the Interstate ramps, NH 3A, NH 13 and on local roads. Accidents can occur at difficult intersections, hills, curves, or straightaways, particularly in **winter weather**. Traffic accidents occur in several locations along hilly and

curvy roads, fast-moving local Town roads, as Logging Hill Road. As the local roads become developed with more homes or businesses, more vehicles, pedestrians and bicyclists will find themselves vying for the same space. As vehicular traffic increases or as the weather turns bad, there is the likelihood that **transportation accidents** will occur in more areas.

However, Bow is also concerned with railroad accidents with the freight lines moving past the Merrimack Station and stationary railcars pulled off to the side in temporary storage. River Road traffic along the railroad tracks is vulnerable as trains and rail cars go by weekly. Freight railcars could be carrying any type of substance for its customers and any **railroad accidents** have the potential to be serious.

As Bow is within the flight path of the Manchester-Boston Regional Airport and in proximity to the Concord Municipal Airport and the NH Air National Guard movements, the potential exists for **air traffic accidents**.

Fire (Arson, Vehicle, Structure)

Fires which are not natural hazards are often associated with vehicles, structures or hazardous materials spills, or sometimes an explosion. These are considered **Technological Hazards**. Arson, the deliberate setting of a fire as an act of sabotage or mischief, is a **Human Hazard** but is described in this section for convenience. No magnitude scales were defined for these types of non-natural fires.

Fire in Bow

The Fire Department annually reports all fires to the NH Fire Marshal's office. The National Reporting System (NRS) provides data on municipal fire events. Over a busy five-year period between **2013-2017**, a total of **153** fires were reported to the NRS by the Bow Fire Department. In **2013**, **26** fires were reported (**11** structure, **1** mobile structure, **4** motor vehicle, **8** natural vegetation, **1** other, and **1** special outside fires). In **2014**, **27** fires were reported (**11** structure, **5** motor vehicle, **2** natural vegetation, **5** other, and **4** special outside fires). In **2015**, **29** fires were reported (**10** structure, **4** motor vehicle, **3** natural vegetation, **3** other, and **9** special outside fires). In **2016**, **34** fires were reported (**5** structure, **2** motor vehicle, **10** natural vegetation, **2** other, and **15** special outside fires). In **2017**, Bow Fire Department reported **37** fires, (**13** structure, **4** motor vehicle, **2** natural vegetation, **8** other, and **10** special outside fire) to the NRS.

The Bow Fire Department runs Incident Type Reports that provide much more specific data for the Town Annual Reports. These reports are used with Capital Area Fire Mutual Aid Compact dispatching and recording. This system differs from the National Reporting System (NRS). As recorded in the Annual Reports, the Bow Fire and Rescue Department responded to the following fire and medical calls, some of which are mutual aid calls:

- ◊ **2013**- to **1,117** calls (**+10.5%** increase)
- ◊ **2014**- to **1,190** calls (**+6%** increase)
- ◊ **2015**- to **1,066** calls (**-10.4%** decrease)

- ◊ **2016**- to **1,037** calls (-3% decrease)
- ◊ **2017**- to **1,047** calls (+1% increase)

The Fire and Rescue Department responds to all types of calls for service and participates in mutual aid with the Capital Area Fire Mutual Aid Compact, sharing training, drills, dispatching and assisting other communities. The Capital Area Fire Compact closely tracks the region's data.

Business and industry are doing very well in Bow. A new Business Development District Zone located roughly between NH 3 A, River Road and the Merrimack River, along with Bow Junction, contain most of the Town's commercial and manufacturing enterprises. These facilities are particularly susceptible to fires, explosions, and incidents.

Locations in Bow which are particularly vulnerable to **fire** (from any source – **lightning**, human, **wildfire**, electrical, power lines, **hazardous materials**, etc.) include the Town Facilities (Municipal Building, Library, Safety Center, and Public Works Department), Bow Elementary, Memorial and High Schools, and White Rock Senior Living Community. Several large businesses in Town have hazardous materials onsite that render them vulnerable should a fire occur. A list of the businesses and hazardous materials facilities which could cause fire or explosions in Town is available in **APPENDIX A Critical and Community Facility Vulnerability Assessment**. Included in these **APPENDIX A** tables is a listing of the vulnerable populations that are working or living in close quarters.

Hazardous Materials Spills

Hazardous materials and hazardous wastes contain properties that make them potentially dangerous or harmful to humans. They can be liquids, solids, contained gases or sludge. Hazardous wastes can be the by-product of manufacturing, as well as discarded commercial products. Most households contain cleaning agents that become hazardous waste when disposed of improperly. Chemicals have numerous benefits but can also cause hazards during their production, storage, transportation, use or disposal. Hazardous materials can have adverse health related effects and may even cause death in certain cases. In addition, hazardous materials may damage homes, businesses and other property, as well as natural ecosystems. Chemical accidents in plants or chemical spills during transportation may often release hazardous chemicals.

The risk from hazardous materials spills or releases into groundwater is present if consumers and homeowners make irresponsible decisions regarding the disposal of household chemicals. These household chemicals can contaminate drinking water in wells and cause damage to various ecosystems. Most people contaminate without being aware that they are doing so. Further education may be needed to reduce hazardous waste contamination.

Hazardous Materials Spills in Bow

The single biggest future hazardous materials risk is the trains that carry in anhydrous ammonia to Granite Shore Power, 8-9 railcars at a time, which either sit on the tracks or its contents are deposited into storage tanks. Trains can derail and spill contents into the [Merrimack River](#) or [Turkey River](#).

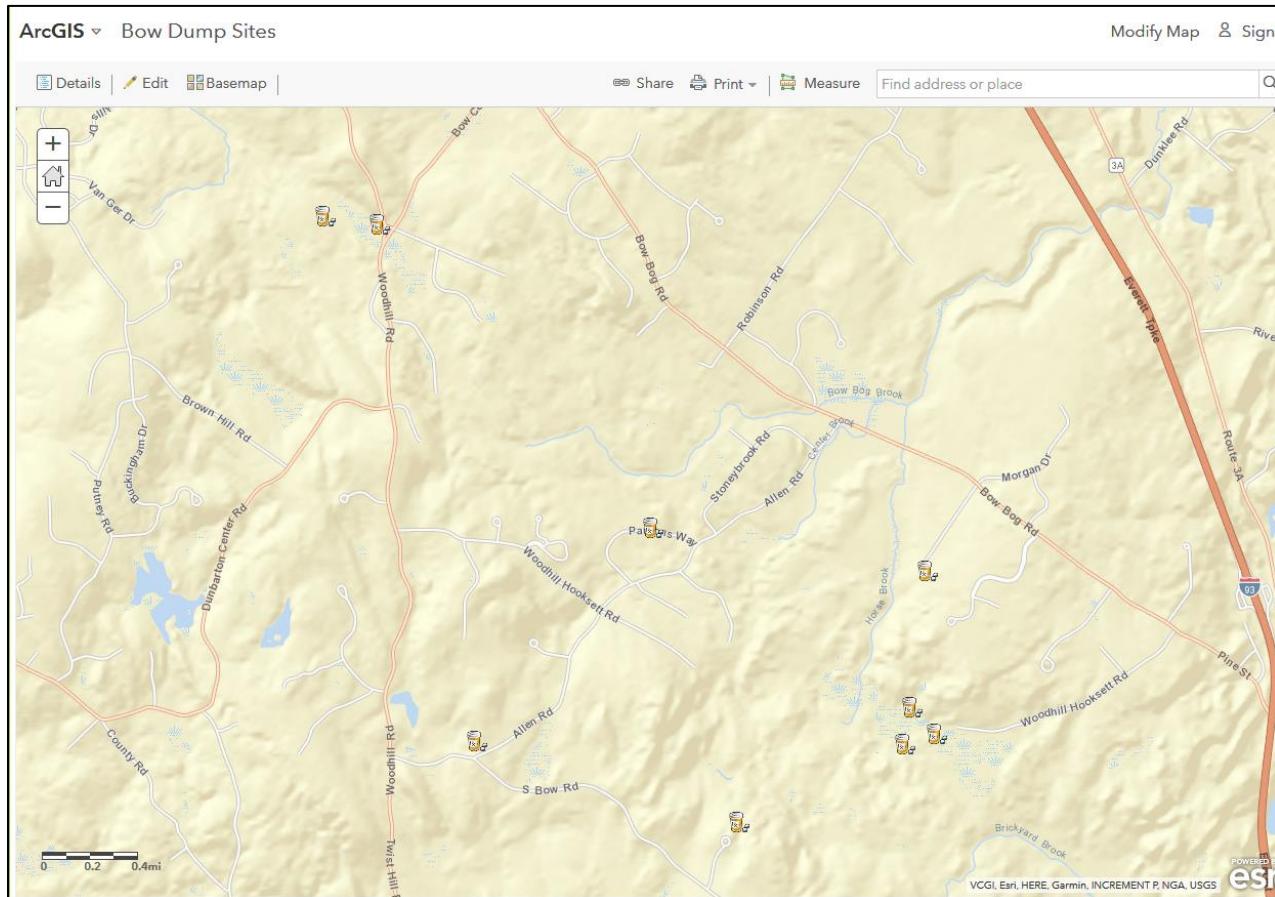
Transportation trucking of hazardous materials on I-89, I-93, NH 3A, NH 13 and along the freight cars on the railroad corridor is likely a regular occurrence. These trucks or freight cars could rollover and spill their contents onto these significant travel ways. The [New Hampshire Hazardous Material Commodity Flow Study 2018](#) and its accompanying maps may provide some enlightening data the Town can use to help protect the community from spills. The Central NH Hazardous Materials Team based from the Concord Fire Department is the responding entity in the area.

For regular trash and recycling, curbside pickup is provided by the Town. Bulky items are brought to the Concord Transfer Station or through a special arrangement with the curbside collector, Pinard Waste Systems, for an extra fee. Dozens of occupational facilities in Town could handle, store, or use hazardous materials. The Town is a large draw to industrial businesses.

Special annual Household Hazardous Waste (HHW) and Electronics Recycling Days are held in October at the Bow Community Building (Logging Hill Road/Bow Center/Knox Road) to collect other residential waste at no cost. This inhibits large volumes of materials that may otherwise be dumped in the woods or in water bodies. Commercial and industrial businesses do not seem to be able to participate in the collection because of their specialized waste products. Any of these facilities could have a spill or an incident at their location. A listing of known facilities which store or could potentially use hazardous materials has been inventoried in [APPENDIX A Critical and Community Vulnerability Assessment](#).

Figure 24 displays many locations in the community identified by residents as “dump sites”. The contents of locations could range from household items such as discarded furniture or appliances, trash, recyclable materials such as tires, bottles and cans, to potential hazardous waste such as 55-gallon drums of unknown materials. Bow Open Spaces placed a public GIS map online for anyone to add locations of identified dumping and to describe what is seen. Bow Open Spaces volunteers monitor the map, coordinate the clean-up of sites, and report progress and resolution on the online map database. This clever technique helps keep the community and water bodies clean, although a regular review of the map and database by the Bow Open Space volunteers would maximize its effectiveness.

Figure 24
Resident-Identified Dump Sites



Source: Bow Open Spaces [www.bowopenspaces.com] ARC/GIS Online Identification Map, accessed 09-18

Public Health Issues

Public health issues can be measured in many ways. Students and the elderly are vulnerable to seasonal health outbreaks as they tend to congregate in large numbers and in shared environments where physical contact is common. Large groups can make bioterrorism more effective.

It is difficult to predict where an epidemic would occur due to human, mosquito and wildlife mobility. Commonly occurring epidemics following extreme heat or cold can include **influenza**, norovirus, rhinovirus (viruses), Lyme disease, Anaplasmosis and babesiosis (tick-borne diseases), Eastern Equine Encephalitis (EEE), West Nile and Powassan (arboviral or mosquito-borne diseases) and any could occur in Bow. The Town has swampy areas around its rivers, wetlands and brooks which are prime breeding ground for **mosquitoes**. Large deer herds that roam can carry **deer ticks** in the Town's heavily forested sections and into State Forests. Agricultural stock such as horses or goats or even pets (dogs and cats) could carry diseases closer to people. **Water quality degradation** (failing septic systems, flooding, pipes breaking) could sicken residents using the public water supplies (those serving over 25 people), dug wells or bedrock wells, or could cause aquatic and wildlife deaths. Epidemics could result.

Public Health Issues in Bow

Anecdotal widespread **public health** issues involving Lyme disease indicate tickborne viruses are increasing in Bow. The Town is a wooded, rural community hosting the **Merrimack River**, **Turkey River**, many other brooks, and water bodies such as Turee Pond, many other ponds, vernal pools and wet meadows. Large outdoor acreages of backyard woodlands, recreational Town Forests, and conservation lands will provide the environment for additional spreading of arboviral (mosquito-borne) and tickborne diseases. A changing climate has enabled a longer tick season and which is not anticipated to abate. See **Flooding** for water bodies and **Drought** for wooded areas.

For indoor contamination, the highest risk facilities for pick-up or transfer of viruses and bacteria can include the Bow Elementary School, Bow Memorial School, Bow High School, White Rock Senior Living Community, and the childcare facilities, which also host the Town's most vulnerable people. Wherever people congregate, such as the Library or at the Town's commercial locations, stores, restaurants, recreational facilities and gathering places (see **APPENDIX A**), the risk of transmission of contagious diseases increases. The contracted Bow Water Precinct municipal managers operate and maintain the Town's drinking water system and pump houses for residents. The municipal septic system has old pipes which are being monitored and cleaned. Older septic systems are thought to be present along the **Merrimack River**. The same populations identified as particularly susceptible to **Excessive Heat** would be most vulnerable to public health issues and epidemics.

In prior years, the Merrimack Station when owned by Public Service of New Hampshire contributed heavily to regional air pollution until the advance air scrubbers and other safety measures were installed. Today, the coal plant fires on an as-needed basis and falls under regulated emission levels. The many business and manufacturing industries in Bow must maintain proper workforce and environmental safety

measures. See **APPENDIX A Critical and Community Facility Vulnerability Assessment** for a list of businesses and potentially hazardous sites.

To help combat local and area public health epidemics, Bow has a plan to join the nearby regional Point of Dispensing (POD) site at the nearby Hopkinton High School, a location where vaccines or other medicines are disseminated to people during an emergency with assistance from the Capital Area Public Health Network (CAPHN).

HUMAN HAZARD EVENTS

Events of human nature include terrorism (ecological, cyber and chemical), sabotage/vandalism, hostage situations, and civil unrest. These are often “behind the scenes” hazards that local Police Departments handle on a regular basis. These events are all caused by direct human action.

There are several types of **Human** hazards examined in the **Hazard Risk Assessment**:

-  **Terrorism**
-  **Sabotage/Vandalism**
-  **Hostage Situation**
-  **Civil Disturbance/Public Unrest**

Human Hazards are examined by descriptions of the types of human hazards and in the **Potential Future Hazards**. Scientific measures of magnitude are not available for individual human hazards. See **APPENDIX A Critical and Community Facility Vulnerability Assessment** for a list of potential human hazard locations.

Terrorism

The use of force or violence against people to create fear, cause physical harm and/or intimidation or for reasons of ransom. Terrorists often make threats to create fear and change public opinion. Cyber terrorism consists of hackers who threaten the economy by attacking the intricate computer infrastructure, affecting business and communication. Biological and chemical terrorism refers to those infectious microbes or toxins used to produce illness or death in people or animals. Large groups or close quarters of people can make bioterrorism more effective. Terrorists may contaminate food or water, thus threatening an unprotected civilian population. Eco-terrorism refers to the destruction of property by persons who are generally opposed to the destruction of the environment or to make a visible argument against forms of technology that may be destructive to the environment.

Terrorism in Bow

It is unlikely that the Town would be the target of any act of international terrorism, yet if it does occur, its impacts would be devastating in this tight-knit community. Domestic terrorism has occurred within the last 15 years both in Bow, in the form of hostage situation and cyberattack, and within the Central NH region. The most likely target will be the Merrimack Station power generation facility, as the loss of its electrical generation could severely impact the Northeast. The sudden loss of this source of electricity may adversely impact medical facilities, gasoline and natural gas delivery, and communications until such time as alternative measures are implemented. The new owners of the Merrimack Station, Granite Shore Power, should ensure this possibility is minimized. The Garvins Falls Dam could also be a high-profile target, not far from the Merrimack Station, or Blue Seal Feeds because of its onsite materials and its visibility.

Bomb scares have occurred at the Bow Schools. By 2018, the Town and School District have worked together to create Emergency Operations and Response Plans and have drilled together to minimize any potential active shooter or bomb events. A School Resource Officer is on duty full time.

Cyberterrorism and hacking of Town and School systems might be the most likely outcome of local terrorism. Otherwise, targets are usually public spaces that would do the most damage to send a message. Possible targets could be Town Facilities (Municipal Building, Baker Free Library, Safety Building, Public Works) or where the most vulnerable citizens are located, the schools, senior housing facility, child care centers, Churches, utilities (water and sewer). Other gathering places such as school fields, stores, businesses, restaurants/bars, and other Town, State or governmental facilities could be high profile. Although unlikely, there could be a massive impact felt in the community even on a small-scale event.

Sabotage/Vandalism

Sabotage is a deliberate action aimed at someone or some institution in order to weaken that person's or institution's integrity and reputation through subversion, destruction, obstruction or disruption. Sabotage may occur in war, a workplace, in the natural environment, as a crime, in politics or as a direct attack against an individual.

Sabotage /Vandalism in Bow

Any incident of **sabotage** in Bow could come from within Bow or any nearby Town, or outside of the State or country, but some sabotage efforts would require perpetrators to be on site. **Vandalism** can also be present at cemeteries, vacant buildings, under bridges. While a nuisance, vandalism has a lower potential to harm than sabotage. Sabotage would be worrisome at dams, bridges, Water Tower, or along the stabilized or eroding channels of the **Turkey River**.

Vandalism could occur at public and private cemeteries, Bow Schools, or recreational sites such as the Town Forests and trails. Infrastructure could be vandalized, such as trailheads, bridges, dams, Pump

Stations or the Water Tower (including graffiti). These facilities would be among the most damaging to the community. Vandalism could also occur at vacant buildings in isolated locations. Bow has many vacant buildings, although most of them are commercial use for sale or lease.

Technological systems such as computer systems and websites of the Town Facilities (Municipal Building, Baker Free Library, Safety Building, Public Works) or the **3** Bow Schools, or other governmental systems could be subject to computer or network sabotage. Utilities could be vulnerable to sabotage or vandalism, such as the **6** telecommunications towers or the Merrimack Station. Many other significant facilities in Bow could be subject to sabotage including the powerlines, transmission lines, transformers and utility substations.

Hostage Situation

A hostage situation is an incident where an innocent civilian is held by someone or some group of persons demanding something from another person or group of persons not related to the person or persons being held hostage. The person or persons held are done so pending the fulfillment of certain terms.

Hostage Situations in Bow

Hostage situations can occur anywhere, are isolated events and are nearly impossible to predict; none have been reported for this Plan. Hostage situations are not normal events and therefore are nearly impossible to predict. Domestic violence events generally occur in resident homes, perhaps one per year.

Conventional hostage situations would most likely target such locations as the Municipal Building, Safety Center, Library, Bow Schools, Bow Youth Center, Merrimack County Savings Bank, churches, or convenience stores/ gas stations. The Town is host to many municipal and other governmental facilities and major, visible businesses such as those along the NH 3A corridor or Bow junction, and it is possible a public hostage situation could occur in any of these locations.

Civil Disturbance/Public Unrest

This hazard refers to types of disturbances that are caused by a group of people, often in protest against major socio-political problems including sit-ins or protests against wars and any general and public expression of outrage against a political establishment or policy. Many instances of civil disturbance and public unrest are quelled by a use of force from police. Participants may be victims of personal injury in severe cases.

The most probable locations of larger civil disturbance and/or protest in New Hampshire are at the State House in Concord and at the universities and colleges. They have also occurred at political locations, such as feminist health centers or political party headquarters.

Civil Disturbance/Public Unrest in Bow

Locally, the highest potential for **public unrest** could take place during Town Meetings and School Meetings, on voting day or during visits from political candidates, or at large events such as Old Home Day, Veteran's Parades, or at School events or functions. People have held demonstrations at the Bow Municipal Building, but they have been peaceful to date.

Large scale incidents of civil disturbance and public unrest such as violent riots are unlikely in Bow. Any organized protest in Bow often manifests in Concord. Locations where **civil unrest** could occur include the Town Facilities (Municipal Building, Baker Free Library, Safety Building, Public Works) or the **3** Bow Schools. Generally, restaurants and establishments serving alcohol, and gathering facilities within other high-density population areas are more susceptible to **civil disturbance**.

Existing and Potential Future Hazards

After the inventory of hazards types and past hazards in Town, hazards that currently exist or that need to be monitored in Bow has been completed along with potential future hazards that could occur in other areas. This unique listing of **Existing and Potential Future Hazards** was compiled so the Town can be aware of areas that might need to be watched for recurring hazardous problems or that may experience some of these hazards for the first time. The listing was developed by knowledge of the Hazard Mitigation Committee and past experiences of hazards. Past locations of hazard events, where they exist for each hazard, are listed under the individual hazard narratives in the previous section. The existing and susceptible hazard locations are taken from the **Hazard Risk Assessment**. With this existing and potential future knowledge listed side by side, it becomes easier for a community to plan mitigation measures for the most prominent hazard events in Town.

Included in **Table 24** is the **Overall Risk** score between **1-16** from the **Hazard Risk Assessment** for **16** natural hazards. The name of the magnitude or extent scale of the natural hazard is represented for ease of reference. Technological and human hazards were not rated for their **Overall Risk** to retain the importance of maintaining a natural hazard perspective for the **Hazard Mitigation Plan 2018**. **NR** is the abbreviation for **Not Rated**.

Table 24
Existing and Potential Future Hazards

Hazard Risk Assessment Hazards	Overall Risk	Hazard Locations in Town – Existing (Susceptible) From Hazard Risk Assessment	Potential Future Hazards – Locations and Impacts	Magnitude/Extent Measure-ment Scale
Flooding	12.0	<p>◆ Entire Town, Floodplains of Merrimack River and Turkey River. Brooks such as Bow Bog Brook, Bela Brook, White Brook, Morgan Brook, Black Brook, and Russell Brook and Sage Meadow result in expanded flooding. Garvins Fall Dam is a High Hazard (H) dam on the Merrimack. Other recreation ponds and several dams can flood, leaving businesses and motorists along NH 3A, I-89 or I-93 at risk.</p> <p>◆ Runoff from roadways or heavy rain can cause floods over the Entire Town.</p> <p>◆ Roads, bridges, drainage systems and areas of past, repaired, or existing potential for road washout:</p> <ul style="list-style-type: none"> • Allen Road • Birchdale Road at White Brook • Bow Bog Brook (undersized culverts to be replaced) • Bow Bog Road (by Dean Avenue) • Branch Londonderry Turnpike • Buckingham Road at Putney Road • Clinton Street (Bela Brook) • Dunklee Road Bridge, Bow Bog Brook (improperly constructed box culvert to be repaired or replaced) • Hall Street • I-89 highway ramp (State owned, Turkey River) • Page Road, Bela Brook (undersized culverts to be replaced) • River Road at Ferry Road, Merrimack River (undersized culverts to be replaced) • NH 3A at Bow Junction (Turkey River) • South Street (Turkey River) 	<p>Many roads in Bow already impacted by flooding are still vulnerable to washouts and floods.</p> <p>Continuing Susceptibility to Flooding, Washout, Overtop</p> <ul style="list-style-type: none"> • Allen Road • Bow Bog Road by Dean Avenue • Bow Junction • Brown Hill Road • Branch Londonderry Turnpike • Buckingham Road at Putney Road • Hall Street (also Concord) • Page Road • River Road by railroad tracks (formerly Johnson Road) <p>Town Undersized Culverts or Bridges to be Upgraded:</p> <ul style="list-style-type: none"> • Bow Bog Road @ Bow Bog Brook • Dunklee Road Bridge @ Bow Bog Brook (improperly constructed box culvert, planned replacement June 2019/2020) • Page Road @ Bela Brook • River Road at Ferry Road @ Bow Bog Brook • Robinson Road @ multiple stream crossings • White Rock Hill Road @ Turee Brook <p>The Merrimack River serves as Bow's western border, separating it from Concord and Pembroke. The River is largely an indirect issue, although along Hall Street and the South end of River Road are vulnerable. The tributaries are mostly impacted. The Mother's Day Flood took a long time for the water to recede because the Merrimack was so high.</p> <p>The Turkey River is problematic in Town, having flooded before onto South Street, the I-89 on-ramp, and NH 3A/Bow Junction. The rest of the River is located in Concord. The Turkey River Bridge on South Street remains a tremendous potential problem – it rests next to I-89. During Tropical Storm Irene, the water came up to the top of the on-ramp and was touching the bridge. People could feel the rumbling underneath when standing on the bridge. The same situation happened on Page Road over Bela Brook. The Town in 2012 located a new main sewer pump station at the Turkey River and would like it</p>	Special Flood Hazard Areas (SFHAs) on 2010 Digital Flood Rate Insurance Maps (Zones A, AE, X)

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Hazard Risk Assessment Hazards	Overall Risk	Hazard Locations in Town – Existing (Susceptible) From Hazard Risk Assessment	Potential Future Hazards – Locations and Impacts	Magnitude/Extent Measure-ment Scale
			<p>to remain in good service and physical condition</p> <p>State Bridges or Box Culverts to be Upgraded:</p> <ul style="list-style-type: none"> • I-89 Highway Exit 1 Ramps @ Turkey River • NH 3A at Bow Junction @ Turkey River • South Street @ Turkey River • Clinton Street @ Bela Brook 	
Flooding	Rapid Snow Pack Melt	3.3 <p>◆ Melt runoff from impervious surfaces and roadways or from tree cover into waterbodies such as the Turkey River or Merrimack River can cause floods over the Entire Town.</p> <p>◆ Particularly susceptible areas to rapid snow melt include Bow Junction area (NH 3A and 1-89/ I-93) and along any of the Town's fast moving brooks (Bela Brook, Bow Bog Brook, White Brook, etc). Damage to roads is expected. Other areas include the regular road washouts (see Flooding), as well as the dam and bridge vulnerabilities.</p>	<p>Road washouts and/or culvert failure locations or other areas flooded from rapid snow melt over the years have included, and are anticipated to continue in the future, at the Bow Junction area, (NH 3A, 1-89/ I-93) and I-89 ramps, and along any of the Town's fast moving brooks (Bela Brook, Bow Bog Brook, White Brook, etc) and down roadways (see Flooding for specific lists). Potential channel movement of the Turkey River and further sedimentation of the Merrimack River (from the Suncook River) means a greater likelihood for further rapid snow pack melt damages.</p> <p>On the local Town roads and private roads (such as cul-de-sac roads), the road beds may be washed away, preventing traffic from passing. All areas of Town could be susceptible to rapid snow pack melt, particularly those near wetlands and brooks and within the floodplains</p>	None specific known but can use SFHAs
Flooding	River Ice Jams	1.0 <p>◆ Merrimack & Turkey River ice jams could endanger the dams and nearby facilities, especially near the Garvins Falls Dam on the Merrimack and the Chen Yang Li Restaurant on the Turkey River.</p>	<p>The specific locations are capable of future ice jam conditions include the Turkey River at the I-89 ramps which could also flooding in the case of river ice jams. The historic grist mill, the Chen Yang Li restaurant, along the Turkey River is very susceptible to any disturbance on the Turkey River and the Garvins Falls Dam is a critical site on the Merrimack River. This hazard is not of particular concern to the community.</p>	No known widely-used scale measuring the magnitude of river ice jams

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Hazard Risk Assessment Hazards	Overall Risk	Hazard Locations in Town – Existing (Susceptible) From Hazard Risk Assessment	Potential Future Hazards – Locations and Impacts	Magnitude/Extent Measure-ment Scale
Flooding Fluvial Scouring, Erosion, Channel Movement	3.3	<p>♦ Merrimack & Turkey Rivers and their Floodplains, Brooks. Because of the high volumes and swift moving Merrimack River and Turkey River, bank erosion, scouring and channel movement are hazards of potential concern.</p> <p>♦ Erosion of Hall Street banks is presently occurring. River Road is regularly threatened and has growing cracks in the pavement; mitigation is necessary to stop the road from collapsing into the Merrimack. Road, and West Meadow Road.</p>	<p>Erosion on the Turkey River and the Merrimack River will continue in the future.</p> <p>The 2015 Turkey River Fluvial Geomorphic Assessment indicated existing and future river bank erosion continuing on the floodplains of the Turkey River, at the historic Grist Mill (Chen Yan Li Restaurant) @ South Street and I-89 Exit 1, along Bow Junction, and at the Grappone Dealership buildings @ NH 3A and Bow Junction.</p> <p>Merrimack River- A Hall Street is known to have experience erosion, based on an engineering study conducted by the Town.</p> <p>On River Road, at some time in the future, either bank erosion mitigation will be necessary or else River Road will ultimately collapse into the River. Currently, cracks can be seen developing immediately adjacent to the pavement edge in some locations along River Road. Areas that are vulnerable at this time are at Old Ferry Crossing and some buildings on new Granite Shore Power (formerly PSNH) property. Sections of River Road were renamed Johnson Road, and erosion is dealt with by the Public Works Department.</p>	EPA Bank Erosion Risk Index

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Hazard Risk Assessment Hazards	Overall Risk	Hazard Locations in Town – Existing (Susceptible) From Hazard Risk Assessment	Potential Future Hazards – Locations and Impacts	Magnitude/Extent Measure-ment Scale
Wind	2.7	<p>◆ Entire Town. Most Tornado - vulnerable areas include populated buildings and high-density locations: Merrimack Station electric plant and the Utili/ Eversource powerlines, communications equipment at the crest of Woodhill Hooksett Road; high density or vulnerable populations such the Bow Elementary, Middle and High Schools, White Rock Senior Living Community; historic buildings in the old Town Center; and the 6 telecomm towers [NH 3A (2 by Peterbilt), Robinson Road, South Bow Road, Knox Road @ Safety Center, Woodhill Road].</p> <p>◆ Much of the Town is wooded and forested and sections would be difficult to access with trees and power lines down on the residential roads; most of the over 2 dozen housing developments are situated on cul-de-sacs.</p> <p>◆ Most remote roads/areas of Town include: South Bow Dunbarton Road, Ferry Road, Woodhill Hooksett Road off Bow Bog Road, Branch Londonderry Turnpike (East & West), and the South Bow area. They could be difficult to access with treefall and power lines down from Tornadoes.</p>	<p>Future risks from significantly high winds, especially during hurricanes, tornadoes, winter storms, and thunderstorms, are high in many locations in Town. Falling objects and downed power lines are dangerous risks associated with high winds. In addition, property damage and downed trees are common during high wind occurrences.</p> <p>Sites or populations of concern for future tornadoes include: Merrimack Station, Garvins Falls Dam, communications towers, power lines and other utilities; heavily traveled I-89, I-93, I-89 ramps, NH 3A commuter route, NH 13 and Bow Junction; High density populated sites include the Baker Free Library (Warming/Cooling Center), Bow Elementary School, Bow High School as Town Shelter, Bow Memorial (Middle) School, Community Building (Warming/ Cooling Center), Bow Youth Center, Casa Dei Bambini Children Center, Celebrating Children @ Bow Municipal Building, Joyful Noise Learning Center / Crossroads Community Church, Little Sprouts Day Care, Meeting House Montessori School, Rockwood Acres Learning Center, White Rock Senior Living Community and the other senior housing developments, Stone Sled Farm, Wind Chimes, and The Pines of Bow; over 2 dozen one-egress residential developments, remote areas in Town, the Town Forests and conservation lands, and Bow Center historical buildings. The dozens of manufacturing, retail, commercial and commercial businesses may have equipment or substances to be wary of during tornado and clean up events.</p> <p>Debris impacted infrastructure is a problem, with trees down and as projectiles. All utilities, including power lines, are at risk and their damage or destruction would create secondary hazards in Bow.</p>	Enhanced Fujita (EF) Tornado Scale

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Hazard Risk Assessment Hazards	Overall Risk	Hazard Locations in Town – Existing (Susceptible) From Hazard Risk Assessment	Potential Future Hazards – Locations and Impacts	Magnitude/Extent Measurement Scale
Wind	5.0	<p>♦ Entire Town. Most areas vulnerable to downbursts include populated buildings and high-density locations: Merrimack Station electric plant and the Utilit/Eversource powerlines, communications equipment at the crest of Woodhill Hooksett Road; high density or vulnerable populations such the Bow Elementary, Middle and High Schools, White Rock Senior Living Community and other senior housing developments; historic buildings in the old Town Center; and the 6 telecomm towers [NH 3A (2 by Peterbilt), Robinson Road, South Bow Road, Knox Road @ Safety Center, Woodhill Road].</p> <p>♦ Local government operations are susceptible to damage by debris impacted infrastructure. See also previously listed Wind and Flood vulnerability sites.</p> <p>♦ Much of the Town is wooded and forested and sections would be difficult to access with trees and power lines down on the residential roads; most of the over 2 dozen housing developments are situated on cul-de-sacs.</p> <p>♦ Most remote roads/areas of Town include: South Bow Dunbarton Road, Ferry Road, Woodhill Hooksett Road off Bow Bog Road, Branch Londonderry Turnpike (East & West), and the South Bow area. They could be difficult to access with treefall and downed power lines.</p> <p>♦ Agricultural areas are vulnerable to damage: Alexander Dairy Farm and Millican Tree Nursery.</p>	<p>Downbursts are considered a greater future threat than tornadoes in Bow, but are isolated incidents. The vulnerabilities are similar, with historic resources and exposed, taller buildings, communications towers, and utilities most likely to be affected.</p> <p>High winds are unpredictable, and are often more prevalent at higher elevations. Interstates 93, 89, I-89 ramps, NH 3A and NH 13 are heavily travel and lined with businesses and homes.</p> <p>Like a tornado, the highest populated locations could have the greatest potential for injury and property damage from downbursts. These include the Town facilities, vulnerable populations, 3 Bow School District Schools, White Rock Senior Living Community, the other aged 55+ housing developments, the single-egress subdivisions, Merrimack Station, business and industry area along NH 3A, and forested lands. The most remote roads or areas of Town include: Putney Road, Buckingham Road, Brown Hill Road, North Bow Dunbarton Road, South Bow Dunbarton Road, Ferry Road, Woodhill Hooksett Road off Bow Bog Road, Branch Londonderry Turnpike (East & West), and the South Bow area. Power outages may last for several days before service is restored in a large event. A secondary effect of quick, severe hazard events with power failure include alarms in the elderly resident homes. Alarms turn on, scaring residents, and can cause medical emergencies due to shock and heart problems. All of these populated areas carry greater risk of downbursts because of higher density (see Tornado section). See also APPENDIX A Critical and Community Facility Vulnerability Assessment for a complete list of sites.</p> <p>Agricultural operations run the risk of high damage from downbursts which creates economic consequences, but there are few in Bow, including Alexander Dairy Farm and Millican Tree Nursery. The old, historic Bow Center carries much of the history of Bow, and any loss of old buildings and historic homes, Bow Bog Meetinghouse, Community Building, and more, would be a detriment to the community.</p>	Enhanced Fujita (EF) Tornado Scale

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Hazard Risk Assessment Hazards	Overall Risk	Hazard Locations in Town – Existing (Susceptible) From Hazard Risk Assessment	Potential Future Hazards – Locations and Impacts	Magnitude/Extent Measure-ment Scale
Wind	Hurricanes and Tropical Storms	6.7 <ul style="list-style-type: none">◆ Entire Town.◆ See Floods and Flash Floods, Downbursts for specific locations that are most susceptible to hurricane events.	When hurricanes or tropical storms occur in Bow's future, multiple hazard events will endanger people: Flooding of the Merrimack River, Turkey River, Bela Brook, and other major brooks; High Wind effects to the Town's utilities, forests, trees, power lines and buildings all across Town; Debris Impacted Infrastructure on roads, stream crossings, bridges, dams and powerlines which exacerbate the effects of storms; and Power Failure from the inevitable trees down on powerlines along roadways. The areas and sites previously listed in detail in the Tornado section provide a good synopsis of the potential risks and future vulnerabilities of the Town from hurricanes and tropical storms. Additional sites are provided in APPENDIX A Critical and Community Facility Vulnerability Assessment for a complete list of sites and appear on the Maps 1-4 series.	Saffir-Simpson Hurricane Wind Scale
Wind	Severe Winds, Rain Storms and Thunderstorms	6.7 <ul style="list-style-type: none">◆ Entire Town.◆ See Floods and Flash Floods, Downbursts for specific locations that are most susceptible to severe wind/rain/storm events.	These types of storms are quite common and will occur in the future. Power failures nearly always result from tree fall or projectiles; the reconnection time could be minutes, hours or several days in the more remote or densely populated areas of Town, depending on where debris has fallen onto roads and the extent of local and regional powerline damage. In addition, hail can occur with these severe storms, damaging homes, vehicles, property or crops as well as lightning which can cause localized building fires, building electronics damage (computer circuitry), or wildfires. Flooding will usually occur, overflowing culverts, storm drains, and basements. Town Departments respond as needed and provide or receive mutual aid when necessary under the Capital Area Mutual Aid Compact, the NH Public Works Mutual Aid, local Police Department mutual aid, and under other local agreements.	Accuweather Thunderstorm Criteria Scale, Hail Size Scale

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Hazard Risk Assessment Hazards	Overall Risk	Hazard Locations in Town – Existing (Susceptible) From Hazard Risk Assessment	Potential Future Hazards – Locations and Impacts	Magnitude/Extent Measure-ment Scale
Lightning	6.7	<p>◆ Entire Town. Areas of particular concern to lightning include critical facilities such as the Merrimack Station electric plant and their powerlines, communications equipment at the crest of Woodhill Hooksett Road and the 6 telecomm towers [NH 3A (2 by Peterbilt), Robinson Road, South Bow Road, Knox Road @ Safety Center, Woodhill Road]. Locations of concern are remote areas which could not be easily accessed by emergency vehicles (Woodhill Hooksett Road).</p> <p>◆ Old, historic or wooden structures (Town Center). Those structures without lightning rods would be more susceptible to damage from a strike than those buildings with the rods.</p> <p>◆ Remote, forested areas, parks, conservation areas can be dangerous to people and property: Public Town forests and conservation areas (Nottingcook Forest), open recreation fields, points of higher elevation than surrounding area.</p> <p>◆ Other aboveground utilities transformers, water towers are vulnerable to lightning.</p>	<p>Lightning can strike in the future at any given location, including Bow's tall utilities: the 6 communications towers, telephone lines, power lines, broadband cable internet service, Merrimack Power Station, Garvins Falls Substation, Bow Precinct water pump station, Water Tower (Dunklee Road), municipal sewer pump stations (Grandview Road, White Rock Hill Road).</p> <p>The vulnerable populations and sites listed previously, including the Schools, White Rock Senior Living Community and the other senior housing developments, Stone Sled Farm, Wind Chimes, and The Pines of Bow; Bow Center buildings, or other wooden or historical buildings; the single-egress subdivisions; business and industry area along NH 3A; and forested lands. The most remote roads or areas of Town include Putney Road, Buckingham Road, Brown Hill Road, North Bow Dunbarton Road, South Bow Dunbarton Road, Ferry Road, Woodhill Hooksett Road off Bow Bog Road, Branch Londonderry Turnpike (East & West), and the South Bow area and could be particularly vulnerable to lightning and resulting wildfires. These sections of Town would be difficult to access with trees and power lines down on the residential roads. There is a lot of wood slash remaining in the woodland interior due to the July 2008 Tornado and the December 2008 Ice Storm which, with drought conditions, contributes to an increased overall hazard potential for wildfires.</p> <p>Forested areas, parks, conservation areas or open recreation fields can be dangerous to people and property during thunderstorms and lightning strikes. These include recreational lands where people may be hiking or bicycling during storms., such as Town Forests and conservation lands, Nottingcook Town Forest, Boucher Forest Easement, Hammond Nature Preserve & Walker Forest; Knox Town Forest & School Forest. The highest areas or cleared areas are especially vulnerable to lightning strike.</p>	Lightning Activity Level (LAL)
Fire				

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Hazard Risk Assessment Hazards	Overall Risk	Hazard Locations in Town – Existing (Susceptible) From Hazard Risk Assessment	Potential Future Hazards – Locations and Impacts	Magnitude/Extent Measure-ment Scale	
Fire	Wildfire	5.3	<p>◆ Entire Town. Locations most susceptible include vulnerable populations and buildings as identified in Lightning.</p> <p>◆ Much of the Town is wooded and forested and sections would be difficult to access in case of wildfire; most of the over 2 dozen housing developments are situated on cul-de-sacs.</p> <p>◆ Most remote roads/areas of Town include: South Bow Dunbarton Road, Ferry Road, Woodhill Hooksett Road off Bow Bog Road, Branch Londonderry Turnpike (East & West), and the South Bow area. Inaccessible locations are more vulnerable to wildfire impacts because fire crews and emergency personnel have greater difficulty responding quickly to fires in these locations.</p>	<p>Wildfire will occur in the future, whether from lightning, drought conditions or accident. Single family homes in Bow are situated in the woods. Over 2 dozen cul-de-sacs are identified as one-way access and surrounded by woods; these forested, dead-end residential neighborhoods would be difficult to evacuate. River Road along the railroad tracks is vulnerable as trains and rail cars go by weekly. Woodhill Hooksett Road, an unmaintained Class VI road, harbors illegal camping and is accessible to residents and visitors. Town Forests and conservation lands are popular recreational destinations. The heavily forested woodlands of Town are often remote locations and difficult to access by emergency vehicles.</p> <p>However, the Fire Department has several fire ponds and dry hydrants throughout Town (Putney Road Pond, Rising Wood Pond, Higgins Pit Pond, South Bow Dunbarton Marsh, McNichols Pond, Knox Road Town Pond). Many of the neighborhoods have residential or commercial sprinkler systems. All of these water systems can help reduce the impact of wildfire.</p>	NWCG Wildfire Classification
Extreme Temperature	Severe Winter Weather, Cold, Wind Chill and Ice Storms	10.7	<p>◆ Entire Town. Particular areas of concern during winter weather include: critical facilities such as the Merrimack Station electric plant and their powerlines, communications equipment at the crest of Woodhill Hooksett Road and the 6 telecomm towers [NH 3A (2 by Peterbilt), Robinson Road, South Bow Road, Knox Road @ Safety Center, Woodhill Road]. Locations of concern are remote areas which could not be easily accessed by emergency vehicles (Woodhill Hooksett Road), and elderly homes/housing (chill and snow load).</p> <p>◆ Failure of the PSNH substation on Bog Road over the Concord line on NH 3A would affect Bow residents.</p> <p>◆ Logging Hill Road is a sharp incline/decline and cars have trouble traveling the road during winter conditions. NH 3A is a major travel way for residents and commuters while I-89 runs through the Town.</p>	<p>The combination of winter storms and power outages are very dangerous, especially with so many senior living facilities in Bow. Bow will continue to experience all types of winter weather events in the future. Utilities tend to fail during severe winter events. People can become isolated on the cul-de-sac roads and remote roads or have traffic accidents. Debris impacted infrastructure becomes a problem during snow storms.</p> <p>Logging Hill Road is a hard incline/decline and cars would have trouble traveling the road. Interstate 89, Interstate 93, I-89 ramps, NH 3A, NH 13, Bow Junction, and River Road are very heavily traveled. The majority of commercial development is located in the southeast of Bow between NH 3A, River Road, and the Merrimack River.</p> <p>The Department of Public Works keeps up with the snowfall, but ice storms require more time and resources to keep the roads safe. The Town Shelter at Bow High School and warming Shelters at Baker Free Library, Community Building, Old Town Hall can be opened by Bow Emergency Management to</p>	NWS Windchill Index, Sperry-Piltz Accumulation (SPIA), NCDC Regional Snowfall Index (RSI) for Northeast

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Hazard Risk Assessment Hazards	Overall Risk	Hazard Locations in Town – Existing (Susceptible) From Hazard Risk Assessment	Potential Future Hazards – Locations and Impacts	Magnitude/Extent Measurement Scale
		<ul style="list-style-type: none"> ◆ Wooded and forested sections of Town are vulnerable to snow and ice effects. ◆ Local government operations are susceptible to winter weather. See also previously listed Wind and Flood vulnerability sites. ◆ Much of the Town is wooded and forested and sections would be difficult to access with excessive snowfall, tree fall or power outage. There are over 2 dozen housing developments are situated on cul-de-sacs. ◆ Most remote roads/ areas of Town include: South Bow Dunbarton Road, Ferry Road, Woodhill Hooksett Road off Bow Bog Road, Branch Londonderry Turnpike (East & West), and the South Bow area. ◆ The entire road network is susceptible to winter conditions, including the state and interstate roads (I-89, I-93, NH 3A). ◆ People may be subject to cold temperature, snow isolation, transportation accidents, power failure and communications failure during winter storm events. 	help both Bow residents and to help accommodate people from nearby smaller communities as space is available.	
Extreme Temp	Drought 5.3	<ul style="list-style-type: none"> ◆ Entire Town / Region. Areas susceptible to drought and dry conditions include farms and nurseries: Alexander Dairy Farm and Millican Tree Nursery. ◆ Water Supplies: residences with private dug wells and Town water supplies. Drought means increased risk of brush fire with dry vegetation (see Wildfire for areas). Gravel roads affected because can't grade them when water is low. Higher elevations and ledgy locations tend to run dry first. ◆ All fire ponds will be low or dry during drought times: 6 Dry Hydrants at Fire Ponds- Putney Road Pond, Rising Wood Pond, Higgins Pit Pond, South Bow Dunbarton Marsh, McNichols Pond, Knox Road Town Pond. 	Future drought events have impacts on Bow residents. A large aquifer runs beneath Bow but is not refilled during drought conditions, a particularly concerning issue. The Town water bodies are critical to Bow's rural identity and to the natural resources of future generations. Waterbodies help keep drought levels in check and reduce the chance of wildfire or fire spreading, whether in the Town's commercial developments or residential subdivisions. Dug wells will continue to dry up during droughts. The lack of water would become a community problem to keep people hydrated, to keep utilities running, and to maintain healthy forests and aquifers. Increased likelihood of wide-spread brush fire and wildfire will occur with drier vegetation. Lightning strikes could contribute to wildfire risk during droughts.	Palmer Hydrological Drought Index (PHDI)

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Hazard Risk Assessment Hazards	Overall Risk	Hazard Locations in Town – Existing (Susceptible) From Hazard Risk Assessment	Potential Future Hazards – Locations and Impacts	Magnitude/Extent Measurement Scale
Extreme Temp	Excessive Heat	10.7 <ul style="list-style-type: none"> ◆ Entire Town / Region. Groups most susceptible to excessive heat include: Elementary, Middle and High Schools, Montessori School and Casa Dei Bambini, White Rock Senior Living Community, and high-density housing. ◆ Vulnerable areas most susceptible to extreme heat include the farms and nurseries (see Drought). ◆ The Safety Center (and possibly Library) can be opened as a cooling center during extended heat conditions. ◆ See APPENDIX A for the list of vulnerable facilities or groups. 	Bow will continue to experience excessive heat events with climate change. During these times, the groups of children and elderly residents in Town are particularly susceptible to excessive heat, including the White Rock Senior Living Community and the other senior housing developments, Stone Sled Farm, Wind Chimes, and The Pines of Bow; Bow Elementary School, Bow Memorial School and Bow High School; and the Casa Dei Bambini, Bow Youth Center, Rockwood Acres Learning Center, Meetinghouse Montessori School, Celebrating Children, Little Sprouts Day Care, and Joyful Noise Learning Center child care facilities. The aged 55+ residences and schools, child care centers should have access to either air conditioning or cooling facilities. Older, individual homes may lack air conditioning. Excessive heat can cause dehydration, heat exhaustion and more serious illnesses. The Baker Free Public Library [capacity ~50], Old Bow Town Hall [capacity ~85], Community Building [capacity ~50], or Safety Center could open during these times as a Cooling Center.	NWS Heat Index
Earth	Earthquake	6.7 <ul style="list-style-type: none"> ◆ Entire Town. The Central NH Region is seismically active and earthquakes are regularly felt from area epicenters. Locations with high density population or potential gathering sites to evacuate include: Schools, White Rock. ◆ Earthquake damage to Merrimack (coal-fired) Station, utility poles and wires, roadways and infrastructure (dams, water lines, bridges) could be significant. ◆ Areas with underground utilities, community water systems, Water District, and the old, historic buildings (such as the Old Town Center) are more vulnerable to earthquake damage. ◆ See APPENDIX A for the list of vulnerable facilities or groups. 	Earthquakes are fairly regular events in the area and while it is likely Bow residents will continue to feel earthquakes in the future, it continues to be likely that no major damage will result from these small earthquakes. Damage to utility poles and wires, roadways, the Merrimack Station and any of the 6 telecomm towers [NH 3A (2 by Peterbilt), Robinson Road, South Bow Road, Knox Road @ Safety Center, Woodhill Road] could be significant should a large earthquake (>3M) occur. Areas with underground utilities, community water systems, and the old/historic buildings, Old Town Center, and large facilities such as White Rock Senior Living Community and the 3 Bow Schools are particularly at risk because of building size and/or large population concentrations. Older buildings (stone foundations) in Town could be susceptible to earthquake damage. Stone walls, other dams, bridges, cemeteries, and telecommunications towers could also be susceptible to damage.	Richter Magnitude Scale

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Hazard Risk Assessment Hazards	Overall Risk	Hazard Locations in Town – Existing (Susceptible) From Hazard Risk Assessment	Potential Future Hazards – Locations and Impacts	Magnitude/Extent Measure-ment Scale
Earth	Landslide	2.7 <ul style="list-style-type: none">◆ Slopes greater than 25%, including roads with steep ditching or embankments are most vulnerable to landslide. Roads with steep ditching or embankments are most vulnerable to landslide include NH 3A by St. Germain's (668 NH 3A). Landslide is a fairly uncommon hazard but one that can have devastating effects, including property damage and in some cases, loss of life.◆ The excavation sites in Town are potential sites of landslide.	Development in proximity to areas of steep slopes (greater than 15% or 25%) could present a risk to residents, but it is not a large future threat in Bow. Most potential landslides will be in conjunction with another hazard event, such as flooding, a severe rain event, earthquake, or from the construction of buildings or infrastructure in a topologically vulnerable area. Most roads are gravel roads which already experience washout during heavy rain events, flooding, or rapid snow pack melt. Some of the steeper roads could experience landslide or rockslide erosion during heavy rain events. Although a large-scale road landslide would damage few structures, road (infrastructure) closures are costly and can last for months. The Merrimack River's river banks and brook banks could erode or scour be subject to mass failure, which is the water version of landslide. Generally, vegetation in Bow is good at preventing landslides, except for the gravel pits in Town. Roads with steep ditching or embankments are most vulnerable to landslide. Areas of concern for potential landslide include NH 3A by St. Germain's. Road washouts and flash-flooding could cause landslides, but the Town is not particularly susceptible	No known widely-used scale measuring the magnitude of landslides
Technological	Dam Failure or Release	4.0 <ul style="list-style-type: none">◆ High Hazard (H) dam is the Garvins Falls Dam (H) on the Merrimack River, could be vulnerable to dam failure although very unlikely to occur. Two Low Hazard (L) dams are Bow Fire Pond Dam and Putney Meadow Pond Dam. Other active Non-Menace (NM) dams are in Town are more likely to experience dam failure.◆ Beaver dams have a high probability of flooding and potential to break. Turkey River beaver dam at St Paul's in Concord would be catastrophic for downstream Bow if it breaches.	Two High Hazard Dams have the potential to breach in the far future, impacting Bow: Garvins Falls Dam, and Turkey River Dam (Concord). The May 2006 rainstorm threatened to breach the dam located on the St. Paul School property in Concord. Failure of this dam would cause the Turkey River to breach its banks and threaten the Bow Mills area (including Chen Yang Li Restaurant's historic grist mill), the South Street bridge over the Turkey River, and the Valley Street residences.	
Technological	Power/ Utility Failure	NR <ul style="list-style-type: none">◆ Entire Town, including Vulnerable Populations (see APPENDIX A) and Areas of particular concern during power failures. Critical facilities such as the Merrimack Station electric plant and the Eversource/Utilil powerlines, communications equipment at the crest of Woodhill Hooksett Road;	Power failure occurs with most natural weather events and is restored in the most critical or populated locations first, such as Town facilities, schools, shelters, and vulnerable populations. The most remote roads/ areas of Town include South Bow Dunbarton Road, Ferry Road, Woodhill Hooksett Road off Bow Bog Road, Branch Londonderry Turnpike (East & West), and	N/A

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Hazard Risk Assessment Hazards	Overall Risk	Hazard Locations in Town – Existing (Susceptible) From Hazard Risk Assessment	Potential Future Hazards – Locations and Impacts	Magnitude/Extent Measurement Scale	
		<p>high density or vulnerable populations such the Bow Elementary, Middle and High Schools, White Rock Senior Living Community; historic buildings in the old Town Center; and the 6 telecomm towers [NH 3A (2 by Peterbilt), Robinson Road, South Bow Road, Knox Road @ Safety Center, Woodhill Road].</p> <ul style="list-style-type: none"> ◆ Much of the Town is wooded and forested and sections would be difficult to access with excessive tree fall or power lines down. There are over 2 dozen housing developments are situated on cul-de-sacs. ◆ Most remote roads/ areas of Town include: South Bow Dunbarton Road, Ferry Road, Woodhill Hooksett Road off Bow Bog Road, Branch Londonderry Turnpike (East & West), and the South Bow area. ◆ The agricultural farms (feeding or dairy animals) should be monitored. ◆ Power outages may last for several days before service is restored from a large event. 	<p>the South Bow area. Over 2 dozen cul-de-sacs are susceptible to power failure and the often-related tree fall on roadways that accompany it. Specific vulnerable locations to power outage include communications equipment at the crest of Woodhill Hooksett Road; high density or vulnerable populations such the Bow Elementary, Middle and High Schools; historic buildings in the old Town Center; and the 6 telecomm towers [NH 3A (2 by Peterbilt), Robinson Road, South Bow Road, Knox Road @ Safety Center, Woodhill Road], and the water and sewer utilities. The Bow High School can serve as the Town Shelter available to Bow and area residents once opened. The multiple businesses in Town rely on electricity provided by powerlines, and in most cases the Town's busy enterprise comes to a standstill during event.</p>		
Technological	Communications Systems Failure	NR	<p>◆ Entire Town. Communications systems are detailed in the APPENDIX A Facility Vulnerability Assessment tables. Systems failures could affect Town businesses and local government on an isolated scale. The internet enables alternative communication options.</p> <p>◆ The 6 telecomm towers [NH 3A (2 by Peterbilt), Robinson Road, South Bow Road, Knox Road @ Safety Center, Woodhill Road] are the primary towers in Town. The Fire Department has a repeater on site.</p> <p>◆ Communications failure would be worse if it occurred during a holiday or inhibited emergency dispatch and EOC operations. Most Town radios are interoperable, and they are used in more than one location.</p> <p>◆ The Town is serviced by the Capital Area Mutual Aid Compact, which does all the emergency medical service and Fire dispatching. They have redundant capabilities and are currently upgrading their systems.</p>	<p>Like power failure, communications failure usually occurs as a secondary effect of a natural disaster such as a severe storm or winter weather. However, Town radios are interoperable and they are used in more than one location, and repeaters are used to minimize future emergency communications failures. Vulnerable areas and populations previously identified are at highest risk of danger from personal communications failure, including the 3 Bow Schools, the senior housing developments, and childcare facilities and more detailed in the Tornadoes section.</p>	N/A

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Debris Impacted Infrastructure	NR	<p>♦ Most dams, culverts, and bridges could experience debris impacted infrastructure. the Turkey River, Bela Brook or Bow Bog Brook or the Garvins Falls Dam (High) on the Merrimack.</p> <p>♦ Roads with culverts that regularly washout are listed above under Flooding.</p> <p>♦ Many of these facilities would be high impact in the event of debris impacted infrastructure because of the highway system of I-89, I-93 and NH 3A. Box culverts as replacements for failing culverts have been recently installed in many Bow roads as a result of recurring flooding events.</p> <p>♦ Debris impacted infrastructure can also refer to roadways blocked by downed trees and power lines during storms (see Tornadoes and Downbursts lists above).</p>	<p>A future flooded Turkey River carrying large debris could threaten the South Street bridge over that River as well as the I-89 on/off ramps at that same location. Vegetation on islands in the Merrimack River poses a danger if their trees were uprooted and flowed downstream. Lists of culverts to be replaced to ensure their carrying capacity are provided in the Flooding section. Erosion along the Merrimack River, and potentially the Turkey River in places, causes sediment and debris to flow downstream and is a hazard to the landowners who have shoreland frontage, significantly raising flood risks. Sedimentation from the Suncook River flowing downstream into the Merrimack River is a form of debris and could accumulate at the Garvins Falls Dam, creating a larger ponding effect and raising risks of inundation flooding. Debris in the form of trees is a possibility during any storm event, whether trees fall onto roadways, into waterways or onto powerlines. The Town could call the NH Department of Environmental Services for emergency removal from waterbodies or remove the trees themselves and obtain a “retroactive permit” during emergency situations. Bridges are vulnerable to debris dislodged during storm events, including State bridges. The Town has 2 redlisted bridges that are structurally deficient as of September 2018, Page Road over Bela Brook and Dunklee Road over Bow Bog Brook. The Town is working hard to upgrade these bridges over the next couple of years with NH Bridge Aid funding. All outlying State and local roads are susceptible to tree fall and downed powerlines, such as NH 3A, NH 13, Putney Road, Buckingham Road, Brown Hill Road, North Bow Dunbarton Road, South Bow Dunbarton Road, Ferry Road, Woodhill Hooksett Road off Bow Bog Road, Branch Londonderry Turnpike (East & West), and the South Bow area as well as the cul-de-sac roads listed in the Tornadoes section.</p>	N/A
Transportation Accidents	NR	<p>♦ Interstate 89, Interstate 93 and NH 3A are the main highways through Town. Interstate on/off ramps are dangerous, especially Exit 1 Logging Hill Road. Bow Junction intersections and traffic access can be dangerous with potentially severe transportation accidents.</p>	<p>Bow is a major transportation corridor with NH 3A and Interstate 93 bisecting the Town north-south, and I-89 and I-93 join within the boundaries of the Town. A railway along the Merrimack River is frequently used to bring chemicals and coal to the PSNH power generation plant, and other materials to Concord. The most significant</p>	N/A

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		<ul style="list-style-type: none"> ◆ In addition to accidents at these locations, transportation accidents occur throughout the community at rural intersections, along hills and s-curves as shown on Maps 1-4. ◆ Accidents increase during hazard events, winter weather and wind storms. 	<p>transportation accidents in Bow are likely to happen on one of these travel-ways.</p> <p>Bow has an inherent vulnerability with limited egress points, only NH 3A, interstate 93, and South Street. Very limited access is available from Albin Road. Significant issues arise about getting to Concord Hospital if I-93 is blocked.</p> <p>Of a lesser concern are the cargo and passenger airplanes traveling over Bow as the Town is sometimes in the flight path of the Manchester-Boston Regional Airport and nearby the Concord Municipal Airport.</p>	
Technological	Hazardous Materials Spills/ Radiological Accidents	<ul style="list-style-type: none"> ◆ Railroad to Merrimack Station, Interstate 89, Interstate 93 and NH 3A, Bow Junction, and some local roads are the most realistic routes taken where vehicular and railcar traffic transport hazardous waste. Serious transportation accidents involving hazardous materials have the greatest possibility here. ◆ Vulnerable areas for targeted evacuation include the Schools and White Rock Senior Living Community. ◆ The largest or most dangerous stationary sites that store and/or handle haz mat on site (fertilizer, pesticides, fuel, etc) are listed in APPENDIX A. Occupational haz mat sites where spills could occur include schools, manufacturing, industry, of which there are many in Bow. 	<p>The single biggest future hazardous materials risk is the trains that carry in anhydrous ammonia to Granite Shore Power, 8-9 railcars at a time, which either sit on the tracks or its contents are deposited into storage tanks. Trains can derail and spill contents into the Merrimack River or Turkey River.</p> <p>Transportation trucking of hazardous materials on I-89, I-93, NH 3A, NH 13 and along the freight cars on the railroad corridor is likely an regular occurrence. These trucks or freight cars could rollover and spill their contents onto these significant travel ways.</p> <p>Trucks traveling along NH 3A, Interstate 93, and Interstate 89 can rollover and spill their contents onto these significant roadways.</p>	N/A
Technological	Fire (Vehicle, Structure, Arson)	<ul style="list-style-type: none"> ◆ Several locations around Town are potential sites for explosions and serious fires and numerous other sites that have the potential for prolonged burning. They include above ground fuel tanks on farms, Merrimack Station electrical plant, Eversource/ Utili high tension power lines, manufacturing and industrial businesses, areas away from fire ponds; vacant buildings, foreclosed homes or seasonal buildings; or buildings in densely populated areas. ◆ Vehicle fires could occur anywhere, parking lots, driveways, roadways. See also APPENDIX A. ◆ Human-started fires could occur in Nottingcook Forest and other 	<p>Future fires in Bow are likely to remain vehicle fires (accidents), structure fires, brush fires, other outside fires, and special fires, similarly to recent reports to the NH Fire Marshal's Office. these fires can include wildfire. The Interstates and NH 3A host many accidents and related vehicle fires. Much of the Town's manufacturing and industry are located along NH 3A and River Road. With new construction, vacant for lease or for sale commercial buildings could become potential fire hazards.</p> <p>Several businesses, including some mentioned above, are potential sites for explosions and serious fires. There are numerous other sites in town that store tires and that have the potential for prolonged burning. Sites in Bow are: Blue Seal, PSNH</p>	N/A

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		wooded or popular conservation areas.	<p>Merrimack Station, and Champney's Fireworks.</p> <p>A listing of facilities which store or use hazardous materials is found in APPENDIX A, which has a direct correlation to fire. For instance, Air Gas on Robinson Road has thousands of cylinders on site containing oxy-nitro. These locations may be most susceptible to explosions and the resulting fires.</p> <p>Recreation within the Town Forests and conservation lands can also result in fire, accidental or otherwise.</p>		
Technological	Public Health Issues	NR	<p>◆ Congregate populations. Bow Elementary, Middle and High Schools, White Rock Senior Living Community, populated areas, large employers, restaurants, stores, Blue Seal Feeds store, and public assembly venues listed in APPENDIX A - all of these locations increase the risk of exposure to and transfer of illness, causing potential public health concerns.</p> <p>◆ The many forests, conservation areas, agriculture, wooded areas, and ponds can host ticks (Lyme, Anaplasmosis, etc) and mosquitos (arboviral- West Nile, EEE, Equine Infectious Anemia, etc) which carry diseases.</p> <p>◆ Wheelabrator in Penacook and the Merrimack Power Station are considered the largest source of local air pollution in addition to vehicular traffic of Concord and the highways.</p>	<p>The greatest future risk to public health may be the growing tickborne and arboviral diseases, a result of our changing climate. Wheelabrator in Penacook and the Merrimack Power Station are considered the largest source of local air pollution in addition to vehicular traffic.</p> <p>For indoor contamination, the highest risk facilities for pick-up or transfer of viruses and bacteria can include the Bow Elementary School, Bow Memorial School, Bow High School, White Rock Senior Living Community, and the childcare facilities, which also host the Town's most vulnerable people. Wherever people congregate, such as the Library or at the Town's commercial locations.</p> <p>Hopkinton High School is Bow's local Point of Dispensing (POD) site.</p>	N/A
Human	Terrorism	NR	<p>◆ Unlikely, but terrorism could possibly occur anywhere in Entire Town. Most susceptible sites could include: High School, Elementary and Middle Schools (bomb threats), Merrimack Power Station, Municipal Water and Wastewater System, Town Office, Safety Building, churches, Baker Free Library, Eversource high tension power lines, banks, Blue Seal.</p> <p>◆ All other governmental or state facilities, political offices or rallies, churches, 6 telecomm towers, manufacturing or industrial businesses with large quantities of hazardous materials, grocery or convenience stores, restaurants, or</p>	<p>Terrorism is considered low in Bow, as it is not a high profile target that would garner the world-wide press coverage desired by the perpetrators, but it remains a possibility. The new owners of the Merrimack Station, Granite Shore Power, should ensure this possibility is minimized. The Garvins Falls Dam could also be a high profile target, not far from the Merrimack Station, or Blue Seal Feeds because of its onsite materials and its visibility.</p> <p>Bomb scares have occurred at the Bow Schools. By 2018, the Town and School District have worked together to create Emergency Operations and Response Plans and have drilled together to minimize any potential active shooter or bomb events. A School Resource Officer is on duty full time.</p>	N/A

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		other public places could be possible terrorism targets. ◆ Cyberterrorism is a more likely scenario, with the Town records or website targeted via internet hacking.	Cyberterrorism and hacking of Town and School systems might be the most likely outcome of local terrorism. Otherwise, targets are usually public spaces that would do the most damage to send a message. Possible targets could be Town Facilities (Municipal Building, Baker Free Library, Safety Building, Public Works) or where the most vulnerable citizens are located, the schools, senior housing facility, child care centers, Churches, utilities (water and sewer). Other gathering places such as school fields, stores, businesses, restaurants/bars, and other Town, State or governmental facilities could be high profile. Although unlikely, there could be a massive impact felt in the community even on a small-scale event.	
Human	Sabotage/Vandalism	NR ◆ Town or Governmental Facilities. Sabotage would be most likely to occur at Municipal Water or Waste Water systems, Merrimack Station, Town Offices (computer systems & website), Safety Building, other Town buildings. ◆ Vandalism could occur at dams, under bridges, other public water supplies or towers, cemeteries, vacant buildings, beaver dams, recreation areas, etc.	Vandalism could occur at public and private cemeteries, Bow Schools, or recreational sites such as the Town Forests and trails. Infrastructure could be vandalized, such as trailheads, bridges, dams, Pump Stations or the Water Tower (including graffiti). These facilities would be among the most damaging to the community. Vandalism could also occur at vacant buildings in isolated locations. Bow has many vacant buildings, although most of them are commercial use for sale or lease. Technological systems such as computer systems and websites of the Town Facilities (Municipal Building, Baker Free Library, Safety Building, Public Works) or the 3 Bow Schools, or other governmental systems could be subject to computer or network sabotage. Utilities or telecommunications towers could be vulnerable to sabotage or vandalism, such as the 6 telecomm towers or the Merrimack Station. Many other significant facilities in Bow could be subject to sabotage including the powerlines, transmission lines, transformers and utility substations	N/A
Human	Hostage Situation	NR ◆ Unlikely, Isolated events. Locations where hostages could be taken include: Town Offices and other public buildings, 3 Schools, White Rock Senior Living Community, workplaces, grocery and convenience stores, restaurants, high density population areas, public events, and domestic home situations.	Although not considered a high future threat, Conventional hostage situations would most likely target such locations as the Municipal Building, Safety Center, Library, Bow Schools, Bow Youth Center, Merrimack County Savings Bank, churches, or convenience stores/ gas stations. The Town is host to many municipal and other governmental facilities and major, visible businesses such as those along the NH 3A	N/A

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Hazard Risk Assessment Hazards		Overall Risk	Hazard Locations in Town – Existing (Susceptible) From Hazard Risk Assessment	Potential Future Hazards – Locations and Impacts	Magnitude/Extent Measurement Scale
			♦ See vulnerable populations listed in APPENDIX A .	corridor or Bow junction, and it is possible a public hostage situation could occur in any of these locations	
Human	Civil Disturbance/ Public Unrest	NR	<p>♦ Unlikely, Limited locations. Locations where civil disturbance could occur: High School, Elementary and Middle Schools (including bomb threats), Merrimack Power Station, Municipal Water and Wastewater System, Town Office, Safety Building, churches, Baker Free Library, banks, Blue Seal, all other governmental facilities or state facilities, establishments serving alcohol, high density population areas.</p> <p>♦ Occasions of potential public unrest include: Town & School Meetings, voting day, local board meetings, during visits from political candidates, large events such as Old Home Day, Veteran's Parade, School sports events or graduations.</p>	Also not a large scale future event, the highest potential for public unrest could take place during Town Meetings and School Meetings, on voting day or during visits from political candidates, or at large events such as Old Home Day, Veteran's Parades, or at School events or functions. People have held demonstrations at the Bow Municipal Building, but they have been peaceful to date. Any organized protest in Bow often manifests in Concord. Locations where civil unrest could occur include the Town Facilities (Municipal Building, Baker Free Library, Safety Building, Public Works) or the 3 Bow Schools. Generally, restaurants and establishments serving alcohol, and gathering facilities within other high density population areas are more susceptible to civil disturbance	N/A

Source: Bow Hazard Mitigation Committee

Although there are many potential hazards in Bow's future, the community is knowledgeable about where some of the worst occurrences might result with this descriptive **Potential Future Hazards** inventory. A comprehensive, specific community facility inventory that indicates each site's **Primary Hazard Vulnerabilities** is found next in **5 COMMUNITY VULNERABILITY ASSESSMENT**.

Bow's Built Environment Changes Since the 2013 Plan

The locations of where people and buildings are concentrated now or where new lands may be developed should be compared to the changing locations of potential natural hazards in order to best mitigate potential property damage, personal injury or loss of life.

The Town's Statement of Vulnerability Change

The overall vulnerability of the Town to natural disasters is believed to have remained the same over the last 5 years. Although there are more challenges to meet, the Town is more prepared than **5** years ago. Still, with both challenges and progresses, the Town's **vulnerability** itself remains unchanged because more severe and frequent weather events occurred that risked life, property or infrastructure during this time. Climate change is occurring and will continue to alter weather patterns in an often unpredictable way.

Progresses: Since **2013**, the Town has invested in better infrastructure (Birchdale Road Bridge and culvert upgrades), new safety facilities (Bow Safety Center), has developed and exercised the Bow School District Emergency Operations Plan, has maintained better communication among Departments, and has upgraded communications systems (including a new radio frequency forthcoming) among the School, Public Works, Fire, Police and Emergency Management Departments.

Challenges: There have been several building development changes in the last **5** years, bringing increased population, housing, industry, and population density. Along the highways and local roadways, there are increased traffic exposures to weather events. The Public Works Department responds more frequently to weather events in **2018** (~**32** deployments per year) than **10** years ago in **2008** (~**20** deployments per year). The Town Departments have handled the impacts of natural disaster events when they occurred and obtained federal Public Assistance funding to help offset some of the costs when necessary.

The future climate may be very different than **2018**, as temperatures rise and storms of greater magnitude become more commonplace. The Town will continue to reduce its vulnerability were possible by enacting more progressive measures and undertaking mitigation projects.

Facilities and their locations with vulnerabilities to specific natural hazards are listed in **APPENDIX A Critical and Community Facilities Vulnerability Assessment**.

AREAS OF HIGHEST DENSITIES

Bow is a small, **28.1** square mile, highly populated community with an overall Town density of **277** people per square mile. People are interspersed among over **2** dozen cul-de sac neighborhoods totaling about **458** homes throughout the rural locations of Bow, having limited access to and from their homes. Bow also has Town unmaintained Class VI roads along which people live and cannot maintain or repair damages to either Class VI or private roads. Along these stretches, icy roads and hazardous driving conditions are often present during **severe winter weather** events. **Severe wind events** often impact every road in the community.

The main Town Departments are located nearer the closer access roadways to the Interstates: Municipal Building (Town Offices) on Grandview Road, Baker Free Library (South Street), and Safety Center (Fire and Rescue Department, Police Department, Emergency Management) on Knox Road. Further to the east, the Public Works Department is on Robinson Road. The **3** Bow Schools are located further south off of Bow Center Road and White Rock Hill Road. **Fire** from any source (**lightning, wildfire, or human-generated**) is a concern for the residential neighborhoods, businesses, the Merrimack Station, and especially the historic wood frame facilities and Old Bow Center buildings.

Not only residential, Bow is a thriving business and industry community. The Merrimack Power Station, now owned by Granite Shore (formerly PSNH and Eversource), continues to function on an as-needed basis for additional coal-generated electricity. The entire complex area is situated along the **Merrimack River**, alongside which the railroad tracks were built, often carrying and storing freight cars with unknown and hazardous chemicals. The northeastern most corner of Town around South Street, Hall Street, and the Interstates contains much commercial and commuter activity, known as Bow Junction. River Road and NH 3A have high concentrations of non-residential enterprises and cater to truck traffic and commuter traffic through Manchester and Hooksett. Moving people from these areas and keeping these main routes accessible and relatively free-flowing will be of key importance during disaster and emergency events. **Flooding** remains of concern for the areas along the **Turkey River**, I-89 ramps, Bow Junction and next to the **Merrimack River**, or along brooks with undersized culverts. Technological hazards like **transportation accidents** or natural hazards like **severe winter weather** may be the greatest threats to the population living along major transportation routes or local Class V and VI roads, causing **debris impacted infrastructure** and possible isolation.

Any of the high-density areas can be **flooded** by rapid snow pack melt or **rainstorms**, and could sustain **power and communications failure** by any **natural hazard**, be subject to **transportation accidents** and host the potential for **hazardous materials spills**. Rerouting traffic would be very difficult, as would an **evacuation** of the Interstate corridors.

Areas of Highest Density Changes Since 2013 Plan

The Town has grown by nearly **150** homes since the **2013 Plan** in terms of housing, according to **2**

COMMUNITY PROFILE. Most of these new homes are interspersed around the community, with a majority of the residential development activity located in the south central part of Town, in the Rural District (R). A large portion of the new homes are located within a high-density single-family home elderly development (Stone Sled Farm off Woodhill Hooksett and Alan Roads) or many open space (cluster) single family home developments.

Since **2013**, many new businesses or industries have located to Bow, including Exel (**200,000 SF** warehouse on NH 3A), Coastal Forest Products (**250,000 SF** manufacturing on River Road), Cenfer LLC **6** commercial condominiums (**25,000 SF** on NH 3A), Matt Brown Truck Repair (**8,000 SF** on Thibeault Drive), plus significant commercial additions and other new construction. All of these businesses were constructed within the southwest part of Town, between NH 3A and the Merrimack River, which has municipal water that can be used for fire suppression systems.

The Zoning Ordinance was revised at the **2016** Town Meeting to create a high-density mixed use zone, the new Business Development District (BD) from what was previously low-density Residential (R) and Institutional (IN) Districts, and also changed **36** acres of the Rural District (RU) to Limited Industrial (I-1).

VULNERABLE POPULATIONS

Most of the high density cul-de-sac **residential** neighborhoods mentioned above are also vulnerable populations located in areas of potential hazards. With **institutional populations** and staff in a small geographic area, facilities become especially vulnerable to natural, technological, and human hazards.

Bow has **3** District schools within its limits, the Bow Elementary School and Bow Memorial Middle School on Bow Center Road and the Bow High School off White Rock Hill Road. The High School serves as the Town's emergency shelter. **Human** hazard events would be the most likely to impact the schools. White Rock Senior Living Community on Bow Center Road contains approximately **200** housing units for seniors. Evacuating or providing extended services to the senior population during a disaster event could require a significant amount of the Town's resources. Multiple child care facilities are scattered throughout the community.

Vulnerable populations could be subject to area hazards such as **downbursts, lighting or wildfire**, other **severe wind events**, and **snowstorms**. **Power and communications failure** as a result of these events could impact the facilities although emergency generators are onsite at some critical facilities. Extra attention may be required at these locations during any natural disaster event. Non-natural hazards can include **hostage situation, civic unrest, public health outbreaks** from close quarters and **sabotage** (such as computer systems, utility interruption) are of concern. Health care facilities, manufacturing, and school labs have some **hazardous materials** onsite. The Bow Water Precinct pump house and storage tank could

be sabotaged as could the **6** telecommunications towers. The potential for domestic **terrorism** or **civil disturbance** at these facilities exists.

While not a population, a particularly **vulnerable site** remains the stand-by Merrimack Station coal-fired power-generating facility on River Road near the **Merrimack River**. The facility, its personnel, and its contents are subject to **flooding, human-instigated** hazard events, and **hazardous materials spills**. Another potentially vulnerable site is the High Hazard Garvins Falls Dam.

Vulnerable Populations Changes Since 2013 Plan

The Town of Bow, while having most of its governmental, institutional and business facilities in different areas, has not seen much increase with its **vulnerable populations**. The Town has improved emergency communications with Concord and the Capital Area Fire Mutual Aid Compact communication system. The new Bow Safety Center has now co-located its Police Department, Fire/Rescue Department and Emergency Management Department. While this arrangement offers tremendous benefits, these essential facilities are under one roof should any event impact the building.

The Bow school student enrollment increased by approximately **15%** since **2013**. There are no other specific known changes to existing vulnerable populations.

FUTURE DEVELOPMENT IN BOW

Single family housing continues strong in Bow, and future trends indicate further residential growth in a community with an already high population density. Before long, Bow may find itself a suburb of Concord and Manchester. Since the easily developable land in Town has already been built or subdivided, these newest developments could built on **wetlands**, near **steep slopes** or at higher elevations. To help keep residents safe, cisterns are being required for fire suppression, with sprinklers optional. **Floods, landslides, erosion**, and **fires** could occur in these residential areas. **Severe winter weather** and **wind events** on these hilly locations will bring trees down on roadways and interrupt **power and communication** services.

Future Development Changes Since 2013 Plan

New developments since the **2013 Plan** will continue to build out in the future, including the Bow Bog/Robinson Lot (Residential), conceptual **34** lot open space (cluster) development; Capozzi Trust Lot (Residential), recently approved **6** lot open space development; High Meadows (Residential), recently approved **13** lot mixed open space and traditional development; Coastal Forest Products (Manufacturing), **250,000** SF office/warehouse/manufacturing, currently under construction; and Dow Road (Commercial), conceptual **40,000-500,000** SF high bay warehouse/distribution center. With more and more of the residential subdivisions being single-access road open space developments, one of the **2017 Master Plan's** objectives is to promote connectivity through the requirement of local street connections between existing, new and future developments.

Severe winter weather and **wind events** will be expected to impact any new facilities or developments in Bow. **Housing** development is expected to occur on the largest parcels in Bow eventually. Subdivision of the last legacy parcels, those family-owned large parcels throughout the Town, may occur at any time when these lots are inherited by the next generation. The developments could be vulnerable to **wildfire**, **severe winter weather**, and **lightning**.

When developments come before the Planning Board, potential hazards including **flooding**, **fire**, **traffic accidents**, and **evacuation** are regularly considered. Developers try to solve the problem before a project is approved. The existing roads and bridges experiencing **erosion** and **flooding** will need to be upgraded for additional usage. The Town will continue to grow and develop, and attention should be focused on the hazards any new development could face during the consideration process. At this time, techniques to mitigate identified hazards could be undertaken before the facilities are sited and constructed.

There may be more home-based businesses and more agricultural operations in the future. As of **2018**, there is **1** existing dairy farm and a few equestrian facilities in Bow. Home Occupation is a permitted use under Zoning, and there is no ability to track the home businesses as the Town has no requirement for business registration. Both types of businesses might increase in the future. Not many known transportation improvements are forthcoming, other than the local road, bridge and culvert maintenance mentioned in the **2018 Plan**. Rideshare services will continue to become available in Bow and the use of drones for multiple purposes is anticipated to continue.

The main natural hazards for this bustling community remain **flooding**, all **severe wind events**, **storms**, **severe winter weather**, **debris impacted infrastructure**, (trees down on powerlines and trees/powerlines down on roads), and **power outages**. The Town will need to ensure that the Town's public services are not eclipsed by the needs of new development.

Any future development in Town could be vulnerable to the various natural hazards identified previously. The Town is heavily forested, rural, and agricultural and yet highly developed. New (or replacement) buildings and infrastructure and potential future development appear in **APPENDIX A Critical and Community Facility Vulnerability Assessment**.

5 COMMUNITY VULNERABILITY ASSESSMENT AND LOSS ESTIMATION

The Hazard Mitigation Committee developed and/or updated as needed each of the assets tables within this Chapter. Sites were added or removed, and contact information was revised. Modifications were made to the **Primary Hazard Vulnerability** column to reflect changes over the last five years. Revisions were made to the future development section, which now includes a clear table. The Plan's maps were also updated from the **Bow Hazard Mitigation Plan 2013**.

The identification of Critical and Community Facilities within Bow is integral to determining what facilities may be at risk from a natural disaster. Every Critical and Community Facility can be damaged by multiple hazards listed in **4 HAZARD RISK ASSESSMENT**. A tabular inventory of facilities in Bow is provided in **APPENDIX A Critical and Community Facilities Vulnerability Assessment**. The **911 Street Address** and **Phone** number of each facility is supplied, the assessed **Structure Replacement Value \$**, and the **Primary Hazard Vulnerabilities** to which the facility is most susceptible are listed. The hazards identified are primarily natural disasters but regularly include the technological (and secondary disasters) such as power failure and communications systems failure as well as human hazards such as vandalism/sabotage.

Most sites appear on **Map 3: Critical and Community Facilities** and **Map 4: Potential Hazards and Losses**.

Potential dollar losses for each of the facilities' **Structure Replacement Value \$** (not land) have been obtained through the [January 2018 assessments](#) to provide a starting point of the financial loss possible should these structures become damaged or require replacement. These community facility losses are estimated for the value of structure and do not include land (unless indicated), contents, or infrastructure.

Problem Statements were then generated for each type of facility when issues were identified by the Hazard Mitigation Committee during discussion of the facility characteristics and **Primary Hazard Vulnerabilities**. These **Problem Statements** are listed here.

Potential dollar losses to buildings in Bow from flooding and other natural hazards are provided using the methods described in the chapter. The Town's participation in the National Flood Insurance Program (NFIP) offers a way for individuals to obtain insurance coverage for flooding. The Town's history with NFIP claims and repetitive losses are examined.

The Chapter provides an inventory of the **Community Facilities** and **Critical Facilities** and the most prevalent hazards to which they are vulnerable. Potential structure damage loss is also provided. The detailed information is available in **APPENDIX A Critical and Community Facilities Vulnerability Assessment**:

Facility Name	Street Address (911)	Phone	Structure Replacement Value* \$	Primary Hazard Vulnerabilities
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Critical Facilities

Critical Facilities are categorized as those Town or State buildings or services that are first-responders in a disaster or that are required to keep the community running during a disaster. The Town Offices, Fire Department, Police Department (Safety Center), Public Works Department, Transfer Station and Water services are the minimum services necessary for providing and coordinating every day and emergency services. Other **Critical Facilities** would include educational facilities, clinics and emergency shelters. Utilities or utility features such as cisterns, culverts, dry hydrants, pump stations, water and sewer lines, and electric transmission lines are included because of the essential communication and power /water services provided.

Many such facilities are located in Bow. The assessed structure/building only value is provided for each facility where available, otherwise estimates are provided to help ascertain the financial impact a disaster can have on the community. To view the detailed **Critical Facilities** sites and tables, see **APPENDIX A**. Most of these facilities appear on [**Map 3: Community and Critical Facilities**](#).

Essential Facilities include: Department of Public Works, Municipal Building (Town Offices), Safety Center (Fire, Police and Emergency Management), Town Salt Shed, Coffin Building. Assessed structure (only) valuation for these essential facilities total **\$13.4m**.

Utilities include: Abenaki Water Company (Gilford) [95 customers], Cellular Tower (AT&T), Comcast Xfinity (Cable/Internet), Evergreen Drive Water Corp, GSP Merrimack LLC (Merrimack Station) [~121 customers], Garvins Substation (Bow 1), Liberty Utilities Natural Gas, Merrimack Station (Coal Electricity), NH State Police, Omnipoint Holdings, Inc, Pennichuck Water Service Corp (Merrimack) [~128 customers], Sprint Spectrum LP, Utili Energy Systems, US Cellular Corp, Verizon Wireless, WhiteWater Inc Sewer and Water, WW Municipal Sewer Pump Station 1 [~167 users], WW Municipal Sewer Pump Station 2 [~167 users], WW Water Pump Station, [~36 users], WW Water Tank [~36 users]. Assessed values for these utility structures in Town total **\$288.9m**.

Dams include: **1** High Hazard (**H**) dam- 027.12 Garvins Falls Dam @ **Merrimack River** (Eversource); **2** Low Hazard (**L**) dams- 027.17 Bow Fire Pond Dam @ **Morgan Brook** (Town of Bow); 027.19 Putney Meadow Pond Dam @ **Black Brook Tributary** (Lane) - Located in Dunbarton, has been removed 5-6 years ago; **3** Non-Menace dams- 027.14 McKay Fish Pond Dam @ natural swale (Foster Estate); 27.25 Martin Pond Dam @ above Greyllore Farm Pond (Martin); 027.26 Knight Pond Dam @ unnamed wetland (Knight). Estimated structure (only) repair values for these dams plus the assessed valuation of Garvins Falls total **\$19.3m**.

Bridges include: **2** Town redlisted bridges- Page Road over **Bela Brook** (065/140), and Dunklee Road over **Bow Bog Brook** [New bridge has been designed and engineered, close to going out to bid. Town is waiting for NHDOT bridge funding to become available] (182/113). **3** Town bridges- Birchdale Road over **White Brook** [completed **September 2018**] (092/136), River Road over **Bow Bog Brook** (184/127), and River Road

over PAR (194/115). **15** State bridges- NH 13 over **West Branch Bela Brook** (052/140), NH 13 over **East Branch Bela Brook** (061/141), I-89 (Ramp F) over **Turkey River** (130/161), I-89 over South Street (132/160), South Street over **Turkey River** (132/161), I-93, Fee TPK SB over I-89, **Turkey River**, Ped (135/158), I-89 (Ramp A) over **Turkey River** (135/161), I-89 (Ramp D) over **Turkey River** (135/162), Grandview Road over I-93, Fee TPK (136/155), I-93, Fee TPK NH over I-89, **Turkey River** (136/158), I-93 NB C-D Road over I-89, **Turkey River**, Ped (136/161), NH 3A over **Turkey River** (140/159), I-93, Fee TPK over Dow Road (158/137), I-93, Fee TPK over Robinson Road (168/120), NH 3A over **Bow Bog Brook** (180/109). Estimated structure rehabilitation values for these **20** bridges total **\$78.6m**.

Shelters, Schools, and Medical Facilities include: Baker Free Library (Warming/Cooling Center) [**~50** capacity], Bow Elementary **School** [**~460** students + **~100** staff], Bow High School [**~600** students + **~100** staff] as Town Shelter [**~200** shelter capacity], Bow Memorial (Middle) School [**~475** students + **~100** staff], Community Building (Warming/ Cooling Center) [**~50** capacity], Old Town Hall Center (Warming/ Cooling Center) [**~85** capacity], Cronhardt Family Dentistry. Assessed structure (only) valuation for these schools, medical facilities and shelters total **\$38m**. If the Schools needed to be rebuilt, actual cost would be at least **\$20m** to **\$30m** each; the assessed structure *valuation* does not reflect the actual structure *replacement* cost. See also **Vulnerable Populations**.

PROBLEM STATEMENTS AND EVALUATION

During discussion of these **Critical Facilities**, the Hazard Mitigation Committee identified specific issues or problems that could be further evaluated. **Problem Statements** were developed after ascertaining the **Primary Hazard Vulnerabilities** to the sites and known existing issues. These potential hazards were typically those from the **Hazard Risk Assessment**. The Committee also evaluated these statements to determine whether mitigation actions could be developed.

- Ⓐ There are issues with the building insulation in the Municipal Building, in that it is old asbestos insulation. The March 2018 Town Meeting approved a warrant article to replace insulation and remediate asbestos.
- Ⓐ The substandard Town salt shed building and site on Robinson Road resides in the Town's wellhead protection area (2 municipal water wells around River Road) and there are concerns about sodium leaching and wellhead contamination. Until the sites mandate support, some financially infeasible, about \$600,000. DPW Uses BMPs for salt runoff and control. Salt sheds and cemeteries are exempt from water quality control. If had to move, would move to Allen Road excavation site facility. The drinking water well is 70' away and always tests fine. A faucet provides potable water and the DPW facility.
- Ⓐ If Bow experienced a significant earthquake 5.0M or greater, the Town's essential facility buildings would suffer extreme damage. The new Safety Center building was

built to normal earthquake standards in 2017. None are scheduled to be rehabilitated within the CIP (6 years).

- ◉ Some of the private water systems are outdated and experiencing system failure. For instance, Grappone (Bow Junction) and South Street have contaminated, non-potable water (MTBE, salt, etc.) Bow also has high concentration of natural arsenic. Most facilities have their own community water systems but are also experiencing contamination. PB requires testing and most hook up to Town water systems as a result. Building CO not provided until a safe water test. May have to consider zoning regulations or other building code enforcement more stringent. Aquifer is clean but bedrock is far lower, most drillers go beyond 60' of the aquifer far down to bedrock.
- ◉ The Town's sewer system infrastructure is antiquated (about 170 users) and has the potential for failure. Currently being monitored, recorded and studied. Phase I done (oldest) 2018, Phase II, Phase III in 2020. In Bow Junction and Bow Center, and the 3 school active sewer lines.
- ◉ If the upstream St. Paul's Dam on the Turkey River fails, the South Street bridge, I-89, NH 3A, and sewer pump station and the Mobil Station would be flooded. This would be both an environmental catastrophe and require tremendous traffic rerouting logistics. Remediating the I-89 and South Street bridge has been studied and in the State 10-year plan, options are being considered, including removing Bow Mobil (new ramp goes through that site) and rehabilitating the South Street Bridge. Discussed FEH prospect, all properties in TIF zone as of Mar 2018.
- ◉ If the High Hazard Garvins Falls Dam fails, the likely effect would be inundation affecting about 6 downstream residences but not the Merrimack Station Plant. Some homes are along Ferry Road with multiple families.
- ◉ Continued sedimentation transport from the Suncook River to the Merrimack River is currently causing bank erosion in Bow and may exacerbate any Merrimack River inundation events. Town has experienced erosion on River Road where it continued into Hooksett and it is slowly moving to the Edgewater, half of the roadbed is probably in the River. Eversource lost a piece of property. Town trying to sell property, has no interest in stabilization. Sediment landed on Allenstown side, causing changes in Bow. Place stabilization funding into the CIP and Bridge and Road Capital Reserve Fund to counteract the Merrimack's erosion along River Road and other identified locations.
- ◉ The Page Road bridge is redlisted and there is no current funding available for repair for NH Ten Year Plan replacement for 2025, an 80/20 funding program.
- ◉ South Street over the Turkey River bridge (owned by the State) came very close to overtopping during the 2006 flood. The slim width of the bridge creates a lot of traffic

accidents. The intersection is confusing with the on/off I-89 ramps next to one another.

The State should rehabilitate these ramps and bridge over the Turkey River. In State's 10-year Plan, it's been in the plan since 2006. TIF is raising funding to encourage State to push up in priority. Hinders the Town's tax base.

- Ⓐ There is no second means of egress from the 3 Bow Schools. Baker Free Library has the same problem. This is a problem if widespread evacuation becomes necessary after a hazard event. Shelter in place is necessary in locations such as this. Recently had a meeting with School District about evacuating Elementary and Middle School in a crisis.
- Ⓐ There is a lack of an alternate power source (no generator) for the Old Town Hall (warming center), Library, Elementary School. The School District's annual meeting decided not to consider the generator. It should be in their CIP for the next years. SD prefers bonds.
- Ⓐ Excessive snow loads on the flat roofs of the 3 Schools could cause collapse during significant winter storms. At this time, they are shoveled when needed. They were likely engineered for snowload at the time they were built. Today, because of climate change, they MAY NOT BE ADEQUATE for wet heavy snow.

Many of these problem statements were developed into Actions discussed later in **7 PRIOR ACTION STATUS** and **8 MITIGATION ACTION PLAN**.

CULVERT UPGRADES

A table of culverts in need of upgrade does not appear with the **Critical and Community Facility Vulnerability Assessment** but is included here within this section. Culverts (including box culverts, often considered "almost bridges") are responsible for carrying large volumes of water safely under roadways, and with the prior severe flooding events it is necessary to keep Town infrastructure in good condition.

Table 25 displays Bow's listing of main culverts in need of upgrade and approximately when the upgrades should occur. Included are red-listed bridge rehabilitations and significant upgrades. The estimated cost for all of these projects reaches nearly **\$2m** for materials, permitting, study and design; labor for the smaller projects is performed by Town staff and usually considered an in-kind cost. For the larger projects, contracted engineering, design and permitting may need to occur and are included in the respective cost estimates. The optimal timeframe for these upgrades to protect the Town from **flooding, scouring and erosion** and **debris impacted infrastructure** is between **2019-2023** which is within the span of this **2018 Plan**, but a few more projects are listed beyond as known.

Table 25
Town-Owned Culverts in Need of Upgrade

Location of Culvert(s) to Upgrade	# of Culverts	Intersecting Watercourse	Issue(s) with the Culvert(s)	Upgrade Diameter <i>Inches</i>	Estimated Upgrade Year	Total Approx \$ Cost for All
Birchdale Road	1	White Brook	Undersized culvert is galvanized steel from the 1950's, and its wing walls are deteriorated. E-2 culvert on the red list.	Box culvert	Sept 2018 (completed)	\$750,000
Dunklee Road	1	Bow Bog Brook	Improperly constructed box culvert	Rebuild to engineered specs	2019/ 2020	\$850,000
Bow Bog Road	1	Bow Bog Brook	Flow line deterioration	60' TBD	2020/ 2021	\$150,000
Page Road	1	Bela Brook	Flow line deterioration	48-48	2023	\$25,000
White Rock Hill Road	1	Turee Brook	Flow line deterioration	36-36	2024	\$25,000
Robinson Road	3	Stream crossings	Flow line deterioration	24-30	2025	\$25,000
Totals						\$1,825,000

Source: Public Works Department 2018

This table can help the Town develop a formalized culvert upgrade and maintenance planning document. Mapped drainage facilities permits data to be collected and is easily revised and updated. Instant access to culvert and drainage information can be of valuable assistance during **flooding** events, such as **run-off**, **overtop flooding conditions** and **road washouts**. On an annual basis, a culvert maintenance plan can help guide the Town's decisions of priority replacement, maintenance, and monitoring of culverts and drainage facilities. Budgeting is more clear and may be more successful at Town Meeting with such a plan.

Most of the culverts listed in **Table 25** have been developed into **Mitigation Action Plan** items in **8 MITIGATION ACTION PLAN**.

Community Facilities

The **Community Facilities** inventoried in **APPENDIX A** are generally vulnerable to disasters and in need of careful consideration. Some facilities are vulnerable populations, places where people gather, the economic assets of the community, contain the history of the town, or could release hazardous materials during hazard or disaster events. While **Critical Facilities** are strong with emergency preparedness and mitigation measures, **Community Facilities** are typically not as well attuned to these issues and would require more emergency services during a hazard event disaster.

Vulnerable Populations include: Bow Youth Center [~100 children + 13 staff], Casa Dei Bambini Children Center [~87 students + 12 staff], Celebrating Children @ Bow Municipal Building [~32 students + 12 staff], Joyful Noise Learning Center / Crossroads Community Church [~20 students + 4 staff], Little Sprouts Day Care [~20 students + 6 staff], Meeting House Montessori School (24 students + 2 staff), Rockwood Acres Learning Center [~20 students + 6 staff], White Rock Senior Living Community [~200 residents + 4 staff]. See also **Shelters, Schools and Medical Facilities**. Assessed structure (only) valuation for these vulnerable population facilities total **\$13.2m**.

Economic Assets include those **businesses and services** that employ a large number of people or contribute to the local economy: Alltown Truck Stop, Amber Bow Associates LLC (multi-tenant complex), Amoskeag Beverages, BIP LLC. DBA Broadview Industrial Park (multi unit building), Blue Seal Feeds, Bovie Printing & Fabrication, Chen Yang Li, Conproco, Credit Warehouse Realty LLC (AKA Exel or State Liquor Warehouse), Eagle Storage, Grappone Auto Group, Hampton Inn, JDS PROPERTIES LLC (DBA Coastal Forest Products), MagiKitch'n, Merrimack Savings Bank, NH Automotive Dealers Assoc, Pitco Frialator Inc, RBD Construction Co (multi unit buildings), Rosenfield Granliden LTD (multi unit building), RS Audley Inc, Rumford Stone, Structures Unlimited/Keller Co, Sullivan Tire, Van Guard Stables (DBA Copper Horse Stables), Young Furniture. See also **Hazardous Materials Facilities** that are also economic assets to the community. Assessed structure (only) valuation for these economic asset facilities total **\$76.3m**.

Hazardous Materials Facilities include: A 1 Starter & Alternator, Advanced Siteworks, Antifreeze Technology Systems, Arch Equipment, Autologic LLC, Automotive Consultants, Bow Auto Parts Service Inc, Bow Bus Garage (School District/DWP #3), Bumper To Bumper Auto Body Inc, Capital Construction Equipment & Supply, Casco Food Equipment, Champnys Fireworks Store (seasonal), Commercial Tech Services/ Northeast Exhaust, Concord Awning & Canvas Inc, Conproco Corp., Dyno Nobel, Energy North Propane, Ensio Resources Inc., Equipment East, Exterior Auto Works, Exxon (Bow Mobil), Goddards Automotive Repair, Grappone Collision Center, Grappone Ford Inc, Grappone Honda, Grappone Hyundai, Grappone Mazda, Grappone Toyota Inc, Hansen Fox Co, Hews Company LLC, Irving Mainway, J W Fleet & Equipment Inc, Kal-Lite Sales Division, Kalwell Corporation Flat Sheet Division, Keller Products Plastic Extrusion Division, Lewis Arms, Alltown Gas Station & Truck Stop, Pennichuck East Utilities (Scrapyard & Salvage), Perini Corp, Eversource Central Warehouse, (Multi-Tenant Building), Quality Wood Priming Inc, Redimix Concrete, Phytech Industries, Scanada International Inc, Steves Auto Sales, Sullivan Tire

Commercial Truck Tire Service, The Melanson Company Inc., and Z Tech. See also **Economic Asset Facilities**. Assessed structure (only) valuation for these hazardous material facilities total **\$40.1m**.

Cemeteries and Churches include: Bow Mills United Methodist Church and Crossroads Community Church. Alexander Cemetery (Town), Brown Hill Cemetery (Town), Evans (North) Cemetery (Town), Goodhue Cemetery (private), Green Cemetery (Town), Hadley Cemetery (Private), Hammond Cemetery (Town), Heath Cemetery (Town), Miss Alice Brown Cemetery (Private), Ordway Cemetery (Private), Quimby Cemetery (Private). As cemeteries do not contain structures, broad estimates of headstone or mausoleum replacement value were provided instead. Structure (only) valuation for cemetery and church facilities total **\$1.9m**.

Historic Sites and Buildings include: Benjamin Noyes Mill Site, Bow Bog Meeting House 1835, Bow Canal Lock at Garvins Falls 1813, Bow Center One Room School House 1894, Bow Center Tavern, Crossroads Community Church 1832, District #14 School- Bow Mills, District #3 School- White, District #4 School- River Road, First Meeting House Site 1771, Grist Mill (Chen Yang Li Restaurant), Mary Baker Eddy Birthplace 1821, Noyes Ferry Landing 1764, Old Town Hall 1847, Sergeant John Ordway Home, and Town Pound (Bow Center) 1821. See also **Recreational and Gathering Sites**. Assessed structure (only) valuation for these historic facilities total **\$1.1m**.

Recreational and Gathering Sites of both land and buildings include: Baker Free Library [**406** capacity + **15** staff], BMS/BES Fields, Bow High School Fields, Field House Sports, Merrimack River Boat Ramp (formerly PSNH), Public Service Athletic Complex, Recreation Center & Town Pond, Richard Hanson Memorial Recreational Park (Hanson Park), Rotary Park & Town Gazebo, Sargent Park & St Cyr Playground, Turee Pond Boat Access (NH Fish & Game), Granite State Gymnastics Center, Nottingcook Town Forest and Recreational Trails (**771** acres), Knox Town Forest (**318** acres), Hammond Nature Preserve Recreational Trails and Walker Forest (**144** acres). Some of these sites can be **Economic Assets** to the Town. Assessed structure valuations for the recreational facilities total **\$8.1m**.

Future Development potential includes: **Approved Planning Board developments** - Bow Bog/Robinson Lot **130** acres (residential), Capozzi Trust Lot **32** acres (residential), Coastal Forest Products (manufacturing), Dow Road (commercial). **Legacy parcels** (large family lots with development potential) include- Colby Family **42** acres (mixed use). There are too many large family legacy parcels to identify without an inventory. **Large-sized lots for sale Jan 2018** include- Woodhill Hooksett Lot (**28** acres), Blevens/Putney Lot (**36** acres), Allen Road Lot (**11** acres), River Rd Commercial Lot (**1.4** acres), NH 3A Commercial Lot (**6.7** acres). Assessed vacant land valuation for most of these properties totals **\$4.0m**.

One Egress Residential Developments include: Abbey Road Subdivision [~**12** homes], Audley Divide Subdivision [~**16** homes], Beaver Brook Drive Subdivision [~**10** homes], Chandler Circle Subdivision [~**13** homes], Clearview Drive Subdivision [~**27** homes], Clough Street Subdivision [~**30** homes], Colby Lane Subdivision [~**8** homes], Dicandra Drive Condominiums [~**42** homes], Fox Meadow Drive Subdivision [~**10** homes], Hampshire Hills Subdivision [~**34** homes], Heather Lane Subdivision[~**14** homes], Hope Lane Subdivision [~**12** homes], McNichol Lane Subdivision [~**6** homes], Meadow Lane Subdivision [~**25** homes],

Peaselee Road Subdivision [~34 homes], Rosewood Drive Subdivision [~22 homes], Sterling Place Subdivision [~8 homes], Stone Sled Farm 55+ Adult Community [~32 homes], Sundance Lane Subdivision ~13 homes], The Pines of Bow 55+ Adult Community [~27 homes], Tower Hill Road Subdivision [~14 homes], Whittier Drive Subdivision [~15 homes], Wilson Meadow Road [~9 homes], and Wind Chimes 55+ Adult Community, [~25 homes]. These 24 subdivisions are listed because homeowners lack secondary access to main Town streets should these cul-de-sac roads be damaged or blocked by weather events such as flooding, high winds or debris impacted infrastructure. At least 458 homes are represented in these 1-egress residential developments and their residents may encounter evacuation issues or experience delayed emergency services during disasters. No structure value is provided for these homes but is available in the Town's assessing files and online at <https://www.axisgis.com/BowNH/>.

PROBLEM STATEMENTS AND EVALUATION

During discussion of these Community Facilities, the Hazard Mitigation Committee identified specific issues or problems that could be further evaluated. **Problem Statements** were developed after ascertaining the **Primary Hazard Vulnerabilities** to the sites and known existing issues. These potential hazards were typically those from the **Hazard Risk Assessment**. The Committee also evaluated these statements to determine whether mitigation actions could be developed.

- Ⓐ The White Rock Senior Community of 55+ older residents has no emergency generator in the event of a sustained power failure from storms, winds or winter weather.
- Ⓐ The Bow Youth Center and Little Sprouts (Clough Hill Rd) have only one means of egress to and from their buildings. Currently have a requirement in SPR and Sub that a generator is necessary.
- Ⓐ The numerous Bow Junction businesses are vulnerable to flooding by the Turkey River and water backup and runoff from the Merrimack River. There is sheet runoff from both I-89 and I-93 into the area. State has not done any work on these locations to improve the situation. The Garvins Falls Dam controlled by the ACOE, who performs water releases when needed. Businesses are now situated in the new TIF district in March 2018.
- Ⓐ Transportation of hazardous materials along I-89, I-93 and NH 3A bring with it the possibility of toxic or explosive spills/releases.
- Ⓐ The large supply of anhydrous ammonia waiting and used for the scrubbers at the Merrimack Station on the railcars is a potential issue for a natural, technological or human-caused disaster. Train is parked for a lengthy period of time, ends at Blue Seal. With Coastal Forest Products, there is the potential for more usage of the railroad and with it, additional hazardous materials.
- Ⓐ Many local businesses do not follow the EPA's EPCRA/CERCLA Right to Know Law requirements. Compliance is not 100% and the Town wants to know which materials

are available at these locations. No registration requirements. Fire Department should communicate.

- The flooding of the Turkey River would impact the historic Grist Mill, which flooded in May 2006 with water flowing into the building. A fire at this location would remove the restaurant (economic asset) and destroy the historic site. Localized gambling at this location.
- The Bow Center One Room School and Bow Bog Meeting House are vulnerable to lightning and fire as they are old, wooden historic assets of the community.
- Emergency response access to wilderness areas is difficult, for response to fires, downed trees, and injured or lost people. The Town is in the process of GPSing trails on other Town Forest lands (not listed above) to develop maps and has 2 all-terrain vehicles available. Hammond Preserve, Town Forest, Knox Forests. Approval for replacement for ATVs, snowmobile rails good, mountain bike club in contact to get contact info to ascertain type of apparatus for the location.
- The Fire Department's accessibility to fight wildfires or lightning-based fires in wilderness areas is difficult. Limited points of access restrict entry and the width of foot trails and is not conducive for fire suppression apparatus.
- Access for water rescue on the Merrimack River is limited to just the (Eversource) PSNH River Road boat ramp. This reduces response time. Water rescue staging from this site occur at least once annually. Unable to get under the Turkey River Bridge, no headroom. Allenstown has a ramp across the Merrimack River at their field, but Pembroke's Memorial Field is too sandy and not stabilized.
- Vandalism occurred at High School and baseball dugouts (graffiti, vehicle traffic damage turf and sprinkler heads). Hansom Field graffiti, some on I-89 bridge.
- The lack of secondary means of egress for homes limits the ability to self-evacuate during a natural hazard (storms, wind events, winter weather, wildfire, floods, etc). Regulations allow up to 12 lots on a dead end. Emergency response can also be delayed if the developments' roadway is blocked. Residents should plan ahead for emergencies, for isolation up to three days and a personal evacuation plan.
- Additional residential or commercial lot development would require new infrastructure (roads and utilities), traffic control, maintenance and plowing of roads, and emergency response, becoming an economic impact on community services. The Town does have underground utility regulations. Have Impact Fees for Public Safety Building (\$1,3000), also the High School (\$13,000 prior before paid off).

Many of these problem statements were developed into Actions discussed later in **7 PRIOR ACTION STATUS** and **8 MITIGATION ACTION PLAN**.

Potential Losses from Natural Disasters

Natural disasters, including floods, wind events, severe winter storms and ice storms, secondary disasters as a result of the natural disasters (such as power loss) and to a lesser degree, human and technological hazards as documented in **4 HAZARD RISK ASSESSMENT** have occurred in Bow. This section estimates Town-wide structure/building damage in Town from natural hazard events. It is difficult to ascertain the amount of damage caused by a hazard because the damage will depend on the hazard's location and magnitude, making each hazard event somewhat unique. Human and technological hazards are typically even more incalculable. Human loss of life was not included in the potential loss estimates for natural hazards, but could be expected to occur, depending on the severity of the hazard.

While this Plan focuses on being pro-active in those geographic areas of Bow most prone to recurring hazards (like flooding), some initial estimates of measurable property damage and building damage have been discussed by utilizing simple techniques such as the numbers of structures and assessed valuation. This two-dimensional approach of calculating dollar losses from tangible structures offers a basic yet insightful tool to begin further loss estimation analyses.

TOOLS FOR COMMUNITIES WITH GIS

For gauging more three-dimensional estimation of damages, FEMA has developed a software program entitled HAZUS-MH (for multi-hazard), which is a powerful risk assessment software program for analyzing potential losses from floods, hurricane winds and earthquakes. In HAZUS-MH, current scientific and engineering knowledge is coupled with the latest Geographic Information Systems (GIS) technology to produce estimates of hazard related damage before, or after, a disaster occurs. Developed for ARCGIS which produced the *Maps* for this Plan, HAZUS-MH takes into account various effects of a hazard event such as:

- Physical damage: damage to residential and commercial buildings, schools, critical facilities, and infrastructure;
- Economic loss: lost jobs, business interruptions, repair and reconstruction costs; and
- Social impacts: impacts to people, including requirements for shelters and medical aid.

Federal, State and local government agencies and the private sector can order HAZUS-MH free-of-charge from the FEMA Distribution Center. Bow should first ascertain whether a municipal geographic information system (GIS) of hardware and software is appropriate, and if so, consider training staff to perform models. With many Town existing and under-development infrastructure GIS data layers

available, HAZUS-MH could prove very helpful for estimating losses for the community on a disaster-specific basis. However, much staff time is necessary to train staff and maintain a GIS system. Official map generation is typically subcontracted out to other agencies now, including ***the mapping and appraisal company Avitar Associates of New England used by the Town*** and the Central NH Regional Planning Commission who developed the Maps for this **Hazard Mitigation Plan**.

METHODS OF POTENTIAL DOLLAR LOSSES BY NATURAL HAZARDS

A more manageable technique was used for loss estimation for the purposes of this **Hazard Mitigation Plan Update**. Natural hazard losses are calculated based on dollar damage ranges over the entire community, or in the case of flooding, buildings in the Special Flood Hazard Areas (SFHAs) are counted and their value is collected. The number of total parcels in the community as of **March 2018** is **3,433**. Using **March 2018** assessment data, **the total assessed value of all residential and non-residential structures ONLY in Bow \$942,937,900** is the basis for loss estimation calculations.

Potential Building Dollar Losses by SFHA Flooding

Using geographic information system (GIS) technology, parcels within the floodplain were identified using Bow's **2018** digital online tax maps concurrently with the **2010** FEMA Digital Flood Insurance Rate Maps (DFIRMs). Next, parcels containing buildings were identified using the **September 2018** Town tax assessor's database for the Town. Buildings in the digital (DFIRM) Special Flood Hazard Areas (SFHAs) were verified using the new statewide Building Footprint data layer, so all those parcels in the SFHAs without the building itself in the SFHA were discarded. Without knowing the elevation of each building, this is the most accurate assessment to date identifying likely buildings in the **100**-year (**1%** annual chance) and **500**-year (**0.2%** annual chance) floodplains.

Building type, mirroring the previous data collected about Bow's Building Types (see **2 COMMUNITY PROFILE**) was characterized into one of four categories, Single Family Homes, Multi Family Homes, Manufactured Homes, and Non-Residential Buildings. Bow does not have Manufactured Homes but the category was retained for consistency. The number of buildings and their assessed structure value were excerpted from the assessing database. ***Land value, building contents value and infrastructure were not considered in these calculations.*** **Table 26** summarizes this data, identifying **35** primary buildings in Bow's SFHAs.

Table 26
Building Value in the Special Flood Hazard Areas (SFHAs)

Building Type	Number of Buildings	Total Value of Buildings in SFHA	Average Building Value
Single Family Homes	16	\$2,938,500	\$183,656
Multi-family Homes	0	\$0	\$0
Manufactured Homes	0	\$0	\$0
Non-Residential Buildings	19	\$20,857,800	\$1,097,779
Totals	35	\$23,796,300	-----

*Sources: CNHRPC Digital Parcel Data Intersection with 2010 DFIRMs,
Building Footprints and Town 09-18 Assessing Data*

In **Table 26**, **16** single family residential homes, **0** multi-family homes, **0** manufactured homes, and **19** non-residential buildings were considered to be situated the Special Flood Hazard Areas (SFHAs). The average assessed value is **\$184k** for a single-family home or **\$3m** for all single family homes in the SFHA. The average replacement value for a non-residential building is **\$1.1m**. The total value of all buildings in the Special Flood Hazard Areas is about **\$23.8m** which includes **\$20.9m** for the **19** non-residential buildings.

There are alternative ways to calculate potential SFHA losses. In the following tables, the average building value was calculated by adding the assessed values of all structures in the special flood hazard areas and dividing by the number of structures. The Federal Emergency Management Agency (FEMA) has developed a process to calculate potential loss for structures during flooding. The potential loss was calculated by multiplying the average building value by the percent of damage expected from the hazard event, and then by multiplying that figure by the number of structures.

The costs for repairing or replacing infrastructure such as bridges, railroads, power lines, roads, drainage systems, telephone lines, or natural gas pipelines, and land value and the contents of structures have not been included in these estimates.

Table 27 represents the **worst case scenario of all** single-family homes, multi-family homes, manufactured homes, and non-residential buildings within the Special Flood Hazard Area that are damaged by a flood hazard event.

Table 27

Dollar Damage Ranges for Total Buildings in Special Flood Hazard Areas (SFHA)

Building Type	Total Value of Buildings in SFHA	Total Value of Potential Damages in SFHAs by Respective Building Type		
		Eight-Foot Flood 49% Damage	Four-Foot Flood 28% Damage	Two-Foot Flood 20% Damage
Single Family Homes	\$2,938,500	\$1,439,865	\$822,780	\$587,700
Multi-Family Homes	\$0	\$0	\$0	\$0
Manufactured Homes	\$0	\$0	\$0	\$0
Non-Residential Buildings	\$20,857,800	\$10,220,322	\$5,840,184	\$4,171,560

Sources: See **Table 26**; FEMA

If all 16 single family homes were damaged by a **Two-Foot Flood (20% Damage)**, the dollar damage to the structures could be **\$590k** while an **Eight-Foot Flood (49% Damage)** could cause **\$1.4m** in damage. If all 19 non-residential buildings in the SFHA were damaged by a **Two-Foot Flood**, the dollar damage to the structures could be **\$4.2m** while an **Eight-Foot Flood** could cause **\$10.2m** in damage. Dollar damage estimations vary according to the standard percentages of damage levels associated with flooding levels set by FEMA. **Land value, building contents value and infrastructure were not considered in these calculations.**

Table 28 also represents the worst case scenario, but of *individual* single-family homes, multi-family homes, manufactured houses, and non-residential buildings within the Special Flood Hazard Area that are damaged by a flood hazard event.

Table 28

Dollar Damage Ranges for Individual Buildings in Special Flood Hazard Areas (SFHA)

Building Type	Average Value of Individual Buildings in SFHA	Individual Value of Potential Damages in SFHAs by Respective Building Type		
		Eight-Foot Flood 49% Damage	Four-Foot Flood 28% Damage	Two-Foot Flood 20% Damage
Single Family Homes	\$183,656	\$89,992	\$51,424	\$36,731
Multi-Family Homes	\$0	\$0	\$0	\$0
Manufactured Homes	\$0	\$0	\$0	\$0
Non-Residential Buildings	\$1,097,779	\$537,912	\$307,378	\$219,556

Sources: See **Table 26**; FEMA

One (1) single family home averages **\$37k** if damaged by a **Two-Foot Flood** while an **Eight-Foot Flood** could cause **\$90k** in damages to that 1 home. One (1) non-residential building averages **\$220k** when damaged by a **Two-Foot Flood** while the projected dollar damage by an **Eight-Foot Flood** could cause **\$538k** in damages.

Although not an accurate assessment, these structure dollar damage estimates for **flooding** in the floodplains (SFHAs) provide a general sense of the scale of potential disaster and financial need in the community during flooding events.

Potential Building Dollar Losses by Other Natural Hazards

Flooding is often associated with heavy rains and flash floods, hurricanes, ice jams, rapid snow melting in the spring, and culvert washouts. These are all types of flooding hazards discussed or evaluated previously but can also occur outside of the SFHA.

Building damage by natural disasters in New Hampshire is not limited to SFHA flooding alone, which is easier to quantify and predict. Simple calculations can be made based upon generalizations of a disaster impacting a certain percentage of the number of buildings in the Town. **The March 2018 assessed value of all residential, commercial, and industrial structures in Bow is \$942,937,900 (no land) on 3,433 parcels.** Disaster damages are often illustrated in the following section utilizing a percentage range of town-wide building damage. At **2,946** housing units in Bow estimated from the **2017** NH Office of Strategic Initiative (NH OSI) population estimates, any type of disaster impact to **10%** of Bow housing units would yield **295** damaged homes.

The inventory of Town sites or buildings in **APPENDIX A Critical and Community Facilities**

Vulnerability Assessment indicates which hazards each site is most susceptible to and provides its assessed valuation. This dollar value can be used as a damage estimate from the natural hazard events listed below. Yet the potential losses discussed in this section involve all buildings across the community to provide a more distinct portrait of potential losses using the assessed valuation of all town buildings. Damages from natural hazards to anything other than buildings, such as infrastructure, land, humans or building contents, are not examined here. Specific individual studies would be needed to assess more detailed scenarios.

Wind Events

Damage caused by wind events such as **tropical storms & hurricanes, downbursts, tornadoes** and **severe wind storms** can be both excessive and expensive. Bow's roadways are wooded, and any event topples trees and often power lines onto the roads. This rural, hilly community is heavily forested with residences spread out throughout the Town. Most neighborhoods are easily isolated. The assessed value of all residential, commercial, and industrial structures in Bow is **\$942,937,900** (no land).

With a scenario range of **1%** to **5%** of buildings damaged by wind events throughout the Town, a wind event could potentially cause up to **\$9.4m (for more localized downburst, high winds, or tornadoes)** to **\$47.1m (for more damaging and widespread tropical storms and hurricanes)** in building-only damage costs, not including contents, infrastructure, or land.

Severe Winter Weather

Heavy **snow loads, icy conditions, extreme cold, wind chill**, and the secondary hazards (including **power failure, transportation accidents and debris impacted infrastructure**) are result of **winter storms**. Storms with these conditions have been felt in Bow in the past. These hazards and secondary impacts are a risk to the community, including isolation, more falls and personal injury (especially by the older residents), and the potential for roof collapse. The most remote locations in Bow, wooded and forested sections vulnerable to tree fall including the over **2** dozen cul-de-sac neighborhoods. Damage caused by this type of hazard varies according to wind velocity, snow accumulation, tree/limb fall and duration.

With a scenario range of **1% to 5%** of buildings damaged throughout the Town, **severe winter storms** could potentially cause up to **\$9.4m to \$47.1m** in building-only damage costs.

Rapid Snow Pack Melt

Flooding caused by **rapid snow pack melt** is often found along roadways and from watercourses such as the brooks and wetlands in Town. Those locations which are particularly susceptible include the floodplain, Bow Junction, and the NH 3A area. Any hilly gravel roads with limited drainage or anywhere the water cannot yet percolate into the frozen ground could be vulnerable to snow melt.

With a scenario of **0.5%** of buildings flooded throughout the Town, **rapid snow pack melt flooding** could potentially cause **\$4.7m** in building-only damage costs alone, not including contents, infrastructure, or land.

River Ice Jams and Debris Impacted Infrastructure

Ice jams on the Merrimack River, Turkey River or the local large brooks would be the major causes of **ice jam flooding** which could recur in the future, particularly along the I-89 ramps, South Street Bridge, and Garvins Falls Dam. Woody material causing **debris impacted infrastructure** would be more likely to occur to bridges than ice jams, in the smaller locations. Two (**2**) closed red-listed bridges in Bow are owned by the Town Page Road over Bela Brook, Dunklee Road over Bow Bog Road which is waiting for NHDOT funding. Multiple additional small brooks culverts and drainage systems abound. The **2019-2028 NH Department of Transportation Ten Year Plan (TYP)** provides many examples of basic cost estimates bridge replacement and rehabilitation.

This average figure of **\$700,000** can be used for one (**1**) local bridge *replacement* in Bow due to the physical damage caused by **river ice jams or debris impacted infrastructure**. The same bridge damaged by **ice or debris** which only requires *rehabilitation* could cost **\$450,000**.

Another way to view potential damages is if half (**8**) of the **16** single family homes in the floodplain were damaged by **Two-Foot Flooding (20% Damage)** resulting from **river ice jams or debris impacted infrastructure**, there could be up to **\$294m** in building damage costs.

Earthquake or Landslide

Earthquakes can cause buildings and bridges to collapse, disrupt water supplies, electricity and phone lines and are often associated with **landslides** and **flash floods**. Buildings that are not built to a high seismic design level or are large in size could be susceptible to structural damage. Historic Town Buildings (Old Town Hall, Bow Bog Meetinghouse, historic old Schools, Churches), White Rock Senior Living Community and the **3** Bow Schools are particularly at risk because of building sizes and/or their large numbers of people. The Bow Water District water delivery pipes, pump house and water tower may be more prone to **earthquake** damage because of age and structural integrity. The large Garvins Falls Dam along **Merrimack River** could be vulnerable, but also disastrous if breached. Loss of these or other community buildings could result in fewer services available to residents. Buildings which are located on or near the sides of river and stream banks or that are located on a hill over **15%** could be subject to **landslide** triggered by rains or **erosion**. The Central NH Region area with Boscawen, Webster, Hopkinton (Contoocook), Henniker, Hillsborough and Warner (Davisville) hosts frequent epicenters of deep earthquakes.

With a scenario of **0.5%** of buildings damaged throughout the Town, an **earthquake** or **landslide** could potentially cause up to **\$4.7m** in building-only damage costs alone, not including contents, infrastructure, or land.

Wildfire

The risk of **wildfire** is difficult to predict based on location. Forest fires are more likely to occur during years of **drought**. In addition, areas and structures that are surrounded by dry vegetation that has not been suitably cleared are at high risk. Humans can contribute by accidents in the woods or dry fields, or by the deliberate setting of **fire** in a structure. The heavily forested woodlands of Town are often remote locations and difficult to access by emergency vehicles. The remote homes and woods of dozens of one-egress access residential subdivisions and the over **1,000** acres of Town Forest where people could be recreating at any given time are particularly vulnerable to **wildfire** especially where there may not be anyone around to report it until the fire is large. Businesses and manufacturing are also spread throughout the Town, often with large businesses surrounded by woods. The Fire Department displays a Fire Danger sign visible from Bow Center Road. Dollar damage would depend on the extent of the fire, the number and type of buildings burned, and the amount of contents destroyed within the buildings.

With a scenario of **1.0%** of buildings damaged in the Town, a **wildfire** could potentially cause up to **\$9.4m** in building-only damage costs alone, not including contents, infrastructure, or land.

Lightning

Damage caused by **lightning** would not be Town-wide because it typically strikes in smaller areas. Few places in Bow are at specific risk but lightning strikes can cause fires. Damages will vary according to the value of the structure and home and the contents inside, and dollar amounts would depend on if the hazard hit an area with a high density of buildings. Specific sites which would cause the greatest impact if struck by **lightning** include the 6 communications towers, Old historic buildings, 3 Schools, high tension

power lines, telephone lines, power lines, Bow Water District with its Water Pump Station and Water Tower. The telecomm towers in Town are frequently struck by **lightning**.

With a scenario of **0.5%** of buildings damaged throughout the Town, a **lightning strike** could potentially cause up to **\$4.7m** in building-only damage costs alone, not including contents, infrastructure, land, or through fire spreading.

Drought

Drought is often declared on state-wide or region-wide basis, and sometimes by individual town. Dollar damage caused by drought would be difficult to quantify, but would most likely impact the agricultural and economic base of a community. Although everyone could be charged to conserve water, orchards, farms, and nurseries would be most affected.

As physical damage is usually isolated to specific locations, the effects of potential disasters at certain facilities could be researched utilizing the Town's assessor's database for valuation on targeted land. Agricultural land may be among the most affected by drought. Many farm operations have been inventoried in Bow. People who rely on well water, which is everyone outside of the Bow Water District, have found the dug wells running dry in **2015-2016** and again in **2018**. The woods and Town forests become drier, and are also susceptible to loss during **drought** conditions.

These lands could be vulnerable to **droughts** and may become physically and economically damaged by these long-term droughts. A dollar estimate is incalculable at this time.

Severe Winds, Rainstorms and Thunder Storms

This general **storm** hazard crosses into other hazards previously mentioned, including the **wind events, flooding** and **lightning**. When summer **rainstorms** or **thunderstorms** occur, they are often regional in nature, but could just as commonly be localized in some areas, easily identifiable when one section of a roadway is dry and another section of the same road is wet. Sometimes **hail** accompanies these storms. **Thunderstorms** and **rainstorms** are more likely to damage trees, powerlines or crops than buildings. These storms typically cover most of, if not the entire, Town, as **winds** and **rainstorms** are large enough and blow through to impact multiple New Hampshire counties.

When buildings are damaged, any of the separate hazard events (**wind, flood, hail or lightning**) could have debilitated the structures. With a scenario of **0.5%** of buildings damaged throughout the Town, a **rainstorm** or **thunderstorm** could potentially cause up to **\$4.7m** in building-only damage costs alone, not including contents, infrastructure, land or through **fire** spreading from **lightning**.

Extreme Heat

Similar to **drought** cataloged above, **extreme heat** can harm landscaping and agriculture. People will draw more water from their wells to help alleviate these conditions. Extreme heat can sicken people, causing sunstroke, heat exhaustion and dehydration if the environment is not cool enough or water intake is too

low. In this manner, extreme heat is not measurable for dollar damage. An inventory of **Vulnerable Populations** was undertaken which can be used by emergency responders to ensure the most susceptible people remain healthy.

Critical Facilities Buildings

The dozens of Bow essential facilities, utilities, dams, bridges, and shelters and medical facilities are inventoried in **APPENDIX A Critical and Community Facilities Vulnerability Assessment**. provide the **Structure Only Value \$** from the Town's **appraisal systems**. The **Structure Only Valuation \$** from the Town's **appraisal systems** provides an idea of the possible building-only damage loss, and multiple hazards are identified which may damage each inventoried building. Therefore, if the Town wanted to ascertain the damage cost from any natural hazard to an individual critical facility, the assessed structure values are readily available for consideration. In addition to the **APPENDIX**, critical facilities in Bow are displayed on [**Map 3 Critical and Community Facilities**](#).

Community Facilities Buildings

The dozens of community facilities such as vulnerable populations, recreation and gathering sites, historic sites, economic assets, hazardous materials facilities, and more are inventoried in **APPENDIX A Critical and Community Facilities Vulnerability Assessment**. The **Structure Only Valuation \$** from the Town's **appraisal systems** provides an idea of the possible building-only damage loss, and multiple hazards are identified which may damage each inventoried building. Therefore, if the Town wanted to ascertain the damage cost from any natural hazard to an individual community facility, the assessed structure values are readily available for consideration. In addition to the **APPENDIX**, community facilities in Bow are displayed on [**Map 3 Critical and Community Facilities**](#).

National Flood Insurance Program (NFIP)

In 1968, Congress created the National Flood Insurance Program (NFIP) to help provide a means for property owners to financially protect themselves. The NFIP offers flood insurance to homeowners, renters, and business owners if their community participates in the NFIP. Participating communities such as Bow agree to adopt and enforce ordinances that meet or exceed FEMA requirements to reduce the risk of flooding. For more information on the National Flood Insurance Program, visit https://www.floodsmart.gov/floodsmart/pages/about/nfip_overview.jsp.

The initial identification of the Special Flood Hazard Areas (SFHAs) occurred in **May 1974** with the first Flood Hazard Boundary Map on **September 24, 1976** and the first Flood Insurance Study (FIS) in **August 1978**. The first FIRMs were developed **April 16, 1979**, and there were three subsequent revisions until **2010**. Records indicate Bow has been a participant in the National Flood Insurance Program (NFIP) since **August 1978**. Like the other Central NH region Merrimack County communities, no amended FIS was developed for the Town until almost four decades later.

In the present day, Bow's effective FIRMs are digital (DFIRMs) dated **April 19, 2010** as is the Merrimack County Flood Insurance Study (FIS) which includes Bow (community **#330107**); individual community FIS are no longer being developed. These **2010** newest documents were adopted by the Board of Selectmen, supercede all previous NFIP documentation, and are placed into the Town Zoning Ordinance. **Table 29** summarizes the historical background of the Town's NFIP effective dates.

Table 29
NFIP History of Bow – Effective Dates

Flood Insurance Study (FIS)	Flood Insurance Rate Maps
August 1978	April 16, 1979
August 1978	Oct 16, 1981
August 1978	Nov 20, 2000
April 19, 2010	April 19, 2010

Source: FEMA Merrimack County Flood Insurance Study (FIS) Table 7, 2010

BOW'S NFIP STATISTICS

In **Table 30** is a cumulative history of the trends and overall totals of flood insurance policies and losses of those property owners utilizing the NFIP insurance in Town. Three snapshots in time, one from each of Bow's **Hazard Mitigation Plan** versions, display the number of NFIP policies in force and paid loss statistics between **Sep 2006 and July 2018**.

Table 30
History of NFIP Policy and Paid Loss Statistics

Report Date	Policies in Force	Insurance in Force	Number of Paid Losses Since 1978	Total Losses Paid Since 1978
Sept 2006	15	\$5,125,000	4	\$155,069
July 2012	20	\$8,165,400	6	\$508,061
July 2018	18	\$7,827,600	6	\$508,061

Source: Bow Hazard Mitigation Plan 2013, FEMA last accessed 09-14-18

From **Table 30**, in **Sept 2006** after the **2006 Mother's Day Flood** interestingly had the lowest number of NFIP flood insurance policies in force sampled, totaling **15** policies. Six years later, by **Jul 2012**, **20** flood insurance policies were active on properties across Bow, a **+5** policies increase. As of the **Jul 2018**, there are **18** policies active, a **-2** policies decrease over this **6**-year period.

To date, since Bow joined the NFIP in **1978**, there have been **6** payouts totaling about **\$508k** in paid losses to policyholders for insurance claims. There have been no new claims since before **Jul 2012**. The overall lackluster number of policies since could be influenced by the lack of current flooding events, recent changes in flood insurance regulation, and the higher cost of insurance, or because people are unaware flood insurance exists for everyone.

Table 30 also illustrates that while all Bow landowners are eligible to purchase flood insurance for their property, **only 18 properties out of the 3,433 total parcels in the entire community are insured against flooding**. As described previously, a total of **16** homes and **19** non-residential buildings are likely to be situated in the Special Flood Hazard Areas (SFHA). Assuming the **18** policies' properties are within the SFHA, **51%** of buildings in the floodplain (**Zone A 1.0% annual** and **Zone X 0.2% annual**) are insured against flooding.

Most buildings are uninsured in the SFHA for when the next flooding event occurs in Bow. However, flooding conditions can occur anywhere in the community due to runoff, debris impacted infrastructure (culverts), drainage overflow, rapid snowpack melt, road washouts, etc which are not limited to the floodplain (SFHAs).

REPETITIVE LOSS PROPERTIES

A specific target group of properties is identified and serviced separately from other NFIP policies when repetitive losses occur on the same properties. The group includes every NFIP-insured property that, since **1979** and regardless of any change(s) of ownership during that period, has experienced four or more paid flood losses of more than \$5,000 each or two or more separate claim payments (building payments only) where the total of the claims exceeds the current value of the property. Two of the claim payments must have occurred within 10 years of each other. The loss history includes all flood claims paid on an insured property, regardless of any changes of ownership, since the building's construction or back to **1978**.

Bow joined the NFIP in **1978** and has **(0)** repetitive loss properties (RLP) in the community, even after the significant flooding and infrastructure damage sustained over the active **flood** and **storm** disaster period of **2005-2012** (See **4 HAZARD RISK ASSESSMENT**). **Table 31** displays the repetitive loss data:

Table 31
Number of Repetitive Loss Properties

Building Type	Number of Repetitive Loss Properties
Single Family	0
Multi-Family	0
Non-Residential	0
Total Properties	0

Source: NH Office of Strategic Initiatives (NH OSI) on behalf of FEMA, 03-31-18

These RLP data records are confidential for the property-specific information they contain. Repetitive losses are determined by any repetitive damage claims on those properties that hold flood insurance through the NFIP.

FLOODPLAIN ORDINANCE

A major objective for floodplain management is to continue participation in the National Flood Insurance Program. Communities that agree to manage Special Flood Hazard Areas shown on NFIP maps participate in the NFIP by adopting minimum standards. The minimum requirements are the adoption of the Floodplain Development Ordinance and Subdivision Regulation / Site Plan Review requirements for land designated as Special Flood Hazard Areas (SFHAs). Flood insurance is available to any property owner located in a community participating in the NFIP.

Community Assistance Visits in Bow

A Community Assistance Visit (CAV) is a process required by the National Flood Insurance Program (NFIP) as a way of reviewing a town's compliance with established floodplain regulations to be sure that they meet NFIP requirements. If the Town is not in compliance with regulations in any way, the officials that conduct the CAV provide assistance and guidance to assist with correcting any violations.

Since the NH Office of Strategic Initiatives (NH OSI) and FEMA do not identify Bow as a repetitive loss community, which is based upon **Table 31** data, the Town is classified as a **Tier 2** community. In the Repetitive Losses Program (RLP), **Tier 1** communities will have a new CAV process undertaken every five years or if a severe flooding event occurs in Town. Otherwise, a telephone call may be made to the community every 5-10 years or otherwise as needed when classified as a **Tier 2** community.

On **June 27, 2005**, a Community Assistance Visit (CAV) was held in Bow to review compliance with NFIP policies and educate staff on the policies by CNHRPC staff. Findings of the visit were summarized in a letter dated **July 6, 2005** to the Chair of the Board of Selectmen. According to the letter, the Town of Bow Zoning Ordinance, Subdivision Regulations, Site Plan Review Regulations, and Building Permit Application process then conformed to all National Flood Insurance Program (NFIP) requirements. The Town was advised to label or separately file permits issued in the floodplain, which has been done since the CAV. It was noted that a biennial report was due, which was mailed in **July 2005**.

In **2017**, another CAV was conducted in Bow by the NH Office of Strategic Initiatives. No additional notes were provided regarding this CAV.

Several rounds of changes were made to the Zoning Ordinance and the Planning Board's Site Plan Review and Subdivision Regulations in following years in accordance with FEMA requirements.

Although Bow is **Tier 2** community with no reported repetitive losses, future flood events could cause NFIP policy holders to file a claim, resulting in a future reclassification to **Tier 1**. As needed, a follow up phone call should be made by NHOSI to request a review of Community Development and Code Enforcement procedures and the contents of the Floodplain Ordinance, Subdivision Regulations and Site Plan Review Regulations after **2023**, when this **2018 Plan** expires.

Floodplain Ordinance Amendments

The Town of Bow has a Floodplain Development Ordinance that currently contains the required FEMA regulations to remain eligible for the NFIP. The Town of Bow approved their first Floodplain Ordinance in **March 13, 1979** along with the FIRMs.

Over time, Bow voters have approved revisions to the Floodplain Development Ordinance. Changes were made to the Ordinance in **1988** (replaced Environmental Protection Areas with Floodplain Development Ordinance), **1994** (added regulations for recreational vehicles in floodplain), **2006** (required waiver of liability for building permits in floodplain), **2008** (updated definitions and administration), **2010** (referenced new maps and added Board of Selectmen adoption provisions), and **2012** (added design standards to new construction).

The revisions of **March 2010** to corrected and added language and inserted the new, adopted effective **April 19, 2010** Digital Flood Insurance Rate Maps (DFIRMs).

The **2018** Bow Zoning Ordinance contains all the elements to date requested by FEMA and the NH Office of Strategic Initiative's Floodplain Management Program.

NFIP Familiarity in Bow

According to NFIP policies, when an applicant files a request for a building permit in the floodplain, the applicant must include an elevation certificate in order to be in compliance. In addition, if an applicant intends to fill onsite, a letter of map revision must be submitted along with the application. According to NFIP requirements in the Floodplain Ordinance, building permits should be reviewed to assure sites are reasonably safe from flooding and require anchoring to prevent flotation, collapse, or lateral movement and construction out of flood resistant materials.

Ongoing attention and familiarity with the NFIP will keep Town staff and volunteers in top form. In order to reduce flood risks, the Code Enforcement Officer, Town Assessor, Community Development Department, volunteer Planning Board members, and other Town staff whose duties include review/inspection of development or construction, should be familiar with the Floodplain Ordinance and the NFIP.

Because of their unique position to ensure development conforms with ordinances prior to approval, the Community Development staff and Planning Board should be familiar with NFIP policies, especially those regulations that are required to be incorporated into the Subdivision and Site Plan Review regulations. A workshop sponsored by the NH Homeland Security and Emergency Management (NHHSEM) or the NH Office of Strategic Initiatives (NHOSI) would be appropriate to educate current staff and volunteers. New online courses by FEMA for floodplain management, mapping, elevation certificates and more are available at no charge. For online training taken at the convenience of the individual, see the [FEMA Emergency Management Institute's](https://www.training.fema.gov/is/searchis.aspx?search=Flood&all=true) current training course index for flooding:

<https://www.training.fema.gov/is/searchis.aspx?search=Flood&all=true>

An essential step in mitigating flood damage is Town and property owner participation in the NFIP. Bow should work to consistently enforce NFIP compliant policies to continue its participation in this program. Currently, Town staff are fielding many property owners asking for assistance because their mortgage lenders are requiring proof that the properties in question are not located in a Special Flood Hazard Area to determine whether NFIP flood insurance is required. The only way to rectify this growing problem is to have a survey done of the property to complete a Certificate of Elevation to keep on file at the Town Office. If the property is shown to be located out of the floodplain, a Letter of Map Amendment should be completed by the owner or by the Town to ensure future flood maps are corrected. This time of interaction with property owners is emotional and intense and may therefore not be the best time to advertise the availability of flood insurance.

When possible, Town staff should try to promote flood insurance to property owners in Town; only **18** properties out of the **3,433** parcels in Bow are protected by flood insurance and currently take advantage of the NFIP insurance opportunity. Informational links for the public on flood topics could be located on the Town's website at www.bownh.gov.

6 CAPABILITY ASSESSMENT

Local mitigation capabilities are existing authorities, plans, ordinances, policies, mutual aid, programs, staffing, technical skills and assets, funding, outreach, public education, and resources that reduce hazard impacts or that could be used to help implement hazard mitigation activities. These capabilities were inventoried for the **Bow Hazard Mitigation Plan Update 2018**.

The **Capability Assessment** contains an inventory of locally-important existing mitigation support activities, or capabilities, which have a positive impact on the way hazard events are handled within the community. Most capabilities are not hazard mitigation Actions but support the Action Plan and help decrease the community's hazard risk. These community-strengthening capabilities are not STAPLEE-rated (Social Technical Administrative Political Legal Environmental and Economics questions) like the Actions, but instead the capabilities serve to sustain and assist the community to maintain and accomplish its hazard mitigation Actions and priorities. Selected **Future Improvements** (mitigation-oriented) to some of these capabilities have the potential to be considered as Actions in **7 PRIOR ACTION STATUS** and **8 MITIGATION ACTION PLAN**.

<u>Capability Assessment Types</u>
Planning & Regulatory
Administrative and Technical
Financial Resources
Education and Outreach

There are four overall Capabilities considered for which an inventory of mitigation support items was identified by the Hazard Mitigation Committee, **Planning & Regulatory**, **Administrative and Technical**, **Financial Resources**, and **Education and Outreach**.

Each Capability had inventoried the latest version or adoption Date; a Description of the item; the location of the capability in Town; the Level of Effectiveness of the Capability; which Department, Board or other has Responsibility for the capability; what Changes were made to the capability since the **2013 Hazard Mitigation Plan**; and Future Improvements to the Capability.

Town Capabilities

A summary of the items within the four Capability tables is provided here to offer a portrait of resources Bow has at hand to assist with mitigation. Careful consideration of each Capability's **Level of Effectiveness** helped the Departments to determine any clear **Future Improvements** to undertake. Many of the Town's Capabilities involved existing plans, procedures, reports, policies, regulations, and resource documents from individual Departments. These plans and documents were reviewed and incorporated into the **Capability Assessment**.

Future Improvements to these documents were identified and many later became Action items in **8 MITIGATION ACTION PLAN**. Capabilities of all Town Departments and the School District as related to hazard mitigation are detailed within the following tables.

Level of Effectiveness	Description
High	Capability is working well and is regularly followed
Moderate	Capability could use some revisions but is followed
Low	Capability is not working and needs revisions

DEPARTMENT ABBREVIATION KEY:

BOS	Board of Selectmen
CC	Conservation Commission
CD	Community Development Department
CE/BI	Code Enforcement/Building Inspector
CP	Capital Improvements Program Committee
EM	Emergency Management
FD	Fire & Rescue Department
PB	Planning Board
PD	Police Department
PR	Parks and Recreation Department
PW	Public Works Department
SD	Bow School District
TA	Town Administration
WD	Water District

Primary Mitigation Department

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6 CAPABILITY ASSESSMENT

PLANNING AND REGULATORY CAPABILITIES

The planning and regulatory capabilities displayed in **Table 32** are the plans, policies, codes, and ordinances that reduce the risks or impacts of hazards. There are 3 categories: Plans, Codes, and Regulations. Most of the documents listed below are the Town's documents, but others are School, local, regional, state and federal which support the Town's hazard mitigation goals, objectives, and/or Actions.

Table 32
Planning and Regulatory Capabilities

Latest Adoption or Version Date	Capability Assessment: Planning and Regulatory Resources	Description	Location of Capability	Level of Effectiveness	Responsibility	Changes Since Last Haz Mit Plan (2013)	Future Improvements to Plans
PLANS & PLANNING DOCUMENTS							
To be developed 2019	PD Capital Area Tactical Interoperable Communications Plan	Bow helped develop this plan, which documents communications resources available and who controls the resources, and what rules are in existence during activation of each resource. Large drill w/HSEM, DOT, Sheriff, other departments, Haz Mat, etc. upcoming.	Entire Town	High	Police Dept	Continued working to develop a Town wide frequency	Develop a written plan. Should have a yearly drill or when department heads change.
Oct 2017	FD Merrimack Station Reaction Plans	Fire Dept works with Merrimack Station staff. Have had meetings and discussions on how we would utilize each of our resources depending on various issues presented with various situations at Merrimack Station. We would always use a joint command structure when we have an incident at the power plant. Merrimack Station and Bow Fire Dept need to work well together to alleviate any problem occurring at their plant. Tour occurred with Merrimack Station of their buildings in August 2012. Have continued with the drills and had a fire/haz mat/mass casualty exercise completed on June 14, 2008. Continue to do	Merrimack Station	High	Fire Dept	Reviewed and conducted drills semi-annually. Met with head of new Merrimack Station. Last drill Oct 2017	Continue existing activities, which includes involve drills, exercises, and site visits.

Town of Bow, NH Hazard Mitigation Plan Update 2018

6 CAPABILITY ASSESSMENT

Latest Adoption or Version Date	Capability Assessment: Planning and Regulatory Resources	Description Related to hazard mitigation planning and coordination	Location of Capability	Level of Effectiveness	Responsibility	Changes Since Last Haz Mit Plan (2013)	Future Improvements to Plans
		annual site visits and examination of fire protection systems. Included the Central NH Haz Mat	Entire Town or Selected Areas				
2017	FD Capital Area Public Health Plan	Capital Area Public Health Plan identifies Bow High School as an inoculation site for towns (POD).	Bow High School, Entire Town	High	Fire Dept	Updated the Plan, developed POD Plans for Bow, and conducted an actual activation for H1N1 in 2017.	Complete the new regional shelter plan. Drill at least once per year (Mar 2018). Continue to enhance the operational POD Plan document.
2017	EM Emergency Operations Plan, 2017	Bow fire officers meet with the three schools during monthly sessions to plan and train for life protection. Prior EOPs developed in 2006 and 2012.	Entire Town	High	Fire Dept	Updated in summer 2017.	Practice drills with Police Department, Schools, Public Works, Fire Department and all others.
2017	EM Multiple Emergency Plan Development and Update Program	Updates of LEOP, Hazardous Materials Plan, and the development of shelter plans, POD plans, public water supply treatment plans, school plans, and day care plans.	Entire Town	High	Emergency Mgt	Updated LEOP and developed Water Supply Protection Plan, Haz Materials Plan, local shelter Plans, Emergency Action Plans for schools and daycares.	Currently working on EAP and COOP for all Town Departments. Continue to update and create plans as appropriate.
2017	PB Master Plan 2017	Developed by the Planning Board, includes Community Facilities, Transportation, Natural Resources, Utilities, Land Use, etc.	Entire Town	High	Planning Board	Updated MP in 2017	Boards and Departments should review their list of recommendations. PB should review annually.
2018	CP Capital Improvements Program	Strategic 6-year long term planning for improvement of Town equipment over \$25,000 Put funding away. Several Capital Reserve	Entire Town	Moderate	Capital Improvements Program	Updated annually	Continue to update annually and place funding into CRF for

Town of Bow, NH Hazard Mitigation Plan Update 2018

6 CAPABILITY ASSESSMENT

Latest Adoption or Version Date	Capability Assessment: Planning and Regulatory Resources	Description Related to hazard mitigation planning and coordination	Location of Capability	Level of Effectiveness	Responsibility	Changes Since Last Haz Mit Plan (2013)	Future Improvements to Plans
		Funds, sometimes take out funding intended for another project.			Committee		select hazard mitigation projects
Oct 2015	PB Subdivision Regulations	Contain minimum specifications for roads, lot sizes, infrastructure, drainage, buffers, easements, noise, erosion control, underground utilities, dams, etc for new residential development	New Subdivisions	High	Planning Board	Updated in 2015 and used by PB when reviewing applications	Revise the Subdivision application process to streamline review
Oct 2016	PB Site Plan Review Regulations	Contain minimum specifications for roads, lot sizes, infrastructure, impervious surfaces, buffers, landscaping, parks, erosion, egress, etc for non-residential or multi-family dwelling development	New Subdivisions	High	Planning Board	Updated in 2016 and used by PB when reviewing applications	Revise the Site Plan application process to streamline review
2017	EM Dam Operational Plans (DOPs)	Archives several NHDES High Hazard private dam plans on record that need to be reviewed. Most plans are done by engineers.	Dams	High	Emergency Mgt	Continued collecting current High (H) hazard DOPs	Continue to annually review the overall effectiveness of the dam plans
BUILDING CODES,	PERMITTING,	INSPECTIO NS					
Feb 2018	PW Bridge Inspections	DPW conducts routine inspections of the 5 Town-owned bridges in Bow. The State conducts annual inspections of all bridges.	5 Town-owned Bridges	High	Public Works Dept	Continued to regularly monitor the condition of red listed bridges	Continue to inspect bridges for repairs and replacement. Continue to place dam improvement funding into the Capital Improvements Program (CIP).
Summer 2017	PW Dam Inspections	DPW conducts routine inspections of the dams in Town. The State Dam Bureau conducts inspections of all dams. Debris from beavers. Weekly Monday morning inspection. Inspect weekly during spring, summer and fall seasons.	Town Pond Dam (fire pond)	High	Public Works Dept	Completed weekly inspections of Town Pond Dam	Continue to inspect and monitor dams. Continue to place dam upgrade projects into the Capital Improvements Program (CIP) and DPW Operating Budget.

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Latest Adoption or Version Date	Capability Assessment: Planning and Regulatory Resources	Description	Location of Capability	Level of Effectiveness	Responsibility	Changes Since Last Haz Mit Plan (2013)	Future Improvements to Plans
Mar 2018	PW Infrastructure Inspections	DPW conducts routine inspections and general maintenance of the Town's infrastructure. Assistance to other buildings is a phone call away (on-duty custodian).	Town Buildings	High	Public Works Dept	Completed weekly inspections of Town buildings.	Continue as funded to manage building maintenance. Continue to place infrastructure repairs and upgrades into the Capital Improvements Program (CIP).
Current as of 06-2018	BI Release of Liability for Building in the Floodplain	Building permit process has a flood release of liability form. Residents must sign a document stating they are building on the floodplain, which gets recorded in the Registry. Can build to slightly new codes.	Floodplain	High	Building Clerk / Code Enforcement Officer	Continued utilizing permits for building in floodplain	Maintain compliance of the flood zone construction practices as required in the building codes
Current as of 06-2018	BI Building Codes	The State has adopted statewide requirements for compliance of residential (2009 IRC) and commercial (2009 IBC) building codes	Entire Town	High	Code Enforcement Officer	State adopted the most recent & current editions of the building codes, as did the Town.	Zoning Ordinance is updated to coincide w/ current State version of building codes. Continue with compliance & enforcement practices
2009/2015	BI State Life Safety Code 2009, Construction Inspected by the Town Code Enforcement Officer and Fire Dept	New construction is continually evaluated during the process with the final inspection conducted by both the Fire and Building Officials prior to the issuance of a certificate of occupancy.	Entire Town	High	Code Enforcement Officer with Fire Dept assistance	Town only enforced when State adopts the new code	Would like to see the State adopt the current version
2009/2015	BI State Building Code (International Building Code 2009)	Contains a suite of residential, commercial, plumbing, electrical, mechanical, energy, and existing buildings	Entire Town	High	Code Enforcement Officer	Town still follows the code from 2009	Would like to see the State adopt the current version
2009/2015	FD NFPA 101 Life Safety	Contains 15 types of occupancies that may be	Places of Assembly,	High	Fire Dept	Continued inspections	Would like to see the State

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Latest Adoption or Version Date	Capability Assessment: Planning and Regulatory Resources	Description	Location of Capability	Level of Effectiveness	Responsibility	Changes Since Last Haz Mit Plan (2013)	Future Improvements to Plans
	Codes Occupancy Inspections	inspected by Fire Departments - Places of Assembly - Mercantile - Business - Health Care - Ambulatory Health Care - Residential Board and Care - Day Care - Educational - Apartment Buildings - Lodging or Rooming Housing - Hotel or Dormitory - 1 and 2 Family Dwellings - Industrial - Storage - Detention and correctional	Day Cares, and Educational sites			for these 3 types of buildings	adopt the current version
2009/2015	FD NFPA 1 Fire Codes Permitting	Section 1:12, and Table 1.12.7a specifically outline instances when permits are required	Select Structures	High	Fire Dept	Continued to issue permits	Would like to see the State adopt the current version
LAND USE PLANNING, ORDINANCES,		REGULATIONS					
Mar 2012	PB Floodplain Zoning District	Floodplain District reduces the damage of floods, based on FIRM map dated April 19, 2010. The ordinance was updated in 2008, 2010 and 2012. Revised 10.02 F Floodplain District Design Standards to require that new construction and substantial improvements be built at least two feet above the base flood elevation;	Floodplain (F) District	High	Planning Board	Revised Floodplain District Design Standards to require new construction and substantial improvements be built at least two feet above the base flood elevation.	Periodically revise and update the ordinance to maintain compliance with FEMA requirements and enhance to fit Bow's needs.
Mar 2015	PB Wetlands Conservation District Zoning Ordinance	Wetlands Conservation District protects water quality, flood storage, potential water supplies, and aquifers. The 1990 ordinance was updated regularly in response to	Wetlands Conservation District	Moderate	Planning Board	Revised for setbacks in underground fuel tanks and exempt certain logging	Periodically update ordinance in response to legal and scientific changes and to

Town of Bow, NH Hazard Mitigation Plan Update 2018

6 CAPABILITY ASSESSMENT

Latest Adoption or Version Date	Capability Assessment: Planning and Regulatory Resources	Description Related to hazard mitigation planning and coordination	Location of Capability Entire Town or Selected Areas	Level of Effectiveness	Responsibility	Changes Since Last Haz Mit Plan (2013)	Future Improvements to Plans
		changes in NHDES rules and Town needs.				operations from review.	fit Bow's needs. Increase enforcement.
2012	PB Aquifer Protection District Zoning Ordinance	Aquifer Protection District protects groundwater from contamination by regulated substances to preserve and maintain existing and potential drinking water supplies. The ordinance was updated in 2009, using the NHDES model ordinance and district expanded in 2012 to include Municipal Water Supply (MWS) Wellhead Protection Area (WHPA).	Aquifer Protection District	High	Planning Board with help from Drinking Water Protection Committee	PB used the Aquifer Ordinance when review applications.	Increase enforcement. Inventory & inspect all businesses in MWS WHPA registered for regulated substances.
Mar 2017	PB Buildable Land Requirement Zoning Ordinance	Buildable Land Requirement ensures that all developed sites have adequate area to support improvements outside areas of special hazards	Entire Town, Bow Mills Mixed Use District	High	Planning Board	Changed buildable land requirement because of Mixed Use District.	Review minimum standards and update as necessary.
2015	PB Soils Erosion and Sediment Control Plan Requirement (Subdivision & Site Plan)	Erosion Plan – major subdivisions and site plans must provide an engineered erosion & sedimentation control plan. Some individual house lots have bonds to cover their culverts.	Entire Town (New Developments)	Moderate	Planning Board	Revised for stormwater engineering in 2015	Continue to review the regulation and update as necessary to fit Bow's changing needs.
2013	PB Drainage and Grading Plan Requirement (Subdivision & Site Plan)	Engineered Drainage and Grading Plan ensures that storm drainage is infiltrated on site and does not cause erosion.	Entire Town (New Developments)	Moderate	Planning Board	Continued to use the Drainage and Grading Plan regulations when reviewing development applications	Periodically update in response to emerging technology.
2013	PB Fire Suppression Requirement (Subdivision & Site Plan)	For subdivisions or site plans that include 12 residential lots, a Fire Department approved fire Suppression/Water Supply, is required, such as a cistern or sprinkler system.	Entire Town (not on municipal water supply)	High	Planning Board w/ Fire Dept	Continued to use the Fire Suppression regulations when reviewing development applications.	Continue to review the regulation and update as necessary to fit Bow's changing needs.

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Latest Adoption or Version Date	Capability Assessment: Planning and Regulatory Resources	Description	Location of Capability	Level of Effectiveness	Responsibility	Changes Since Last Haz Mit Plan (2013)	Future Improvements to Plans
1999	PB Subdivision Road Limitations	Road Access – can only have a maximum of 12 lots on single access. Limit dead end roads or attempt to connect.	Entire Town or Selected Areas	Moderate	Planning Board	Continued to use the Fire Suppression regulations when reviewing development applications.	Attempt to interconnect the dozens of dead end roads in Town if possible.
2016	PB Road Design and Construction Standards (Subdivision /Site Plan Regulations)	Road design and construction provide specifications for building new & private Town roads and driveways. PB updated documents recently. Engineer contracted for application to follow the standards	Entire Town (New Developments)	High	Planning Board, with Public Works Dept	Increased pavement requirements from 3" to 4" total height.	Continue to review the regulation and update as necessary to fit Bow's changing needs.
Mar 2015 (zoning) Oct 2016 (site plan)	PB Standby Emergency Electricity Generators Zoning Ordinance (also Site Plan Regs)	Standby emergency electricity generators shall be provided for developments of Housing for Elderly and specified Multi-family Residential Dwellings. These provisions shall apply to all new developments and to renovations equal to or greater than 50% of structure value, that add elevator or chair lift, or that provide for health and life sustaining appliances	Entire Town (New Developments)	High	Planning Board	As of 03-18, the ordinance has not yet been tested.	Continue to review the regulation and update as necessary to fit Bow's changing needs.
2013	PB Excavation and Reclamation Ordinance	The Town has a materials excavation and reclamation ordinance which provides operational and reclamation standards.	Excavation Areas	High	Planning Board	Added the R-1 District to the definition for Minor / Pre-development Excavations in 2013	Continue to review the regulation and update as necessary to fit Bow's changing needs.

Source: Bow Hazard Mitigation Committee

Town of Bow, NH Hazard Mitigation Plan Update 2018

6 CAPABILITY ASSESSMENT

ADMINISTRATIVE AND TECHNICAL CAPABILITIES

The administrative and technical capabilities in **Table 33** include staff, volunteers, and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions. Smaller jurisdictions without local staff resources often rely on public or shared resources. There are 3 categories: Admin Programs, Staffing, and Technical Capabilities.

Table 33
Administrative and Technical Capabilities

Latest Adoption or Version Date	Capability Assessment : Administrative and Technical	Description	Location of Capability	Level of Effectiveness	Responsibility	Changes Since Last Haz Mit Plan (2013)	Future Improvements to Plans	
ADMINISTRATIVE		PROGRAMS AND POLICIES						
Oct 2017	PD Merrimack Station Security Collaboration	Working with Merrimack Station to enhance security measures. Will include plans and training. Town Officers conduct trainings and site visitations to maintain familiarity with the site. Conducted an active shooter/haz mat/motor vehicle exercise on site in 06-08 to evaluate the effectiveness of plans and procedures. Kept same security measures as from Eversource to use for new owner of Merrimack Station.	Merrimack Station Facility on River Road	High	Police Dept	.Conducted haz mat exercise on site 10-17 to evaluate the effectiveness of plans and procedures with off-site release involving 3 other communities. Will wait to drill again until contact with owner initiated	Continue to maintain the relationship with Merrimack Station and Town emergency services.	
Nov 2016	PD Mutual Aid Agreement (MAA)	Mutual aid agreement with Weare and New Boston Hooksett, Dunbarton, Hopkinton, and Concord, in addition to State Police. Dispatch out of Merrimack County. Trying to increase communications with schools and Town. Recently added Allenstown, Pembroke, Pittsfield, Loudon, Laconia, and UNH.	Entire Town	High	Police Dept	Added new to agreement: Allenstown, Pembroke, Pittsfield, Loudon, Laconia, and UNH.	Each new Dept is responsible for establishing mutual aid agreements. MAA will continue with other communities.	
Nov 2016	PD Standard Operating Procedures	The SOPs are currently being developed. Collaborative effort among Departments. Developed water system protection measures (new) procedure, and installed security fences, alarm systems and	Entire Town	High	Police Dept	Continued revisions, including K-9, Critical Incident Management, Facility & Emergency, Holding &	Continue updating Standard Operating Procedures to maintain compliance	

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6 CAPABILITY ASSESSMENT

<u>Latest Adoption or Version Date</u>	<u>Capability Assessment</u> : Administrative and Technical	<u>Description</u> Related to hazard mitigation planning and coordination	<u>Location of Capability</u> Entire Town or Selected Areas	<u>Level of Effectiveness</u>	<u>Responsibility</u>	<u>Changes Since Last Haz Mit Plan (2013)</u>	<u>Future Improvements to Plans</u>
		cameras along water system. SOPs include patrol, media relations, firearms, pursuits, roadblocks, search and seizure, and training.				Confinement, Uniform & Appearance, Death & Injury notification, Key Fob	and uphold safety.
Feb 2018	PD Explorer Post	For age 14-21 young adults interested in law enforcement, Bow Police Explorer Post provides training. Purpose is for young adults to provide support in times of need to PD: Parking and traffic control, public relations and notification, and general support during disasters.	Entire Town	High	Sergeant	Meet twice per month, also trail with FD on different activities, including water rescues, extraction, CPR & First Aid, ICS 100. Five (5) Explorer members attended CERT training.	Explorer Post should become more integral with the Town's emergency operations. Continue training in law enforcement related issues as well as emergency first aid, search and rescue, communications, and incident management.
2018	FD Standard Operating Procedures	All current, all continued to be updated. Collaborative effort among Departments. The Fire Dept will continue to develop the FD SOPs. One recently added for the new municipal water system.	Entire Town	High	Fire Dept	SOPs have been revised and updated. They are always a work in progress.	Continue to review and update SOPs and add new SOPs when relevant.
Mar 2018	FD Mutual Aid Agreements (MAA)	Bow is a member of Capital Area Fire Mutual Aid Compact with 20 towns in the greater Concord area. All towns required to have MAA drills in each community at least every other year. Historic drills included June 14, 2008 at Merrimack Station, a multi-hazard drill; 2010 tour of White Rock Senior Living; and August 2012 water supply using the new hydrant system.	Capital Area, including Bow	High	Fire Dept	Drills on Oct 2017 at Merrimack Station (3 towns), received mutual aid for house fire, Sullivan Tire, provided EMS to Concord, etc.	Continued expansion of MAAs to other communities, and continued response and communications capabilities

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<u>Latest Adoption or Version Date</u>	<u>Capability Assessment :</u> Administrative and Technical	<u>Description</u> Related to hazard mitigation planning and coordination	<u>Location of Capability</u> Entire Town or Selected Areas	<u>Level of Effectiveness</u>	<u>Responsibility</u>	<u>Changes Since Last Haz Mit Plan (2013)</u>	<u>Future Improvements to Plans</u>
Apr 12, 2011	EM NIMS Adoption	Board of Selectman adopted a resolution to adopt NIMS for all town departments.	Entire Town	High	Emergency Management	Used by all Dept engaged in emergency response	Continue to ensure NIMS strategies are used by all Town Depts
2016	PW Winter Road Maintenance Policy	Public Works Dept has a written winter maintenance policy which outlines priorities for plow routes, main lines and bus routes for hazardous conditions.	Entire Town	High	Public Works Dept	Updated in 2016 (online)	Update as Infrastructure grows or every 5 years (2021) and make the policy available to the public
Mar 2018	PW Public Protection and Hazard Correction Procedures	Dept has unwritten procedures in place to protect the public first then correct the problem after being notified about a hazard by the Police or Fire Department.	Entire Town	High	Public Works Dept	Used on Brown Hill for a sinkhole in Mar 2018	Develop a written policy to enable other Depts to understand the responsibility
Jan 2018	PW NH Public Works Mutual Aid Compact Member	Developer and maintainer of the NH Public Works Mutual Aid Compact. Town has both received and provided aid in the last year.	Entire Town	High	Public Works Dept	Continued to utilize the mutual aid. Continued annual drills.	Continue to undertake training for Mutual Aid
Mar 2018	EM Capital Area Public Advisory Council Member	As a member of the Capital Area Public Advisory Council, the EMD actively participates in RCC, CERTS, CAPHN and MRC activities as well as having a regional sheltering agreement with other participating towns in the CAPHN network.	Entire Town, Region	High	Emergency Management	Developed a 3-day CERT program, updated the regional shelter plan	Continue membership and responsibility in activities to enable Bow to be safer from disasters.
2017	PD Traffic Management Procedures (SOP)	Traffic management procedures are used to control traffic corridors when an accidents, hazardous materials spills, or natural disasters occur. Invested in emergency traffic management equipment related to procedures. Training has also occurred.	Roadways, Schools	High	Police Dept	Worked on reunification with the schools, to lay out map of traffic control, how to get in buses and cruisers, apparatus & town vehicles.	Continue to work for reunification and encourage the schools to participate
Nov 2017	PD Member of NH SWAT	Member of Central NH State Police SWAT unit for high risk warrants, missing persons, barricaded	Town-wide	High	Police Dept	Funding for CNHSOU in by get for July 2018. Used	Trying to get in CNH SOU, Continue

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<u>Latest Adoption or Version Date</u>	<u>Capability Assessment:</u> Administrative and Technical	<u>Description</u> Related to hazard mitigation planning and coordination	<u>Location of Capability</u> Entire Town or Selected Areas	<u>Level of Effectiveness</u>	<u>Responsibility</u>	<u>Changes Since Last Haz Mit Plan (2013)</u>	<u>Future Improvements to Plans</u>
		subjects, hostage situations.				assistance in Nov 2017	participation in training
2017	FD Call "Response Cards"	Call "Response Cards" indicate who responds to which emergencies or disasters within the Mutual Aid (MAA) Compact. Town has 2 primary zones and target areas for MAA towns coming in.	Entire Town	High	Fire Dept	Updated in 2017 to change status of towns, adding engines to fire district (not tankers)	As Bow grows, reevaluate the effectiveness of the 2 protection zones and target areas.
Fall 2017	PW Procedures to Cutback Overgrown Limbs (Unwritten)	Removing overhanging (hazardous) limbs near power-lines will reduce that potential hazard in the Town. PW communicates with Unitil, who has a system to evaluate annually to make sure that branches are cut back from power lines to reduce the potential hazards from wind. PW follows RSAs for cutting trees along roadside.	Roadways	High	Public Works Dept	Continued annually, hazardous trees identified and removed.	Continue best management practices for roadside tree trimming. Consider writing policy
2013 (contract)	WD Regular Waterline Maintenance Programs	Contracted in 2013 by Whitewater Inc (10 year agreement), a subsidiary of RH White Utility. System could use some repairs or redesign.	Water Precinct	High	Water Precinct	Performed weekly inspections of waterlines and maintained when necessary.	Continue BMPs for water systems operations.
Aug 2017	SD School Evacuation and Lockdown Procedures	Evacuations and lockdowns are drilled with the schools on fire alarm.	3 Schools and Preschool at Municipal Building	Low	School Superintendent Office	Drilled Mar 2018, and held monthly drills with schools as described within School Emergency Procedures	Continue to review and enhance procedures to address the ever changing potential hazards within the school systems, and work with Town entities for overall cooperation.
TECHNICAL SKILLS,		TRAINING, ASSETS AND	RESOURCE S				
Current 06-18	PD Three Levels of Police Training	Progressive training is available to officers: first, Police Academy basic training, second, field	Entire Town	High	Police Dept	Added taser training and ATV training.	.

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<u>Latest Adoption or Version Date</u>	<u>Capability Assessment</u> : Administrative and Technical	<u>Description</u> Related to hazard mitigation planning and coordination	<u>Location of Capability</u> Entire Town or Selected Areas	<u>Level of Effectiveness</u>	<u>Responsibility</u>	<u>Changes Since Last Haz Mit Plan (2013)</u>	<u>Future Improvements to Plans</u>
		training program by three field training officers who document training to Town. Third, annual in-service training: including but not limited to computer crime, taser, urban rifle, accident reconstruction.					
Current 06-18	PD School Resource Officer	The SRO attends meetings, drafts alarm response procedures and in house procedures, provides copy of school admin procedures. Serves as liaison between PD and Schools.	Bow Elementary Middle, and High Schools	High	Police Dept	SRO has continued to be an integral part of school crisis planning and conducts regular drills/exercises to evaluates the plans	Continue to maintain the position and related activities.
Current 06-18	FD Bomb Scare Training	Fire Dept meets with schools' officials and Police Dept to plan for and provide solutions for bomb threats and scares.	Bow Elementary Middle, and High Schools	High	Fire Dept	Annually met with all staff of the three schools and the FD conducts routine site visits to maintain familiarity with essential facilities. Also conducted individual trainings held at the various schools.	Continue to review procedures for enhancing response to related incidents. Consider adding other critical/important facilities.
Current 06-18	FD Fire Fighter In-Service Training	Hold weekly in service training sessions. Members have to be recertified in certain areas annually and some are water rescue specialists. Training includes but is not limited to EMS-related activities, hazardous materials, rescue, etc and maintaining standard fire suppression skills per state and federal requirements	Entire Town	High	Fire Dept	All procedures have been reviewed and/or updated in addition to the mandatory recertification in all applicable areas and specialized training for technical rescues, water rescue, incident	Continue weekly in-service training in addition to specialized training at the state fire academy and national academy.

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<u>Latest Adoption or Version Date</u>	<u>Capability Assessment:</u> Administrative and Technical	<u>Description</u> Related to hazard mitigation planning and coordination	<u>Location of Capability</u> Entire Town or Selected Areas	<u>Level of Effectiveness</u>	<u>Responsibility</u>	<u>Changes Since Last Haz Mit Plan (2013)</u>	<u>Future Improvements to Plans</u>
						management, etc.	
Current 06-18	FD 24/7/365 Coverage	Enhancement of the FD program occurred to provide 24/7/365 coverage for fire and EMS operations at a minimum of the intermediate level.	Entire Town	High	Fire Dept	Enhancements to coverage	Aim to provide 24/7/365 service with increased full time staff levels at the paramedic levels for fire and EMS operations.
Current 06-18	EM Emergency Operations Center	Located at the Rescue Building (2 Knox Road). Backup is the Police Dept.	Entire Town	High	Emergency Mgt	Identification of new location, equipment, supplies, communications, and four activations in the past year.	Continuous meetings, drill scenarios, and trainings
Last Used in 2011	EM Emergency Shelters and Warming Centers	Cooling/Warming centers designated at Old Town Hall, Baker Free Library, and Bow Community building. Shelter designated at the Bow High School. Red Cross and NH DHHS approved with established regional mutual-aid agreement. Point of distribution drill in 2010. Shelter Activation with tropical storm Irene in 2011.	Old Town Hall, Baker Free Library, Bow Community building, Bow High School	High	Emergency Mgt	Continued to drill	Continual updates, training, and planning with appropriate ESFs and appropriate private and regional partners.
2018	EM Emergency Management Training	Applicable emergency management training to all town departments and EOC Staff. Conducted ICS, NIMS, EOC Workshops, and WEBEOC training	Entire Town	High	Emergency Mgt	Continued to train	Expand trainings
Current 06-18	EM Funding for Emergency Equipment	Emergency Management computers, overhead projectors, tables, communications, office equipment, through EMPG grants for HAZMIT update.	Entire Town	High	Emergency Mgt	Improved equipment and operations in EOC, newly built Safety Center	Look at grants for communications equipment and new safety complex equipment-generators, communications

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6 CAPABILITY ASSESSMENT

<u>Latest Adoption or Version Date</u>	<u>Capability Assessment :</u> Administrative and Technical	<u>Description</u> Related to hazard mitigation planning and coordination	<u>Location of Capability</u> Entire Town or Selected Areas	<u>Level of Effectiveness</u>	<u>Responsibility</u>	<u>Changes Since Last Haz Mit Plan (2013)</u>	<u>Future Improvements to Plans</u>
							ns, and weather stations.
Current 06-18	SD Safe Routes to School	Safe Routes to School project is being worked on by the School and Town Departments together to extend a sidewalk from Main St sidewalk into elementary school. This will make it safer for students to walk to school.	Elementary School sidewalk, Main Street	High	School District with Town Administration	Grant for Safe Routes to School project applied for and funding approved	Complete design work and implement the results.
2018	EM Coordinate Using School Buses for Evacuation	Coordinate with the School District and Public Works Department to enable school buses need to be used for evacuating residents during flooding, epidemics, fires, etc.	Entire Town	High	Emergency Mgt	Component of the Town EOP	Continue working with the School District and PWD to ensure agreement stands. Hold drills.
Current 06-18	PW Dept of Public Works Training	Regular training is undertaken, including annual chainsaw safety course, traffic control course, winter operations, downed power lines, fall protection, hoisting, culvert installation, etc. Entire crew takes all the mandatory courses (safety oriented.)	Entire Town	High	Public Works Dept	Continued to train	All crew members should be encouraged to attend all training opportunities, or look at additional mandatory classes.
Current 06-18	PW Public Water Supply in Industrial Zone (Route 3, River Road)	Installation of public water supply included fire (wet) hydrants on River Road, portions of NH 3A (in the Industrial Zone) occurred in 2012. Can be used for sprinklers as well as water supply. Businesses will be encouraged to connect to the system.	River Road, portions of NH 3A (Industrial Zone)	High	Public Works Dept	Continued to upgrade water system & pipes where possible	Continue to monitor the water system for malfunction and encourage businesses to connect to the system.
2018	PW Stabilized Merrimack River Bank along River Road	Stabilize the bank of the Merrimack River along River Road to inhibit erosion of River Road.	River Road	High	Public Works Dept	Continued to stabilize bank temporarily as erosion continues	Continue to monitor the bank for signs of erosion and any handle new situation accordingly.

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6 CAPABILITY ASSESSMENT

<u>Latest Adoption or Version Date</u>	<u>Capability Assessment</u> : Administrative and Technical	<u>Description</u> Related to hazard mitigation planning and coordination	<u>Location of Capability</u> Entire Town or Selected Areas	<u>Level of Effectiveness</u>	<u>Responsibility</u>	<u>Changes Since Last Haz Mit Plan (2013)</u>	<u>Future Improvements to Plans</u>
Current 06-18	TA Town Hall Security	In the process of upgrading the panic system in the Town Hall. Will facilitate rapid response to physical threats	Town Hall, Parks and Recreation	High	Town Administration	Panic system upgraded, locking doors. Recent drill April 2018	Complete the project.
Current 06-18	TA Town Hall Fire Alarm System	Connecting system will dial out to send call to monitoring service is in process.	Town Hall	High	Town Administration	A new code compliant fire alarm system has been installed	Fire drill system to be developed and implemented. Complete the project.
June 2018	FD Capital Area Public Health Network Member	Point of Dispensing (POD) for Bow is in Northwood at Coe-Brown Academy for distribution of vaccines or pharmaceuticals for communicable disease, human, biological problems, exposure to chemicals, etc.	Entire Town	High	Fire Dept	Participated in training,	Conduct educational outreach to Bow's vulnerable populations about health safety

Source: Bow Hazard Mitigation Committee

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6 CAPABILITY ASSESSMENT

FINANCIAL CAPABILITIES

The financial resources in **Table 34** available for hazard mitigation projects are those the Town has access to, has used in the past, or may be eligible to use in the future for hazard mitigation projects. These often include FEMA Public Assistance Grants (Disaster Recovery Costs), Warrant Articles, Town Capital Improvements Program (CIP) Project Funding, Department Operating Budgets, Bonds and FEMA and NH Department of Transportation grants.

Table 34
Financial Capabilities

Latest Adoption or Version Date	Capability Assessment:	Description	Location of Capability	Level of Effectiveness	Responsibility	Changes Since Last Haz Mit Plan (2013)	Future Improvements to Plans
FINANCIAL	PROGRAM OR	FUNDING RESOURCE FOR	HAZARD	MITIGATION			
Oct 2017	BOS FEMA Public Assistance Grants (Disaster Recovery Costs)	Public Assistance Categories A-G may become available after disaster declarations. Continue to utilize the FEMA funding to help recover from declared disasters.	Entire Town	High	Town Administration with EMD	Most recently used for PA-B Protective Measures for October 2017 wind storm	Continue to utilize the FEMA PA program to help with disaster costs
2018	BOS NH Department of Transportation (NH DOT) Bridge Program	The bridge program is an 80/20 funding opportunity, with only 20% required by towns. Using the CIP Capital Reserve Funds, communities can set aside money for the several years it takes for the state to undertake the local bridge project.	Echo Valley Farm Road Bridge	Moderate	Town Administration with Public Works	Town is waiting for NHDOT bridge funding to become available for Dunklee Road redlisted bridge. Birchdale Road over White Brook completed in Sep 2018	Continue using DOT bridge funding to replace redlisted bridges
PROGRAMS WHICH COULD POTENTIALLY BE USED BY TOWN FOR FUTURE PROJECTS							
Actively used for easements	CC Conservation Easement Fund	The Conservation Easement Fund protects water supplies through purchase of conservation easements.	Priority locations	High	Conservation Commission	Deposits to the fund continued when current use land converted to developable land.	Consider using fund for water and flood protection by purchasing at-risk parcels for conservation

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6 CAPABILITY ASSESSMENT

<u>Latest Adoption or Version Date</u>	<u>Capability Assessment:</u> Financial	<u>Description</u> Related to hazard mitigation planning and coordination	<u>Location of Capability</u> Entire Town or Selected Areas	<u>Level of Effectiveness</u>	<u>Responsibility</u>	<u>Changes Since Last Haz Mit Plan (2013)</u>	<u>Future Improvements to Plans</u>
Not used yet	PB Town Capital Improvements Program (CIP) 2018 Project Funding	Sets aside funds for large equipment/projects.	Entire Town	High	CIP Committee	CIP is to be modified in 2018	CIP could include expensive or long-term hazard mitigation projects
Not used yet	EM Emergency Management Operating Budget	Budget can contain funding for outreach programs, mitigation projects	Entire Town	High	Emergency Management	Small equipment and project budget, but had helped to fund new EOC in Safety Center	Use Emergency Management Operating Budget to finance future hazard mitigation improvements
Fees collected as of 06-18	WD User Fees for Water	Portions of water user fees are set aside to upgrade infrastructure.	Water district area	High	Abenaki, White Water contractors	Contracted water managers update sections of pipe as needed	Continue to make ongoing improvements to water and sewer infrastructure.

Source: Bow Hazard Mitigation Committee

Town of Bow, NH Hazard Mitigation Plan Update 2018

6 CAPABILITY ASSESSMENT

EDUCATION AND OUTREACH CAPABILITIES

In **Table 35**, identifying Town Department education and outreach programs and methods already in place or those which could be implemented can supplement or encourage mitigation activities and communicate hazard-related information to residents, businesses and the general public.

Table 35
Education and Outreach Capabilities

Latest Adoption or Version Date	Capability Assessment: Education and Outreach Programs	Description	Location of Capability	Level of Effectiveness	Responsibility	Changes Since Last Haz Mit Plan (2013)	Future Improvements to Plans
PUBLIC	OUTREACH	PROGRAM					
Current as of 06-2018	PD Drug Take Back Box & Drug Day	People can drop off narcotics or other drugs with immunity and also unused prescription medication at Safety Center anytime	Police Station	TBD	Police Department	Newly installed box with Safety Center Construction. Gave old Box to Website	Continue to advertise publicity on PD Facebook, in Safety Building, on Town website, other
Current as of 06-2018	PD School Resource Officer/ Education for Students	Bow has an active SRO program. Educational tool not only for drugs but safety protocol for children.	Bow Elementary, Middle and High Schools	High when operational	Police Department	Continuation of program	Continue funding in Town and School Budgets for this successful program
Current as of 06-2018	FD Public Outreach	FD holds many public outreach events: Open houses, participate in community functions, Fire Prevention Week, tours for school children, fire inspections, etc.	Entire Town	High	Fire Dept	Continuation of program	Continue to expand and add new outreach programs.
Current as of 06-2018	EM Public Awareness and Education	Outreach to citizens, schools, and civic organizations. Public relations activities have been conducted with civic organizations, schools, daycares, and at Town Wide Events (Old Home Day, National Night Out).	Entire Town	High	Emergency Mgt	Continuation of program	Continue to interface with the public and provide awareness and education.
2011	EM Functional/ Medical Needs Survey for Residents	Development of Functional Needs Survey- distributed to town residents. Incorporated into computer database. Created and implemented	Entire Town	High	Emergency Mgt	Database used during storm events	Annual update of information, expansion of database capabilities.

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6 CAPABILITY ASSESSMENT

Latest Adoption or Version Date	Capability Assessment: Education and Outreach Programs	Description	Location of Capability	Level of Effectiveness	Responsibility	Changes Since Last Haz Mit Plan (2013)	Future Improvements to Plans
		Functional/Medical Needs database based upon responses from residents. Database used during two actual activations- Tropical Storm Irene 2011 and the "Snowtober" storm 2011.	Entire Town or Selected Areas				
Current as of 06-2018	PW Educated Homeowners on Private Culvert Maintenance	Educate homeowners about private culvert maintenance. Developed information packet for homeowners in June 2008 so they can try to fix their own drainage issues.	Entire Town	High	Public Works Dept	Developed information packet for homeowners in June 2008	Continue to educate homeowners and provide information packets

Source: Bow Hazard Mitigation Committee

Review of Existing Plans

As described above, during the Hazard Mitigation process and the identification of existing mitigation **Capabilities**, the Hazard Mitigation Committee used their knowledge of the existing plans, policies, procedures and other documents utilized for their Department duties to develop Capability **Future Improvements**. However, several additional documents not listed in the **Capability Assessment** are also utilized by the community and have a positive relationship to the **Hazard Mitigation Plan 2018**. Most of the documents below are not the Town's documents, but the hazard mitigation goals, objectives, and/or Actions in this Plan are supported by the **Mitigation Support and Resource Documents** listed below in **Table 36**.

Table 36
Mitigation Support and Resource Documents

Latest Adoption or Version Date	Mitigation Support and Resource Documents Not Listed within Capability Assessment Tables
Feb 2007	NH DHHS NH Influenza Pandemic Public Health Preparedness & Response Plan 2007
2008	USGS Flood of April 2007 in NH
2007	USGS Flood of May 2006 in NH
2009	NFPA 1 Fire Code 2009

Town of Bow, NH Hazard Mitigation Plan Update 2018

6 CAPABILITY ASSESSMENT

Latest Adoption or Version Date	Mitigation Support and Resource Documents Not Listed within Capability Assessment Tables
2010	NWS Thunderstorms, Tornadoes, Lightning, Preparedness Guide
2011	USGS Analysis of the Transport of Sediment by the Merrimack River in Bow, Pembroke, and Allenstown, New Hampshire after the May 2006 Flood
Apr 2010	FEMA Flood Insurance Study for Merrimack County 2010
Apr 2010	NH Hospital Mutual Aid Network MOU
2011	NH DES Management of Collected Debris Following Severe Storm Events Fact Sheet
Dec 2011	NH DHHS Disaster Behavioral Health Response Plan
Feb 2012	NH DHHS Child Care Center Emergency Preparedness Guide
Oct 2013	State of NH Multi-Hazard Mitigation Plan Update 2013
Jul 2014	NH DOS Statewide Fire Mobilization Implementation Master Plan 2014
Jul 2014	American Red Cross of NH Strategic Plan – Humanitarian Services FY 2014-2019
Jul 2014	NH DHHS NH Excessive Heat Emergency Response Plan 2014
2015	NFPA 101 Life Safety Code 2015
Feb 2015	Central NH Regional Plan 2015
Mar 2015	NH State of NH Tickborne Disease Plan 2015
Sep 2015	NH DOS Bureau of Emergency Management Services EMS Provider Manual 2015
Jul 2015	NHHSEM NH Recovery Plan with RSFs 2015
Jan 2016	Eversource Energy Electric Operations Response Plan
Sep 2016	Utilil Electric Emergency Response Municipal Information
Oct 2016	CNHREPC Central New Hampshire Regional Emergency Planning Committee Regional Hazardous Materials Emergency Plan 2016
Aug 2016	CAPHN Capital Area Public Health Network Public Health Emergency Preparedness and Response Plan for the Capital Area 2016
Jul 2017	NH DHHS NH Arboviral Illness Surveillance, Prevention and Response Plan & Map 2017
As provided	NHDES Dam Emergency Action Plans for High, Significant & Low Hazard Dams
Mar 2018	NH DOT Recommendations for the Ten-Year Transportation Improvement Plan (Projects) 2019-2028
2018	USGS Preliminary Stage and Streamflow Data at Selected Stream Gages for Flood of Oct 2017

Source: Bow Hazard Mitigation Committee

7 PRIOR ACTION STATUS

The **Hazard Mitigation Plan Update 2013** provided a basis to begin Action development, many of which originated from the previous **2007 Plan** or **2013 Plan** or **2015 Addendum**. A review of the **2013** and **2015** Actions is provided by the Hazard Mitigation Committee, determining which Actions have been **Completed**, **Deleted**, or **Deferred** to the **2018 Plan**.

Action Status Determination

The status of all Hazard Mitigation Plan Actions varies. Priorities over the previous five years can change, budgets are uncertain, and staff are allocated time for certain tasks. Actions developed, evaluated and implemented across Hazard Mitigation Plans accommodate existing, new, and future development (buildings and infrastructure). To accommodate the review of the **2013 Plan's** and **2015 Addendum's** **36 total** Actions in addition to the **New** Actions from the **2018 Plan**, there are four designated Action types to describe the detailed Actions following within the **7 PRIOR ACTION STATUS** and/or **8 MITIGATION ACTION PLAN**:

- Completed
- Deferred
- Deleted
- New

Actions which were **Completed** from the **2013 Plan** are listed in **Table 37** along with completion dates.

Actions which were **Deleted** from the **2013 Plan** might have been no longer necessary or a priority to the Town, no longer relevant to the Town's situation or objectives, could not realistically be undertaken, were not financially feasible, were modified and incorporated into other existing Actions, or duplicated existing efforts of Bow's activities. Deleted Actions are listed in **Table 38**.

Actions which were **Deferred** from the **2013 Plan** are still important to the Town but were not completed because they did not have the staff capability or the funding to undertake them, other Actions took higher priority, more time was required for completion, or they may need to be repeated to be effective. These **Deferred** Actions are in **Table 39** and have been re-prioritized with the **New** Actions in the **Mitigation Action Plan**.

Changes in priority of the **Deferred 2013 or 2015 Actions** occurred over the last five years. The **2013 Plan** also used the **12-36 Priority Score enhanced STAPLEE** system while the **2018 Plan** included both a **Ranking Score** and an **Action Timeframe** to determine priorities with a more useful **15-75 Priority Score enhanced STAPLEE** system. Both methods are described.

New Actions are described later in **8 MITIGATION ACTION PLAN**.

DEFINITIONS

The following definitions were used to ascertain which Actions should be considered *mitigation* Actions versus which should be considered *preparedness* Actions more suitable for incorporation into the [Town Emergency Operations Plan](#). The mitigation Actions are those which are carried forth in this **2018 Plan** into the [Mitigation Action Plan](#).

Action Type	Duration	Definition or Characteristics
Mitigation	Long Term	Action supports sustained risk prevention or reduces long-term risk to people, property and infrastructure. ↳ Best suited for <i>Town Hazard Mitigation Plan</i> .
Preparedness	Short Term	Action assists or supports planning, protective activities, public education, training and exercise. ↳ Best suited for <i>Town Emergency Operations Plan</i> .
Response, Recovery, Other Related	Short Term	Action supports preventative, response, recovery-related, repeated or deferred maintenance activities. ↳ Best suited for <i>Town Emergency Operations Plan</i> .

HAZARDS CONSIDERED

With **27** different hazards examined in this Plan, it is not always practical to list each one when describing location vulnerabilities or solutions. Brevity will suffice where possible. In many cases, simply listing the more encompassing main hazard group names taken from **4 HAZARD RISK ASSESSMENT**, such as **Flood, Wind, Fire, Extreme Temperature, Earth, Technological and Human**, will cover most of the situations.

For further detail at a specific location, the addition of specific hazards such as **Scouring & Erosion** from the *Flood* category, **Storm** (applying to the warm weather all-encompassing storms) from the *Wind* category, **Winter** from the *Extreme Temperature* category, or **Dam Failure** from the *Technological* category can provide the necessary amount information needed to understand certain issues in Bow. These are already used as sub-grouped hazards in the **APPENDIX A Critical and Community Facilities Vulnerability Assessment**.

When the main hazard group names or sub-group hazards names are not precise enough, the exact hazard name from the group of **27** examined will be utilized for accuracy. Where possible however, simply using the main hazard group name (for example, **Flood** or **Wind** instead of each of its sub-hazards), can reduce the need for listing every type of hazard that may impact a certain location and be better accommodated in its broadness.

Review of 2013 and 2015 Actions

The **2013 Hazard Mitigation Plan** was written in a different format and its content had to comply with less specific review guidelines before the **Local Hazard Mitigation Review Guidebook (FEMA), 2012** became standardized and tailored by each FEMA Region over the years. In **2015**, the **Bow Fluvial Geomorphic Assessment Addendum to the 2013 Hazard Mitigation Plan** was completed which added more Actions to the **Hazard Mitigation Plan**.

Bow's mitigation Actions from the **2013 Plan** and **2015 Addendum**, which included Actions from the Town's previous **2007 Plan**, were allocated **Action Numbers** and each **Project**'s status was determined by the Hazard Mitigation Committee as either **Completed**, **Deleted** or **Deferred**.

Five (5) Actions were **newly Completed** as shown in **Table 37**, which also contain the original **2007 Plan Completed Actions** (4). From the latest **2013 Plan** and **2015 Addendum**, 32 Actions were **Deleted** as shown in **Table 38** and the remaining 15 were **Deferred** (**Table 39**) and appear within the **Mitigation Action Plan**. Several of the recently **Completed** Actions will also be **Deferred** as they need to be repeated for successful implementation.

Table 37
Completed Mitigation Actions

Priority Score (2013)	Action Number	Action	Completed By Date	Who is Responsible	Approx \$ Cost	Natural Hazards Addressed
33	#01-2007	Homeowner Education on Private Culvert Maintenance	Jun 2008 (packet 1st made available to public)	Public Works Department	\$300	Flood, Scouring & Erosion, Wind, Rapid Snow Pack Melt, Storms, Debris, Dam Failure or Release
31	#02-2007	Investigate Mutual Aid Agreement for Building Department Permitting and Inspections	2008	Community Development Department	\$0	Flood, Scouring & Erosion, Wind, Rapid Snow Pack Melt, Storms, Debris, Structural Integrity
26	#03-2007	Stabilize Merrimack River Bank along River Road	April 2010 (needs to be repeated)	Public Works Department	\$2.5m+	Flood, Scouring & Erosion, Wind, Rapid Snow Pack Melt, Storms, Debris, Dam Failure or Release
32	#04-2007	Coordinate School Buses for Evacuation	Jul 2011	Emergency Management Director	\$150	Flood, Wind, Storms, Debris, Power Failure, Wildfire, Active Shooter
<hr/>						
28	#31-2007	Review and Update Master Plan	Oct 2017	Planning Board	\$15k-\$20k	Flood, Wind, Storms, Lightning, Wildfire, Winter, Drought
34	#34-2013	Inspect and Maintain Dry Hydrants and Cisterns	2018 (needs to be repeated)	Fire Department	\$0	Flood, Fire, Debris

Town of Bow, NH Hazard Mitigation Plan Update 2018

7 PRIOR ACTION STATUS

Priority Score (2013)	Action Number	Action	Completed By Date	Who is Responsible	Approx \$ Cost	Natural Hazards Addressed
34	#48-2013	Update the Zoning Ordinance to Comply with NFIP Requirements	Mar 2013 (needs to be repeated)	Community Development Department	\$0	Flood, Scouring & Erosion, Wind, Rapid Snow Pack Melt, Storms, Debris, Dam Failure or Release
31	#49-2013	Install Fire Suppression System in Subdivisions	2018 (needs to be repeated)	Planning Board, with Fire Department	\$0	Fire, Haz Mat
24	#50-2013	Include the Fluvial Erosion Hazard (FEH) Study of the Turkey River Results into the Haz Mit Plan	Jun 2018	Emergency Management	\$0	Flood, Scouring & Erosion, Debris Impacted Infrastructure

Source: Bow Hazard Mitigation Committee

Town of Bow, NH Hazard Mitigation Plan Update 2018

7 PRIOR ACTION STATUS

The pink highlighted rows indicate the **32** total **Deleted** Actions in **Table 38** from the previous **Plans** that will not be incorporated into the **2018 Plan** as **Deferred** Actions. Many of the recent Actions were deleted because they were preparedness, response or recovery items and more appropriately belonged in the Town's *Emergency Operations Plan*. The reason why each Action was not included is provided in the last column **Why Deleted?**

Table 38
Deleted Mitigation Actions

Priority Score (2013)	Action Number	Action	Deleted Date	Who is Responsible	Approx \$ Cost	Why Deleted? The Action...
35	#05-2007	Obtain St. Paul's Dam Information	Sep 2012	Emergency Management	\$0	Duplicated existing efforts
36	#06-2007	Increase Turkey River Bridge Safety with NHDOT Conversations	Sep 2012	Emergency Management	\$0	Duplicated existing efforts
35	#07-2007	Develop Police Cruiser Public Service Announcement Program	Sep 2012	Police Department	\$800 annually	Was unrealistic and duplicated existing efforts
33	#08-2007	Develop Department of Public Works Public Service Announcement and Communication Program	Sep 2012	Public Works Department	\$800 annually	Was unrealistic and duplicated existing efforts
30	#09-2007	Develop Multi-Family Community Utility Outage Plan	Sep 2012	Emergency Management	\$0	Was not relevant to the Town's situation
22	#10-2007	Plan for Rail Line Evacuation	Sep 2012	Emergency Management	Unknown	Duplicated existing efforts
36	#11-2007	Incorporate Hazard Mitigation Plan into Employee Training	Sep 2012	Town Administration	\$0	Duplicated existing efforts
35	#12-2007	Educate Property Owners on Merrimack River Erosion along Hall Street	Sep 2012	Emergency Management	\$300	Duplicated existing efforts and was not relevant to the Town's situation
32	#13-2007	Obtain Disposable Hazardous Materials Suits for Employees	Sep 2012	Fire Department	\$1,000	Duplicated existing efforts
33	#14-2007	Obtain Telecommunications Towers Inspection Reports	Oct 2012	Emergency Management	\$0	Was incorporated into another activity
32	#15-2007	Coordinate with School District to Enable Cooperation for Imminent Threats to Life or Property	Oct 2012	Emergency Management	\$0	Was incorporated into another activity
31	#16-2007	Update Zoning Ordinance for Building Codes	Oct 2012	Community Development Department	\$300	Was incorporated into another activity
28	#17-2007	Develop Communications Failure Plan	Oct 2012	Emergency Management	\$0	Duplicated existing efforts
28	#18-2007	School Hazard Warning Radios	Oct 2012	Emergency Management	\$0	Was incorporated into another activity

Town of Bow, NH Hazard Mitigation Plan Update 2018

7 PRIOR ACTION STATUS

Priority Score (2013)	Action Number	Action	Deleted Date	Who is Responsible	Approx \$ Cost	Why Deleted? The Action...
28	#21-2007	Raise the Town's Enforcement Capacity	Apr 2018	Community Development Department	\$100k annually	Was a preparedness, response or recovery activity
31	#22-2007	Develop Reverse 911 Notification to Residents	Apr 2018	Emergency Management	\$40k	Was a preparedness, response or recovery activity
34	#23-2007	Enhance Emergency Management Communications with the Public	Apr 2018	Emergency Management	\$5,000 annually	Was a preparedness, response or recovery activity
36	#25-2007	Provide Additional Public Works Department Training	Apr 2018	Public Works Department	\$600 - \$800 annually	Was a preparedness, response or recovery activity
36	#26-2007	Hold or Participate in Drills and Actual Events that Test Interoperable Communications	Apr 2018	Emergency Management	\$0	Was a preparedness, response or recovery activity
35	#27-2007	Develop List of Local Professional Resources for Disaster Assistance	Apr 2018	Emergency Management	\$1,000	Was a preparedness, response or recovery activity
34	#28-2007	Develop Policy for Wide-Scale Permitting and Inspections Post-Disaster	Apr 2018	Community Development Department	\$0	Was a preparedness, response or recovery activity
30	#29-2007	Develop Policy for Property Reoccupation	Apr 2018	Community Development Department	\$10,000	Was a preparedness, response or recovery activity
28	#32-2007	Minimize Dead End Roads	Apr 2018	Planning Board	\$0	Was modified and incorporated into other Actions
31	#38-2013	Trim Dangerous Tree Limbs on Utility Wires (Unitil/ PSNH)	Apr 2018	Public Works Department	\$0	Was out of the Town's jurisdiction.
34	#40-2013	Update Functional Needs Survey	Apr 2018	Emergency Management	\$5,000	Was a preparedness, response or recovery activity
33	#41-2013	Undertake Community Outreach During an Emergency	Apr 2018	Emergency Management	\$30k	Was a preparedness, response or recovery activity
33	#42-2013	Continue Public Information Programs	Apr 2018	Emergency Management	\$5,000	Was a preparedness, response or recovery activity
36	#44-2013	Participate in National Flood Insurance Program (NFIP) Training	Apr 2018	Community Development Department	\$0	Was a preparedness, response or recovery activity
36	#45-2013	Train Employees on Proper HAZMAT Response Procedures	Apr 2018	Town Administration	\$0	Was a preparedness, response or recovery activity
36	#46-2013	Expand Emergency Preparedness Training	Apr 2018	Emergency Management	\$0	Was a preparedness, response or recovery activity
36	#47-2013	Enhance Communications Interoperability between Emergency Services and Schools	Apr 2018	Emergency Management	\$12,000	Was a preparedness, response or recovery activity

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7 PRIOR ACTION STATUS

Priority Score (2013)	Action Number	Action	Deleted Date	Who is Responsible	Approx \$ Cost	Why Deleted? The Action...
32	#53-2015	Insert Required Engineering Analysis for New Development's Erosion Control Measures on Site Shown within the Turkey River Fluvial Erosion Hazard (FEH) Meander Belts into Town Regulations (FGA)	Apr 2018	Community Development Department	\$500	Was unrealistic

Source: Bow Hazard Mitigation Committee

The tan highlighted rows in **Table 39** indicate the **15 Deferred** mitigation Actions from previous **Plans** which also appear in the forthcoming **Mitigation Action Plan** for **2018**. Many Action titles have been revised to reflect the new focus on mitigation although the principle for each remains the same. They will all be reevaluated to accommodate **2018** needs.

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7 PRIOR ACTION STATUS

Table 39
Deferred Mitigation Actions

Priority Score (2013)	Action Number	Action	Deferred Date	Who is Responsible	Approx \$ Cost	Why Deferred? Because...	Hazards Addressed
36	#19-2007	Evaluate the Municipal Building for Employee Safety and Implement Safety Measures to Reduce the Risk of Human Hazards	Apr 2018	Town Administration	\$7,000	Town did not have the funding capability	Human
32	#20-2007	Develop a Study and Upgrade River Road Bridge over Bog Brook Study to Reduce the Impact of Floods and Erosion	Apr 2018	Public Works Department	Unknown	More time was necessary	Flood, Ice Jam, Scouring & Erosion, Debris
32	#24-2007	Educate Homeowners on Private Culvert Maintenance to Reduce Erosion and Washouts	Apr 2018	Public Works Department	\$0	Action needs to be repeated for effectiveness	Flood, Ice Jam, Scouring & Erosion, Debris
29	#30-2007	Implement the Street Renaming Policy to Eliminate 911 Confusion and Enable Faster Response Time to Locations Impacted by Flood, Storms, and Fires	Apr 2018	Board of Selectmen	\$10,000	More time was necessary	Flood, Storms, Wind, Debris, Wildfire, Lightning, Hazardous Materials, Human Hazards
22	#33-2007	Develop Class VI Emergency Access Lanes Study to Reduce the Impact of Fire, Wildfire and Lightning	Apr 2018	Fire Department	\$10,000	Other activities took higher priority	Storms, Wind, Scouring & Erosion, Debris, Wildfire, Lightning
34	#34-2013	Upgrade Dry Hydrants and Cisterns for Inspection and Maintenance Responsibility to Reduce the Impact of Fire, Wildfire and Lightning	Apr 2018	Fire Department	\$0	Action needs to be repeated for effectiveness	Lightning, Wildfire, Drought, Hazardous Materials, Fire
32	#35-2013	Upgrade Redlisted Page Road Bridge over Bela Brook to Reduce the Impact of Erosion and Scouring	Apr 2018	Public Works Department	\$400k	More time was necessary	Flood, Ice Jam, Scouring & Erosion, Debris
32	#36-2013	Upgrade Dunklee Road Bridge over Bow Bog Brook to Reduce the Impact of Floods and Erosion	Apr 2018	Public Works Department	\$700k	More time was necessary	Flood, Ice Jam, Scouring & Erosion, Debris
32	#37-2013	Upgrade Birchdale Road Culvert over White Brook to Reduce the Impact of Floods and Erosion	Apr 2018	Public Works Department	\$400k	More time was necessary	Flood, Ice Jam, Scouring & Erosion, Debris

Town of Bow, NH Hazard Mitigation Plan Update 2018

7 PRIOR ACTION STATUS

Priority Score (2013)	Action Number	Action	Deferred Date	Who is Responsible	Approx \$ Cost	Why Deferred? Because...	Hazards Addressed
31	#39-2013	Trim Dangerous Tree Limbs from Right of Way (PWD) to Reduce the Impact of Wind, Storm or Winter Events	Apr 2018	Public Works Department	\$0	Action needs to be repeated for effectiveness	Wind, Storms, Lightning, Wildfire, Winter, Drought
29	#43-2013	Encourage Building Owners to Consider the Use of Fire Suppression Systems to Reduce the Impact of Fire Events	Apr 2018	Fire Department	\$0	Action needs to be repeated for effectiveness	Lightning, Wildfire, Drought, Hazardous Materials, Fire
34	#48-2013	Update the Zoning Ordinance to Comply with NFIP Requirements to Regulate Building in the Floodplain to Reduce Impact of Flood, Ice Jams, Scouring & Erosion	Apr 2018	Planning Board	\$0	Action needs to be repeated for effectiveness	Flood, Ice Jam, Scouring & Erosion
34	#51-2015	Initiate Discussions with NHDOT Regarding South Street Bridge and I-89 On-Ramps and Off-Ramps over the Turkey River to Reduce the Impact of Floods and Erosion (FGA)	Apr 2018	Board of Selectmen	\$0	More time was necessary	Flood, Ice Jam, Scouring & Erosion, Debris
35	#52-2015	Produce an Educational Program for Future Development to Place Appropriate Erosion Control Measures on Site to Reduce Impacts of Flooding, Erosion and Scouring (FGA)	Apr 2018	Community Development Department	\$500	Action needs to be repeated for effectiveness	Flood, Ice Jam, Scouring & Erosion, Wind, Storms, Landslide, Dam Failure or Release, Debris
33	#54-2015	Evaluate Potential Risk to the Sewer Pump Station on the Turkey River with a Vulnerability Assessment to Reduce Impact of Flooding and Earthquake (FGA)	Apr 2018	Town Administration	\$10,000	Other activities took higher priority	Flood, Scouring & Erosion, Earthquake, Water Quality (Public Health)

Source: Bow Hazard Mitigation Committee

8 MITIGATION ACTION PLAN

The Chapter provides a summary discussion of the Actions the community can consider completing to help mitigate the effects of hazard events.

The **Mitigation Action Plan** is the culmination of the work of the previous Assessments, inventories, and evaluations from the previous Chapters. Actions to help Bow mitigate the damages caused by disasters have been developed and prioritized by Hazard Mitigation Committee consensus in consideration of both existing and new development.

SOURCES OF ACTIONS

After determining the status of the existing Actions, **New Actions** can be determined. **New Actions** were evaluated by the Hazard Mitigation Committee using the **Problem Statements** determined during discussion of critical facility and community facility sites' potential vulnerability to hazards in the **Critical Facility and Community Vulnerability Assessment**. Many of these problems were further evaluated and developed into **New mitigation Actions**.

The **Capability Assessment** yielded a wealth of information from the **Future Improvements** of the plans, programs, ordinances, policies, agreements, technical skills, financial resources, and other resources the Town Departments, School District, and Stakeholders had available. These activities are important to the community. They assist Departments with the procedures, training, regional coordination, mutual aid, planning and purchases needed to perform their duties effectively. These activities in turn increase the capability for mitigating hazard events. For the **2018 Plan**, most of the **Capability Assessment's Future Improvements** activities were not utilized as Actions since they are more appropriate for the Town's **Emergency Operations Plan** recommendations.

Other community ideas were introduced to or by the Hazard Mitigation Committee as a result of Department, Board, Commission or Town discussions. Where appropriate, supported activities were introduced as New mitigation Actions.

Mitigation Actions developed emphasize both new and existing buildings and infrastructure to better protect populations of Bow.

Several uncompleted **Deferred** (2013) Bow mitigation Actions have been carried forward into the **2018 Plan** with the updates to the evaluation, cost, prioritization, etc.

ACTION MATRIX

A listing of **15 Deferred** mitigation Actions from previous Plans and **15 New** mitigation Actions from **2018** important to the Town of Bow was developed for evaluation with initial information provided for implementation. Each Action identifies at least one **Hazard Mitigated** which correlates to **3 GOALS AND OBJECTIVES**, describing how it can mitigate these identified natural hazard objectives. A short **Description and Evaluation** is provided and the **Affected Location** is listed to ensure easier understanding and reassessment of the Actions in the future during implementation.

The Actions are numbered for easier tracking over the years with this practice beginning in this **2018 Plan**. The earliest **2007** actions received the designations of **#01- 2007** through **#33- 2007**. The **2013** Actions received the designations of **#34- 2013** through **#50- 2013**. From the **2015 Turkey River Fluvial Geomorphic Assessment Addendum**, the **2015** Actions were numbered **#51- 2015** through **#54-2015**. The **2018** Actions begin where the prior Actions left off, **#55- 2018** through **#69- 2018**.

Over time, the Actions can be tracked to see which have been **Deferred** and to organize the **Completed** or **Deleted** Actions. For those with funding needs, the ability to reference an Action within the Capital Improvements Program or in a Warrant Article can alleviate confusion and further support the mitigation Actions.

Each Action is sorted into one of these four mitigation Action categories, although it might identify with several:

- Local Planning and Regulation**
- Structure and Infrastructure Projects**
- Natural Systems Protection**
- Education and Awareness**

Within the **Mitigation Action Plan**, the **Deferred 2013** Actions and the **New 2018** Actions are evaluated by the relative ease of completion using a numeric **Ranking Score** generated by the enhanced STAPLEE prioritization, by the **Action Timeframe** by which the Hazard Mitigation Committee would like to see the Action implemented, and by a basic **Cost to Benefit Analysis** as contained within the STAPLEE.

The **Responsible Department** is indicated for each Action as the party who will ensure the Action gets completed. An **Approximate Cost** is provided, although no definitive cost estimates or quotes have been obtained now. Ways the Action can be **Funded** is identified and offered as an avenue to explore during implementation. The purpose is to offer an idea of how much funding is provided for each Action and how it may be paid for.

Bow's Mitigation Action Plan 2018

At the meetings, the Hazard Mitigation Committee identified by consensus these mitigation Actions from the various **Assessments** and evaluations conducted. The process for Action development has been described in previous Chapters and sections. Combined with the visual Maps of the **2015 Addendum** and the **Hazard Mitigation Plan 2018**, the **Mitigation Action Plan** shown in **Table 40**, **Table 41**, **Table 42** and **Table 43** should be able to guide future hazard mitigation efforts in the Town through an annual implementation process.

Fifteen (**15**) **Deferred** Actions from previous **Plans** and **15 New** Actions from the **2018 Plan** combine to develop the **30** Actions of the **2018 Mitigation Action Plan**. The **Deferred** Actions' cells are highlighted in tan and those Actions related to the **2015 Addendum (Fluvial Geomorphic Assessment or FGA** abbreviated) are denoted by blue cells and an (FGA) suffix.

Town of Bow, NH Hazard Mitigation Plan Update 2018

8 MITIGATION ACTION PLAN

Table 40

Local Planning and Regulation Actions

Action Number	Action	Action Timeframe	Ranking Score	Who is Responsible	Approx Cost to Town	Description and Evaluation of Action	Hazards Mitigated?	Affected Location in Town	What Cost Will Pay For	How Funded
#30-2007	Implement the Street Renaming Policy to Eliminate 911 Confusion and Enable Faster Response Time to Locations Impacted by Flood, Storms, and Fires	<u>Long Term</u> 4-5 Years	54	Board of Selectmen	\$1,500 - \$3,000	Renaming streets to eliminate confusion during 911 response is part of the E-911 system. The numbering system of roads will also be modified. Currently 14 roads needed to be renumbered under current Town Ordinance. Board of Selectmen are responsible.	Flood, Storms, Wind, Debris, Wildfire, Lightning, Hazardous Materials, Human Hazards	Town Roads	Cost is for public noticing, new street signs. Staff time is in-kind.	Board of Selectmen Noticing Budget, Public Works Signage Budget
#33-2007	Develop Class VI Emergency Access Lanes Study to Reduce the Impact of Fire, Wildfire and Lightning	<u>Long Term</u> 4-5 Years	60	Fire Department	\$10,000	Determine which Class VI roads must be maintained as emergency lanes for rescue or forest fire fighting. This Action will be a highly political endeavor. Cost to develop the study includes hiring an engineer to determine the improvements to be made and where, feasibility analysis and design for improvements, with cost estimates. In-kind cost for staff to incorporate this into the Study. Perhaps \$30,000 to bring designated roads to passable status, but this will be determined as a future action.	Storms, Wind, Scouring & Erosion, Debris, Wildfire, Lightning	Class VI Roads	Cost is for engineering feasibility analysis.	Fire Department Budget
#48-2013	Update the Zoning Ordinance to Comply with NFIP Requirements to Regulate Building in the Floodplain to Reduce Impact of Flood, Ice Jams, Scouring & Erosion	<u>Short Term</u> 1-2 Years then Ongoing	68	Planning Board	\$100	The Zoning Ordinance needs to be updated as new requirements to the National Flood Insurance Program are necessary for retention of NFIP participation. The Floodplain Ordinance protects life and property by regulating distance of structures to flood hazard areas, regulating elevation, clarifying definitions, regulating new structures and	Flood, Ice Jam, Scouring & Erosion	Floodplains of the Merrimack River, Turkey River, and other Floodplains	Cost is for public noticing. Staff time is in-kind.	Community Development Public Noticing Budget

Town of Bow, NH Hazard Mitigation Plan Update 2018

8 MITIGATION ACTION PLAN

Action Number	Action	Action Timeframe	Ranking Score	Who is Responsible	Approx Cost to Town	Description and Evaluation of Action	Hazards Mitigated?	Affected Location in Town	What Cost Will Pay For	How Funded
						encroachments, stating duties of the Code Enforcement Officer, etc. In 2010, the Town adopted the recommended updates to the ordinance. The existing ordinance is amended with federal updates on a recurring basis. In 2013, the FP ordinance was revised to changing terminology and zone description.				
#54-2015	Evaluate Potential Risk to the Sewer Pump Station on the Turkey River with a Vulnerability Assessment to Reduce Impact of Flooding and Earthquake (FGA)	<u>Long Term</u> <u>4-5 Years</u>	<u>57</u>	Town Administration	\$10,000	The new municipal Sewer Pump Station is shown on the maps as in an area of channel migration. An engineering study (vulnerability assessment) is needed to discover any potential risks to the Pump Station. Whitewater is the contractor to maintain the system. Determine mitigation options for the system, such as sealing mancovers, dam releases, etc.	Flood, Scouring & Erosion, Earthquake, Water Quality (Public Health)	Turkey River	Cost is for engineering feasibility analysis.	Sewer User Fees, or seek NH DES Water Quality Grant
#55-2018	Consider Site Plan Review, Subdivision Regulations or Building Codes to Require New Developments and Seekers of Certificates of Occupancy to Test as Potable Water, Otherwise to Install Remediation Onsite to Reduce the Impact of Contaminated Water	<u>Medium Term</u> <u>3-4 Years</u>	<u>54</u>	Community Development	\$100	Some of the private water systems are outdated and experiencing system failure. For instance, Grappone (Bow Junction) and South Street have contaminated, non-potable water (MTBE, salt, etc.) Bow also has high concentration of natural arsenic. Most facilities have their own community water systems but are also experiencing contamination. PB requires testing and most connect to Town water systems as a result. Building CO not provided until a safe water test, otherwise. Consider zoning regulations or other building code enforcement more stringent.	Flood, Hazardous Materials, Water Quality (Public Health)	New Developments	Cost is for public noticing. Staff time is in-kind.	Community Development Public Noticing Budget

Town of Bow, NH Hazard Mitigation Plan Update 2018

8 MITIGATION ACTION PLAN

Action Number	Action	Action Timeframe	Ranking Score	Who is Responsible	Approx Cost to Town	Description and Evaluation of Action	Hazards Mitigated?	Affected Location in Town	What Cost Will Pay For	How Funded
#56-2018	Support the School District to Identify Secondary Motor Vehicle Access Options, with Traffic Engineering Designs, to Reduce the Impact of Wind, Storm, and Fire Hazards	Long Term 4-5 Years	47	Board of Selectmen	\$30,000	There is no secondary motor vehicle access at the three Bow Schools. This is a problem if widespread evacuation becomes necessary after a hazard event. Shelter in place is necessary in locations such as this. Public Works, Emergency Mgt, Fire and Police Depts, and Town Admin recently had a meeting with the School District about evacuating the Elementary and Middle School during a crisis.	Storms, Wind, Scouring & Erosion, Debris, Wildfire, Lightning, Hazardous Materials	Bow Schools	Cost is for the engineering study. Staff time is in-kind.	Joint Warrant Article and School District Budget
#57-2018	Add Language to Regulations and/or Zoning Ordinance for New High Occupancy Facilities to Require a Generator and Secondary Motor Vehicle Access to Reduce the Impact of Wind, Storm, and Fire Hazards	Medium Term 3-4 Years	65	Planning Board	\$100	New high occupancy buildings, including churches and daycare facilities, should have a secondary vehicle access and emergency generator. The Bow Youth Center and Little Sprouts (Clough Hill Rd) have only one means of access to and from their buildings. Currently in SPR and Sub regulations, the PB has a requirement for a generator for certain uses. Zoning Ordinance changes for secondary motor vehicle access will be required.	Storms, Wind, Scouring & Erosion, Debris, Wildfire, Lightning, Hazardous Materials	New High Occupancy Facilities (including Daycare, Church, etc)	Cost is for public noticing. Staff time is in-kind.	Community Development Public Noticing Budget

Source: Bow Hazard Mitigation Committee

Table 41

Structure and Infrastructure Projects

Action Number	Action	Action Timeframe	Ranking Score	Who is Responsible	Approx Cost to Town	Description and Evaluation of Action	Hazards Mitigated?	Affected Location in Town	What Cost Will Pay For	How Funded
#19-2007	Evaluate the Municipal Building for Employee Safety and Implement Safety Measures to Reduce the Risk of Human Hazards	Medium Term 3-4 Years	61	Town Administration	\$8,000 - \$10,000	The threat exists, and has been proven to exist, to Town employees. Prior improvements reprogramming alarm system and adding additional panic buttons. Now, an allen wrench is required to lock doors, new door configuration does not work. An 2018 - gave out 14 panic buttons and tested, doorbell for mailroom. EAPs have been completed. Need intercom system, different locking doors, more to be evaluated for options.	Human	Municipal Building	Cost is for doors, locks. Evaluation is done by staff in-kind.	Municipal Building Budget
#20-2007	Develop a Study and Upgrade River Road Bridge over Bog Brook Study to Reduce the Impact of Floods and Erosion	Long Term 4-5 Years	63	Public Works Department	\$750,000 - \$1m	Study the culvert carrying River Road over Bow Bog Brook for replacement. Culvert needs to be replaced but no engineering has been done for it. Its purpose is to repair damage caused by severe flooding, maintain traffic capability of River Road and flow of Bow Bog Brook. This culvert is not the State's red list bridge, and posted as E-2. State is beginning to do engineering, and the Town is still setting aside its 1/3 share. The Town may decide to bond it in the future.	Flood, Ice Jam, Scouring & Erosion, Debris	Bow Bog Brook, River Road	Cost is for the engineering study, permitting, and concrete culvert materials. Staff labor is in-kind.	NHDOT Bridge Aid 80/20, Bridge & Roads CRF
#34-2013	Upgrade Dry Hydrants and Cisterns for Inspection and Maintenance Responsibility to Reduce the Impact of Fire, Wildfire and Lightning	Short Term 1-2 Years then Ongoing	66	Fire Department	\$0 - \$7,000 each	FD inspects the dry hydrants and cisterns with Public Works during the summer months on scheduled Saturday and Sunday to ensure they can maintain and/or restore the functionality of the systems. There are about 14 dry hydrants and cisterns, about 7 of each. Ownership and maintenance responsibility is being	Lightning, Wildfire, Drought, Hazardous Materials, Fire	Dry hydrant locations and water bodies	Cost is for upgrading the materials of dry hydrants, estimated at \$7,000 each. Staff	Fire Department Budget, NH RC&D Grant

Town of Bow, NH Hazard Mitigation Plan Update 2018

8 MITIGATION ACTION PLAN

Action Number	Action	Action Timeframe	Ranking Score	Who is Responsible	Approx Cost to Town	Description and Evaluation of Action	Hazards Mitigated?	Affected Location in Town	What Cost Will Pay For	How Funded
						researched with the goal of upgrading the 7 steel dry hydrants to PVC pipe dry hydrants.			labor is in-kind.	
#35-2013	Upgrade Redlisted Page Road Bridge over Bela Brook to Reduce the Impact of Erosion and Scouring	<u>Short Term</u> 1-2 Years	65	Public Works Department	\$840,000	Undersized culvert is galvanized steel from the 1950's, and its wing walls are deteriorated. E-2 culvert on the red list. Replace with engineered plan provided by State NHDOT. The bridge is red listed and in danger of falling in. As March 2018, design has been completed. Replace with box culvert.	Flood, Ice Jam, Scouring & Erosion, Debris	Page Road (Bela Brook)	Cost is for design, engineering study, permitting, materials, and contracted labor.	NHDOT Bridge Aid 80/20, Bridge & Roads CRF
#36-2013	Upgrade Dunklee Road Bridge over Bow Bog Brook to Reduce the Impact of Floods and Erosion	<u>Short Term</u> 1-2 Years	68	Public Works Department	\$854,700	The bridge is red listed and Dunklee Road is the primary route to the Town's business areas. Wing walls were not engineered and constructed properly when culvert was replaced in 2006. They need to be rebuilt with a new engineered drainage plan, which has already been designed. To be advertised to go to bid in 2018.	Flood, Ice Jam, Scouring & Erosion, Debris	Dunklee Road (Bow Bog Road)	Cost is for design, engineering study, permitting, materials, and contracted labor.	Court Settlement 1/3, 1/3 share of Town, 1/3 engineer & contractor
#37-2013	Upgrade Birchdale Road Culvert over White Brook to Reduce the Impact of Floods and Erosion	<u>Short Term</u> 1-2 Years	71	Public Works Department	\$750,000	Undersized culvert is galvanized steel from the 1950's, and its wing walls are deteriorated. E-2 culvert on the red list. Replace with engineered plan provided by State NHDOT. The road is a lower priority than the other as other alternate routes are available. The bridge is red listed and in danger of falling in.	Flood, Ice Jam, Scouring & Erosion, Debris	Birchdale Road (White Brook)	Cost is for design, engineering study, permitting, materials, and contracted labor.	NH DOT 80/20, Town paying for it upfront, State will reimburse their share in 7 years

Town of Bow, NH Hazard Mitigation Plan Update 2018

8 MITIGATION ACTION PLAN

Action Number	Action	Action Timeframe	Ranking Score	Who is Responsible	Approx Cost to Town	Description and Evaluation of Action	Hazards Mitigated?	Affected Location in Town	What Cost Will Pay For	How Funded
#39-2013	Trim Dangerous Tree Limbs from Right of Way (PWD) to Reduce the Impact of Wind, Storm or Winter Events	<u>Short Term</u> 1-2 Years	70	Public Works Department	\$0	Tree limbs can fall onto roads and block roadways, or fall onto moving vehicles. Department of Public Works eliminates potential hazardous conditions in rights of way by trimming dangerous tree limbs. Public Works is notified by school bus drivers, the Police Dept, and residents. Dangerous limbs are taken care of as soon as PWD sees them or is notified of a hazard. This is an annual fall event.	Wind, Storms, Lightning, Wildfire, Winter, Drought	Right of Way	Cost is for in-kind staff and volunteer labor	N/A
#51-2015	Initiate Discussions with NHDOT Regarding South Street Bridge and I-89 On-Ramps and Off-Ramps over the Turkey River to Reduce the Impact of Floods and Erosion (FGA)	<u>Short Term</u> 1-2 Years	59	Board of Selectmen	\$15,000	Continue to consult with the NHDOT to determine whether they have completed a current analysis of flow capacity and velocity using the newest methods for accurate measurement. A Vulnerability Assessment would be the desired product for (Town) emergency management planning purposes. NHDOT plans to address interchange in 2025. April 2018 meeting held to comment on DOT's plan of intersection, including removing or keeping the connection between 3A and I-89. Town sent letter in May 2018 to request different alternative. Construction would be DOT's timeframe. In TIF District.	Flood, Ice Jam, Scouring & Erosion, Debris	I-89 and South Street Bridge in the TIF District	Cost is for Town will need to pay for its alternative design to present to the NHDOT.	Bridge and Roads CRF possibility, other being considered
#58-2018	Partner with the School District and Library to Purchase & Install a Generator to Reduce the Impact of Wind, Storm or Winter Events	<u>Medium Term</u> 3-4 Years	64	Emergency Management	\$40,000	There is a lack of an alternate power source (no generator) for the Old Town Hall (warming/cooling center), Library (warming/cooling center), Elementary School. The School District's annual meeting decided not to consider the generator. It should be in their CIP for the next years. SD	Wind, Storms, Lightning, Wildfire, Winter	Elementary School, Baker Free Library	Cost is for the Library generator and installation. Cost for the generator and	Library Budget and possible State/FE MA EMPG

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8 MITIGATION ACTION PLAN

Action Number	Action	Action Timeframe	Ranking Score	Who is Responsible	Approx Cost to Town	Description and Evaluation of Action	Hazards Mitigated?	Affected Location in Town	What Cost Will Pay For	How Funded
						prefers bonds. \$160,000 for 2 generators, \$80 each.			installation will be borne by the School District.	
#59-2018	Encourage White Rock to Install a Generator or Hardwire Buildings to Utilize a Portable Generator to Reduce the Impact of Wind, Storm or Winter Events	<u>Short Term</u> <u>1-2 Years</u>	62	Emergency Management	\$0	The White Rock Senior Community of 55+ older residents has no emergency generator in the event of a sustained power failure from storms, winds or winter weather.	Wind, Storms, Lightning, Wildfire, Winter	White Rock Senior Community	Cost for the generator and installation will be borne by White Rock. Cost for the Town is by using in-kind staff and volunteer labor.	N/A
#60-2018	Install Lightning Rods on the Bow Center One Room School and Bow Bog Meeting House to Reduce the Impact of Lightning	<u>Medium Term</u> <u>3-4 Years</u>	66	Fire Department with Historical Society	\$10,000	The Bow Center One Room School and Bow Bog Meeting House are vulnerable to lightning and fire as they are old, wooden historic assets of the community.	Lightning, Wildfire, Drought, Hazardous Materials, Fire	Bow Center, One Room School and Bow Bog Meeting House	Cost is for contracted labor and materials for two lightning rods and grounding equipment.	Building and Maintenance Line Item, possible Grant
#61-2018	Investigate Possibilities for Constructing a Town Boat Ramp off of Hall Street Above Garvins Falls Dam to Help with Water Rescue Staging During Inundation,	<u>Medium Term</u> <u>3-4 Years</u>	52	Public Works Department with Fire Department	\$50,000 +	Above Garvins Falls dam, should find access for water rescue on the Merrimack River is limited to just the (Eversource/Granite Shore) PSNH River Road boat ramp. This reduces response time. Water rescue staging from this site occur at least once annually. Unable to get under the Turkey River Bridge, no headroom.	Flood, Ice Jam, Debris	Merrimack River at Hall Street	Cost is for study, acquisition, permitting, materials and construction of a town boat ramp	Very early stages of consideration. Warrant article, NH Fish and

Town of Bow, NH Hazard Mitigation Plan Update 2018

8 MITIGATION ACTION PLAN

Action Number	Action	Action Timeframe	Ranking Score	Who is Responsible	Approx Cost to Town	Description and Evaluation of Action	Hazards Mitigated?	Affected Location in Town	What Cost Will Pay For	How Funded
	Icy or Debris Conditions					Allenstown has a ramp across the Merrimack River at their field, but Pembroke's Memorial Field is too sandy and not stabilized. Need to obtain permission from railroad to cross.			into the Merrimack River.	Game, FEMA grants to be explored
#62-2018	Initiate an Annual Culvert Assessment and Replacement Program	<u>Short Term</u> 1-2 Years	66	Public Works Department	\$15,000 annually	Each year, assess all culverts in Town and upgrade them if they are deficient or are required prior to road paving projects. This program will help reduce flooding, erosion and scouring in these drainage outlets and stream crossings. A proactive program will help prevent road closures due to culvert failures and sink hole hazards.	Flood, Ice Jam, Scouring & Erosion, Debris, Sinkhole	Roadways at Stream Crossings and Drainage Areas	Cost is for drainage pipes, structures and materials	Public Works Operating Budget (annual)
#63-2018	Conduct a Sewer Main Inventory and Inspection Program to Protect Groundwater and Reduce Risk of Flooding and Earthquake	<u>Short Term</u> 1-2 Years	65	Sewer Commission with Public Works assistance	\$20,000	The Town's sewer system infrastructure is antiquated and corroded (about 170 users) and has the potential for failure. Currently being monitored, cleaned, recorded and studied by running cameras down every manhole to ascertain breakage potential and identify priority upgrade sections. Problems with the pipes could lead to breakage, blockage, spillage and public health issues. Phase I is in progress in 2018, Phase II in 2019, Phase III in 2020, \$30,000 total. Locations of active sewer lines include Bow Junction, Bow Center, and the 3 schools. Oldest pipes are at I-89/93 cloverleaf, Valley Road, along bike path, behind Grappone Toyota, Hall Street to new pump station. Before NHDOT construction of the new I-93 bridge, the Town studied that area and replaced that sewer	Flood, Scouring & Erosion, Earthquake, Water Quality, Public Health	Waste Water System locations	Cost is for the consultant study, two more years at \$10,000 each year and Public Works Department camera inspection of sewer mains, recording and inventorying, and cleaning and/or upgrading of pipes	Sewer Operating Budget (annual)

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8 MITIGATION ACTION PLAN

Action Number	Action	Action Timeframe	Ranking Score	Who is Responsible	Approx Cost to Town	Description and Evaluation of Action	Hazards Mitigated?	Affected Location in Town	What Cost Will Pay For	How Funded
						pipe prior to bridge replacement. It is unknown what NHDOT's responsibility is to the Town when they do their project.			when needed.	
#64-2018	Upgrade Municipal Building Parking Lot Drainage System and Waterproof Building's Foundation	<u>Short Term 1-2 Years</u>	69	Public Works Department	\$90,000	Mold and moisture permeate the Municipal Building's basement which leaks when heavy rains or snowmelt occurs. Waterproofing of the foundation needs to occur as well as upgrading the parking lot's drainage around the building. This will protect the structure from deterioration and the public from serious health issues. Scheduled for 2019-2020 for floodproofing	Flood, Storms (rain), Rapid Snow Pack Melt, Public Health (Mold, Air Quality)	Town Office Building, Grandview Road	Cost is for excavation, drainage and waterproofing of building foundation where parking lot abuts building.	Building & Grounds Capital Reserve Fund, Warrant Article

Source: Bow Hazard Mitigation Committee

Table 42

Natural Systems Protection Actions

Action Number	Action	Action Timeframe	Ranking Score	Who is Responsible	Approx Cost to Town	Description and Evaluation of Action	Hazards Mitigated?	Affected Location in Town	What Cost Will Pay For	How Funded
#52-2015	Produce an Educational Program for Future Development to Place Appropriate Erosion Control Measures on Site to Reduce Impacts of Flooding, Erosion and Scouring (FGA)	<u>Long Term</u> 4-5 Years	64	Community Development	\$1,000	Help new developers understand the appropriate mitigation measures when developing new sites along the Turkey River prior to site plan review. May include disseminating information to owners of developed property.	Flood, Ice Jam, Scouring & Erosion, Wind, Storms, Landslide, Dam Failure or Release, Debris	Turkey River	Cost is for professional assistance to produce the program, printing.	Community Development Public Noticing Budget
#65-2018	Monitor and Stabilize Erosion Locations (River Road) on the Merrimack River to Reduce Impacts of Flooding, Erosion and Scouring	<u>Short Term</u> 1-2 Years then Ongoing	68	Public Works Department	\$12,000 annually	Continued sedimentation transport from the Suncook River to the Merrimack River is currently causing bank erosion in Bow and may exacerbate any Merrimack River inundation events. Sediment landed on Allenstown side, causing changes in Bow. Bow has experienced erosion on River Road (formerly Johnson Road) where it continues into Hooksett and the erosion is slowly moving toward Edgewater; half of the River Road roadbed is probably in the River. Eversource lost a piece of shoreland property to erosion. The Town is currently trying to sell its shoreland property and has no interest in stabilization. Place stabilization funding into the CIP and Bridge and Road Capital Reserve Fund to counteract the Merrimack's erosion along River Road and other identified	Flood, Ice Jam, Scouring & Erosion, Wind, Storms, Dam Failure or Release, Debris	Johnson Road, Merrimack River	Cost is for gravel and riprap materials to repair erosion, plus materials from Allen Road Excavation	Public Works Drainage Materials Budget and Allen Road Excavation

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8 MITIGATION ACTION PLAN

Action Number	Action	Action Timeframe	Ranking Score	Who is Responsible	Approx Cost to Town	Description and Evaluation of Action	Hazards Mitigated?	Affected Location in Town	What Cost Will Pay For	How Funded
						locations. PW will monitor monthly and fix when conditions deteriorate.				
#66-2018	Rebuild the Town Salt Shed to Water Resistant Specifications and Undertake Drainage Upgrades to Reduce Salt Contamination in the Wellhead Protection Area	Long Term 4-5 Years	66	Public Works Department	\$650,000	Town water wells were constructed for a community water supply. The existing Town salt shed location and its road maintenance supply piles then fell within the new wellhead protection area and became subject to its limitations. It is necessary to mitigate the potential for sodium contamination to the Town's water supply.	Flood, Storms (rain), Rapid Snow Pack Melt, Public Health (Salt, Water Quality)	Well Head Protection Area	Cost is for demolition of the existing salt shed, drainage upgrades to the site, and salt shed replacement on the same Town property.	Salt Shed Capital Reserve Fund (CIP). Possibility for State NH grant if salt becomes classified as a contaminant
#67-2018	Assess Feasibility to Acquire Hall Street Floodplain Properties for the Potential of Voluntary Acquisition to Increase Floodplain Storage Capacity and Reduce Erosion of Riverbanks	Long Term 4-5 Years	43	Community Development with Emergency Management Assistance	\$100,000	Approximately 6 homes on Hall Street in the floodplain. Suspect septic systems are inappropriately draining in Merrimack. Erosion and washout along homes, backyards. Area floods during times of Merrimack River flooding. One of these locations may be suitable to construct a boat launch here if homes were voluntarily acquired. This area, and its current residents, would be protected from future flooding and inundation by acquiring the homes if the feasibility assessment concurs.	Flood, Scouring & Erosion, Ice Jams	Hall Street along Merrimack River	Cost is roughly estimated for feasibility assessment (\$10k) of 6 homes, Town's 10% portion of voluntary acquisition (6 homes valued @ \$100k each - \$60k), and demolition and reclamation of homes (6 homes at	FEMA Acquisition Grant 90/10, Other Grants

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8 MITIGATION ACTION PLAN

Action Number	Action	Action Timeframe	Ranking Score	Who is Responsible	Approx Cost to Town	Description and Evaluation of Action	Hazards Mitigated?	Affected Location in Town	What Cost Will Pay For	How Funded
									\$5k each - \$30k), assuming all are obtained.	

Source: Bow Hazard Mitigation Committee

Table 43

Education and Awareness Actions

Action Number	Action	Action Timeframe	Ranking Score	Who is Responsible	Approx Cost to Town	Description and Evaluation of Action	Hazards Mitigated?	Affected Location in Town	What Cost Will Pay For	How Funded
#24-2007	Educate Homeowners on Private Culvert Maintenance to Reduce Erosion and Washouts	<u>Short Term</u> 1-2 Years then Ongoing	67	Public Works Department	\$0	RSA 236:13, VI requires private property owners to keep driveway culverts clear and flowing to reduce flooding and enhance drainage. In June 2008, an informational packet was made available to the public so they can try to fix their own drainage issues. This informational pamphlet is included with all Driveway permits.	Flood, Ice Jam, Scouring & Erosion, Debris	Private Driveways	Cost is for in-kind photocopies of materials and/or staff talking with people.	N/A
#43-2013	Encourage Building Owners to Consider the Use of Fire Suppression Systems to Reduce the Impact of Fire Events	<u>Short Term</u> 1-2 Years then Ongoing	67	Fire Department	\$0	During Technical Review Committee (PB), the new Bow water system will enable fire suppression systems to be more cost effective for residents and business owners. Property owners should be contacted to encourage them to install sprinkler systems in their buildings. Reliable fire protection is available to businesses, generating income to support the new water systems, and allowing larger buildings to be built as a result.	Lightning, Wildfire, Drought, Hazardous Materials, Fire	New and/or Existing Development	Cost is for in-kind staff and volunteer labor.	N/A
#68-2018	Educate the Public to Notify the Fire Department about Recurring Hazardous Material Vehicles to Reduce the Impact of a Haz Mat Spill	<u>Short Term</u> 1-2 Years	65	Emergency Management	\$0	Many local businesses do not follow the EPA's EPCRA/CERCLA Right to Know Law requirements. Compliance is not 100% and the Town wants to know which materials are available at these locations. There are no local registration requirements, but the businesses should be in communication with the Fire Department.	Fire, Hazardous Materials, Public Health	Main local roads: Dunklee Road, River Road, NH 3A	Cost is for in-kind staff and volunteer labor.	N/A

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Action Number	Action	Action Timeframe	Ranking Score	Who is Responsible	Approx Cost to Town	Description and Evaluation of Action	Hazards Mitigated?	Affected Location in Town	What Cost Will Pay For	How Funded
#69-2018	Educate the Public to Gather Emergency Kits for 72 Hours and to Plan a Secondary and Escape Route to Reduce the Impact of Human Injury from Natural Hazard Events	Short Term 1-2 Years	59	Emergency Management	\$0	The lack of secondary means of egress for homes limits the ability to self-evacuate during a natural hazard (storms, wind events, winter weather, wildfire, floods, etc). Regulations allow up to 12 lots on a dead end. Emergency response can also be delayed if the developments' roadway is blocked. Residents should plan ahead for emergencies, for isolation up to three days and a personal evacuation plan.	Flood, Winter, Storms, Wind, Scouring & Erosion, Debris, Wildfire, Lightning, Hazardous Materials, Public Safety, Water Quality (Public Health)	Entire Town, Dead-End Roads & Cul-de Sacs	Cost is for in-kind staff and volunteer labor.	N/A

Source: Bow Hazard Mitigation Committee

Great Projects... And the Realities of Project Implementation in New Hampshire

These important but costly and/or time consuming mitigation projects identified in the **Mitigation Action Plan** represent the best case scenarios (or to some, “wish-list” items) for completion. There are many barriers to successful implementation of any project which is outside the typical duties of a Town staff member or volunteer. The annual struggle to obtain municipal funding at Town Meetings and the uncertainty of political & local support needed for hazard mitigation projects, the limited staff time available to administer and complete the projects, and dwindling volunteer support to help locate grants and work on the Action Plan items all reduce the Town’s ability to complete successful hazard mitigation projects within the Plan’s **5**-year lifespan. Town staff and volunteers are usually required to be reactive to their numerous daily duties or annual processes and have little availability to be proactive. This is especially true for the Central NH region’s smaller communities that rely on voter support for staff hiring and/or hazard mitigation project budget funding, which is 19 out of 20 municipalities.

Therefore, mitigation and other projects are generally completed on an “as-needed basis” or on an “as-available basis” despite the different ways of evaluation and prioritization shown within the **Hazard Mitigation Plan 2018**. Small New Hampshire communities do the best they can with the resources available to them to make ends meet, particularly in times of economic duress or hardship and our State’s aging population. Town Meeting voters decide whether to approve new zoning ordinances which can help mitigate hazards, vote to approve Department Budgets which usually are sustainable and do not allow enough flexibility to plan ahead, and vote to approve Warrant Articles for a hazard mitigation project. Town volunteers are relied upon to do much of the hazard mitigation work as Town staff are already engaged in real-time, constant public engagement issues and have little additional time available for planning. Few younger people are stepping up to the plate of community volunteering when our existing volunteers are retiring. Indeed, many staff or volunteers have dual or triple roles in the community to fill vacancies, such as a Town Administrator serving as Health Officer and Human Services Officer and a volunteer Fire Chief serving as volunteer Emergency Management Director.

NH communities are used to “toughing it out” and will try to accomplish all they can with the time, funding, and resources available to them. However, many of these **2018** Actions may end up

Deferred to 2023 simply because of the unique nature of our independent State and community culture.

Action Evaluation and Prioritization Methods

A variety of methods were utilized to evaluate and prioritize the Actions. These methods include the enhanced STAPLEE (Social Technical Administrative Political Legal Environmental and Economics) criteria, designating the Action to be completed within a certain timeframe, and completing a basic **Cost to Benefits Analysis**, a later section. These prioritization methods are meant to enable the community to better identify which Actions are more important and are more feasible than others.

ENHANCED STAPLEE METHOD

An enhanced STAPLEE Method provided a better methodology for prioritizing the Actions against one another. The Hazard Mitigation Committee ranked each of the mitigation Actions derived from the evaluation process. The total **Ranking Score** serves as a guide to the relative ease of Action completion by scoring numerous **societal and ethical impact questions** and does not represent the Town's Action *importance* priority. Instead, the STAPLEE process evaluates each Action and attempts to identify some potential barriers to its success. As revised in **2018**, a score of **75** would indicate that the mitigation strategy, or Action, would be among the easiest Actions to complete from a social and ethical standpoint.

The previous Plans including the **2013 Plan** had answered the same questions with the exception of **3** new questions added in **2018** regarding funding, staffing, and historic preservation. On a scale of **1-3**, with “**1**” indicating a **NO** response, “**2**” indicating a **MAYBE** response, and “**3**” indicating a **YES** response, a total possible score of **36** could be obtained after answering **12** qualitative questions about each Action.

There is more latitude in the **2018 Plan**’s enhanced STAPLEE scores to better identify the relatively easiest Action projects for completion. All enhanced STAPLEE answers are subjective and depend on the opinions of the Committee members discussing them. The Committee answered these **15** questions with a numeric score of “**1**” indicating a **NO** response, “**2**” indicating an **UNCERTAIN** response, “**3**” indicating a **MAYBE** response, “**4**” indicating a **LIKELY** response or “**5**” indicating a **YES** response, about whether the Action can fulfill the criteria:

- Does the action reduce damage and human losses?
- 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?
- Is the action socially acceptable?
- Is the action technically feasible?

Action Completion	
RANKING	SCORE
Excellent	75 - 60
Good	45 - 59
Fair	44 - 30
Poor	29 - 15

- Is the action administratively possible?
- Is the action politically acceptable?
- Does the action offer reasonable benefits compared to its cost in implementing?
- Is the action legal?
- Is the action support or protect the environment?
- Does the action have the funding necessary for completion?
- Does the action have the necessary staff or volunteers to undertake?
- Does the action support historic preservation?

The enhanced STAPLEE scores can range from a low of **15** to a high **75**. Bow's **Mitigation Action Plan** STAPLEE rating is shown in **Figure 25**.

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Figure 25
Enhanced STAPLEE Ranking of Mitigation Actions

Action Number	Action	Does the Action..... or Is the Action.....	Reduce Damage? (or Injury)	Contribute to Town Objectives? (Supported by Master Plan or current thinking?)	Meet Regulations? (if there are any)	Protect Sensitive Structures? (Buildings, roads, culverts, human-made things?)	Implemented Quickly? (See also Action Plan for Timeframe)	Socially Acceptable? (People like it)	Politically Acceptable? (Public Officials like it)	Administratively Realistic? (Have admin skills or time for paperwork)	Technically Feasible? (Have tech skills or special equipment)	Have a Reasonable Cost to Benefits Gained?	Legal? (Or will be legal upon completion)	Support or Protect the Environment?	Have the Funding?	Have Necessary Staff or Volunteers?	Support Historic Preservation?	Ranking Score 15-75
#37- 2013	Upgrade Birchdale Road Culvert over White Brook to Reduce the Impact of Floods and Erosion	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	71	
#39- 2013	Trim Dangerous Tree Limbs from Right of Way (PWD) to Reduce the Impact of Wind, Storm or Winter Events	5	5	5	5	5	5	5	5	5	5	5	2	5	5	3	70	
#64- 2018	Upgrade Municipal Building Parking Lot Drainage System and Waterproof Building's Foundation	5	5	5	5	5	5	5	5	5	5	5	5	2	5	5	69	
#36- 2013	Upgrade Dunklee Road Bridge over Bow Bog Brook to Reduce the Impact of Floods and Erosion	5	5	5	5	3	5	5	5	5	5	5	5	5	4	1	68	
#48- 2013	Update the Zoning Ordinance to Comply with NFIP Requirements to Regulate Building in the Floodplain to Reduce Impact of Flood, Ice Jams, Scouring & Erosion	3	4	5	3	4	5	5	5	5	5	5	5	5	5	4	68	
#65- 2018	Monitor and Stabilize Erosion Locations (River Road) on the Merrimack River to Reduce Impacts of Flooding, Erosion and Scouring	5	5	5	5	3	5	5	5	5	5	5	5	5	2	5	68	
#24- 2007	Educate Homeowners on Private Culvert Maintenance to Reduce Erosion and Washouts	3	5	5	3	5	5	5	5	5	5	5	5	5	5	3	67	
#43- 2013	Encourage Building Owners to Consider the Use of Fire Suppression Systems to Reduce the Impact of Fire Events	3	5	5	3	5	5	5	5	5	5	5	5	3	5	5	67	
#34- 2013	Upgrade Dry Hydrants and Cisterns for Inspection and Maintenance Responsibility to Reduce the Impact of Fire, Wildfire and Lightning	3	5	5	4	5	5	5	5	5	5	5	5	1	4	5	66	
#60- 2018	Install Lightning Rods on the Bow Center One Room School and Bow Bog Meeting House to Reduce the Impact	3	5	5	3	4	5	5	5	5	5	5	5	3	3	5	66	
#62- 2018	Initiate an Annual Culvert Assessment and Replacement Program	5	5	5	3	2	5	5	5	5	5	5	5	5	5	5	66	
#66- 2018	Rebuild the Town Salt Shed to Water Resistant Specifications and Undertake Drainage Upgrades to Reduce Salt Contamination in the Wellhead Protection Area	5	5	5	5	2	5	5	5	5	5	5	5	3	5	1	66	
#35- 2013	Upgrade Redlisted Page Road Bridge over Bela Brook to Reduce the Impact of Erosion and Scouring	5	5	5	5	3	5	5	5	5	5	5	5	5	2	4	65	
#57- 2018	Add Language to Regulations and/or Zoning Ordinance for New High Occupancy Facilities to Require a Generator and Secondary Motor Vehicle Access to Reduce the Impact of Wind, Storm, and Fire Hazards	4	5	5	5	4	5	5	5	5	5	5	5	1	5	5	65	
#63- 2018	Conduct a Sewer Main Inventory and Inspection Programs to Protect Groundwater and Reduce Risk of Flooding and Earthquake	5	5	5	5	2	5	5	5	5	5	5	5	5	2	5	65	
#68- 2018	Educate the Public/Business Community to Notify the Fire Department about Hazardous Materials Onsite to Reduce the Impact of a Haz Mat Spill	4	5	5	4	3	5	5	5	5	5	5	5	3	5	5	65	
#52- 2015	Provide an Educational Program for Future Development to Place Appropriate Erosion Control Measures on Site to Reduce Impacts of Flooding, Erosion and Scouring (FGA)	3	5	5	3	3	5	5	5	5	5	4	5	3	5	5	64	

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Action Number	Does the Action..... or Is the Action.....	Reduce Damage? (or Injury)	Contribute to Town Objectives? (If there are any) (Supported by Master Plan or current thinking?)	Meet Regulations? (If there are any)	Protect Sensitive Structures? (Buildings, roads, culverts, human-made things?)	Implemented Quickly? (See also Action Plan for Timeframe)	Socially Acceptable? (People like it)	Politically Acceptable? (Public Officials like it)	Administratively Realistic? (Have admin skills or time for paperwork)	Technically Feasible? (Have tech skills or special equipment)	Have a Reasonable Cost to Benefits Gained?	Legal? (Or will be legal upon completion)	Support or Protect the Environment?	Have the Funding?	Have the Necessary Staff or Volunteers?	Support Historic Preservation?	Ranking Score 15-75
	ACTION																
#58- 2018	Partner with the School District and Library to Purchase & Install a Generator to Reduce the Impact of Wind, Storm or Winter Events	4	5	5	5	3	5	5	5	5	5	5	1	1	5	5	64
#20- 2007	Develop a Study and Upgrade River Road bridge over Bog Brook Study to Reduce the Impact of Floods and Erosion	5	5	5	5	1	5	5	5	5	5	5	5	2	4	1	63
#59- 2018	Encourage White Rock to Install a Generator or Hardwire Buildings to Utilize a Portable Generator to Reduce the Impact of Wind, Storm or Winter Events	1	5	5	4	5	5	5	5	5	5	5	1	5	5	1	62
#19- 2007	Evaluate the Municipal Building for Employee Safety and Implement Safety Measures to Reduce the Risk of Human Hazards	4	5	5	1	4	5	5	5	5	5	5	1	4	5	2	61
#33- 2007	Develop Class VI Emergency Access Lanes Study to Reduce the Impact of Fire, Wildfire and Lightning	1	4	5	5	4	5	5	3	5	5	5	5	1	4	3	60
#51- 2015	Initiate Discussions with NHDOT Regarding South Street Bridge and I-89 On-Ramps and Off-Ramps over the Turkey River (FGA) to Reduce the Impact of Floods and Erosion	1	5	5	1	5	5	5	5	5	5	5	1	5	5	1	59
#69- 2018	Educate the Public to Gather Emergency Kits for 72 Hours and to Plan a Secondary Escape Route to Reduce the Impact of Human Injury from Natural Hazard Events	2	5	5	1	4	5	5	5	5	5	5	1	5	5	1	59
#54- 2015	Evaluate Potential Risk to the Sewer Pump Station on the Turkey River with a Vulnerability Assessment to Reduce Impact of Flooding and Earthquake (FGA)	1	4	5	5	3	5	5	3	5	5	5	5	1	2	3	57
#30- 2007	Implement the Street Renaming Policy to Eliminate 911 Confusion and Enable Faster Response Time to Locations Impacted by Flood, Storms, and Fires	5	5	5	3	1	1	1	5	5	3	5	2	5	5	3	54
#55- 2018	Consider Site Plan Review, Subdivision Regulations or Building Codes to Require New Developments and Seekers of Certificates of Occupancy to Test as Potable Water, Otherwise to Install Remediation Onsite to Reduce the Impact of Contaminated Water	1	5	5	1	4	3	3	5	5	5	5	1	5	5	1	54
#61- 2018	Investigate Possibilities for Constructing a Town Boat Ramp off of Hall Street Above Garvin's Falls Dam to Help with Water Rescue Staging During Inundation, Icy or Debris Conditions	1	5	5	1	2	3	3	5	5	5	5	1	5	5	1	52
#56- 2018	Support the School District to Identify Secondary Motor Vehicle Access Options, with Traffic Engineering Designs, to Reduce the Impact of Wind, Storm, and Fire Hazards	1	5	5	1	3	5	5	5	2	5	5	1	1	2	1	47
#67- 2018	Assess Feasibility to Acquire Hall Street Floodplain Properties for the Potential of Voluntary Acquisition to Increase Floodplain Storage Capacity and Reduce Erosion of Riverbanks	3	3	5	5	1	3	2	5	3	2	5	5	1	3	4	43

Source: Bow Hazard Mitigation Committee

ACTION TIMEFRAMES

The Actions are also prioritized by an estimated **Action Timeframe** for completion based upon the other Town activities (hazard mitigation-related or not), funding potential for the Action, the need for the Action project, and possible staff time and volunteers available to complete the Action. This relative Action importance priority is measured by the **time indicated for project completion**. All Action projects within the **Mitigation Action Plan** have been assigned an **Action Timeframe**.

Those projects which are designated as **Ongoing** mean the Action should be undertaken on a regular basis throughout the five-year lifespan of the Plan. Actions that could qualify as **Ongoing** include public education, zoning ordinance or regulation revisions, essential mitigation maintenance and more. However, even **Ongoing** Actions are completed once before repetition. As a result, those Actions with an **Ongoing Action Timeframe** also include a duration (**Short, Medium or Long Term**).

Action Timeframe	Description of Timeframe
Ongoing	Action undertaken throughout the life of the 5-year Plan
Short Term	Action should be undertaken during Years 1-2 of the Plan
Medium Term	Action should be undertaken during Years 3-4 of the Plan
Long Term	Action should be undertaken during Years 4-5 of the Plan

Short Term projects are those which are the more important Actions and should be undertaken during **Years 1-2** of the Plan's lifespan if possible. **Medium Term** Actions are recommended by the Hazard Mitigation Committee to be undertaken during **Years 3-4** of the Plan's lifespan, while **Long Term** Actions are those which should wait until last, with suggested implementation undertaken during Plan **Years 4-5**. It is important to remember the **Action Timeframes** are relative to each other and are another an indication of Action importance. If an Action cannot be completed within the **Action Timeframe**, it may still be a higher priority than other Actions but was unable to be implemented for some reason.

Both the **Action Timeframe** and the **Ranking Score** are incorporated into the **Mitigation Action Plan** to assist the Town with implementing the hazard mitigation Actions. The Actions can be sorted within their Action Category by either priority for easy display of the desired characteristic; Actions can also be sorted by **Responsible Department** to keep them all together for ease of completion.

COST TO BENEFIT ANALYSIS

A simple **Cost to Benefit Analysis** ranking is contained within the enhanced STAPLEE criteria.

Natural Hazards Evaluated for Which Specific Actions Were Not Identified

The Hazard Mitigation Committee assessed each of the hazards and made determinations whether to specifically develop mitigation Actions for all natural hazards. Nearly all the potential Actions can be applied to multiple natural or other hazards based upon the generality of the Action's effect. Still, there could be no solutions or mitigation Actions developed for some of the more difficult to mitigate natural hazards. Many possible reasons are considered such as feasibility, prohibitive cost, jurisdiction, staff availability to develop and administer the project, lack of local support, unrealistic favorable outcome for the effort and more, all resulting in the point that for some natural hazards, potential Actions would not have worked for the Town.

Many Actions are general in nature and have the capacity to mitigate multiple types of natural hazards. Those hazards for which no specific or feasible Action was identified are displayed in **Table 44**.

Table 44
Committee Assessment of Natural Hazards with No Mitigation Actions

Natural Hazard	Committee Assessment
Tornadoes	The Committee felt Tornadoes specifically would be a difficult, unpredictable hazard event to mitigate. Although if another Tornado were to occur in Bow, existing activities such as the State Building Code, current practices of Public Works Department or utility company hazardous tree removal, and generators are in place to help mitigate effects. The Town monitors storms aggressively, establishes central command and uses Capital Area mutual aid. Several of the Severe Wind or Storm-related Actions could also apply to Tornadoes . The Committee felt no specific Actions were within the scope of their jurisdiction.
Downbursts	The Committee's assessment of Downbursts is the same as Tornadoes . They felt Downbursts could be mitigated by those Actions that addressed Wind or Storm events. The Committee did not feel specific mitigation Actions for Downbursts could be pursued.
Hurricane and Tropical Storms	The Committee feels Hurricane forces could appear in the community. The Actions designed to mitigate general Severe Wind or Storm -related events are applicable to Hurricane as well. These include Actions that address secondary access to the Schools, regulations requiring generators for certain facilities, hazardous trees, generators for sheltering facilities, street renaming, emergency response preparation, education programs, shoreland stabilization, and more. The Committee felt Hurricanes are addressed within the same Severe Wind or Storm-related Actions.
Excessive Heat	The Committee believes Excessive Heat issues may be better addressed at the public education level than by mitigation projects. The Safety Center Departments, including Emergency Management, Fire & Rescue and Police Departments, publicize excessive heat events, have lists of vulnerable residents to check on and the assisted living and 55+ facilities. Along with Heat comes the potential for more severe arboviral and tick-borne diseases. The Community Building, Baker Free Library and Old Bow Town Hall [~185 capacity total] offer Cooling Centers, and if needed, the Town Shelter Bow High School [~200 capacity]

Town of Bow, NH Hazard Mitigation Plan Update 2018

8 MITIGATION ACTION PLAN

Natural Hazard	Committee Assessment
	can open. The Committee did not feel additional mitigation Actions could be proposed for Excessive Heat beyond those which generally cover public health education undertaken regularly by emergency responders.

Source: Bow Hazard Mitigation Committee

9 ANNUAL IMPLEMENTATION AND EVALUATION

The Town received FEMA approval for the prior **Hazard Mitigation Plan** in **June 2013**. The completion of a planning document is merely the first step in its life as an evolving tool. The **Hazard Mitigation Plan Update** is a dynamic document that should be considered by all Town Departments, Boards, and Committees within their normal working environments. While evaluating the effectiveness of Actions in its everyday implementation, everyone should be able to contribute to the relevancy and usefulness of the Plan and to communicate with the Hazard Mitigation Committee where changes should be made. An annual effort will be undertaken to complete Actions and add new Actions as old tasks are completed and new situations arise. This Chapter will discuss the methods by which the Town of Bow will review, monitor, and update its new **Bow Hazard Mitigation Plan Update 2018**.

Annual Monitoring and Update of the Mitigation Action Plan

The Board of Selectmen should vote to establish a permanent Hazard Mitigation Committee within **3 months** of receiving the **FEMA Letter of Formal Approval** as indicated in **1 PLANNING PROCESS**. The purpose is to meet on a regular basis to ensure the **Hazard Mitigation Plan's** Actions are being actively worked on and the Plan is evaluated and revised to fit the changing priorities of the Town.

The Emergency Management Director or Board of Selectmen designee should continue to serve as Chair of the Committee for Hazard Mitigation meetings, and should be appointed to such a capacity by the Board of Selectmen. Current Hazard Mitigation Committee members can be appointed to continue to participate as members of the permanent Committee. More information is provided in **APPENDIX B**.

Committee membership should include:

<ul style="list-style-type: none">✓ Emergency Management Director✓ Town Administration✓ Fire Chief✓ Police Chief✓ Public Works Director✓ Code Enforcement Officer/ Zoning Compliance Officer✓ Town Planner or equivalent✓ 1 Board of Selectmen member✓ 1 Planning Board member	<ul style="list-style-type: none">✓ 1 Conservation Commission member✓ 1 Parks and Recreation Committee member✓ 1 Economic Development Committee member✓ 1 Library Trustee✓ 1 Historical Society member✓ 1 School District Representative✓ 1 Water District Representative✓ Members at Large (Stakeholders)
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9 ANNUAL IMPLEMENTATION AND EVALUATION

Stakeholders who should be solicited to attend meetings and to participate equitably in the Plan development process include representatives from the local utilities (Pennichuck, Abenaki) major industries and businesses, Bow School District, child care centers, White Rock Senior Living Community, neighborhoods, agricultural/farms, non-profits, and local, State or Federal agency representatives and members of the public. This composition provides a wide spectrum of potential interests and opportunities for partnership to develop and accomplish Actions.

This Committee will **aim to meet up to 4-6 times per year** with the following potential future meeting activities to update the **Mitigation Action Plan** and complete the Plan's annual evaluation as displayed in **Table 45**.

Table 45

Hazard Mitigation Committee Preliminary Annual Future Meeting Activities

Meeting Month	Preliminary HMC Interim Meeting Agenda Items
February	HMC continues update to the Mitigation Action Plan using Department Mitigation Action Progress Reports and an updated Action Status Tracking sheet . HMC provides revised copies to Department Heads, keeps original Word and Excel files accessible on Town computer system.
MARCH HMC Meeting <i>\$ available</i>	Annual funding is received from Town Meeting. HMC completes annual update of the Mitigation Action Plan and the associated Plan Chapter and sections (CHAPTER 8) with Progress Reports #3 . HMC determines Action Plan items to pursue for this year, including \$0 cost items.
March – June	HMC ensures Department Heads are provided with information to work on their Actions. HMC meets with Department Heads to inform about the Action priorities and requests attention to Short Term (1-2 Years) Actions. Departments begin working on Actions.
JUNE HMC Meeting <i>Infrastructure projects underway</i>	Infrastructure projects will be underway. HMC provides a Progress Report #1 for all Actions to responsible Depts/Boards for response by beginning of July. HMC reviews Annual Evaluation of the Plan (CHAPTER 9) . HMC works with the CIP Committee to get certain projects placed into CIP. Depts to begin placement of next year's high-cost Action Plan items into the CIP.
August	HMC to assist Department Heads with their budget requests to include Action Plan items, and to determine which Actions should have warrant articles. HMC continues assistance to Departments for Action Plan items. HMC begins to update the Action Status Tracking Sheet . HMC ensures Haz Mit Actions are added into the CIP.
SEPTEMBER HMC Meeting	HMC will identify projects to accomplish (including \$0) for the upcoming year. HMC attends Board of Selectmen budget meetings and suggests warrant articles for Action Plan items. HMC attends Budget Committee meetings scheduled through January to champion Action item funding.
DECEMBER HMC Meeting <i>Budget determined</i>	Town operating budgets are determined for the next year. HMC assists Board of Selectmen and Budget HMC with getting their mitigation projects funded and written into budgets. Action implementation continues. HMC provides a Progress Report #2 for all Actions to responsible parties for response by beginning of February along with the Action Status Tracking Sheet to display Action progress and request updates. HMC continues update to the Action Status Tracking Sheet using the Department Mitigation Action Progress Reports .

Sources: Bow Hazard Mitigation Committee

Annually and independent of the Town's budget cycle, a simpler listing of the Hazard Mitigation Committee's tasks should include:

-  **Document New Hazard Events that Occurred in Town**
 - Hazard Risk Assessment (**CHAPTER 4** table)
 - Local and Area History of Disaster and Hazard Events (**CHAPTER 4** table)
-  **Coordinate Completion of Annual Mitigation Actions by Assigning to Departments**
 - Appendix B Mitigation Action **Progress Report**
-  **Seek and Help Departments Acquire Funding for Actions & Fill in Tracking File**
 - Appendix B Mitigation **Action/Project Status Tracking**
-  **Evaluate Effectiveness of the Plan and Its Actions Yearly**
 - Appendix B Plan **Evaluation Worksheet**
-  **Obtain Semi-Annual Progress Reports from Departments & Update Tracking File**
 - Appendix B Mitigation **Action/Project Status Tracking**
-  **Update & Reprioritize Mitigation Action Plan and Update Supporting Plan Document Sections**
 - Mitigation Action Plan (**CHAPTER 8** table)
 - Enhanced STAPLEE Prioritization (**CHAPTER 8** table)
 - **Hazard Mitigation Plan Update 2018** sections as needed
 - Make note of the new information added/changed for the **2023 Plan** update!
 - Remember to invite the Stakeholders and public to all meetings and take minutes
-  **Repeat**

For each of the Hazard Mitigation Committee meetings, the Emergency Management Director (or Staff Coordinator) will invite other Department members, Board and Committee members, Town Staff, Bow School District representatives, and other participants of the **2018 Plan** Committee meetings. Identified and general members of the public will also be invited as indicated previously. Their purpose is to attend and participate in the meetings as full participants, providing input and assisting with decision making. Public notice will be given as press releases in local papers, will be posted in the public places in Bow, and will be posted on the Town of Bow website at www.bownh.gov.

The **Hazard Mitigation Plan's Mitigation Action Plan** will be updated and evaluated annually generally following the suggestions outlined within the Chapter. All publicity information, Agendas, and Attendance Sheets, should be retained and compiled for inclusion into **APPENDIX C**.

The Emergency Management Director and Department heads will work with the Board of Selectmen to discuss the funding of Action projects as part of the budget process cycle in the fall of each year. The

projects identified will be placed into the following fiscal year's budget request if needed, including the Capital Improvements Program (CIP), Town Operating Budgets, and other funding methods.

The Federal Emergency Management Agency (FEMA) encourages communities to upload their Hazard Mitigation Plan Actions into an online database. The **Mitigation Action Tracker** follows municipal Actions through their completion. This added attention to the Town's Actions could enable additional support for grant opportunities when it is shown the Town can complete its mitigation projects. The Town would need to set up an account to enter their Actions into the **FEMA Mitigation Action Tracker** at <https://mat.msc.fema.gov>.

Tasks of the Plan Update

A number of tasks will be accomplished for the complete (five-year, FEMA approved) update to the Hazard Mitigation Plan. Note that information from many Chapters will be used or referenced by other Chapters. The annual **Mitigation Action Plan** update tasks for the Hazard Mitigation Committee are indicated in bulleted list above and are noted below under the brief instructions for chapter updates.

1 PLANNING PROCESS

Add the new Hazard Mitigation Committee members, contributors, and the public who participated in meetings. Add any new Agendas to the Table. Retain all meeting, attendance, publicity and invitation documents in updated **APPENDIX C Meeting Information**.

2 COMMUNITY PROFILE

Revise the Tables with new demographic and housing information as it becomes available. Update the building permit figures. Revise land use data from the Avitar Appraisal System and compare to previous years' data. Update any zoning changes. The text analysis will need to be revised to reflect all changes.

3 GOALS AND OBJECTIVES

Review and update the general and hazard-specific objectives (Flood, Wind, Fire, Extreme Temperature, Human, Technological) to ensure their continued relevance.

4 HAZARD RISK ASSESSMENT - ANNUAL UPDATE (3 TABLES)

Review and update the **Hazard Risk Assessment**. Add new disasters, new Public Assistance funding received, and significant new hazard events since the last Plan into the Tables and Appendices. Determine the magnitude of new declared disasters. Add any specific narrative dialogue about new hazard events occurring in Bow. Update **Local and Area Hazard Event History** with new disasters or hazard events and review the **Hazard Risk Assessment** for necessary changes. Update **Potential Future Hazards** to document the possible new hazards that could occur in Town based on historic or current evidence.

5 COMMUNITY VULNERABILITY AND LOSS ESTIMATION

Review and update the **APPENDIX A Critical and Community Facility Vulnerability Assessment**

Tables to ensure accuracy. Update the Structure Valuation cost when new Avitar assessing data becomes available. Generate additional **Problem Statements** that arise because of issues with facilities. Update the Culvert Upgrade Table. Revise the number and type of buildings in the Special Flood Hazard Areas (floodplains) including new structure valuation and recalculate the discussion values. Once the new structure assessments are available, recalculate the building dollar losses by the other natural hazards. Update the NFIP Tables and changes to the Floodplain Development Ordinance.

6 CAPABILITY ASSESSMENT

Each Department and Board are to review and update the **Capability Assessment** for adoption date revisions, changes since the last plan, or future improvements. List additional example capabilities in the Chapter. Add additional mitigation support resource documents to the Table.

7 PRIOR ACTION STATUS

Review **Mitigation Action Plan** Actions for validity and revise as needed to place them in different categories: Completed, Deferred or Deleted. Explain why each Action was Deleted or Deferred and indicate when each Action was Completed.

8 MITIGATION ACTION PLAN - ANNUAL UPDATE (4 TABLES)

Remove Completed and Deleted Actions and move to **7 PRIOR ACTION STATUS**. Add New Actions to the **Mitigation Action Plan 2018** and ensure they are reviewed in the previous Chapter, listed above. Reevaluate Actions not yet completed, remove the Deleted, and evaluate any New Actions utilizing the enhanced **STAPLEE Mitigation Action Prioritization** matrix. Modify the approximate cost, date for completion, and funding changes as needed.

9 ANNUAL IMPLEMENTATION AND EVALUATION - ANNUAL ACTIVITY

The Hazard Mitigation Committee (HMC) should be permanently appointed by the Board of Selectmen to hold up to **4-6** meetings yearly to review, implement, and evaluate the Plan. Updates any procedures or processes in the Chapter. Use the **APPENDIX B Annual Plan Evaluation and Implementation Worksheets** to guide the annual update of **8 MITIGATION ACTION PLAN**. Keep track of publicity, Department Reports, and all progress made towards the identified Actions. Add progress since the last Plan for implementation programs. Review continued public involvement for accuracy. Add other new information to the Chapter or revise as needed if new information becomes available.

10 APPENDICES

Revise the **APPENDICES A-F** as needed to update the data and documentation for Bow. Ensure all the publicity documents, Agendas, Attendance Sheets, revised files and more are available for transfer to CNHRC when the **5-year** Plan update is due. These interim files will be placed into an updated **APPENDIX C Meeting Information**.

11 MAPS

Update [Map 1](#), [Map 2](#), [Map 3](#), and [Map 4](#) of the Plan as needed to reflect the changes of the hazard event locations and site locations. Mapping assistance may be sought elsewhere, such as with the Central NH Regional Planning Commission (CNHRPC). The other maps, [Map 5](#) (Fluvial Geomorphic Features and [Map 6](#) Fluvial Erosion Meander Belts were developed through special, one-time project funding and there are no future plans to update these maps.

Implementing the Plan through Existing Programs

In addition to work by the Hazard Mitigation Committee and Town Departments, several other mechanisms exist which will ensure that the **Bow Hazard Mitigation Plan Update 2018** receives the attention it requires for optimum benefit. Incorporating Actions from the Plan is often the most common way the Hazard Mitigation Plan can be integrated into other existing municipal programs, as described below.

MASTER PLAN

The latest **Bow Master Plan** was adopted in **2017**, developed by the Planning Board with assistance from the CNHRPC. The Master Plan is being updated again in **2018**, with the goal of rotating Chapter review and revision annually. Chapters updated include past and present housing and demographics, Existing and Future Land Use, Historical and Cultural Resources, Natural Resources, Transportation, Economic Development, Community Facilities, Regional Concerns, and Implementation. The Planning Board is aiming to update the Master Plan Chapters as needed annually to keep it current.

The Planning Board should consider adopting the Hazard Mitigation Plan Update as a separate Chapter to its Master Plan in accordance with **RSA 674:2.II(e)**. The **Hazard Mitigation Plan** should be presented to the Planning Board after FEMA's **Formal Approval**. The Plan can be considered for adoption after a duly noticed public hearing, just as any typical Chapter of a Master Plan.

Process to Incorporate Actions

The Hazard Mitigation Committee will present the approved **Hazard Mitigation Plan** to the Planning Board within **6** months after FEMA's **Letter of Formal Approval** is received for consideration and adoption into the Master Plan after a duly noticed public hearing. This is the same process used to adopt other components of the Master Plan. The NH State law supporting the development of a natural hazard mitigation plan as a component of a community Master Plan is **RSA 674:2-III(e)**. The Hazard Mitigation

Committee will oversee the process to begin working with the Planning Board to ensure that the relevant **Hazard Mitigation Plan** Actions are incorporated into the Master Plan.

Implementation Progress through the Master Plan Since the 2013 Plan

The existing **2017 Master Plan** developed by the Planning Board does not contain the **Hazard Mitigation Plan 2013** (or the **2015 Addendum**) as an Appendix.

How Was This or Will This Be Accomplished?

The **2017 Master Plan** will be updated by the Planning Board within the **5-year** Plan cycle. This is an opportune time to integrate the **Hazard Mitigation Plan 2018**. The Planning Board will be given a copy of the **2018 Plan** and can choose to incorporate several Action items that pertain to the Planning Board or incorporate the entire Plan by reference. Several Actions include revisions to Board regulations and to Capital Improvements, Zoning Amendments, or Subdivision and Site Plan Review regulations. The Emergency Management Director or designee will recommend that the Board incorporate the identified Planning Board-responsibility Actions as appropriate into the Future Land Use, Natural Resources, and Community Facilities and Services Chapters and include the **Hazard Mitigation Plan** into the **Master Plan** Appendix whenever the Planning Board updates the Master Plan.

CAPITAL IMPROVEMENTS PROGRAM

Bow's latest **Capital Improvements Program (CIP)** is a **6-year** plan for **2018-2023** with the intention of a **an annual** update. The HMC would like to ensure Actions requiring capital improvements funding from the **Hazard Mitigation Plan Update** will be inserted into the Capital Improvements Program for funding during the CIP's next update. Depending on the Town's funding needs, a Capital Reserve Fund for Hazard Mitigation Program Projects may be established to set aside funding for the many projects identified in the **Hazard Mitigation Plan Update**.

Process to Incorporate Actions

The Hazard Mitigation Committee will oversee the process to begin working with the Planning Board's CIP Committee to incorporate the various Hazard Mitigation Plan projects into the updated CIP. As the CIP is amended, a representative from the Hazard Mitigation Committee could request to sit on the CIP Committee or submit a CIP Project Application to ensure the mitigation projects are added, especially if the CIP is not updated as frequently as intended.

Implementation Progress through the CIP Since the 2013 Plan

Many of the **Completed** mitigation Actions could be finalized because of their placement into and purchase out of the Town's Capital Improvements Program (CIP). Prior CIP documents supported general projects which could be considered mitigation projects, but the listing of CIP projects did not contain hazard mitigation actions identified within the **2013 Plan** (or the **2015 Addendum**).

How Was This or Will This Be Accomplished?

The Town Departments, Emergency Management, and Town Administration will work together with Planning Board's **CIP Committee** to identify the items needed to be included within the updated **2018-2023 CIP** for the **Hazard Mitigation Plan** Action implementation. The Actions identified will be requested to be added to the next CIP or any of its interim updates.

ZONING ORDINANCE AND REGULATIONS

Several of the implementation strategies proposed involve revisions to the Zoning Ordinance, Subdivision Regulations, and/or the Site Plan Review Regulations. The Town Staff and/or Planning Board annually draft Zoning Ordinance amendments for Town Meeting approval. The Zoning Compliance Officer and Board may be requested to draft zoning amendments in order to accommodate Actions. The Land Use Regulations (Subdivision Regulations and Site Plan Review Regulations) are updated by the Planning Board as needed.

Process to Incorporate Actions

A Hazard Mitigation Committee member, perhaps the Town Administration or Zoning Compliance Officer, will work with Planning Board to develop appropriate language for modifications to the **Zoning Ordinance** and the **Subdivision and Site Plan Review Regulations** as they deem appropriate as appropriate to accommodate Actions in the **Hazard Mitigation Plan**. Other Committee members, if requested, could help Town staff draft language for respective changes to the Regulations or the Zoning Ordinance, and assist Town staff with presenting the language to the Planning Board for consideration.

The Hazard Mitigation Committee representative will request from the Planning Board a copy of future required language for any FEMA Zoning Ordinance Updates for incorporation into the Plan.

Implementation Progress through Zoning Since the 2013 Plan

The Town adopted the **April 19, 2010 NFIP DFIRM Maps** and respective updates to the **Zoning Ordinance** via the Board of Selectmen, a very special power granted by the NH Statutes **RSA 674:57**. Other Zoning Ordinance changes must be voted on at the Bow Town Meeting held annually in March. Revisions to Subdivision Regulations and Site Plan Review Regulations do not require Town Meeting

approval, but occur after duly noticed Planning Board public hearings. The last Floodplain Development Ordinance revision was approved in **2013**.

How Was This or Will This Be Accomplished?

The Planning Board directly obtains the required NFIP Floodplain Ordinance revision information from the NH Office of Strategic Initiatives and provides it to the Board of Selectmen for approval, a legislative power granted to the Selectmen. For any future updates to the **Floodplain Development Ordinance** not required by FEMA, the changes will have to be approved at Town Meeting. Other Zoning Ordinances can be proposed to the Planning Board by the Hazard Mitigation Committee members for Board incorporation into annual Ordinance public hearings.

TOWN MEETING

In Bow, the annual Town Meeting is held in March where the voters of the Town vote to raise money for capital projects and approve the annual operating budget of the Town. This is a good, revolving opportunity to fund some of the mitigation Actions of the **2018 Plan**.

Process to Incorporate Actions

The Hazard Mitigation Committee (HMC) members will work with the Budget Committee and Board of Selectmen to develop warrant article language for appropriate Actions for **Town Meeting vote**. The HMC members may also request deposits to appropriate Capital Reserve Funds for some of the larger projects. A representative from the Hazard Mitigation Committee will provide a copy of the current **Mitigation Action Plan** to both the Budget Committee and Board of Selectmen annually and validate the need for funding at the annual Town Meeting to accomplish the projects. The representative will work with Town Administration to write warrant article language for approval Action items if needed or to get the items placed into Department Operating Budgets.

Implementation Progress through Town Meeting Since the 2013 Plan

Town Meetings are used to accomplish many of the Action purchases. **Mitigation Actions Completed** could be implemented through various local funding sources: separate warrant articles, warrant articles to remove funds from the Capital Reserve Funds, or through adoption of Department Operating Budgets and the General Fund.

How Was This or Will This Be Accomplished?

The Emergency Management Director or designee, a member of the Hazard Mitigation Committee, brings Action items to be purchased to the Board of Selectmen and Budget Committee for consideration. The CIP should contain many of the Actions, as discussed previously. The Board of Selectmen and Budget Committee bring Actions to the **Town Meeting** via warrant articles, as well as the Operating Budgets, additional warrant articles which may include Action items in the CIP, and warrant

articles to add funding into the capital reserve funds. Many of the Action items are funded in this manner.

OPERATING BUDGETS

Many of the Actions will not require specific funding but are identified as requiring in-kind Staff labor to perform the work required to undertake the Actions. Town Departments and Staff have rigorous job functions that demand their undivided attention to the tasks required to run their respective Departments. Additions to the work load to accommodate the Actions can put a strain on their ability to serve the public during performance of their normal job duties. When possible, Bow Departments and Staff will be able to prioritize their tasks to work on **Hazard Mitigation Plan Update 2018** Actions. The in-kind work performed comes out of the Operating Budget for that particular Department.

Process to Incorporate Actions

With obtaining assistance from the HMC, the Department or Board is given the responsibility to ensure their Actions are completed, either by working on the Actions allocated to him/her when their normal job duties permit or by delegating the Action to another person. The funding for the Actions comes out of the Department's operating budget as work is undertaken by the Staff person on an as-time-permits basis unless the Action is a component of the Town staff members' normal work duties. Staff or volunteers will attempt to follow the **Action Timeframe** as a guideline for completion. A yearly review of the **Mitigation Action Plan** by the Hazard Mitigation Committee will reprioritize the Actions, and the members can report on their progress, asking for assistance or more time as needed.

Implementation Progress through Operating Since the 2013 Plan

The **Operating Budgets** of the Town Departments typically served to implement many of the Actions displayed in **Mitigation Action Plan**. Most of the Completed projects required small amounts of funding from the respective Department Operating Budget or were completed in-kind using staff or volunteer time. In small New Hampshire communities like Bow, many mitigation projects are completed with the existing staff and materials within the Operating Budget or are completed by volunteers. In either case, Action completion may take longer to implement to help reduce taxpayer costs.

How Was This or Will This Be Accomplished?

Department heads who participated in the Hazard Mitigation Committee submitted their Action items to Board of Selectmen and Budget Committee for consideration. Individual Department needs are recognized as part of their respective **Operating Budgets** and are proposed to the Board of Selectmen and Budget Committee. All Operating Budgets are approved (and often amended) by voters at the annual March Town Meeting. Adding mitigation Actions to Department Budgets is a good way to obtain funding for some projects when the Operating Budgets are approved.

Continued Public Involvement

On behalf of the Hazard Mitigation Committee, the Emergency Management Director and the Staff Coordinator, under direction of the Town Administration, will be responsible for ensuring that Town Departments and the public have adequate opportunity to participate in the planning process. Administrative staff may be utilized to assist with the public involvement process.

For each interim meeting in the annual update process, and for the **5**-year update process procedures that will be utilized for public involvement include:

- »» Provide personal invitations to Town volunteer Board and Committee Chairs, and Budget Committee members;
- »» Provide personal invitations to Town Department heads;
- »» Provide personal invitations to the following entities listed below;
- »» Post public meeting notice flyers on the Town's website at www.bownh.gov and in the Town Offices, Library, Recreation Department, Historical Society, and/or local business(es);
- »» Submit media releases to the Concord Monitor (a paid, regional daily newspaper serving over **40** communities around the Concord area) and the Union Leader (a paid, statewide daily newspaper) and The Bow Times (a monthly, local free, pick-up newspaper serving **5-6** area communities).

Agencies and businesses to invite to future **Hazard Mitigation Plan Update** meetings include representatives from the local utilities (Pennichuck, Abenaki) major industries and businesses, Bow School District, child care centers, White Rock Senior Living Community, neighborhoods, agricultural/farms, non-profits, and local, State or Federal agency representatives and members of the public (see **APPENDIX A Critical and Community Facilities Vulnerability Assessment** Tables: Vulnerable Populations, Economic Assets and Recreational and Gathering Sites). The Emergency Management Directors of the neighboring communities will be invited as will the NH Homeland Security and Emergency Management Field Representative for Merrimack County. The Town will provide the Central NH Regional Planning Commission with Agendas, Minutes and other materials for archiving, to be used when the **5-year** update again becomes necessary (email to salexander@cnhrpc.org). Any State, regional or federal interest in Bow should be considered for direct invitation.

All meetings should be posted to the Town's Calendar and announced on the Town's website home page at www.bownh.gov. The Town should consider developing a new section of the Town website dedicated to Hazard Mitigation Committee activities and the **2018 Plan**. This webpage should be kept updated with meeting notices and materials used by the Hazard Mitigation Committee. A new section would be an optimal location to place the final **2018 Plan** and its **Maps** and **Appendices** and to continue adding materials for annual Plan updates. A number of Action Plan items which will be undertaken

relate to public education and involvement and this website would be an exemplary method of getting the word out.

Implementation and Evaluation of the Plan

During the Committee's annual review of the **Mitigation Action Plan**, the Actions are evaluated as to whether they have been **Completed**, **Deleted**, or **Deferred**. Those Action types are placed into their respective Tables. Any **New** Actions will be added as necessary. Each of the Actions within the updated **Mitigation Action Plan** will undergo the enhanced STAPLEE ranking as discussed in **8 MITIGATION ACTION PLAN**.

A set of comprehensive **Annual Interim Plan Evaluation and Implementation Worksheets** is available to assist the community with Plan implementation in **APPENDIX B**. These worksheets are to be used during the Hazard Mitigation Committee basic meeting schedule outlined previously in **Table 45**.

The worksheets include administrative and organizational documents, those that are used with the Appendices spreadsheets developed, and two Agendas to get started with HMC Interim Update meetings:

- ↳ Permanent Hazard Mitigation Committee Establishment
- ↳ Organization of Public Invitees to Join Meetings
- ↳ HMC Interim Meeting (IM) Publicity Tracking 2019-2023
- ↳ Annual Interim Plan Update Evaluation Worksheet 2019-2023
- ↳ Hazard Mitigation Actions Status Tracking 2019-2023
- ↳ Department Mitigation Action Progress Report 2019-2023
- ↳ Attendance Sheet Example
- ↳ Agenda IM1 Example
- ↳ Agenda IM2 Example

The **5-year** full Plan update will evaluate the Actions in the same manner in addition to fulfilling all of the **TASKS OF THE PLAN UPDATE** earlier in this Chapter.

10 APPENDICES

The following **APPENDICES A-F** are included under a separate electronic or paper document to maintain the relative brevity of this **Hazard Mitigation Plan Update**.

Listing of Bow Hazard Mitigation Plan Update 2018 Appendices

Some of these documents should be updated annually as part of the interim Action implementation and Plan evaluation process*. The remaining **APPENDICES** could be amended as a result of the new or revised annual information, but they are optional. It is necessary to establish a location for placing any new or updated hazard, Action, meeting or Plan data over the **5-year** interim until the Plan is fully updated again.

- A Critical and Community Facility Vulnerability Assessment**
- B Annual Plan Evaluation and Implementation Worksheets ***
- C Meeting Information ***
- D Plan Approval Documentation**
- E Turkey River Fluvial Geomorphic Assessment Addendum 2015**
- F Photographic History of Bow Hazard Events**

11 MAPS

Four detailed Maps were created during the development of the **Bow Hazard Mitigation Plan 2018**.

Data from the previous Plan maps were used, new standardized data layers were available, and Hazard Mitigation Committee members added their own knowledge of sites and hazard events.

Plan Update 2018 Maps

Map 1 - Potential Hazards illustrates potential hazard event locations in Bow that have the possibility of damaging the community in the future. The **Map 1** legend includes (technology) infrastructure hazards such as dams, bridges, electric transmission lines and evacuation routes. Natural hazards are displayed such as Special Flood Hazard Areas (SFHAs), locations of potential flooding/ washout, fire/wildfire, bridge washout, ice and snow, steep slopes (>15%) and more.

Map 2 - Past Hazards illustrates the locations of where hazard events have occurred in Bow in the past, including areas of SFHA, flooding/washout, snowmelt, dam breach, fire/wildfire, wind damage, ice damage, vehicle crash locations, and more.

Map 3 - Critical and Community Facilities includes the infrastructure included in **Map 1 Potential Hazards** on a background of aerial photography and the SFHAs to give viewers a better, real world perspective. The locations of all critical facilities and community facilities as recorded in the **APPENDIX A Critical and Community Facilities Vulnerability Assessment** are displayed on the Map. Each of these sites is numbered on a key listing the names of each facility.

Map 4 - Potential Hazards and Losses utilizes all the features of **Map 3** on an aerial photography background and includes the **Map 1 Potential Hazards** and any realistic **Map 2 Past Hazards** locations where hazard events can occur again in Bow.

-  **Map 1 - Potential Hazards**
-  **Map 2 - Past Hazards**
-  **Map 3 - Critical and Community Facilities**
-  **Map 4 - Potential Hazards and Losses**

The special [**Map 5**](#) displays fluvial geomorphic features identified in Bow's field and research data collection for development of the [**Turkey River Fluvial Geomorphic Features Addendum 2015**](#).

 **Map 5- Fluvial Geomorphic Features Turkey River 2015**

The special [**Map 6**](#) displays *where* the Turkey River is projected to meander in the future and its relative *sensitivity to* meandering during high flow and flooding conditions. Both [**Map 5**](#) and [**Map 6**](#) are essential components of the [**Turkey River Fluvial Geomorphic Features Addendum 2015**](#).

 **Map 6- Fluvial Erosion Hazard Meander Belts Turkey River 2015**