RISK ASSESSMENT

A detailed risk assessment is required as part of §201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

For the 2016 update, past events, Presidential Disaster Declarations, National Oceanic and Atmospheric Administration (NOAA) and local experiences were reviewed and analyzed by the Penobscot County Hazard Mitigation Committee during the risk assessment for all potential hazards within the county[1]. This assessment of local and county wide vulnerabilities was used as a baseline for the committee to make educated decisions in identifying and prioritizing mitigation actions and projects to reduce losses from identified hazards.

For the 2021 update, PTEMA opted not to utilize a committee and let each jurisdiction determine their unique risks and vulnerabilities to natural hazards, sharing that information in the risk survey sent out and returned to PTEMA. PTEMA provided guidance, direction, and federal, state, local, and non-profit stakeholder contact information, if requested, to assist jurisdictions in their determination.

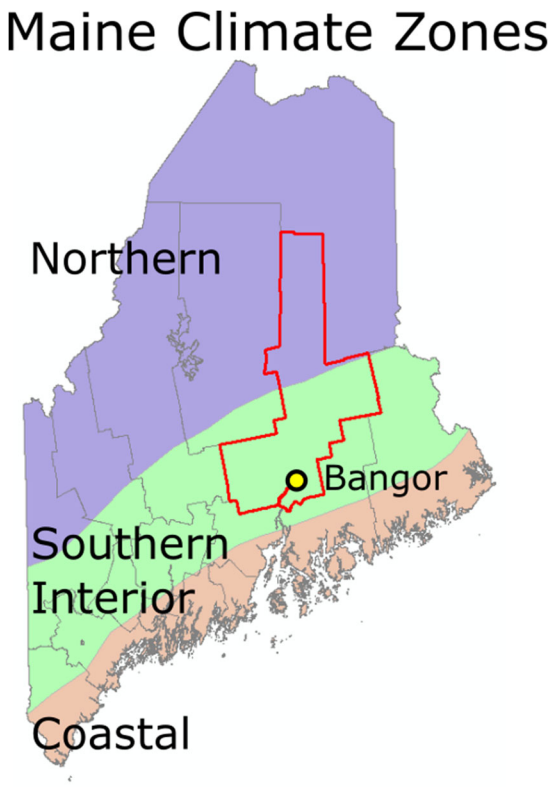
The Risk Assessment evaluates Penobscot County's vulnerability to natural hazards and provides sufficient information to identify and prioritize appropriate mitigation actions to reduce losses. The section starts with a brief overview of scientific research on climate variation and the possible effects on Penobscot County.

Climate and Geography. As shown in the **Figure 4.1** below, Maine has three distinct climate divisions whose boundaries run parallel to the coastline[2]:

.

[1] NOAA storm events database for Penobscot County from January 2016 to October 2021: https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=ALL&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=2016&endDate_mm=10&endDate_dd=14&endDate_yyyy=2021&county=PENOBSCOT%3A19&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=23%2CMAINE

[2] Maine State Hazard Mitigation Plan 2019: https://www.maine.gov/mema/sites/maine.gov.mema/files/inline-files/State%20Hazard%20Mitigation%20Plan%202019%20Update_10.8.2019.pdf



The Northern Division: Encompasses the northernmost 17,916 square miles (54%) of the state. This division is least affected by marine influences and it contains most of the central and western mountainous regions.

The Southern Interior Division: Contains the 10,307 square miles adjacent to the Northern Division and represents 31% of the state's area.

The Coastal Division: Occupies the smallest area, a 20 to 30-mil band along the coast or 4,992 square miles (15% of the state's area). This division is most affected by the ocean, but has minimal elevation chance and thus, minimal climatic impact from any topographic controls.

Figure 4.1: Maine Climate Divisions Source: State of Maine Hazard Mitigation Plan, 2019

Climate Variation

In a 2020 executive summary, the Intergovernmental Panel on Climate Change (2020)[3] concluded that "Since the pre-industrial period, the land surface air temperature has risen nearly twice as much as the global average temperature (*high confidence*). Climate change, including increases in frequency and intensity of extremes, has adversely impacted food security and terrestrial ecosystems as well as contributed to desertification and land degradation in many regions (*high confidence*)." **Figure 4.2** below highlights the drastic change since the pre-industrial period in the land use and the observed climate change interface.

[3] IPCC Climate Change and Land Summary for Policymakers https://www.ipcc.ch/site/assets/uploads/sites/4/2020/02/SPM_Updated-Jan20.pdf

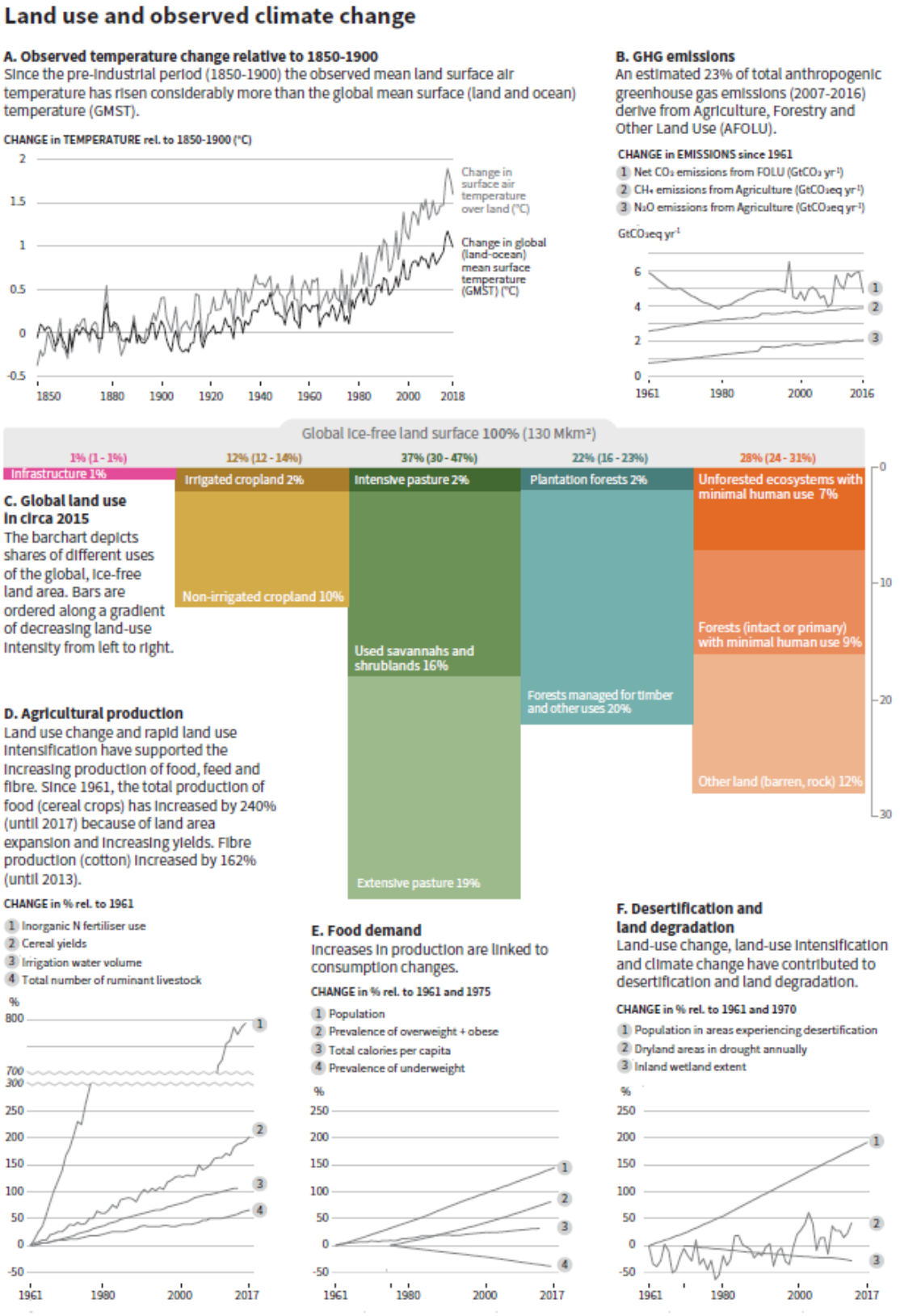


Figure 4.2: Land Use and Observed Climate Change

Source: Intergovernmental Panel on Climate Change, 2020

Narrowing the focus to here in Maine, (Fernandez et al. 2020)[4] reports that

> "In Maine, we are acutely aware of the importance of our ocean, forests, fields, wetlands, lakes, and rivers to our way of life, our livelihoods, and our economy. All of these characteristics of Maine are shaped, in part, by our climate. We have always dealt with the challenges of weather and the joys of four seasons, but what we are experiencing now is both accelerating change in extremes and long-term averages of weather that reflect fundamental changes in the boundary conditions, or the historical range of conditions, of our climate. While these changes are consistent with the patterns reported in global and national climate assessments, those assessments are not specific to Maine, nor to our unique way of life" (Page 2)

In the near-term (between now and 2050), the recent Coastal Maine Climate Futures report (Birkel and Mayewski 2018)[5] outlined five "Plausible Future Climate Scenarios" that could play an important role in the weather and climate we experience over the next decade or more. They range from the mundane to significant "climate surprises" and include: (1) the "New Normal" with recent patterns persisting without additional change for the next decade; (2) "Moderate Warming" which, in the near-term, reflects the trends we have seen in the 2000s with significant consequences even despite modest rates of warming of about 1 °F1ºF over the next decade; (3) "Abrupt Arctic Warming," as we experienced in 2012, causing abrupt warming in Maine but also a potential chronic change driven by the loss of Arctic sea ice; (4) temporary "Volcanic Cooling" due to the chance of a major volcanic eruption someplace on the planet; or (5) "El Niño Warming." These four large-scale climate teleconnections as shown in **Figure 4.3** could influence Maine's weather over the near-term, with particular uncertainty associated with precipitation impacts from El Niño.

[4] Maine's Climate Future: 2020 Update
https://digitalcommons.library.umaine.edu/cgi/viewcontent.cgi?article=1005&context=climate_facpub
[5] Coastal Maine Climate Futures https://climatechange.umaine.edu/wp-content/uploads/sites/439/2018/11/CoastalMaineClimateFutures-1.pdf

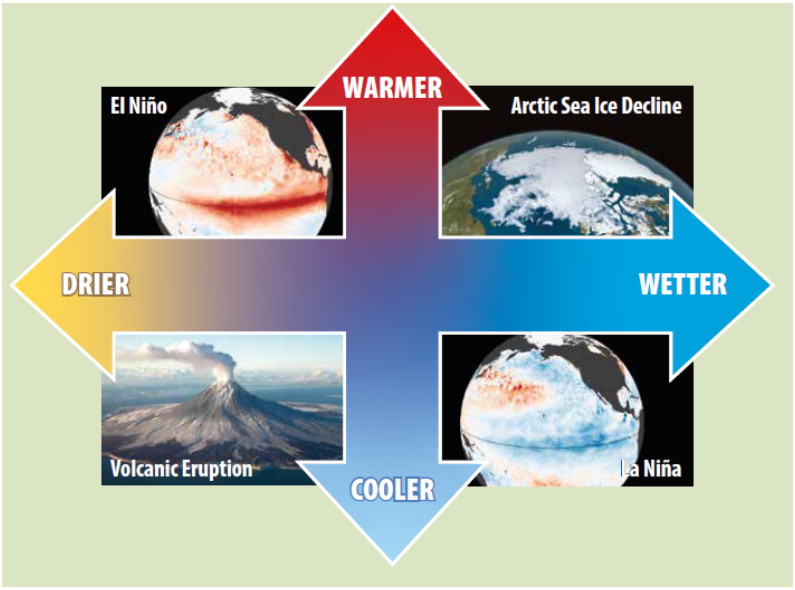


Figure 4.3: Plausible future scenarios
Source: Birkel and Mayewski 2018

Table 4.1 below provides a listing of resources used in researching the effects of climate variations and its impact on ecosystems in Penobscot County. The review and incorporation process described in Section III was also used to incorporate relevant information from these climate change resources.

Resources used in Planning	
FEMA Mitigation Planning Toolkit	FEMA
FEMA Lower Penobscot Watershed – 2021 Update	February 2021 Compass PTS project consultant
National Flood Insurance Program Community Rating System Coordinator's Manual	2021 Addendum to the 2017 Manual FEMA
Flood Insurance Manual, Effective April 1, 2021	April, 2021 FEMA
Scientific Assessment of Climate Change and its Effects in Maine	August 2020 Maine Climate Council – Scientific and Technical Subcommittee
Maine's Climate Future - 2020 Update	2020 University of Maine Climate Change Institute
2019 State of Maine Hazard Mitigation Plan	2019 MEMA
Maine Commodity Flow Study	2018 IEM consulting
People and Nature: Adapting to Climate Change	2010 Maine DEP
Climate Change and Biodiversity in Maine: A ClimateChange Exposure Summary for Species and Key Habitats	2013 Manomet Center for Conservation Sciences

IPCC Summary for Policymakers: Climate Change and Land Report	2020 Intergovernmental Panel on Climate Change
Exercises and Trainings in Preparation	
Regional Spring Flooding Tabletop Exercise	March 2019 Penobscot County Emergency Operations Center
Local Spring Flooding Tabletop Exercise	October 2019 City of Old Town

Temperature Changes: Excerpts from the report "Maine's Climate Future, 2020 Update," (Fernandez et al. 2020), include the following:

> "Temperatures are increasing statewide. Average annual temperature has increased 3.2 degrees Fahrenheit (°F) in the last 124 years, and the rate of warming has increased most notably since 1960. The six warmest years on record have occurred since 1998. Indeed, the Northeast is warming faster than any other region in the U.S., and is projected to warm 5.4 °F (3 °C) when the rest of the world reaches 3.6 °F (2 °C)" (page 3).
>
> "Shorter winters and more extreme rain events are associated with greater tick and mosquito activity and abundance. Lyme disease remains by far the most pervasive problem, and is changing the way Maine people and visitors interact with the outdoors at work and play" (page 10).
>
> "The Gulf of Maine has experienced a rate of warming that few marine ecosystems have encountered, and it is expected to continue warming at an above average rate. Warmer temperatures extend the period of stratification. With less mixing, fewer nutrients reach the surface, a trend that could lead to a less productive Gulf of Maine" (page 11).

In **Figure 4.4** below, is a visual depiction to showcase the entire state of Maine has warmed, and temperature increases have been greatest in the coastal division.

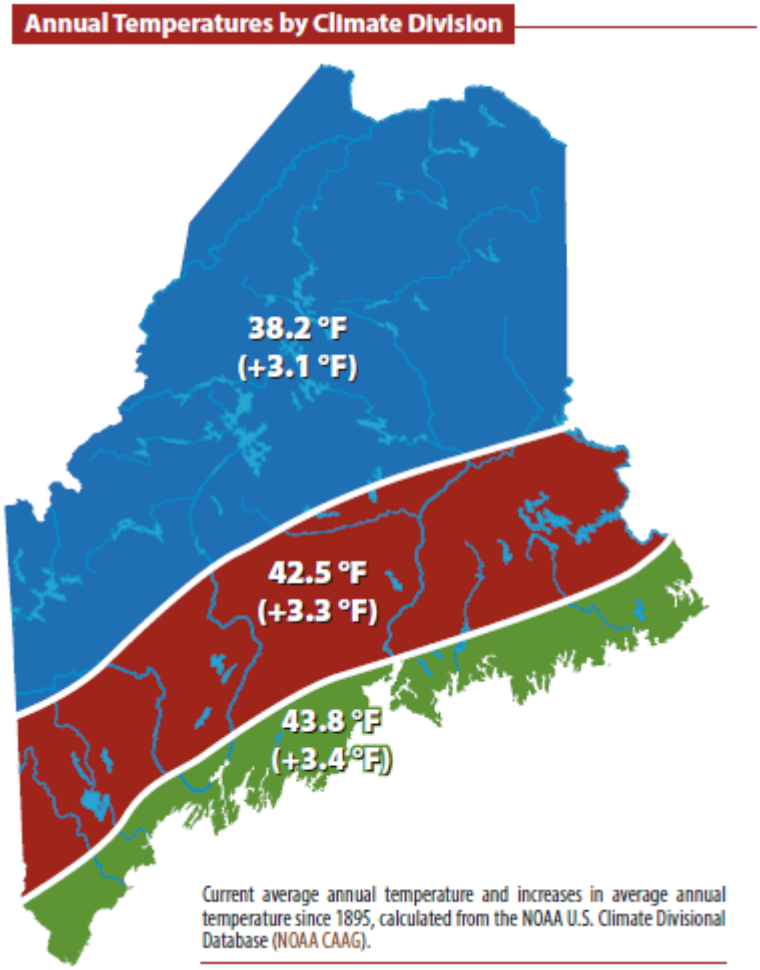


Figure 4.4: Annual Temperatures by Climate Division
Source: Fernandez et al, 2020

"From north to south, inland to the coast, the most warming has occurred in the winter, with average minimum temperatures increasing 3.7 to 4.3 °F over the long-term. Warming winter temperatures mean that more precipitation is falling as rain instead of snow. Statewide average annual snowfall is estimated to have decreased by about 17 percent over the past century. A lesser downward trend of 3 percent is estimated since 1960, partially attributed to increased moisture availability associated with warmer air.

Since the mid-1990s, there has been considerable variability, with winters of low snowfall (e.g., 2004 and 2010) and high snowfall (e.g., 2008 and 2019). In addition, there can be considerable local variability at specific stations when compared to the statewide trend shown here. Northern Maine in particular diverges from the broader trend: the Caribou station shows that January 2019 was the snowiest month on record (58.9″) and 2018–19 winter season as a whole was the third-snowiest on record since record keeping began in 1939 (NWS 2020a). A recent analysis of temperatures and snow cover across the northeastern U.S. and Canada

during winter (November to May) found changes in many seasonal indicators in the region over the last one hundred years, with fewer days of extreme cold, frost, snow, and ice, and more frequent thaws and days with bare ground and mud (Contosta et al. 2019).

More and more, we seem to be experiencing "winter weather whiplash," with rapid shifts from freezing to thawing conditions, heat waves and rain in the depths of winter, and cold or snow in spring and fall when the leaves are still on the trees (Casson et al. 2019). Arctic blasts cause cold snaps and can contribute to major snowstorms during otherwise mild winters (Francis and Skific 2015, Cohen 2016, Cohen et al. 2018, Zarzycki 2018, Harvey 2019)."

Precipitation Changes: Excerpts from the report "Maine's Climate Future, 2020 Update," include the following:

"Precipitation is increasing in frequency and intensity in Maine as depicted in **Figure 4.5**. Average annual precipitation has increased 15 percent (5.8 inches) since 1895, and the increase has come in the form of more rain, and less snow. Since 1895, depth of annual snowfall has decreased 20 percent (2.3 inches). As with temperature, the rate of increase has accelerated in recent decades" (Page 5).

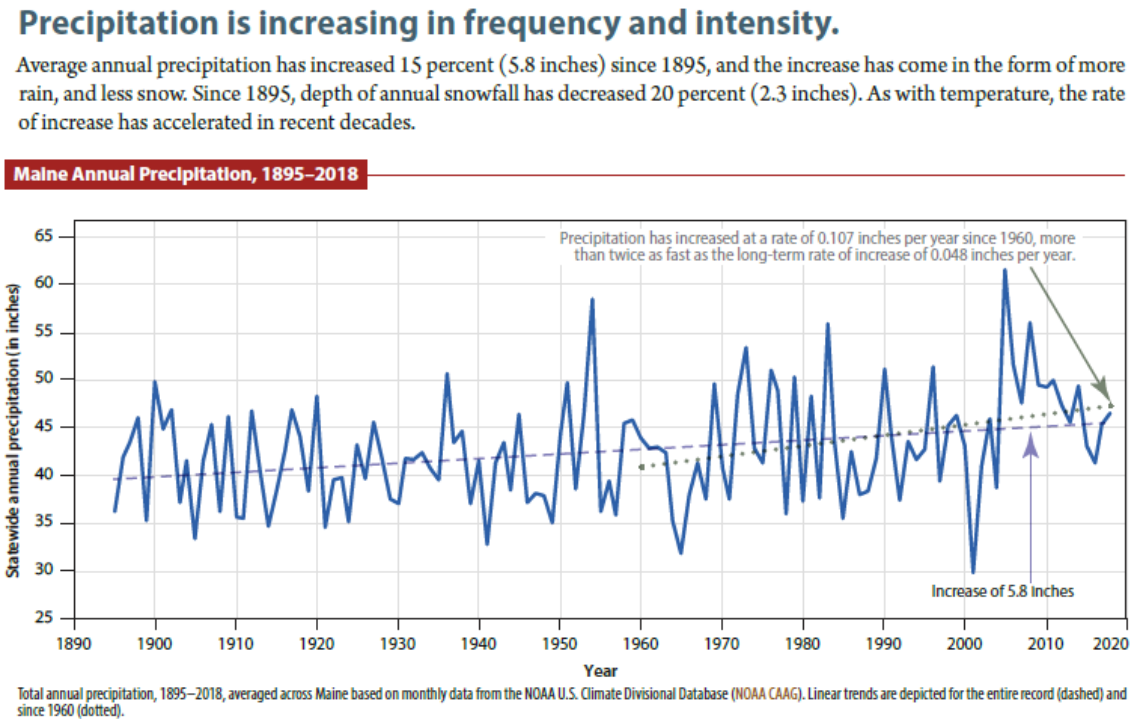


Figure 4.4: Maine Annual Precipitation
Source: Fernandez et al. 2020

"Increased precipitation means increased volume of runoff to local streams, rivers, and ultimately the Gulf of Maine (Vincent et al. 2015, Huntington et al. 2016). These higher flows and floods can impact drinking water (Warner and Saros 2019) and damage roads, bridges, and properties. Storms often include

strong winds, such as the October 2017 event that was the worst wind storm in Maine's history (Jellig 2018). More than half a million people lost electricity due to damaged power lines that cost Central Maine Power Company $69 million (Russell 2018)" (Page 6).

IDENTIFYING NATURAL HAZARDS

Description of Hazards	
Requirement §201.6(c)(2)(i): The risk assessment shall include a description of the type, location and extent of all natural hazards that can affect the jurisdiction.	
Element	B1. Does the Plan include a description of the type, location and extent of all natural hazards that can affect each jurisdiction?
	B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction?

Table 4.2 below examines each hazard that may threaten Penobscot County. Rating their priority was accomplished through the 2018 County hazard vulnerability assessment and review of the 2019 State Mitigation Plan, as well as through discussions with town/city officials. PTEMA also reviewed past disaster declarations and other historical records. The first four High priority hazards that this plan targets remain the same as in the 2016 Plan: flooding (including dam failure/breach), severe summer storms (thunderstorms, tornadoes, and "shoulder season" wind storms), severe winter storms (snowstorms, blizzards, nor'easters, ice storms), and wildfire.

Summary of Hazards Profiled in the Plan		
Hazard	**How Identified**	**Why Identified**
Flooding (Includes riverine, spring and stormwater runoff, ice jams, heavy rains) Includes dam failure/breach,as end result is flooding)	Review of FIRM maps Review of SLOSH maps Review of past disaster declarations(FEMA) Maine's Floodplain ManagementCoordinator PTEMA/MEMA records Review of repetitive loss properties Input from municipal staff	Penobscot County has suffered repeatedly from flood hazard events. These events have resulted in significant damage to property, economic disruption, reduced access for emergency vehicles, injury, and loss of life.

Severe Summer Storms (includes thunderstorms. tornadoes, and shoulder season wind storms)	Review of past disaster declarations Input from municipal staff Review of NOAA records	All of Penobscot County is subject to periodic severe summer storms. Summer storms have caused damage and injury from microbursts and tornado-like tornadoes in recent history.
Severe Winter Storms	Review of past disaster declarations Input from municipal staff Review of NOAA records	All of Penobscot County is subject to periodic winter storms. Ice storms in 1998, 2008, and 2013 caused significant damage in Maine.The last two disaster declarations (DR-4108 in 2013, DR-4208 in 2015) that included Penobscot County were for winter storms/flooding
Wildfire	Review of Maine Forest Service records Input from municipal staff	Outside of the urbanized areas of the county, much of the land area is still forested, and while it puts the area at high risk of wildfire, it would depend on factors such as drought, humidity, or firefighting accessibility. Some areas in the county have a recent history of experiencing very small wildfires (<100 acres).
Earthquake	Review of Northeast States Emergency Consortium Hazus-MH Earthquake Impact Report	Maine has a steady rate of low magnitude earthquake occurrence (<4.0 and with little damage). No substantial damaging ground motion has been recorded in Maine, though such an event would have disastrous consequences. For this reason, a brief regional-scale hazard profile is provided.
Drought	Review of 2020-2021 USDA Disaster Designations, U.S. Drought Monitor and Maine Drought Task Force Reports	Northern Penobscot County has recently experienced abnormally dry and moderate drought conditions. The greatest impact has so far been unique to this part of Penobscot County and so we address this hazard pursuant to Planning Element B1d.

Table 4.2: Hazards profiled in 2021 update

Table 4.3 identifies the hazards that were eliminated from further consideration in the 2021 Plan, due to lack of historical evidence or lack of overall countywide severity. Although these disaster events are not profiled in the MJHMP, it does not mean that any

of these events will not or could not occur and cause great damage. As the climate of Maine changes, the hazards may be added to the high priority list in the future. For this Plan, PTEMA's goal is to keep the plan relevant by profiling only the top four hazards.

Hazard	How Identified	Reason for Non-Inclusion
Dam Failure	PTEMA dam records and files MEMA Dam Safety Program	Penobscot County has a number of high and significant hazard dams. Dam breach can cause rapid downstream flooding. Included under Flooding in the Priority Hazards section
Hurricanes	MEMA records National Weather Service NOAA website	Coastal communities are most at risk from tropical events. While hurricanes can produce heavy rains, intense winds, storm surges resulting in flooding and coastal erosion, they remain a rare event in Penobscot County. Extra-tropical events,such as nor'easters tend to cause more frequent damages (see Winter Storms). However, if hurricane probability were to increase, it would be included in future updates of the plan.
Avalanche	Review of USGS maps	There are no mountains in the county with topographic and vegetative characteristics that result in avalanches.
Blight/Infestation	MEMA data Input from stakeholders	Data indicates that there is limited history of damage, injury, or death resulting from blight and infestation in the county.
Ground Subsidence	Review of Maine Geological Survey records	There have been no reported incidences of sudden land subsidence occurring in Penobscot County.
Landslide	Review of Maine Geological Survey Coastal Bluffs Maps and Coastal Landslide Hazards Maps	Although landslides do occur in the county, they are localized and it is unknown as of this update if they might pose a more widespread risk.
Extreme Temperatures	NOAA Storm Events Database	Though extreme temperature events may occur in Penobscot County, so far, they have not posed a widespread risk to communities.

Table 4.3: Risks omitted

HAZARD SUMMARY BY JURISDICTION

PTEMA reviewed each community's risk survey, and historical statistical data, specifically over the last five years, to determine the county's risk profile. The following Table 4.4 shows the most likely threats to each municipality within the county as reported to PTEMA. Although winter and summer storms are more frequent, the dollar impacts are more predominant for flooding. For the 2021 Plan update, the hazards for each community were again reviewed and it was determined that the threat potential was unchanged.

Name of Municipality	Flood	Severe Summer Storms	Severe Winter Storms	Wildfire
Alton	X	X	X	X
Bangor	X	X	X	X
Bradford		X	X	X
Bradley	X	X	X	X
Brewer		X	X	X
Burlington		X	X	X
Carmel		X	X	X
Carroll		X	X	X
Charleston	X	X	X	X
Chester	X	X	X	X
Clifton		X	X	X
Corinna	X	X	X	X
Corinth		X	X	X
Dexter	X	X	X	X
Dixmont	X	X	X	X
Drew		X	X	X
East Millinocket	X	X	X	X
Eddington	X	X	X	X
Enfield	X	X	X	X
Etna		X	X	X
Exeter		X	X	X
Garland		X	X	X
Glenburn	X	X	X	X
Greenbush	X	X	X	X
Hampden		X	X	X
Hermon		X	X	X
Holden		X	X	X
Howland	X	X	X	X
Hudson	X	X	X	X
Kenduskeag	X	X	X	X
Lagrange		X	X	X
Lakeville		X	X	X
Lee		X	X	X
Levant		X	X	X
Lincoln	X	X	X	X
Lowell		X	X	X
Mattawamkeag	X	X	X	X

Maxfield	X	X	X	X
Medway	X	X	X	X
Milford	X	X	X	X
Millinocket	X	X	X	X
Mount Chase		X	X	X
Newburgh		X	X	X
Newport	X	X	X	X
Old Town	X	X	X	X
Orono	X	X	X	X
Orrington	X	X	X	X
Passadumkeag	X	X	X	X
Patten		X	X	X
Penobscot Nation	X	X	X	X
Plymouth		X	X	X
Seboeis		X	X	X
Springfield		X	X	X
Stacyville		X	X	X
Stetson		X	X	X
Unorganized Territory	X	X	X	X
Veazie	X	X	X	X
Webster		X	X	X
Winn	X	X	X	X
Woodville		X	X	X

Table 4.4: Municipal Risk Assessment
Source: 2021 Municipal Risk Survey

Hazard Profiles

The following highlights the four priority hazards in Penobscot County.

HAZARD: Flooding (including dam failures)

Flooding is defined as a temporary inundation of normally dry land because of: the overflow of inland or tidal waters, or the unusual and rapid accumulation or runoff of surface waters from any source. The nature of Maine's geography, geology and hydrology is such that flooding is usually fast rising, but short in duration. Severe flooding in Penobscot County can cause loss of life, property damage, disruption of communications, transportation, electric service and community services, crop and livestock damage, health issues from contaminated water supplies, molds and mildew within structural components, and loss and interruption of business

In most years, Penobscot County receives a fairly high level of precipitation year-round, as evidenced in **Table 4.5** below. Widespread flooding occurs regularly in the spring and fall, especially along the Penobscot River and its tributaries. Localized flooding occurs during the summer as a result of short high-intensity rainfall from thunderstorms. The average annual rain total is 41.93" and the average annual snowfall total is 66".

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Average Precipitation In Inches	2.89	2.52	3.38	3.62	3.64	3.76	3.46	2.98	3.83	4.17	4.20	3.48
Average Snowfall in Inches	19	15	12	4	0	0	0	0	0	0	2	14

Table 4.5: Average Precipitation by Month in Penobscot County
Source: U.S. Climate Data, 2021[6]

A. Location (i.e., geographic area affected) of flooding/erosion/dam failure hazard:

Flooding occurs annually in Penobscot County at varying extents in various locations. Spring snow melt and heavy rainfall are the most common causes of flooding and may cause rivers to overflow their banks or lakes and ponds to rise above their normal elevations which can also cause erosion.

Additionally in the spring, ice jams may occur and reduce the ability of the water to flow. This causes a higher-than-normal water level behind the jam and when the jam is removed, it may send a substantial volume of water down river. Ice jams occur at varying extents each year in the Penobscot River.

In more densely developed communities, abnormally high-water flow can overwhelm sewer and storm water infrastructure flooding roadways, parking lots and basements.

In rural areas it is not uncommon for "nuisance beavers" to plug culverts and other drainage devices resulting in flooded roadways. Some municipal road commissioners employ culvert guards or fences to mitigate flooding from beaver dams[7].

Another potential flooding issue is the breaching of dams or other water retention features that would cause a water surge to downstream locations. The Penobscot watershed has a number of dams/retention waters to control the flowage particularly on the Penobscot River since it plays a vital role in hydro-power generation.

During any of these events it is not uncommon for roads, culverts and other infrastructure to be compromised and for erosion to occur.

Please see the town and county maps in the map section of this document for locations of water bodies and, where available, Effective and Preliminary Special Flood Hazard Areas (SFHA) products.

The Penobscot River Watershed

Penobscot County contains a portion of the Penobscot River Watershed and the Penobscot River, New England's second largest river system and Maine's largest river basin which

[6] U.S. Climate Data: Penobscot County https://www.usclimatedata.com/climate/bangor/maine/united-states/usme0017
[7] USDA: How to Keep Beavers from Plugging Culverts https://www.fs.fed.us/t-d/pubs/pdfpubs/pdf05772830/pdf05772830dpi300.pdf

drains an area of 8,592 square miles. The West Branch of the Penobscot River begins in Piscataquis County near Penobscot Lake on the Maine/Quebec border. The East Branch also begins in Piscataquis County at East Branch Pond near the headwaters of the Allagash River. The main stem empties into Penobscot Bay in Hancock County near the town of Bucksport some 240 miles from the beginning, and at the mouth dispenses 10.1 billion gallons/day (avg.). Named by native people, the word Penobscot means "waters of descending ledge."

Historically, the river was tidal from the base of the Veazie Dam (which was removed in 2013) to its mouth near Bucksport (approx. 25 miles) and is brackish to the town of Hampden. The river's total fall from Penobscot Lake on the South Branch is 1,602 feet. The terrain ranges from steep mountains including Maine's highest, Mt. Katahdin to rolling hills and extensive bogs, marshes and wooded swamps. Most of the watershed is forested, and sparsely settled. Since the removal of the dam, the rivers tidal influence now extends about a half mile above the prior dam location.

Penobscot County also measures the level of the water in the Penobscot River through the use of a total of 14 river gauges located in the Penobscot River basin. Two new gauges were installed in 2010 to monitor Kenduskeag Stream near Bangor and Penobscot River at Bangor[8].

Since the last Penobscot County MJHMP update in 2016, the FIRM maps for the Penobscot River Watershed have been going through the revision process. In February 2021, FEMA held a Community Coordination Meeting on the updated FIRM Maps for the Lower Penobscot Watershed, which includes 25 municipalities. Below is an overview map as well as several findings related to flooding from the recent study.

- **Penobscot County, southern portion**
- **25 Communities**
- **~600 total stream miles**

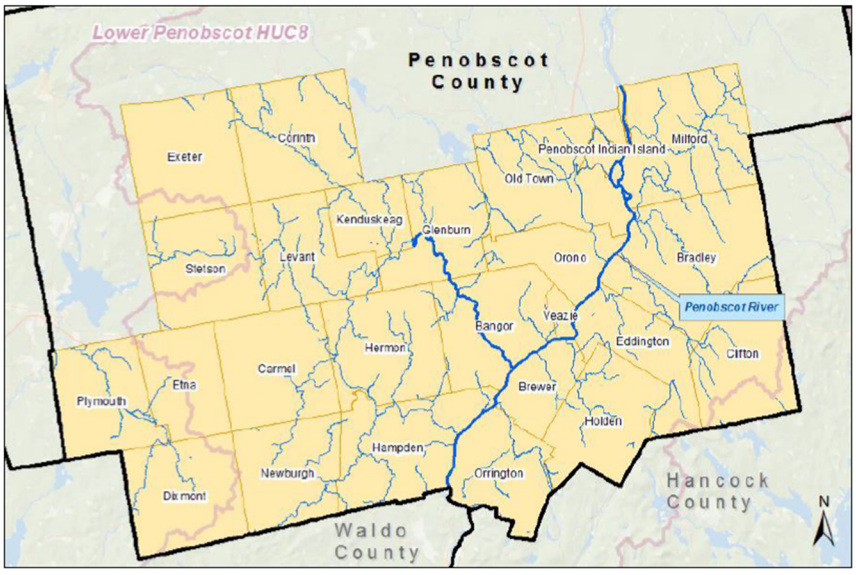


Figure 4.5: Updated FIRM Map municipalities
Source: FEMA

[8] USGS river gages in Maine: https://waterdata.usgs.gov/me/nwis/current/?type=flow

Zone AE – areas that have a 1% probability of flooding every year

Penobscot River *(31.3 mi) – Bangor, Bradley, Brewer, Eddington, Hampden, Milford, Old Town, Orono, Orrington, Veazie, Penobscot Indian Island*

At Township of Argyle/Town of Greenbush/Town of Milford corporate limits to Town of Hampden/Town of Orrington corporate limits

Kenduskeag Stream *(12.3 mi) – Bangor, Glenburn, Kenduskeag*

From ~725 feet upstream of Broadway (ME-15) to confluence with Penobscot River

Figure 4.6: Zone AEa flood probability
Source: FEMA

Zone AE – areas that have a 1% probability of flooding every year

Felts Brook *(4.4 mi) – City of Brewer*

From ~845 feet upstream of railroad to confluence with Penobscot River

Sedunkedunk Stream *(1.2 mi) – Brewer, Orrington*

From 100 feet downstream of Town of Orrington/City of Brewer corporate limits to confluence with Penobscot River

Tributary No. 3 *(0.7 mi) –Bangor, Veazie*

From ~0.9 miles upstream of Mount Hope Avenue to confluence with Penjajawoc Stream

Figure 4.7: Zone AEb flood probability
Source: FEMA

FIRM Panels (maps provided for communities)

- City of Bangor (22 panels)
- Town of Bradley (13 panels)
- City of Brewer (12 panels)
- Town of Carmel (8 panels)
- Town of Clifton (7 panels)
- Town of Corinth (15 panels)
- Town of Dixmont (7 panels)
- Town of Eddington (14 panels)
- Town of Etna (8 panels)
- Town of Exeter (15 panels)
- Town of Glenburn (14 panels)
- Town of Hampden (15 panels)
- Town of Hermon (10 panels)
- Town of Holden (9 panels)
- Town of Kenduskeag (4 panels)
- Town of Levant (7 panels)
- Town of Milford (11 panels)
- Town of Newburgh (8 panels)
- City of Old Town (22 panels)
- Town of Orono (14 panels)
- Town of Orrington (14 panels)
- Town of Plymouth (7 panels)
- Town of Stetson (6 panels)
- Town of Veazie (4 panels)
- Penobscot Nation (4 panels)

Figure 4.8: FIRM Panels per municipality
Source: FEMA

Penobscot County Emergency Management Agency also has copies of flood maps for towns that participate in the National flood Insurance Program. Each of the individual communities generally has copies of their own flood maps.

B. Extent (i.e., magnitude or severity) of flooding/erosion/dam failure:

Flooding

Flooding occurs annually in Penobscot County. Various low-lying areas particularly along the Penobscot River are susceptible to flooding and can cause transportation and utility disruptions, property damage, injuries and loss of life, depending upon the severity of the event. Route 2 in the Mattawamkeag/Howland/Passadumkeag/Greenbush/Milford area is often impassable during a flood event along with Route 11 in the Millinocket/Medway/Grindstone area. Bangor also experiences flooding in the "Downtown" areas. Other areas of concern are Orono/Old Town, Prentiss and Greenfield. All areas along the Penobscot are also susceptible to spring ice jams which may cause the river to overflow its banks. Historical severity includes: road closures, torn out bridges and culverts, and stranded residents.

The extent of flooding in Penobscot County is best represented by historic flood crests monitored by USGS and reported under different flood categories by the National Weather Service in Caribou, Maine. A flood crest is the maximum height reached by floodwaters before eventually receding. The National Weather Service defines flood extent using different flood stage categories, indicating the degree to which waters overflow the natural river banks and begin flooding surrounding areas. The gage station at West Enfield is best

suited for monitoring flood extent because it provides a 119-year historic record and it is located just above river to the more densely populated jurisdictions of Penobscot County[9].

Flood stages on Penobscot River at West Enfield gage station:

- Action stage: 16 feet
  - River approaches bankfull height.
- Flood stage: 18 feet
  - Lowland areas flooded between Greenbush and Orono.
- Moderate flood stage: 22 feet
  - US Route 2 and State Route 116 flooded and impassable.
- Major flood stage: 25 feet
  - Record flooding on par with the Flood of 1923. Extensive flooding in downtown Bangor.

Historic crests, West Enfield gage station:

1. 1 May 1923: 25.15 feet (major stage)
2. 2 April 1987: 23.58 feet (moderate stage)
3. 21 March 1936: 22.03 feet (moderate stage)
4. 30 April 1973: 21.66 feet (flood stage)
5. 1 May 2008: 21.62 feet (flood stage)

Recent Crests, West Enfield gage station:

1. 1 May 2008: 21.62 feet (flood stage)
2. 30 April 2005: 19.76 feet (flood stage)
3. 18 April 1994: 18.61 feet (flood stage)
4. 13 April 1993: 18.93 feet (flood stage)
5. 15 May 1989: 16.44 feet (action stage)

The largest floods in Maine tend to occur in early spring when it is possible for heavy rains to fall upon dense, high-water snowpack still present in the landscape. The combination of heavy rainfall, melting snow, and lack of groundwater infiltration may lead to substantial flooding. The flood of 1923 occurred as the result of three days of rainfall totaling 5.3 Inches on top of a high-water content snowpack[10]. The Flood of 1987 resulted from heavy rainfall on top of snow with a five- to six-inch snow/water equivalent snowpack[11].

In 2012, the Penobscot River Restoration project began the physical removal of the Great Works dam located in the communities of Old Town and Bradley. This activity reflected more than a decade of work by the initiative to restore fish passage in the Penobscot River. In 2013 the Veazie dam was removed with the subsequent removal of the power house in 2014. There are conflicting studies regarding the increased/decreased potential for flooding due to the removal of dams; therefore, we concluded the potential threat for flooding was unchanged.

[9] West Enfield gage station: https://water.weather.gov/ahps2/hydrograph.php?gage=wenm1&wfo=car
[10] Penobscot River Basin Report: https://www.maine.gov/dacf/flood/docs/maineriverbasin/maineriverbasinreport_chap3.pdf
[11] Spring Floods of 1987: https://web.archive.org/web/20131104074018/http://www.erh.noaa.gov/nerfc/historical/apr1987.htm#

Erosion

All areas are susceptible to erosion in the County. Farming and crop cultivation expose large areas to the effects of wind and water on a seasonal basis for planting and harvesting. Forest areas become vulnerable when all vegetation is removed from vast tracts by the lumbering industry or as a result of fire. Property damages occur when development has been allowed to occur in sensitive areas. Erosion within our County is generally related to flooding. Communities throughout Penobscot County have felt the effects of erosion; however, no data was available to determine the previous extent of eroding river and stream-beds at the time of submission.

Numerous attempts were made to acquire specific sites, dates and areas. The size of the Penobscot River watershed alludes to the possibilities of erosion, and has been linked to damages caused by flooding. In recent history, only the City of Brewer and the Town of Greenbush (within Penobscot County) have reported incidents of erosion to the Hazard Mitigation Committee.

The Maine Geological Survey provides a Coastal Bluffs and Landslides map depicting locations that may be particularly susceptible to erosion and/or mass wasting[12]. Though this unique tidal region only covers a small portion of the county, some locations potentially susceptible to erosion are identified on riverfront properties in Bangor, Brewer, Hampden, and Orrington. Though not as well documented, other nontidal river bluffs located throughout the county may also be susceptible to similar erosion mechanisms.

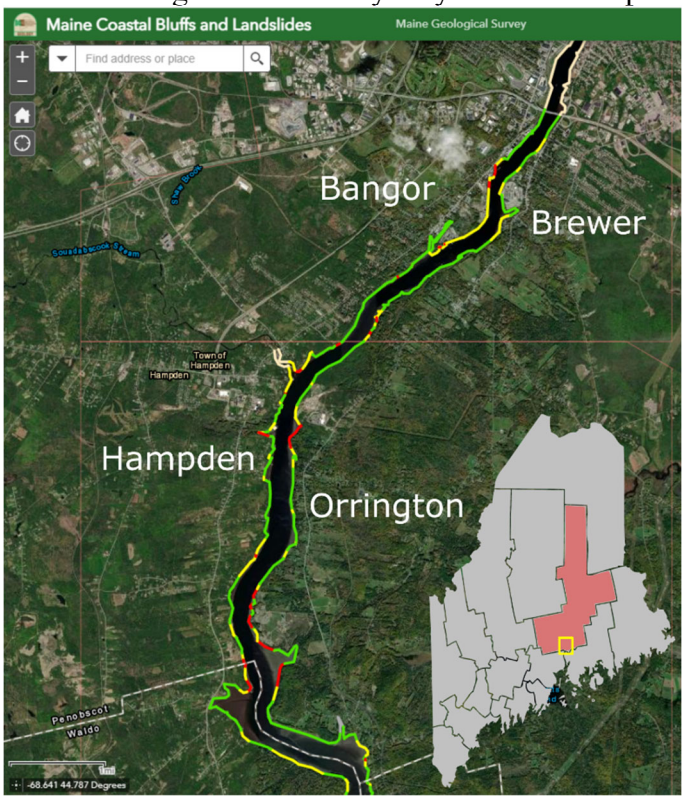


Figure 4.9: Maine Coastal Bluffs and Landslides map. Red lines denote unstable bluffs.

[12] Maine Geological Survey, Maine Coastal Bluffs and Landslides: https://maine.maps.arcgis.com/apps/webappviewer/index.html?id=9f0794fa0a554c6b8afc0e005765dd08

Dams

The following is a listing of high and significant hazard dams for Penobscot County, with their location and their hazard potential. The initials for Hazard Potential found in the table are representative of:

H=High, failure would cause loss of life
S=Significant, failure would cause significant loss of property

HIGH AND SIGNIFICANT HAZARD DAMS

PENOBSCOT COUNTY HIGH & SIGNIFICANT HAZARD DAMS					
MEMA ID	DAM NAME	OTHER NAME	DAM OWNER	MUNICIPALITY	RISK
47.0	Wassookeak Lake		Town of Dexter Utility District	Dexter	**H**
479.0	Weldon	Mattaceunk Project	Brookfield Renewable Energy Group - Northeast Operations	Mattawamkeag	**H**
486.1	North Twin		Brookfield Renewable Energy Group - Northeast Operations	T3 Indian Purchase	**H**
487.0	Millinocket Lake		Brookfield Renewable Energy Group - Northeast Operations	T01 R08 Wels	**H**
520.1	Stone	Quakish Dam	Brookfield Renewable Energy Group - Northeast Operations	Millinocket	**H**
520.9	Stone - Dike 8	Ferguson Pond Dike 5	Brookfield Renewable Energy Group - Northeast Operations	Millinocket	**H**
521.0	Dolby		Brookfield Renewable Energy Group - Northeast Operations	East Millinocket	**H**
45.0	Grand Lake	Matagamon	Mattagamon Lake Association	T06 R08 WELS	**S**

56.0	Malletts Mill	Mill Pond	Malletts Mill Inc	Lee	**S**
252.0	Swetts Pond		Orrington	Orrington	**S**

Table 4.6: High and Significant Hazard Dams
Source: State of Maine, (MEMA) Dam Safety

In 2013, the Maine State Dam Safety Law was changed to reflect a different frequency of dam inspections. High and Significant rated dams must be inspected every six years. All dams must be inspected every twelve years to verify their hazard rating. The Federal Energy Regulatory Commission (FERC) regulates 34 H hazard and 12 S hazard dams in Maine and has 5 engineers to do the inspections. The State regulates 26 H hazard and 79 S hazard dams and employs one engineer. Many of these dams have exceeded their original life expectancy; but as mentioned above are regulated and inspected.

Although located in Piscataquis County, Ripogenus Dam, if breached, is a considerable flooding hazard for Penobscot County. The impoundment of the dam forms Chesuncook Lake, which is Maine's third largest body of fresh water, and is considered the beginning of the West Branch of the Penobscot River. Three distinct sections of the lake are connected: the main stem is known as Chesuncook Lake; the lower body as Caribou Lake; and a third appendage as Ripogenus Lake. The total impoundment is 26,200 acres, with a maximum depth of 150 feet. This dam is connected to McKay power station, and provides power to industrial facilities in Millinocket and East Millinocket as well as the New England Power grid. There have been no known dam breaches in the Penobscot basin in recent history according to the Maine Dam Safety Program.

C. Previous Occurrences:

Flood

The following table is a historical overview of major events since 1970.

Historical Summary of Major Flood Events in Penobscot County Since 1970			
Year	**Month**	**Description**	**Presidential Declaration #**
1969	Feb.	Severe storm, ice jams, flooding	284
1973	May	Heavy rains, flooding	384
1974	Jan.	Severe storm, flooding	410
1987	Mar/Apr	Severe storm, flooding	788
1993	April	Heavy rains, flooding, ice jams and snow melts	988
1996	Jan/Feb	Severe storm, flooding	1106
2001	Mar.	Severe storm, flooding	1371
2008	Apr/May	Severe storm, flooding	1755

Table 4.7: Major Flood Events since 1970
Source: MEMA/FEMA

Flood Losses in Dollars by Town for Disaster Declarations since 1987					
Location	**Disaster Declarations**				
	788 April, 1987	**988 April, 1993**	**1106 Jan 1996**	**1371 March, 2001**	**1755 Apr/May 2008**
PENOBSCOT CTY	$ 3,245.00	$897	$18,624	-	$ 125,377.58
ALTON	$ 3,431.00	-	$9,082	-	-
BANGOR	$ 19,495.00	-	$97,974	-	-
BRADFORD	$ 11,086.00	$340,795	-	-	$ 5,156.97
BRADLEY	$ 2,465.00	-	-	-	-
BREWER	-	-	$6,072	-	-
BURLINGTON	-	-	$9,026	-	-
CARMEL	$110,441.00	-	$7,516	-	$ 15,773.78
CARROLL PLT	-	-	$20,752	-	-
CHARLESTON	$ 13,956.00	-	-	-	-
CLIFTON	-	-	$2,438	-	-
CORINNA	$ 19,517.00	-	-	-	$ 21,414.33
CORINTH	$ 4,327.00	-	-	-	-
DEXTER	$ 37,110.00	-	-	-	-
DIXMONT	$ 38,994.00	$6,216	$16,851	-	-
EAST MILLINOCKET	-	-	-	-	$ 25,898.06
EDDINGTON	-	-	$2,543	-	-
ETNA	$ 3,055.00	-	-	-	-
EXETER	$ 10,879.00	-	$1,924	-	-
GARLAND	$ 11,534.00	-	-	-	-
GREENBUSH	$ 8,567.00	$3,022	-	-	$ 4,919.00
GREENFIELD	$ 7,104.00	-	-	-	-
HAMPDEN	$ 8,296.00	-	$7,052	-	-
HERMON	$ 1,672.00	-	$4,280	-	-
HOLDEN	$ 3,934.00	-	$12,559	-	-
HOWLAND	$ 95,916.00	-	$17,772	-	$ 20,302.21
HUDSON	$ 3,523.00	-	--	-	-
KENDUSKEAG	$ 2,227.00	-	-	-	-
LAKEVILLE	-	-	$6,841	-	-
LAGRANGE	-	$5,820	-	-	$ 17,868.10
LEVANT	$ 11,713.00	-	-	-	-
LINCOLN	-	$9,565	$6,803	-	-
MAXFIELD	$ 24,191.00	-	$6,824	-	-
MEDWAY	-	-	$10,728	-	$ 16,582.37

MILFORD	$ 6,628.00	$17,235	$18,640	-	$ 42,145.61
MILLINOCKET	-	$4,669	-	-	$ 15,355.04
MOUNT CHASE	-	-	$3,593	-	$ 23,412.01
NEWBURGH	$ 42,657.00	$14,181	$8,459	-	-
NEWPORT	$205,889.00	$3,871	$4,427	-	-
OLD TOWN	$ 5,077.00	$728	-	-	$ 29,210.09
ORONO	$ 30,122.00	-	$6,840	-	-
ORRINGTON	$ 9,281.00	$4,716	$9,200	117,332.49	-
PASSADUMKEAG	$ 5,492.00	-	-	-	$ 2,101.75
PATTEN	-	-	$5,834	-	$ 35,293.74
PENOBSCOT NATION	$ 65,949.00	-	$16,763	-	$ 29,227.80
PLYMOUTH	$ 2,078.00	-	$1,053	-	-
STACYVILLE	-	-	$1,057	-	$ 7,333.20
STETSON	$ 5,104.00	-	-	-	-
VEAZIE	$ 10,735.00	-	$2,096	-	-
WEBSTER PLT.	-	$3,868	-	-	-
Total	$845,690.00	$415,583	$343,623	117,332.49	$ 437,371.64

Table 4.8: Federal Disaster Declaration Monetary Losses by Municipality
Source: MEMA/FEMA

For the Penobscot River USGS gauge in Eddington, the river had exceeded flood stage and reached the top #2, #3, and #4 highest historic crest marks between 2005 and 2018. For the USGS gauge in West Enfield further upstream, the most recent flood stage crest was in 2008.

While not part of a presidential declaration, **Table 4.9** lists unusual weather phenomena flooding events in Penobscot County over the last five years.

Location	Date/Time	Deaths & Injuries	Event Details
PENOBSCOT COUNTY --- 0.6 WNW MATTAWAMKEAG [45.52, -68.36], 6.9 NE KINGMAN [45.63, -68.11], 8.9 ENE KINGMAN [45.62, -68.05], 4.1 E KINGMAN [45.54, -68.12], 3.0 ESE WINN [45.47, -68.32]	04/17/19 08:00 EST 04/29/19 13:00 EST	0	Rain and snow melt led to flooding along the Mattawamkeag River. The river reached flood stage during the morning of the 17th...then crested slightly over 2 feet above flood stage from the 23rd into the 24th. Bancroft Road was closed due to flooding during the morning of the 22nd and remained closed for several days. Lowland flooding also occurred along the river.

PENOBSCOT COUNTY --- 11.4 WNW AUGUSTINE POND ARPT [46.15, -68.80], 2.4 WSW GRINDSTONE [45.71, -68.62], 3.8 E GRINDSTONE [45.72, -68.50], 5.6 NW AUGUSTINE POND ARPT [46.17, -68.64]	04/22/19 11:00 EST 04/24/19 09:00 EST	0	Rain and snow melt along with discharge from Grand Lake Matagamon Dam led to flooding along the East Branch of the Penobscot River downriver from the dam to Grindstone. The flooding led to the eventual closure of Route 11 in Grindstone at the railroad bridge and Hay Brook crossing. Lowland flooding also occurred along the river.
PENOBSCOT COUNTY --- 11.4 WNW AUGUSTINE POND ARPT [46.15, -68.80], 3.6 WSW GRINDSTONE [45.70, -68.64], 3.8 ESE GRINDSTONE [45.71, -68.51], 7.2 NW AUGUSTINE POND ARPT [46.16, -68.69]	04/27/19 22:30 EST 04/29/19 10:30 EST	0	Additional rain and snow melt along with continued discharges from Grand Lake Matagamon Dam led to another round of flooding along the East Branch of the Penobscot River. The flooding led to a second closure of Route 11 at the railroad bridge and Hay Brook crossing in Grindstone...the same location where closures occurred several days earlier. A second round of lowland flooding also occurred along the river.
PENOBSCOT COUNTY --- 1.0 ENE MATTAWAMKEAG [45.53, -68.33], 2.1 E WINN [45.48, -68.34], 4.0 NNE PRENTISS [45.53, -68.05], 8.3 ENE KINGMAN [45.62, -68.06]	04/14/20 23:15 EST 04/18/20 23:30 EST	0	A combination of 1.00 to 2.00 inches of rain and snow melt led to minor flooding along the Mattawamkeag River. The river reached flood stage during the late evening of the 14th. The river crested slightly less than a foot above flood stage during the late evening of the 16th. Flooding impacts were minimal...mostly spilling across the marshy flood plain. However, the Bancroft Road between Wytopitlock and Bancroft was occasionally affected along with several camps. The river fell below flood stage during the late evening of the 18th.

Table 4.9: five-year flooding storm events.
Source: NOAA's National Centers for Environmental Information

Dams

No previous events of dam failure were reported to PTEMA. Please see table titled "High and Significant Hazard Dams" on the previous pages.

D. Probability of Future Events

Flooding

Floods are described in terms of their extent (including the horizontal area affected and the vertical depth of floodwaters) and the related probability of occurrence. Flood studies use historical records to determine the probability of occurrence for different flood recurrence intervals. The probability of occurrence is expressed in percentages as the

chance of a flood of a specific recurrence interval in any given year. The most widely adopted design and regulatory standard for floods in the United States is the 1-percent annual chance flood and this is the standard formally adopted by FEMA. The 1-percent annual flood, also known as the base flood, or regulatory flood, has a 1 percent chance of happening in any particular year. It is also often referred to as the "100-year flood." This expression is, however, merely a simple and general way to express the statistical likelihood of a flood. Actual recurrence periods are variable from place to place. Smaller floods occur more often than larger (deeper and more widespread) floods. Thus a "10-year" flood has a greater likelihood of occurring than a "100-year" flood. The following table shows a range of flood recurrence intervals and their probabilities of occurrence.

Flood Recurrence Intervals	**Percent Chance of Occurrence Annually**
10 year	10.0%
50 year	2.0%
100 year	1.0%
500 year	0.2%

Table 4.10: Flood Interval versus Probability
Source: FEMA

As a point of clarification, the 100-year flood does not mean that it will happen once every one hundred years. There is, over an epoch of time, the likelihood that it will average out to once every 100-years but in any given 100-year period there is a 63% chance of the 1% flood.

It is very likely that there will be a future occurrence of flooding in the Penobscot County. Based on discharge and measured high water on the Penobscot River, the estimated recurrence interval is slightly longer than 10 years.

Flooding problems in Penobscot County occur along the Penobscot River, and at scattered locations throughout the remainder of the county with its many brooks, streams, and rivers. Flooding generally occurs as a result of heavy rainfall on snow-covered or frozen ground. Ice jams occasionally compound flooding problems.

The flood of record on the Penobscot River occurred in May, 1923. It has an estimated recurrence interval of 100 years. The most recent high impact flood on the Penobscot River occurred in April 1987. This flood has a recurrence interval estimated to be slightly less than 100 years. Less severe flooding events have occurred in 1993, 1996, 2001 2008, 2019, and 2020 as noted above. It is expected that at least some minor flood damage will occur during any given decade.

Dams

There are no probability statistics or studies available to determine future occurrences of Dam failure. Such failures are not a common event but could occur under the right circumstances.

Regarding the possibility of flooding from dam failure, MRS Title 37-B, Chapter 24, also known as Maine's Dam Safety Law, classifies dams into three hazard potential ratings: high, significant, and low. Each rating carries different responsibilities for the dam owners and situational awareness on the part of the downstream residents and businesses. Dam owners with "high" or "significant" potential ratings must produce an emergency action plan (EAP) and forward it to MEMA for compliance with the law.

The primary purpose of the EAP is to alert and warn potentially affected residents and businesses in the listed "call down area" when there is a threat of failure or actual breach. Copies are kept by the owner, relevant local, county and state agencies and must be updated regularly. See definition excerpts from the law in the table below.

Hazard Rating	**Excerpts from Dam Safety Law Definition**
High	"..will probably cause loss of human life,"
Significant	"..no probable loss of human life but can cause major economic loss.."
Low	"..no probable loss of human life and low economic.. losses.."

The majority of Penobscot County dams are located along the Penobscot River. Therefore, any downstream communities could possibly be affected. Since East Millinocket Hydro, Weldon, North Twin, North Twin - Dike 6, Stone, Stone - Dike and Dolby are high hazard dams, the towns of: Millinocket, East Millinocket, Medway, Mattawamkeag, Winn, Lincoln, Howland, Enfield, Passadumkeag, Greenbush, Milford, Edinburg, Old Town, Orono, Veazie, Eddington, Bradley, Brewer, Bangor, Hampden, Orrington, and Argyle would be most at risk from a breach. Additionally, a breach at Wassookeag Lake (another high hazard dam) would impact Dexter.

A breach at a "significant" dam would most probably cause infrastructure damage especially to downstream roads and bridges. Again, a breach of Grand Lake, North Twin Dike 1, North Twin Dike 2, North Twin Dike 3, North Twin Dike 4, and North Twin Dike 5, which are all along the Penobscot River, could impact the towns of: Millinocket, East Millinocket, Medway, Mattawamkeag, Winn, Lincoln, Howland, Enfield, Passadumkeag, Greenbush, Milford, Edinburg, Old Town, Orono, Veazie, Eddington, Bradley, Brewer, Bangor, Hampden, Orrington, and Argyle. A breach at Long Pond, could impact portions of Lincoln, while a Malletts Mill breach could impact portions of Lee and a breach at Swetts Pond could possibly affect Orrington.

SEVERE WINTER STORMS

Penobscot County is subject to severe winter storm events and conditions can vary from community to community. Part of the reason that Penobscot County has such varying conditions is due to the fact that the northern portion of the county lies within the Northern Climate Division and the southern portion of the county is in the Southern Interior Division. It is not uncommon for more extensive snowfall to accumulate in the Millinocket region while Newport receives "just a dusting".

The worst storm in the last two decades was the ice storm of 1998. The storm, which nearly destroyed the electrical transmission system throughout the state, caused major damage to forests, covered many roadways with debris and ice and caused some limited building damages. However, most severe winter storms within Penobscot County are major snowstorms, these storms can cause delays in the highway snow removal operations and can cause localized power outages. It is expected that a severe winter storm will cause a limited amount of damage/debris within the county each year.

The major severe winter storm damages occur to roadways and utilities. However, there are also limited damages to structures that can occur during a severe winter storm event.

The primary damage losses that are expected during a Severe Winter Storm would be to overhead utility lines and costs to clear debris covering local roads.

According to the National Centers for Environmental Information, there were 89 reported severe winter storm events over the last five years. In **Table 4.11** below are highlighted storms that while not resulting in a local or federal emergency declaration, provide an overview of the severity and wide-ranging types of severe winter weather in Penobscot County.

Location	Date/Time	Deaths & Injuries	Event Details	
NORTHERN PENOBSCOT COUNTY	02/14/2016 02:00 EST 02/14/2016 09:00 EST	0	Dangerous wind chill temperatures occurred across the region during the morning of the 14th. Air temperatures of 10 to 20 below zero combined with winds of 10 to 20 mph to produce wind chills of 35 to 40 below zero.	
NORTHERN PENOBSCOT COUNTY	02/12/2017 20:00 EST 02/14/2017 02:00 EST	0	Storm total snow accumulations ranged from 20 to 30 inches. The roof of a bowling alley collapsed in Millinocket due to the weight of snow. The building was a total loss.	
CENTRAL PENOBSCOT COUNTY	02/2/2021 03:00 EST 02/3/2021 03:00 EST	0	Storm total snow accumulations ranged from 7 to 11 inches...along with 1 to 2 inches of sleet. Ice accumulations of 1/10 to 2/10 of an inch also occurred. Winds gusted to 30 to 35 mph.	

Table 4.11: Five-year Severe Winter Storms Events
Source: Source: NOAA's National Centers for Environmental Information

Extreme Cold

Extreme cold is brought to Penobscot County typically on strong north to northwest winds often preceded by an Arctic front. Prolonged exposure to the cold can cause frostbite or

hypothermia and become life-threatening. Infants and elderly people are most susceptible. Ice jams may form and lead to flooding. Nearly every year, residents of Penobscot County experience extreme cold.

Heavy Snow Storms

Heavy snow can immobilize a region and paralyze a city, stranding commuters, stopping the flow of supplies, and disrupting emergency and medical services. Accumulations of snow can collapse buildings and knock down trees and power lines. Hazard Events shows heavy snow storms, blizzards and ice storms reported for Penobscot County can be found at https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=23%2CMAINE.

Blizzards/Snow Squalls

Sometimes winter storms are accompanied by strong winds creating white-out conditions with blinding wind-driven snow and severe drifting. Strong winds with these intense storms can knock down trees, utility poles, and power lines. The main differences between blizzards and snow squalls are duration and cause. Blizzards last for several hours and are associated with a strong low-pressure system. Snow squalls last for up to 15-30 minutes and usually are found just ahead of a strong cold front (or Arctic front).

Ice Storms

Heavy accumulations of ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. Communications and power can be disrupted for days while utility companies work to repair the extensive damage. Even small accumulations of ice may cause extreme hazards to motorists and pedestrians.

A. Location (i.e., geographic area affected) of Severe Winter Storms

All of Penobscot County is susceptible to Sever Winter Storms. Typically, areas from Howland north receive heavier snowfalls during storm events while the southern zone is more likely to receive mixed precipitation, such as freezing rain, and sleet.

B. Extent (i.e., magnitude or severity) of Severe Winter Storms

Winter storms typically occur between November and April every year in Penobscot County with varying amounts of snowfall, winds and/or freezing rain dependent upon the type of weather system that is moving through the area. Snowfall amounts can range from a few inches to a few feet and can cause transportation and utility disruptions, property damage, injuries and loss of life (especially from automobile accidents) depending upon the severity of the event. To date the worst winter storm damages were from the great ice storm of 1998 with massive power loss, broken pipes from lack of heating, and food spoilage.

C. Previous Occurrences of Severe Winter Storms

The largest storms in recent history for Penobscot County is the 1998 Ice storm. On January 8, 1998, one of history's most devastating ice storms hit the entire state of Maine. Mild temperatures and rain during the day combined with freezing temperatures at night created ice in layers over several days, coating parking lots and sidewalks.

In a report for FEMA Region 1 regarding the evaluation of the severity of the January 1998 ice storm in Northern New England, the U.S. Army Cold Regions Research and Engineering Laboratory Snow and Ice Division indicate that the 1998 storm is consistent with return periods estimated by their extreme value analysis of between 35 and 85 years for severe ice storms in the Northeast with uniform ice thickness between .75 and 1.25 inches.

During the storm, transportation officials and public works crews worked around the clock and through fatigue, barricading streets where power lines had fallen, clearing fallen brush, and plowing. The ice storm caused more damage to Maine's electric delivery system than any previous storm. Hundreds of utility poles snapped and power lines were strewn on frozen snow and roads after limbs and crashed to the ground. The nasty ice storm caused what Governor Angus King called "the worst power outage we've ever had." Power outages caused by tree damage to the electrical distribution system were long-lasting because damaged trees needed to be removed in order to gain access to the downed lines. The storm cost Central Maine Power (CMP), the state's largest power company, $55 million in repairs. Bangor Hydro-Electric Company paid $5 million in repairs. At one point during the storm, 275,000 CMP customers were without power with another 50,000 Bangor Hydro customers without power. An estimated 11 million acres of forests were damaged. All 16 Maine counties were declared federal disaster areas.

Although in 2013 the "Christmas Ice Storm" (an event that occurred between December 21, 2013 and January 4, 2014) did not receive a presidential declaration, it is worthy of mention since it did cause considerable damage to roads and local budgets. Additionally in November of 2014, an early snow/ice event caused loss of power to around 20,000 people in Penobscot County for about 5 days.

The following is a summary of the most severe winter storms in Penobscot County since 1970.

Historical Summary of Major Severe Winter Storm Events in Penobscot County Since 1970

Year	Month	Description	Declarations #
1993	Mar.	Blizzard, severe winds, snowfall	EM-3099
1998	Jan.	Ice storm	DR-1198
2001	Mar.	Severe winter storm	EM-3164
2003	Dec./Jun.	Extreme winter weather	DR-1468
2004	Dec.	Snowfall	EM-3190
2004	Dec.	Snowfall	EM-3194

2005	Feb.	Snowfall	EM-3206
2005	Mar.	Snowfall	EM-3209

Table 4.12: Historical Major Winter Storms
Source: FEMA

Severe Winter Storm Losses in Dollars by Town for Disaster Declarations since 1993						
Location	**Disaster Declarations**					
	3099 Mar 1993	**1198 Jan/Feb 1998**	**3164 Mar 2001**	**1468 Dec/Jun 2002-2003**	**3190 Dec 2003**	**3194 Dec 2003**
PENOBSCOT CTY	$276	$63,467	$3,728	-	-	-
ALTON	-	$17,838	-	-	-	-
BANGOR	$16,925	$966,045	$27,041		$48,928	$71,461
BRADFORD	-	$19,878	-	-	-	-
BRADLEY	-	$9,199	-	-	-	-
BREWER	$5,046	$233,705	$14,414	$39,648	$18,845	$16,180
BURLINGTON	-	$20,519	-	-	-	-
CARMEL	-	$92,171	-	-	-	-
CARROLL PLT	-	$2,857.5	-	-	-	-
CHARLESTON	$1,389	$45,066	-	-	-	-
CHESTER	-	$17,055	-	-	-	-
CLIFTON	-	$6,224	-	-	-	-
CORINNA	$2,346	$43,249	5,513	-	-	-
CORINTH	-	$39,520	-	-	-	-
DEXTER	$2,605	$42,012	7,542	-	-	-
DIXMONT	-	$138,472	3,999	-	$4,085	$4,570
DREW PLT	-	$4,436	-	-	-	-
EAST MILLINOCKET	-	$35,993	6,958	$3,423	-	-
EDDINGTON	-	$21,536	-	-	-	-
ENFIELD	-	$20,524	-	-	-	-
ETNA	-	$29,281	-	-	-	-
EXETER	-	$23,751	-	-	-	-
GARLAND	$1,072	$28,121	-	-	-	-
GLENBURN	-	$39,987.2	-	-	$6,820	$3,700
GREENBUSH	-	$29,064	-	-	-	-
GREENFIELD	-	-	-	-	-	-
HAMPDEN	$3,678	$174,317	10,410	-	$22,669	$24,990
HERMON	-	$83,789	2,869	-		
HOLDEN	$1,545	$63,001	4,675	-	$9,256	$4,190
HOWLAND	$1,033	$28,330	3,412	$14,595	$3,225	$4,976
HUDSON	$1,284	$56,452	3,269		$5,058	$5,850
KENDUSKEAG	-	$26,162	2,775	-	-	-
LAGRANGE	-	$11,936	-	-	-	-

LAKEVILLE	-	$5,764	-	-	-	-
LEE	$1,241	$17,886	-	-	-	-
LEVANT		$56,872	-	-	-	-
LINCOLN	$2,121	$57,142	12,252		$12,752	$17,827
LOWELL	-	$6,225	-	-	-	-
MATTAWAMKEAG	-	$16,423	-	-	-	-
MAXFIELD	$543	$21,801	-	-	-	-
MEDWAY	$1,286	$11,286	3,078	-	-	-
MILFORD	$1,111	$67,467	3,318	-	-	-
MILLINOCKET	$1,502	$39,940	8,569	-	$11,698	$7,215
MOUNT CHASE	-	$6,619	-	-	-	-
NEWBURGH	-	$64,432	-	-	-	-
NEWPORT	$1,810	$78,629	6,568	-	-	-
OLD TOWN	$2,576	$181,302	16,221	-	$15,569	17,530
ORONO	$2,500	$268,967	15,164	-	$22,311	20,087
ORRINGTON	$1,076	$109,645	5,736	-	-	-
PASSADUMKEAG	-	$9,152	-	-	-	-
PATTEN	-	$7,875	-	-	-	-
PENOBSCOT NATION	-	$34,195	4,905	-	$2,846	2,243
PLYMOUTH	-	$55,197.25	-	-	-	-
SPRINGFIELD	-	$8,106	-	-	-	-
STACYVILLE	-		-	-	-	-
STETSON	-	$16,374	-	-	-	-
VEAZIE	$757	$78,857	3,183	-	-	3,631
WEBSTER PLT.	-	-	-	-	-	-
WINN	-	$5,319	-	-	-	-
M. S. A. D. #48		$31,002	-	-	-	-
The Acadia Hospital	-	$ 5,150	-	-	-	-
Eastern Me. Med Ctr	-	$145,912	22,931		$42,737	56,861
Manna, Inc.	-	$ 17,104	-	-	-	-
Community Hlth & Cl.	-	$ 9,511	-	-	-	-
Brewer Hous. Auth.	-	$ 31,559	-	-	-	-
Hope House, Inc.	-	$1,915	-	-	-	-
Penob. Christ. Schl.	-	$ 132	-	-	-	-
Union #34	-	$ 6,812	-	-	-	-
M. S. A. D. #30	-	$ 1,541	-	-	-	-
Union #91	-	$ 7,349	-	-	-	-
Lee Academy	-	$ 2,677	-	-	-	-

M. S. A. D. #22	-	$ 39,291	-	$16,411	-	-
M. S. A. D. #46	-	$ 4,321	-	-	-	-
N. Penob. Tech. R. 3	-	$ 515	-	-	-	-
M. S. A. D. #38	-	$ 5,535	-	-	-	-
M. S. A. D. #23	-	$ 5,773	-	-	-	-
M. S. A. D. #31	-	$ 5,774	1,652	-	-	-
Union #90	-	$19,563	-	-	-	-
M. S. A. D. #63	-	$ 1,628		$783		
Brewer School Dept.	-	$ 2,091	-	-	-	-
Bangor Water District	-	$ 35,663	-	$143,494	-	-
M. S. A. D. #25	-	$ 5,874	-	-	-	-
M. S. A. D. #67	-	$ 3,197	-	-	-	-
Old Town Water Dist.	-	$ 7,175	-	$39,740	-	-
Bangor Hous. Auth.	-	$ 9,616	-	-	-	-
Bangor Childrens Home	-	$ 1,068	-	-	-	-
Old Town Hous. Auth.	-	$ 3,667	-	-	-	-
Pt. Nat. Hlth. Dept.	-	$ 39,442	-		-	-
Dexter Util. Dist	-	-	-	$15,772	-	-
Hampden Water Dist	-	-	-	$6,879	-	-
Orono-Veazie Water dist	-	-	-	$39,907	-	-
Lincoln Water Dist	-	-	-	$8,080	-	-
Total	$53,722	$4,110,290	$200,182	$328,732	$226,799	$261,310

Table 4.13: Historical Major Winter Storms Monetary Damages
Source: MEMA/FEMA. Please note that no detailed breakdowns were available from MEMA for declarations #3206 and 3209.

D. Probability of Future Events of Severe Winter Storms

There are no probability statistics or studies available to determine future occurrences of Severe Winter Storms. All of Penobscot County is susceptible to winter storms and based on past events, it appears that a high probability exits that each year the County will experience winter storms between November and April.

SEVERE SUMMER STORMS

With the increasing complexity in climate change, severe summer storms are becoming more frequent, severe, and extending well into the fall as experienced with the 2017 "October Windstorm." Since the last MJHMP update, Penobscot County has experienced a tornado and damaging shoulder season storms almost on an annual basis. Severe summer storms include hurricanes, thunderstorms, microbursts, tornadoes and "shoulder season" wind storms.

A. Location (i.e., geographic area affected) of Severe Summer Storms

The entire County is vulnerable to one or more severe summer storms each year, usually in the form of thunderstorms.

B. Extent (i.e., magnitude or severity) of Severe Summer Storms

Damages generally result from flooding which may cause flash floods and erosion. This occurs when a storm track produces heavy rainfall amounts in a short period of time; for example, 2-3 inches of rain within a few hours. Strong wind gusts can also occur during these months with gusts occasional 60 mph or higher, mainly in the strongest thunderstorms. Hail, high winds and heavy rain can cause damage to crops, trees, utilities, personal property and real estate. These storms generally occur between June and October.

C. Previous Occurrences of Severe Summer Storms

According to the National Centers for Environmental Information, there were 116 reported severe summer storm events over the last five years. Of those, Penobscot County experienced two federally declared disasters. FEMA-4354-DR, known as the *October Windstorm,* was an extratropical storm that tracked to the west as it rapidly deepened. The strongest winds occurred during the morning of October 30th with wind gusts of 60 to 70 mph. Power outages within the Versant Power service area, which covers the majority of Penobscot County, peaked at around 90,000 customers, represented around 56 percent of their customer base. Damage to public infrastructure was estimated $667,682 in Penobscot county. In addition, and while not a summer storm, Penobscot County was designated by the USDA as a Primary Natural Disaster Area due to severe drought conditions in the summer of 2020.

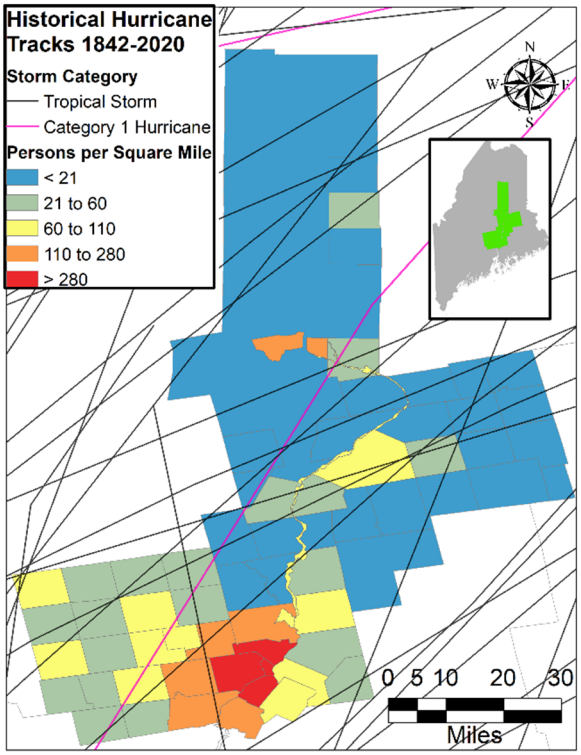
In **Table 4.14** below are highlighted storms that while not resulting in a local or federal emergency declaration, provide an overview of the severity and wide-ranging types of severe summer weather in Penobscot County.

Location	Date/Time	Deaths & Injuries	Event Details
TOWN OF GLENBURN	07/18/2016 14:47 EST 07/18/2016 14:47 EST	0	Severe thunderstorms developed during the afternoon and persisted into the evening producing damaging winds and large hail. Numerous trees were toppled or snapped at Pushaw Lake Campground by wind gusts estimated at 70 mph. Two campers were totaled by falling trees.
TOWN OF MILLINOCKET	08/5/2017 21:47 EST 08/5/2017 21:59 EST	0	An EF1 tornado developed along a line of non-supercell thunderstorms and tracked through a wooded area between Millinocket and Grindstone. Damage along the path consisted of over 1,000 trees snapped or toppled. The average path width was around 30 yards. The estimated maximum wind speeds were between 90 and 100 mph.
CENTRAL PENOBSCOT COUNTY	07/20/2019 10:00 EST 07/20/2019 17:00 EST	0	A combination of temperatures ranging from the upper 80s to mid-90s... with dewpoints around 70...produced Heat Index values ranging from the mid-90s to near 100 degrees during the afternoon.
TOWN OF SPRINGFIELD	07/20/2019 10:00 EST 07/20/2019 17:00 EST	0	A nocturnal thunderstorm complex intensified to severe levels producing large hail and damaging winds. The hail size ranged up to golf ball size and damaged some vehicles.

Table 4.14: Five-year Severe Winter Storms Events
Source: Source: NOAA's National Centers for Environmental Information

D. Probability of Future Events of Severe Summer Storms

There are no probability statistics or studies available determine future occurrences of Severe Summer Storms. However, based on past experiences, Penobscot County can expect to experience thunderstorms every year, some of which will including damaging wind gusts and hail. Tornadoes and shoulder season wind storms, are much less frequent, but generally have a larger impact. Determining the extent and vulnerability of future events caused by severe summer storms is very difficult. With a majority of wildfires being caused by lightning strikes, it is assumed that a worst-case scenario can be considered while determining major losses under wildfire and not within this section.



NOAA maintains a historical record (1842-2020) of hurricane and tropical storm tracks for the United States[13]. According to this database, there have been 16 tropical storms that have crossed through Penobscot County, five of which are named storms that had weakened to tropical storms before their arrival. According to the database, the only Category 1 hurricane in Penobscot County occurred in 1869 and had sustained wind speeds of 80 knots. The oldest reported tropical storm in the county occurred in 1863. By dividing the time period of storm activity (158 years) by the total number of reported storms in Penobscot County, the probability of a tropical storm occurring is approximately once every ten years.

WILDFIRE

Wildfire: A wildfire is an uncontrolled fire spreading through vegetative fuel often exposing or consuming structures. Wildfires often begin unnoticed and spread quickly and are usually sighted by dense smoke. Wildfires are placed into two classifications:

Wildland: Wildland fires are those occurring in an area where development is essentially nonexistent, except for roads, railroads, or power lines.

Urban-Wildland Interface: Urban-Wildland Interface fire is a wildfire in a geographical area where structures and other human development meet or intermingle with wildland or vegetative fuels.

A. Location (i.e., geographic area affected) of Wildfire

All of Penobscot County is susceptible to Wildfires, but at a low acreage occurrence. The more urban areas of the county are particularly vulnerable at their Urban Wildland interface. The rural areas of the county rely heavily on the forest products industry and logging is a common occurrence. (There are 60 municipalities within Penobscot County. Approximately 75 percent or 2668 square miles of the land area of the County is forested, 23 percent is agricultural or open space and 2 percent is classified as urban.) Residential areas bordering forestlands are at risk if fires cannot be controlled[14]. Refer to municipal

[13] NOAA Historical Hurricane tracks: https://coast.noaa.gov/hurricanes/#map=4/32/-80
[14] Radeloff, V. C., D. P. Helmers, H. A. Kramer, M. H. Mockrin, P. M. Alexandre, A. Bar-Massada, V. Butsic, T. J. Hawbaker, S. Martinuzzi, A. D. Syphard, and S. I. Stewart. 2018. Rapid growth of the U.S. Wildland Urban Interface raises wildfire risk. Proceedings of the National Academy of Sciences, 115(13): 3314-3319. http://silvis.forest.wisc.edu/wp-content/uploads/2018/10/Radeloff_2018_PNAS_SI.pdf

maps for information on the location of Wildland-Urban Interface for each participating jurisdiction; these locations are particularly susceptible to the occurrence of wildfires and risk to life and property.

B. Extent (i.e., magnitude or severity) of Wildfire

While adequate rainfall normally reduces the risk of forest fire, seasonal variations, rapidly draining soil types, and unusually dry periods can change the susceptibility rating considerably. Logging operations provide large amounts of ignitable slash, severe summer and winter storms damage trees providing additional fuel while budworm infestation has killed millions of trees. All of these occurrences provide a future supply of dry fuel on the forest floors, as well as tops of trees to sustain crown fires. Spotting and warning program in effect when forest fire danger is high will enable evacuation and firefighting efforts to begin as soon as possible. Mutual aid agreements between municipal fire departments and regional industry must be developed and maintained. The Bureau of Forestry of the Department of Conservation (Maine Forest Service) has an active role in education, prevention, identification and response to forest fires in the State of Maine. The wildfires of 1947 were the most severe in recent history for the state of Maine. A series of large fires in Cumberland, Hancock, York, and Oxford counties burned a total of 205,687 acres and caused 16 deaths. However, no wildfire-related damages were reported in Penobscot County.

C. Previous Occurrences of Wildfire

The tables on the next few pages display the recent occurrences of wildfires within the boundaries of Penobscot County. Maine Office of GIS and the Maine Forest Services provided data sets for calculation and historical listings for these results. From 2004 to 2010, there were 451 reported wildfires and a total of 466.5 acres of forest were burned. During the period of 2011-2014 there were 259 fires with only 161.7 acres of forest land being burned. Swift action by Maine Forest Service in coordination with local fire departments helps to minimize the acres that are damaged.

Unlike California, where billions of dollars of homes are impacted, Penobscot County is very rural and sparsely populated. Historically, most forest fires are small, and low acreage. The following tables detail these “low acreage” fires.

2011-2014 WILDFIRE OCCURENCES AND NUMBER OF ACRES DAMAGED

COMMUNITY OR UNORGANIZED TERRITORY	Number Fires	Acres Burned	Number Fires	Acres Burned	Number Fires	Acres Burned	Number Fires	Acres Burned	Number Fires	Acres Burned

	2011		2012		2013		2014		Totals	
Alton			2	.5	2	1.1			4	1.6
Argyle Twp			1	0.2	1	0.1	1	0.1	3	0.4
Bangor	1	0.2	2	0.8			8	1.1	11	2.1
Bradford			3	5.2	5	12.2	2	1.25	10	18.65
Bradley					1	1.5	2	0.4	3	1.9
Brewer					1	0.1			1	0.1
Burlington	1	0.01	1	0.5	1	0.1	1	0.4	4	1.1
Carmel	19	3.53	5	0.5	1	1	2	0.4	27	5.43
Carroll Plt										
Charleston	1	0.01	3	0.8			1	0.25	5	1.15
Chester			1	0.1					1	0.1
Clifton										
Corinna	2	0.2	1	0.1	1	0.5			4	0.8
Corinth	1	0.2	1	0.3	3	.71	1	1	6	2.21
Dexter	2	0.2					1	0.1	3	0.3
Dixmont					1	0.5			1	0.5
East Millinocket										
Eddington	1	0.2			1	0.1			2	0.3
Edinburg										
Enfield	1	0.1	1	0.2	2	3			4	3.3
Etna	1	0.5							1	0.5
0.5Exeter										
Garland			1	0.2					1	0.2
Glenburn	1	1	1	0.2	2	0.35	1	0.5	5	2.05
Grand Falls Twp										
Greenbush			4	0.7			1	0.5	5	1.2
Greenfield Twp					1	5.4			1	5.4
Grindstone Twp					1	2.5			1	2.5
Hampden	3	0.4	2	1.1	1	4	2	0.2	8	5.7
Hermon	1	0.1	3	1.6	2	0.2	1	2	7	3.9
Herseytown Twp	2	0.6	15	5.97					17	6.57
Holden	2	0.3	2	0.2	1	0.1			5	0.6
Howland	2	0.11	2	0.2					4	0.31
Hudson			1	0.3	2	2			3	2.3
Kingman Twp			2	4					2	4
Lagrange	1	0.1	1	0.5	3	1.2			5	1.8
Lakeville	1	0.01	1	0.1			1	0.1	3	0.21
Lee			2	0.2			1	0.1	3	0.3
Levant			1	0.1	1	0.25			2	0.35
Lincoln	1	0.01	3	1.13	1	0.3			5	1.44
Long A Twp										
Lowell			1	0.1	1	0.1			2	0.2
Mattamiscontis			2	0.2					2	0.2
Mattawamkeag			1	0.1	1	0.2			2	0.3
Maxfield										
Medway			4	0.9	2	1.8	1	0.1	7	2.8
Milford	1	0.5			1	1			2	1.5

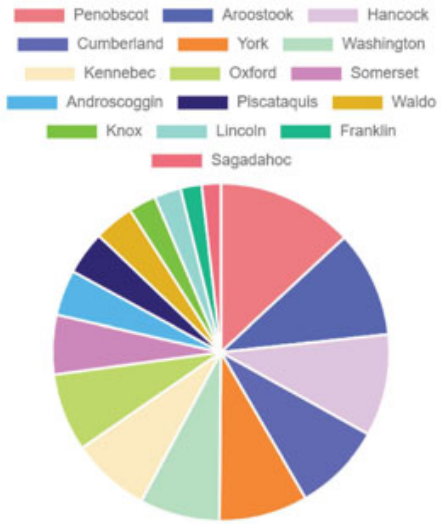
Mount Chase					1	0.5			1	0.5
Newburgh					2	12.2			2	12.2
Newport			1	0.03	4	0.4			5	0.43
Old Town	1	0.1	2	0.3	2	0.2			5	0.6
Orono			2	0.2	1	0.2	3	0.5	6	0.9
Orrington	2	0.3	5	3.5	2	0.2	3	1.9	12	5.9
Passadumkeag			2	0.2					2	0.2
Patten	1	0.1	1	0.1					2	0.2
Plymouth			1	0.4	1	0.2			2	0.6
Prentiss Twp T7 R3 NBPP	2	0.2			1	0.1			3	0.3
Pukakon Twp							1	0.1	1	0.1
Sebois Plt										
Springfield	1	0.1			1	0.1			2	0.2
Stacyville							1	7	1	7
Stetson			4	7.7	3	2.95			7	10.65
Summit Twp										
T01 R06 Wels			2	32.2					2	32.2
T01 R08 Wels										
T02 R08 NWP	1	0.4	1	0.2					2	0.6
T02 R08 Wels	1	0.2							1	0.2
T02 R09 NWP			6	1.5	1	0.1			7	1.6
Twp 3 IP					1	0.2	1	.01	2	0.3
T03 R01 NBPP							1	0.1	1	0.1
T03 R07 Wels					1	0.1			1	0.1
T03 R08 Wels										
T03 R09 NWP										
TWP 4 IP										
T06 R07 Wels	1	0.2							1	0.2
T06 R08 Wels			1	0.1					1	0.1
T07 R07 Wels			1	0.1					1	0.1
T07 R08 Wels										
Veazie	1	0.1			1	0.1	1	0.2	3	0.4
Webster Plt										
Winn			2	1.56			2	0.2	4	1.76
Woodville										
Total	56	10.16	101	75.09	62	57.86	40	18.6	259	161.71

Table 4.15: 2011-2014 WILDFIRE OCCURENCES
Source: Dept. of Agriculture Conservation and Forestry

The following two figures were provided by the Maine Forest Service for the 2021 MJHMP update. They show that Penobscot County had the most wildfires over the past 5 years of any county in the state of Maine. They also show that wildfires were reported more in southern and central portions of the county than across northern Penobscot.

INSPECTOR v1.0.39 E ME - JOSEPH MINTS (SITL)

County	Number of Incidents	Percentage
Penobscot	415	13.10 %
Aroostook	323	10.20 %
Hancock	310	9.79 %
Cumberland	271	8.55 %
York	269	8.49 %
Washington	244	7.70 %
Kennebec	240	7.58 %
Oxford	237	7.48 %
Somerset	180	5.68 %
Androscoggin	139	4.39 %
Piscataquis	132	4.17 %
Waldo	121	3.82 %
Knox	84	2.65 %
Lincoln	81	2.56 %
Franklin	64	2.02 %
Sagadahoc	58	1.83 %
Total	**3168**	



Filter: (IncidentTypeKind = 'FI') AND (IncidentTypeCategory IN ('WF')) AND (FireDiscoveryDateTime <= '2021-06-24T03:59:59.999Z') AND (FireDiscoveryDateTime >= '2016-01-01T05:00:00.000Z') AND (POOState IN ('US ME')) AND (CreatedBySystem NOT IN ('irwinimp')) AND (IsQuarantined IN (0,1) AND IsValid = 1)

Figure 4.10: Five-year Wildfire Summary
Source: Maine Forest Service

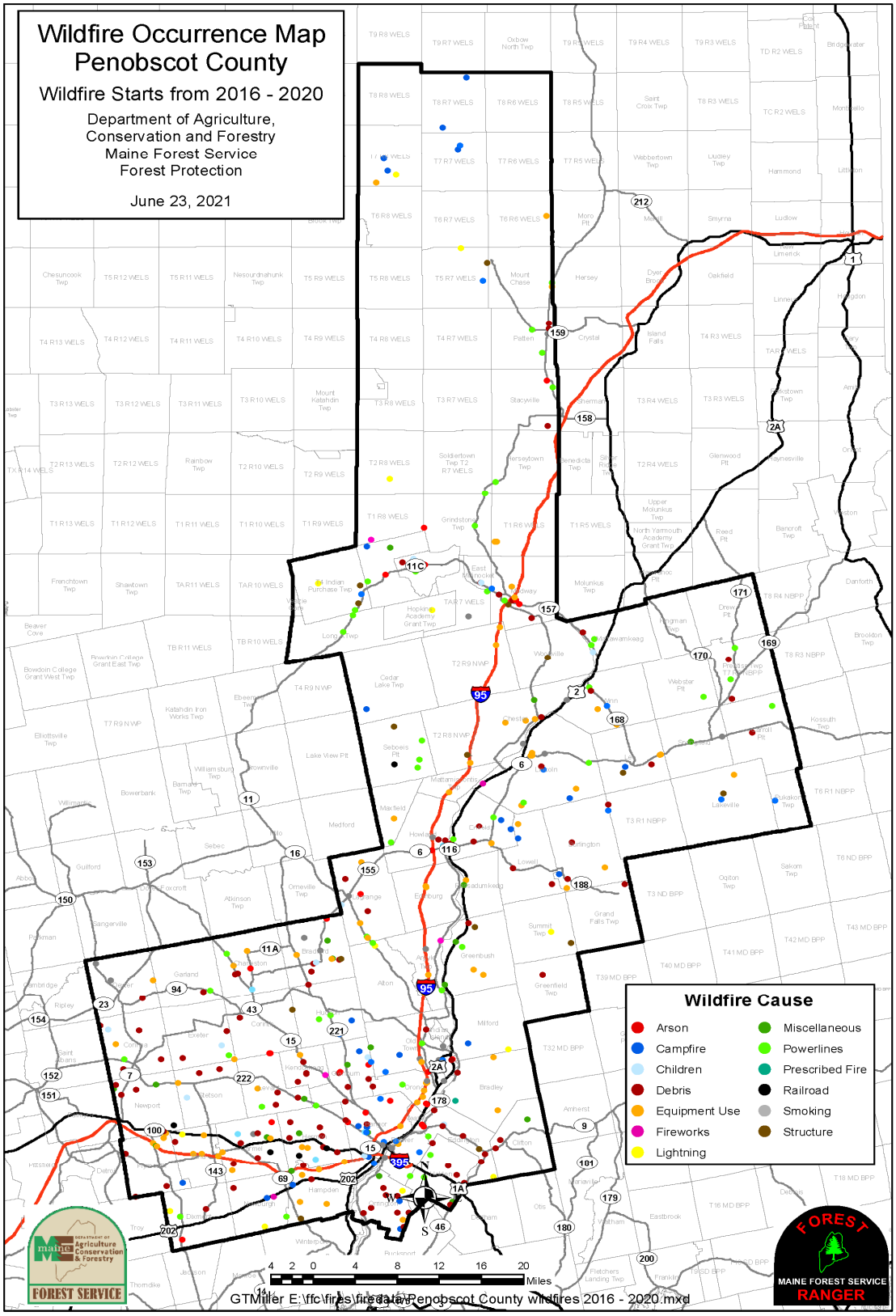
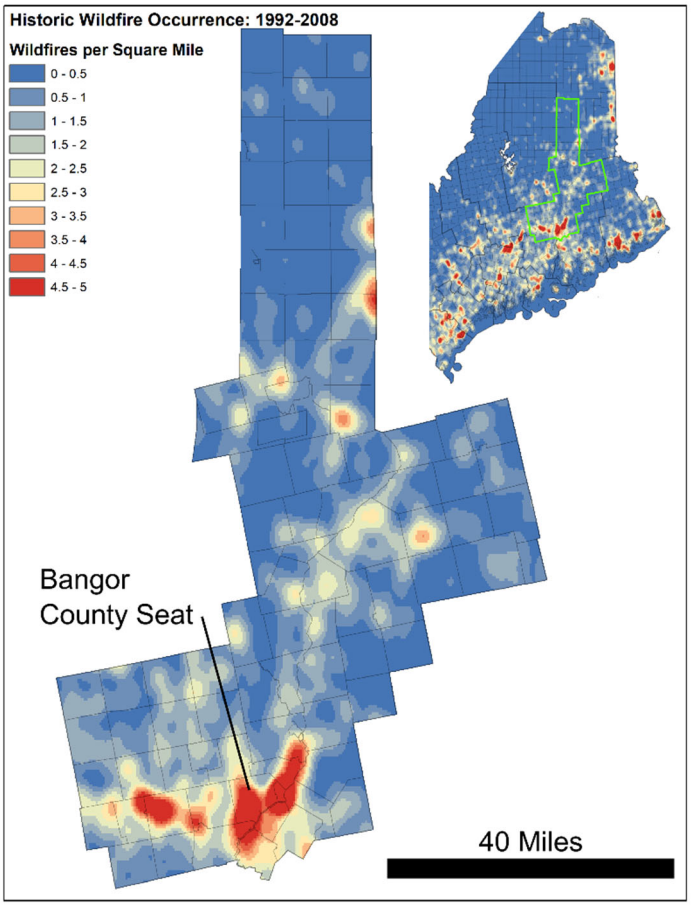


Figure 4.11: Five-year Wildfire Cause
Source: Maine Forest Service



The U.S. Forest Service Research Data Archive documents the spatial wildfire occurrence in the United States, with comprehensive records dating back to 1992[15]. Using this information, it is possible to identify locations with greater propensity of wildfires in Penobscot County. In general, locations with elevated wildfire occurrence are more densely populated areas within the Wildland-Urban Interface in the southern portions of the county rather than heavily forested regions to the north and east. Thankfully, these regions benefit form voluntary and full-time fire protection.

Figure 4.12: Histroric Wildfire Occurrence: 1992-2018
Source: U.S. Forest Service

D. Probability of Future Events of Wildfire

There are no probability statistics available to determine future occurrences of wildfires; but it is likely that there will be a future occurrence of wildfire in Penobscot County since a majority of the county is so densely forested.

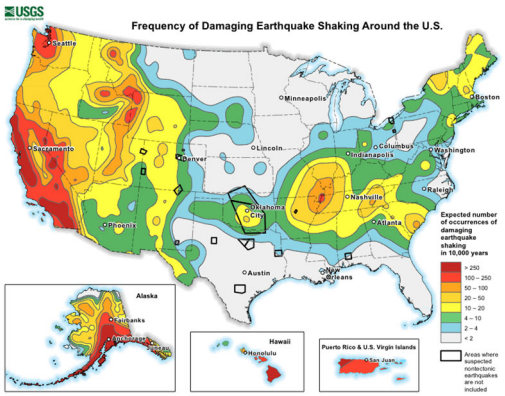
Earthquake

An earthquake is defined as being a sudden motion of the ground which may result in surface faulting (ground rupture), ground shaking and ground failure. This complex motion is caused by a sudden shifting or breaking of subsurface rock to relieve built up stress. The energy released at the center produces a variety of seismic waves that travel out in all directions through the surrounding rock. Some of these waves make their way to the surface to the surface and travel out.

A. Location: All of Penobscot County is susceptible to low magnitude (MW < 4.0) earthquakes. According to the Maine Geological Survey[16], Seismic activity in Maine is typical of the Appalachian region of northeastern North America. There is a low but steady rate of earthquake occurrence. The earthquakes are presumably caused by modern stress

[15] Short, Karen C. 2021. Spatial wildfire occurrence data for the United States, 1992-2018 [FPA_FOD_20210617]. 5th Edition. Fort Collins, CO: Forest Service Research Data Archive. https://doi.org/10.2737/RDS-2013-0009.5
[16] Earthquakes in Maine: https://www.maine.gov/dacf/mgs/hazards/earthquakes/quake.htm

being released occasionally along zones of weakness in the earth's crust, but a more specific cause for the earthquake activity is not known. Recorded earthquake locations and detailed seismic motion studies do not show any clear correlation with either local or regional geologic features.



B. and C. Extent and Previous occurrences: The largest earthquake recorded in Maine between 1747 and 1992 was near Eastport in 1904 with a Modified Mercalli intensity estimated at VII. The largest accurate measurement was on June 15, 1973 from an earthquake just on the Quebec side of the border from northern Oxford County, Maine, with a Richter magnitude of 4.8. Most Maine earthquakes are of small magnitude. Many are too small to feel. No Maine earthquake has caused significant damage. The persistent activity, however, indicates that some crustal deformation is occurring and that a larger earthquake cannot be ruled out.

D. Probability: The U.S. Geological Survey indicates that 10-20 damaging earthquake shaking events are expected to occur every 10,000 years in Penobscot County. A total of 507 earthquakes have occurred in Maine from 1747 to 1992, approximately 12 of which occurred in Penobscot County[17].

Drought

A drought is a prolonged period without rain, specifically a twelve month period during which precipitation is less than 85% of normal as defined by the National Weather Service; 44 inches is the average precipitation level per year in Maine[18].

A. Location: abnormally dry and drought conditions have occurred across Penobscot County, but the majority of impacts occur in the more rural agricultural areas north of Bangor.

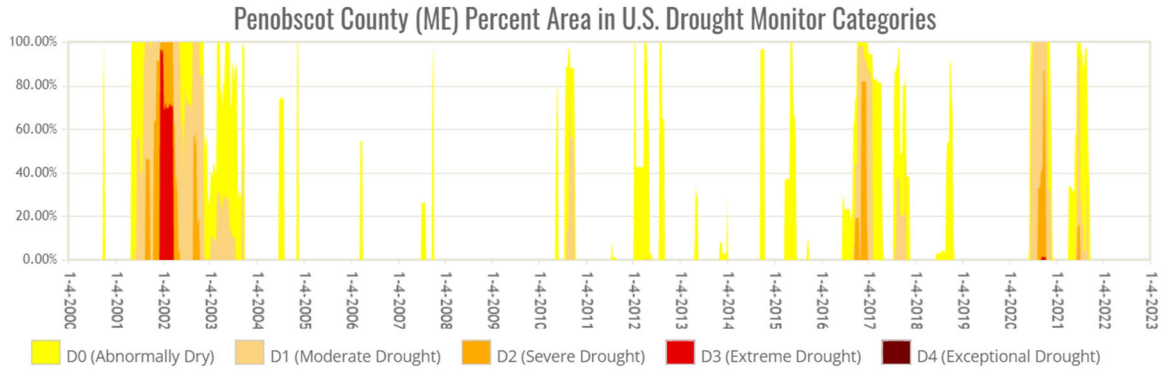
B. Extent: Based on the U.S. Drought Monitor[19], part or all of Penobscot County has experienced moderate to extreme drought in a record spanning 22 years. The last reported instance of extreme drought was in January 2002.

C. Previous Occurrences: There have been 6 instances of moderate drought or greater in the past 22 years. The following is a time series of drought conditions from the U.S. Drought Monitor record:

D. Probability: The U.S. Geological survey has identified drought periods occurring in Maine in 1938-43, 1947-50, 1955-57, 1963-69, 1984-88, and 2000-2003. The most extreme droughts have occurred in the late 40s, mid-1960s, and 2001-2003. Based on

[17] Maine Earthquake map: https://www.maine.gov/dacf/mgs/hazards/earthquakes/quake-2.gif
[18] MEMA drought page: https://www.maine.gov/mema/hazards/natural-hazards/drought
[19] U.S. Drought Monitor: https://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?ME

previous occurrences, the probability of moderate drought in Penobscot County is approximately once every five to ten years. A limited record of extreme drought exists for calculating probabilities, but based on available information, these conditions may occur every twenty to forty years or more[20].



ASSESSING VULNERABILITY

7. Assessing Vulnerability: Overview	
Requirement §201.6(c)(2)(ii): The risk assessment shall include a description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.	
Elements	**A.** Does the new or updated plan include an overall summary description of the jurisdiction's vulnerability to each hazard?
	B. Does the new or updated plan address the impact of each hazard on the jurisdiction?

PTEMA identified critical facilities located within each municipality, using GISdata from the Maine Office of GIS, and Northeast States Emergency Consortium HAZUS documents. Critical facilities are defined by FEMA as "facilities that are critical to the health and welfare of the populationand that are especially important following hazard events". Critical facilities include, but are not limited to, shelters, police and fires stations, and hospitals. The critical facilities identified in Penobscot County are: municipal offices, fire stations, police stations, water treatment facilities, wastewater treatment plants, libraries, schools, shelters, hospitals, airports, dams, rescue units, armories, roads, electric lines, and telephonelines.

As identified above, the four highest priority hazards identified for Penobscot County are flooding, severe winter storms, severe summer storms, and wildfires. The following describes the vulnerability of critical facilities to each of these hazards:

[20] MEMA drought page: https://www.maine.gov/mema/hazards/natural-hazards/drought

A. Summary Description of Penobscot County's Hazard Vulnerability

Flooding

Most of the county's documented flooding occurs along the Penobscot River corridor and its tributaries where residential and commercial developments may have occurred. Route 2 in the Mattawamkeag/Howland/Passadumkeag/Greenbush/Milford area is often impassable during a flood event along with Route 11 in the Millinocket/Medway/Grindstone area. Bangor also experiences flooding in the "Downtown" areas. Other areas of concern are Orono, Old Town, Prentiss and Greenfield. Penobscot County has had three declarations for flooding events in 2008 (DR-1755-ME[21]), 1987 (DR-788-ME[22]), and 1974 (DR-410-ME[23]). All other events were on a smaller scale and any information can be found on the NOAA Storm Events Database[24]. All areas along the Penobscot are also susceptible to spring ice jams which may cause the river to overflow its banks and may cause road closures, damaged bridges and stranded residents.

Many of the rural area's road systems are not built to appropriate roadway drainage standards and are subject to flooding during heavy rains.

Severe Winter Storms

Penobscot County's geographical location in north central Maine makes the county highly susceptible to substantial snowfall during the winter months (primarily between December and March or even early April). The rural nature of the county, with extensive rural roadway network that are maintained by small communities makes the county very vulnerable to the loss of utility services, and closed roadways such as occurred in the 1998 ice storm which impacted many of Penobscot County's residents and businesses.

Severe Summer Storms

Severe Summer Storms are not widely documented through Presidential Declarations, yet they occur often during the summer months. Damage is usually limited to downed trees, and utility lines, and personal property damage. Lightning strikes may also start forest or structural fires.

Wildfires

Penobscot County contains a large portion of rural area that is heavily forested, and thus susceptible to forest fires. These areas are often serviced by small volunteer fire departments and the Maine Forest Service. Maine Forest Service is very proactive with forest fire prevention education.

Larger urban areas generally have full-time fire protection and their exposure is mostly limited to their urban-wild land interface.

[21] DR-1755-ME: https://www.fema.gov/disaster/1755
[22] DR-788-ME: https://www.fema.gov/disaster/788
[23] DR-410-ME: https://www.fema.gov/disaster/410
[24] NOAA Storm Events Database: https://www.ncdc.noaa.gov/stormevents/

Earthquakes and Drought
Refer to regional-scale impacts and vulnerability assessments below.

B. Impact of Hazards on Penobscot County

Flooding

Impacts to Penobscot County from flooding include damage to residential and commercial real estate along with loss of personal property and roadway damage, culvert washouts, erosion and road closures which may also have an economic impact on businesses and individuals. Governments may also have increased clean-up costs from debris.

Severe Winter Storms

Impacts to Penobscot County from severe winter storms also include damage to residential and commercial real estate (roof collapses, and roof leaks). Furthermore, prolonged periods of utility loss can result in frozen pipes and burst pipes, along with the loss of personal property. Again, road closures may have an economic impact on businesses and individuals. The large amounts of snow and ice can also place a large strain on town/county and state budgets.

Severe Summer Storms

The impacts of severe summer storms may also include road closures from washouts, downed utility lines and trees resulting in extensive power outages, damage to commercial and residential real estate and property, and loss of income to businesses and individuals due to business closures. Governments may also have increased clean-up costs from debris.

Wildfires

The primary impacts for the urban areas include loss of structures in the urban-wild land interface. Rural areas would be impacted by both the loss forest land and the loss of homes that are located adjacent to the forest.

Earthquakes

The primary impacts of a moderate or greater magnitude earthquake (> 5 MW) are personal injuries and property damages. If strong enough, violent ground shaking can directly damage building foundations and potentially collapse structures. Rapid ground accelerations can cause impacts from liquefaction and subsidence in structures built over certain soils to major landslides along destabilized slopes. Utility services could be interrupted, chances of fire increase if gas lines are ruptured, and transportation routes may be cut off, posing a challenge for emergency response and evacuation[25].

Drought

[25] MEMA earthquakes page: https://www.maine.gov/mema/hazards/natural-hazards/earthquake

Drought is the number one risk factor for the State's agricultural economy, as it is the basis of over 1.2 billion dollars of food and fiber products annually. It employs 22,000 workers across the state, preserves a lifestyle for over 5,500 Maine families and provides stewardship of over 1.5 million acre of land and wildlife habitat. Since approximately 45% of the state's population relies on dug or shallow wells, a prolonged drought period increases the risk of dry wells also[26]. Using the Maine Dry well survey, 7 households reported having dry wells for the 2020-2021 drought[27].

ASSESSING VULNERABILITY- REPETITIVE LOSS PROPERTIES

8. Assessing Vulnerability: Addressing Repetitive Loss Properties	
Requirement §201.6(c)(2)(ii): The risk assessment must also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged (by) floods.	
Element	**A.** Does the new or updated plan describe vulnerability in terms of the types and numbers of repetitive loss properties located in the identified hazard areas?

The NFIP is a federal program enabling property owners in participating communities to purchase insurance protection against losses from flooding. This insurance is designed to provide an insurance alternative to disaster assistance to meet the escalating costs of repairing damage to buildings and their contents caused by floods. Participation in the NFIP is based on an agreement between local communities and the Federal Government that states if a community will adopt and enforce a floodplain management ordinance to reduce future flood risks to new construction in Special Flood Hazard Areas, the Federal Government will make flood insurance available within the community as a financial protection against flood losses. There are 459 properties within Penobscot County that are listed as having policies with the National Flood Insurance Program.

FEMA maintains a file of repetitive loss properties (properties that have experienced more than one flood loss). The following tables are a summary of the repetitive loss properties in the county:

Town	Mitigated	Insured	Occupancy	No. Losses	Total Paid as of 12-31-09
Bradley	No	SDF	Single Family	7	$12,933
Bradley	No	Yes	Single Family	2	$7,397
Glenburn	No	Yes	Single Family	2	$3,008
Grindstone	No	No	Single Family	2	$25,504
Grindstone	Yes	No	Single Family	2	$6,404
Grindstone	Yes	No	Single Family	2	$1,719

[26] MEMA drought page: https://www.maine.gov/mema/hazards/natural-hazards/drought
[27] Maine 2021 Dry Well Survey: https://maine-dry-well-survey-maine.hub.arcgis.com/

Grindstone	Yes	No	Single Family	4	$4,269
Medway	No	No	Single Family	3	$3,232
Medway	No	No	Assmd	2	$10,276
Milford	No	No	Single Family	3	$5,150
Milford	No	No	Single Family	3	$15,995
Milford	No	Yes	Single Family	2	$1,875
Milford	No	Yes	Single Family	3	$5,420
Old Town	No	Yes	Single Family	2	$4,214
Old Town	No	No	2-4 Family	2	$5,843

Table 4.16: Repetitive Loss Properties through 2009
Source: Maine Flood Management Program

Community Name	Mitigated	Insured	Occupancy	No. Losses	Total Paid as of 7/31/15
BRADLEY	NO	SDF	SINGLE FAMILY	7	$ 90,533
BRADLEY	NO	NO	SINGLE FAMILY	2	$ 14,795
CHESTER	NO	YES	SINGLE FAMILY	2	$ 38,965
DREW PLANTATION	NO	YES	SINGLE FAMILY	2	$ 24,347
GLENBURN	NO	NO	SINGLE FAMILY	2	$ 6,018
GRINDSTONE T1 R7 WELS	NO	NO	SINGLE FAMILY	2	$ 51,008
MEDWAY	NO	NO	SINGLE FAMILY	3	$ 9,698
MEDWAY	NO	NO	ASSMD CONDO	2	$ 20,553
MILFORD	NO	NO	SINGLE FAMILY	3	$ 15,452
MILFORD	NO	NO	SINGLE FAMILY	3	$ 47,866
MILFORD	NO	NO	SINGLE FAMILY	2	$ 3,751
MILFORD	NO	NO	SINGLE FAMILY	3	$ 16,260
OLD TOWN	NO	YES	SINGLE FAMILY	2	$ 8,429
OLD TOWN	NO	NO	2-4 FAMILY	2	$ 11,687

Table 4.17: Repetitive Loss Properties through 2009
Source: Maine Flood Management Program

NFIP Repetitive Loss Properties					
County	**Town/City**	**Residential Structures**		**Non-Residential Structures**	
		# Properties	**# Losses**	**# Properties**	**# Losses**
Penobscot	Bradley *	3	11		
	Chester	1	2		
	Drew Plt	1	2		
	Glenburn	1	2		
	Medway	2	5		
	Milford	4	11		
	Old Town	2	4		

NFIP Repetitive Loss Properties					
County	**Town/City**	**Residential Structures**		**Non-Residential Structures**	
		# Properties	**# Losses**	**# Properties**	**# Losses**
	T1 R7	3	8		
Total		**17**	**45**		

* One of these properties is a Severe Repetitive Loss (SRL)
Table 4.18: Repetitive Loss Properties through 2021. Towns with no repetitive loss properties are not listed in this table.
Source: Maine NFIP Coordinator

A number of repetitive loss properties are not insured. FEMA's statistics on repetitive loss properties include only properties that have flood insurance unless the damaged occurred during declared individual disaster assistance. There are other properties that suffer repetitive flood losses but which are not insured. Statistics on these properties are not always tabulated.

ASSESSING VULNERABILITY – IDENTIFYING STRUCTURES

9. Assessing Vulnerability: Identifying Structures	
Requirement §201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area.	
Elements	**A.** Does the new or updated plan describe vulnerability in terms of the types and numbers of existing buildings, infrastructure, and critical facilities located in the identified hazard areas?
	B. Does the new or updated plan describe vulnerability in terms of the types and numbers of future buildings, infrastructure, and critical facilities located in the identified hazard areas?

A. Existing Buildings, Infrastructure, and Critical Facilities Located in the Identified Hazard Areas

PTEMA used its municipal survey, Maine Geographical Information Systems (MEGIS) data, as well as the 2019 Penobscot County Critical Infrastructure Priority Restoration Plan to produce critical facilities maps to determine the location of critical facilities within the participating communities. The Critical Infrastructure Priority Restoration Plan was

created by surveying each municipality to identify all critical infrastructure within their jurisdiction for the purpose of prioritizing restoration efforts with the utility providers after a storm.

After the completion of the review process for these maps, PTEMA reviewed its list of critical facilities within each community. The critical facilities identified within Penobscot County are police and fire stations, municipal offices, schools, post offices, town garages, sand/salt sheds, hospitals, public utilities (electric and communication), water and wastewater treatment, and hazardous waste sites or storage facilities.

Using data collected from MEGIS and community surveys, the Penobscot Emergency Management Agency determined the extent of vulnerability of the county's critical facilities to the predetermined hazards. It has been previously established that Penobscot County is susceptible to flood (including erosion), Severe Winter Storms, Severe Summer storms, and wildfire.

Town	**Facility**	**Location**	**Notes**
Alton	Elementary School	22 Argyle Road	RSU 34
	Town Office/Fire Dept.	3330-3352 Bennoch Road	pop 908
Bradford	Hilltop Circle	East Road/Station Road	Vulnerable Population
	Town Office	345 East Road	Community Shelter
	Fire Station	223 East Road	
	Fairpoint Comms Station	Main Road south Sawtelle Rd	Comms
Bradley	Elementary School	55 Highland Ave	RSU 34
	Town Office	165 B Main Road	
	Fire Department	25 Elm Street	
Brewer	City Hall	80 North Main Street	
	Brewer Community School	92 Pendelton Street	
	Brewer High School	79 Parkway South	
	Public Safety Building	151 Parkway South	
	Brewer Auditorium	318 Wilson Street	Regional Shelter
	Brewer Wastewater Plant	37 Oak Street	
	Cancer Care of Maine/Lafeyette	33 Whiting Hill Road	Medical
	PCHC	735 Wilson Street	

	Miller Drug	395 North Main Street ?	Distribution Center
	Davita Dialysis	403 Wilson St	Medical
	Public Works Building	221 Greenpoint Road	
	Brewer Rehab	74 Parkway South	Vulnerable Population
	Ellen Leach Home	58 Colonia Circle	Vulnerable Population
	Woodlands Assisted Care	53 Colonial Circle	Vulnerable Population
Brewer Housing	Chamberlain Place	15 Colonial Cirlce	Vulnerable Population
Brewer Housing	Somersert Place	15 Colonial Cirlce	Vulnerable Population
	Wilson Street Corridor	Traffic Signals	Major Roadway
	Brewer Water District	223 Greenpoint Road	
Burlington	Town Office	1523 Long Ridge Road	pop 363
	Fire Department	1523 Long Ridge Road	
Carmel	Town Office/Fire Dept.	1 Safety Lane	
	Caravelle Middle School	520 Irish Road	
	Carmel Elementary School	50 Plymouth Road	
Carroll Pltn	Town Office	Unknown if a location	pop 156
Charleston	Town Office	125 School Road	
	Correctional/Jail	1202 Dover Road	
	Fire Department	13 Atkinson Road	
	Communications Tower	Bull Hill	Regional Comms
	Highview Christian Academy	739 Main Road	
	Observatory Apartments	8 Charleston Road	Vulnerable Population
	Faith Bible College	29 Main Road	
Chester	Town Office	43 South Chester Road	
Clifton	Town Office	135 Airline Road	pop 953

Corinna	Town Office	8 Levi Stuart Drive	
	Elementary School	42 Stetson Road	
	Fire Department	37 Exeter Road	
Corinth	Town Office	31 Exeter Road	
	Central Elementary School	118 Main Street	RSU 64
	Central Middle School	416 Main Street	
	Central High School	402 Main Street	
	Fire Department	314 Main Street	
	Emillio Estate	465 West Corinth Road	Vulnerable Population
	Corinthia Manor	13 Manor Drive	Vulnerable Population
Dexter	Town Office	23 Main Street	
	Police Department	1 Main Street	
	Dexter High School	12 Abbott Hill Road	
	Community School	175 Fern Street	
	Fire Department	98 Church Street	
	Tech Center	14 Abbott Hill Road	
	Dexter Health Center/Rehab	64 Park Street	Medical
	Public Works	Beathan Way??	
	Airport	301 Airport Road	
	Water Filtration Plant	Grove Street	
	Bishop Hill Apartments	100 Zions Hill Road	Vulnerable Population
	Fairway Knolls	140 Zions Hill Road	Vulnerable Population
	Chaia Apartments	44 Main Street	Vulnerable Population
Dixmont	Town Office	758 Western Ave	
	Communications Tower	Dixmont Mtn	Regional Comms
Drew Pltn	Town Office	65 Center Street	pop 46
East Millinocket	Town Office	53 Main Street	
	Public Safety	125 Main Street	

	Schenck High School	45 A North Street	
	Public Works	Church Street	
	Pumping station	Hathaway	
	Wastewater	Main Street	
	Kathadin Christian Academy	1-6 Beech Street	
	Katahdin Area training center	Rt. 157	Higher Education
	Sweet Seniors	30 Pine Street	Vulnerable Population
	Communications Tower	125 Main Street	Regional Comms
Eddington	Town Office/Fire Dept.	906 Main Road	
	Eddington Elementary School	440 Main Road	RSU 63
	Communications Tower	Black Cap Mtn	Regional Comms
	Country Pines	17-45 Eddy Heights	Vulnerable Population
	Hope Manor	845 Airline Road	Vulnerable Population
	Bangor Water District	Bangor Water Works Road	Facility in Otis, drive thru Eddington to get there
	Brewer Water District	257 Hatcase Pond Road	
Edinburg	Town Office	Not known	pop 130
Enfield	Town Office	789 Hammett Road	
	Enfield Station School	561 Hammett Road	
	Sherman Heights	Caribou Road	Vulnerable Population
Etna	Town Office	17 Shadow Lane	
	Etna-Dixmont School	2100 Dixmont Road	
	Fire Department	402 Stage Road	
Exeter	Town Office	1221 Stetson Road	
	Water District	Champion Road	
	Cider Ridge	280 Cider Hill Road	Vulnerable Population
	Agri-Energy	226 Fogler road	Power Plant
Garland	Town Office	108 Corinth Road	CMP/VERSANT

	Fire Department		
Glenburn	Town Office/Fire Department	138-144 Lakeview Drive	CMP/Versant
	Elementary School	991 Hudson Road	
Greenbush	Town Office	132 Military Road	
	Elementary School	129 Military Road	
	Fire Department	129 Military Road	
	Fire Department-Cardville	389 Greenfield Road	2nd Fire Department
Hampden	Town Office/Public Safety	106 Western Ave	
	Reeds Brook School	28A Main Rd South	RSU 22
	Hampden Academy	89 Western Ave	RSU 22
	Roe Village	113 Western Ave	
	Hampden Water District	140 Main Road North	
	Weatherbee School	22 Main Road North	RSU 22
	Cold Brook Energy	Main Road	
	Dead River- propane storage	Western Ave	Propane
	Avalon Village	50 Foxglove Drive	Vulnerable Population
Hermon	Town Office/Fire Department	333 & 327 Billings Road	CMP
	Elementary school	235 Billings Road	
	Hermon Middle School	29 Billings Road	
	Hermon High School	2415 US- 2	
	Maine Energy	Coldbrook Road	Critical
	Towne Center Apartments	TownE Center Drive	Vulnerable Population
	Bouiler Place	8 Bouiler Place	Vulnerable Population
	Sewer pump station	Odlin Road	
Holden	Town Office/Public Safety	570 Main Road	
	Holden Elementary	590 Main Road	RSU 63
	Holbrook Middle School	202 Kidder Hill Road	RSU 63

	Public Works	570 Main Road	
	Irving Corridor	Rt 1A traffic corridor	Major Roadway
	Pine Cone Trailer Park	1A Traffic Corridor	Vulnerable Population
	Cedar Haven Trailer Park	1A Traffic Corridor	Mix- 150 Trailers
	Holden Square Apartments	41 Upper Dedham Road	Vulnerable Population
	Communications Tower	Copeland Hill	Regional Comms
Howland	Town Office	8 Main Street	
	Fire Department	12 Willow Street	
	Riverview Apartments	River Road	Vulnerable Population
Hudson	Town Office	262 Hudson Road	
	Fire Department	2150 Hudson Road	
Kenduskeag	Town Office/Fire Dept.	4010 Broadway	CMP/VERSANT
Lakeville	Town Office	829 Bottle Lake Road	pop 105
LaGrange	Town Office	5791 Bennoch Road	pop 717
	Marion Cook School	22 Howland Road	
	Fire Department	5801 Bennoch Road	
	Fairpoint	Station Road	Comms
	Town Hall Apartments	Bennoch Road	Vulnerable Population
Lee	Town Office	29 Winn Road	pop 924
	Lee Academy	26 Winn road	
	Mt. Jefferson Jr. High	61 Winn road	
	Lee Fire Department	? Lee Road	
Levant	Town Office	691 Townhouse Road	
	Fire Department	3917 Union Street	

	Levant Elementary School	169 S Levant Road	
Lincoln	Town Office	63 Main Street	
	Public Safety Bldg	1 Adams Street	
	Davita Dialysis	250 Enfield Rd.	Medical
	PV Hospital	7 Transalpine Road	Medical
	Health Access Network	175 W Broadway	Medical
	Ella Burr Elementary School	23 Ella P Burr Street	RSU 67
	Mattanawcook Acadamy	33 Reed Drive	RSU 67
	Region 3 Tech School	35 W Broadway	
	Lincoln Water	3 Taylor	
	Lincoln Sanitary District	56 Haynes Street	
	Public Works Department	7 Park Ave	
	Lincoln Retirement Center	Main Street	Vulnerable Population
	Colonial Acres Nursing Home	36 Workman Terrace	Vulnerable Population
	Lakewview Terrace Home	74 Taylor Street	Vulnerable Population
	Lincoln Manor	39 Manor Drive	Vulnerable Population
	Mattanawcook Junior High	45 School Street	RSU 67
	Airport	Airport Road	
	Communications Towers	Fish Hill	Regional Comms
Lowell	Town Office/Fire Department	129 W Old Main Road	pop 354
Mattawamkeag	Town Office/Public Safety	327 Main Street	pop 684
Maxfield	Town Office	231 River Road	pop 93
Medway	Town Office	4 School Street	
	Medway Middle School	25 School Street	
	Fire Department/Public Works	23 Grindstone Road	

	Communications Tower	Unknown Road Name	Regional Comms
	Dead River	Medway Road	
Milford	Town Office/Fire Department	62 Davenport Street	
	Elementary School	13 School Street	
	Public Works	62 Davenport Street	
Millinocket	Town Office/Police Department	197 Penobscot Ave	
	Fire Department	222 Aroostook Ave	
	Stearns High School	199 State Street	Regional Shelter
	Millinocket Hospital	200 Somerset Street	Medical
	Municipal Airport	152 Medway Road	
	Granite Street School	191 Granite Street	
	Millinocket Middle School	199 State Street	
	Communications Tower		Regional Comms
Mount Chase	Town Office	1094 Shin Pond Road	pop 204
	Fire Department	1489 Shin Pond Road	
Newburgh	Town Office	2220 Western Ave	CMP/VERSANT
	Fire Department	2660 State Route 9	
Newport	Town Office	23 Water Street	
	Fire & Police Department	21 Water Street	
	Nokomis High School	266 Williams Road	
	Elementary School	142 Elm Street	
	Sebasticook Middle School	337 Williams Road	
Old Town	Town Office	265 Main Street	
	Fire & Police Departments	150 Brunswick Street	
	Elementary School	576 Stillwater Ave	RSU 34

	Leonard Middle School	156 Oak Street	Regional Shelter
	High School	203 Stillwater Ave	RSU 34
	Stillwater Montessori School	1024 Stillwater Ave	
	Maine Forest Service	87 Airport Road	
	Airport	100 Airport Road	
	Old Town Water District	109 Center Street	
	Public Works	73 Airport Road	
	Penobscot River House	120 Maine Street	Vulnerable Population
	Marsh Island Apartments	345 Main Street	Vulnerable Population
	Bickmore Manor	336 Main Street	Vulnerable Population
	Penobscot Terrares	352 Main Street	Vulnerable Population
	The Meadows	110 Perkins Ave	Vulnerable Population
	Whistle Way Apartments	1- & 20 Whistle Way	Vulnerable Population
	Whim Station Apartments	50 Pembroke Drive	Vulnerable Population
	Anderson Lane Apartments	20 Anderson Lane	Vulnerable Population
	Old Town Pollution Control	298 Water Street	
	Old Town Orono YMCA	472 Stillwater Ave	
Orono	Town Office	59 Main Street	
	Public Safety Building	59 Main Street	
	Asa Adams School	6 Goodridge Drive	RSU 26
	Orono High & Middle School	14 Goodridge Drive	RSU 26
	University of Maine	Multiple locations	Shelter for UMaine
	Orono Veazie Water District	47 Penobscot Street	
	Orono Veazie Water District	100? Bennoch Road	Pump Wells location
	Public Works	135 Kelley Road	
	Wasterwater Treatment Center	60 Broadway Street	
	Communications Towers	Hilltop Commons	Regional Comms
	Communications Towers	Kelly Road	Communications
	Orono Commons	117 Bennoch Road	Vulnerable Population
	Dirigo Pines	9 Alumi Drive	Vulnerable Population

	Longfellow Heights	Elm Street	Vulnerable Population
	Hasbrouck Court	Pine Street	Vulnerable Population
	Crosby Court	30 Crosby Street	Vulnerable Population
Orrington	Town Office	1 Municipal Way	
	Fire Department	14 Johnson Mill Road	
	Police Department	255 Center Drive	
	Center Drive School	17 School Street	
	Power Substation	Fields Pond Road	
	Fairground apartments	Old Fairground Drive	Vulnerable Population
Passadumkeag	Town Office	37 Pleasant Street	pop 367
	Fire Department	36 Pleasant Street	
Patten	Town Office/PW Garage	21 Katahdin Street	pop 992
	Fire Department	27 Dearborn Street	
	Communications Tower	Unknown Road-MMRailway	Regional Comms
	Patten Water & Sewer	85 Main Street	
	Parks & Rec	12 Founders Street	Potential Shelter
	Mountain Heights	83 Houlton Street	Vulnerable Population
	Hathaway Apartments	11 Dearborn Street	Vulnerable Population
	Meadowbrook/Patten Housing	1940 Meadowbrook Drive	Vulnerable Population
	EMS Department	42 Potatoe Row	
	Stetson Memorial United Church	7 Houlton Street	Shelter
	Patten Pentecostal	101 Main Street	Shelter
Plymouth	Town Office	1947 Moosehead Trail	
	Fire Department	39 Lower Detroit Road	
Seboeis Pltn	Town Office	1128 or 1134 Seboeis Road	pop 36
Springfield	Town office	13 Park Street	pop 403
	Fire Department	Rt. 6 near Park Street	

	Communications Tower	Almanac Mtn	Regional Comms
Stacyville	Town Office	414 Station Road	pop 386
Stetson	Town Office/Fire Department	70 Village Road	
	Grammar School	394 Village Road	
	NFI North-Stetson House Private	160 Lapoint Road	
Veazie	Town Office/Public Safety/PW	1084 Main Street	
	Veazie Community School	1040 School Street	
	Casco Bay Energy	125 Shore Road	
	Versant	135 Shore Road	
	Veazie sewer District	34 Hobson Ave	
	Graham Senior Housing	1 & 3 Flagg Street	Vulnerable Population
Webster	Town office	520 Tucker Ridge Rd	pop 84
Winn	Town office	Rt. 168	pop 401
Woodville	Town office	624 Woodville Road	pop 251
Penobscot Nation	Entire island	23 Wabanaki Way	pop 645

Table 4.15: Penobscot County Critical Infrastructure
Source: PTEMA

Flooding/Erosion

Buildings

Flooding has historically occurred in developed areas where there are residential and commercial structures particularly along the Penobscot River and its tributaries.

Infrastructure

Roadways, storm drains and drainage systems are susceptible to damage from flooding. Many rural roadways are not constructed to standards that will withstand floodwaters. Heavy rains and ice jams make this infrastructure vulnerable to damage.

Critical Facilities

The vast majority of critical facilities have been located away from flood prone areas. However, it is sometimes necessary to locate some of these facilities such as wastewater treatment plants within the floodplain.

Severe Winter Storms

Buildings

Buildings county-wide are susceptible to severe winter storms. Damages can vary from broken windows, roofing and siding damage and roof leaks to building collapse from the weight of the snow.

Infrastructure

Infrastructure throughout the county is also vulnerable to severe winter storm damage. Roads and drainage systems can be blocked by falling snow, downed utility lines, debris or ice.

Critical facilities

All critical facilities are also vulnerable to severe winter storms**.** Damages can vary from broken windows, roofing and siding damage, roof collapse or loss of utilities.

Severe Summer Storms

Buildings

Buildings county-wide are susceptible to severe summer storms, Damages can vary from broken windows, water damage, roofing and siding damage to fire from a lightning strike.

Infrastructure

Infrastructure throughout the county is also vulnerable to severe summer storm damage. Roads can be blocked by fallen trees and utility lines, lightning strikes can also occur at pumping stations and rain can cause flooding.

Critical facilities

All critical facilities are also vulnerable to severe summer storms**.** Damages can vary from broken windows, roofing and siding damage to fire from a lightning strike.

Wildfire

Buildings

Building located near wooded areas are susceptible to wild fire damage, either as a total loss or as damage resulting from falling embers. Approximately 63.83% of homes within rural areas of the county are situated within the urban wild land interface.

Infrastructure

Utilities are vulnerable to wild fire and can even be damaged from the heat of the fire.

Critical facilities

Critical facilities located near wooded areas are susceptible to wild fire damage, either as a total loss or as damage resulting from falling embers.

PENOBSCOT COUNTY CRITICAL FACILITY ASSETS BY MUNICIPALITY

Municipality	Municipal Offices	Police Station	Fire Station	Public Works	Water Treatment Plant	Wastewater Treatment Plant	Library	School	Hospital	Airport	Public Wells	Post Office	Shelter	Dams	Hazmat Facilities	Salt/Sand shed
Alton	1	0	1	1	0	0	0	1	0	0	2	0	0	1	0	1
Argyle	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bangor	1	1	3	2	1	1	1	21	2	1	0	1	2	1	4	4
Bradford	1	0	1	0	0	0	1	1	0	0	0	1	0	0	0	1
Bradley	1	0	1	0	0	0	0	1	0	0	0	1	0	4	0	1
Brewer	1	1	1	1	1	1	1	2	1	1	2	1	1	1	3	2
Burlington	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Carmel	1	0	1	0	0	0	1	2	0	1	3	1	0	0	0	3
Carroll Plantation	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Charleston	1	0	1	0	0	0	1	1	0	0	2	1	0	0	0	1
Chester	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clifton	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Corinna	1	0	1	1	0	0	1	1	0	0	3	1	0	0	0	1
Corinth	1	0	1	0	0	0	1	3	0	0	0	1	0	0	0	2
Dexter	1	1	1	1	2	1	1	2	1	1	0	1	0	1	0	0
Dixmont	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1
Drew Plantation	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
East Millinocket	1	1	1	1	0	1	1	2	0	0	1	1	0	0	2	1
Eddington	1	0	1	0	0	0	0	1	0	0	0	1	0	0	0	2
Enfield	1	0	0	1	0	0	1	2	1	0	0	1	0	0	0	1
Etna	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
Exeter	1	0	0	0	0	0	0	0	0	0	2	1	0	0	0	1
Garland	1	0	1	1	0	0	1	1	0	0	0	1	0	0	0	1
Glenburn	1	0	1	0	0	0	1	1	0	0	3	1	0	0	0	1
Greenbush	1	0	0	0	0	0	0	1	0	0	2	2	0	0	1	1
Hampden	1	1	1	1	0	0	1	2	0	0	2	0	0	0	0	1
Hermon	1	1	1	1	0	0	0	4	0	0	3	1	0	0	1	1
Holden	1	1	1	0	0	0	0	2	0	0	0	1	0	0	0	1

Municipality	Municipal Offices	Police Station	Fire Station	Public Works	Water Treatment Plant	Wastewater Treatment Plant	Library	School	Hospital	Airport	Public Wells	Post Office	Shelter	Dams	Hazmat Facilities	Salt/Sand shed
Howland	1	0	1	1	0	0	1	2	0	0	0	1	0	0	0	2
Hudson	1	0	0	1	0	0	0	2	0	0	0	1	0	0	0	1
Kenduskeag	1	0	0	1	0	0	0	1	0	0	0	1	0	0	1	2
Lagrange	1	0	0	1	0	0	0	1	0	0	0	1	0	0	0	2
Lakeville	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Lee	1	0	1	1	0	0	1	2	0	0	0	1	0	3	0	1
Levant	1	0	1	0	0	0	0	1	0	0	2	1	0	0	0	1
Lincoln	1	1	1	1	1	1	1	4	1	1	0	1	0	6	1	3
Lowell	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Mattawamkeag	1	0	1	1	0	0	1	1	0	0	0	1	0	0	1	0
Maxfield	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medway	1	0	1	1	0	0	1	1	0	0	0	1	0	1	0	2
Milford	1	0	1	1	0	0	1	1	0	0	0	1	0	1	0	1
Millinocket	1	1	1	1	1	1	1	2	1	1		1	1	2	1	3
Mount Chase	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Newburgh	1	0	2	0	0	0	0	1	0	0	0	1	0	0	0	1
Newport	1	1	1	1	1	1	1	3	0	0	0	1	0	1	0	1
Old Town	1	1	1	1	1	1	1	4	0	1	1	2	1	4	2	1
Orono	1	1	1	1	1	1	1	3	0	0	0	2	0	1	1	1
Orrington	1	1	1	1	0	0	1	1	0	0	0	1	0	3	0	1
Passadumkeag	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1
Patten	1	0	1	1	0	0	1	0	0	0	1	0	0	0	0	1
Penobscot Nation	1	1	1	1	1	1	0	1	1	0	0	0	1	0	0	1
Plymouth	1	0	0	1	0	0	0	1	0	0	1	1	0	1	0	2
Prentiss Plantation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Seboeis Plantation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Springfield	1	0	1	0	0	0	0	1	0	0	0	1	0	0	0	2
Stacyville	1	0	1	1	0	0	0	3	0	0	0	1	0	0	1	0
Stetson	1	0	1	0	0	0	1	0	0	0	0	0	0	1	0	1
Veazie	1	1	1	0	0	1	0	1	0	0	1	0	0	0	1	1
Webster Plantation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Winn	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Woodville	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0

B. Vulnerability in terms of future buildings, infrastructure, and critical facilities located in the identified hazard areas

Flooding

Buildings and Critical Facilities
The extent of vulnerability of future buildings and critical facilities from flooding should be minimal. State government mandates Shoreland zoning that restricts structures from locating within the floodplain. Additionally, the Flood Insurance Program also restricts development. Therefore, flooding of future buildings and critical facilities is not expected to be an issue for Penobscot County.

Infrastructure
Vulnerability of future roads and drainage systems may continue to be a challenge since many of Penobscot County's existing rural roads originated as logging roads and many are located adjacent to water bodies. Proposed roadways are now, generally, built to specific design standards, which should help to minimize the impact.

Severe Winter Storms

Buildings and Critical Facilities
Vulnerability of future buildings and critical facilities from winter storms will most likely be the same as existing buildings which are susceptible to severe winter storms. Damages can vary from broken windows and pipes, utility loss, roofing and siding damage and roof leaks to even building collapse from the weight of the snow.

Infrastructure
Vulnerability of future infrastructure throughout the county will continue to be a concern regarding severe winter storm damage. Roads and drainage systems can be blocked by falling snow, debris or ice and pipes may burst or utility lines may be down.

Severe Summer Storms

Buildings and Critical Facilities
Future buildings and critical facilities county-wide are susceptible to severe summer storms, Damages can vary from broken windows, water damage, roofing and siding damage to fire from a lightning strike.

Infrastructure
Vulnerability of future infrastructure to severe summer storm damage throughout the county is also a concern. Roads can be blocked by fallen trees and utility lines, lightning strikes can also occur at pumping stations and rain can cause flooding.

Wildfire

Buildings & Critical Facilities

Future buildings located near wooded areas are susceptible to wild fire damage, either as a total loss or as damage resulting from falling embers and smoke damage. The vast majority of homes within the county are situated within the urban-wild land interface. Critical facilities located near wooded areas are susceptible to wild fire damage, either as a total loss or as damage resulting from falling embers.

Infrastructure
Future infrastructure, especially utilities, is vulnerable to wild fire and can even be damaged from the heat of the fire.

ASSESSING VULNERABILITY – *ESTIMATING POTENTIAL LOSSES*

10. Assessing Vulnerability: Estimating Potential Losses	
Requirement §201.6(c)(2)(ii)(B): The plan should describe vulnerability in terms of an estimate of the potential dollar losses to vulnerable structures identified in the paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate.	
Elements	**A.** Does the new or updated plan estimate potential dollar losses to vulnerable structures?
	B. Does the new or updated plan describe the methodology used to prepare the estimate?

FLOODING:

Determining the extent of damages caused by flooding is dependent upon the values placed on consistent variables, value of homes, and the number of homes vulnerable to flooding. PTEMA decided to use FIRM (Flood Insurance Rate Maps) and policies data as the base for developing a standard for flooding vulnerability. Any property listed as having a policy with FIRM was considered vulnerable. The use of FIRM data for each community developed potential dollar losses to residential and commercial structures. The data collected on the following page displays the insured cost of homes located and insured within the flood plain.

Additionally, the effects of erosion are felt throughout the watersheds of the county. From Roadways and Property, to work and recreation, riverbanks are eroding away and causing damage in increasing amounts creating concern. Currently there are no listed critical facilities determined to be under the threat of erosion, but riverfront homes and businesses are vulnerable to damages. The majority of damages are the threats to these homes, eroding roads and bridges, and personal property along the river banks.

Community	Number of Policies	Total Premium	Total Coverage	Number of Claims Since 1978	Total Paid Since 1978
Alton	1	$2,035	$202,500		$ -
Bangor	68	$78,450	$13,115,100	15	$258,106
Bradley	7	$4,064	$808,400	16	$107,584
Brewer	10	$11,599	$2,082,600	1	$ -
Burlington	1	$524	$47,500	0	$0
Chester	2	$1,175	$347,800	1	$1,842
Clifton	2	$986	$420,000	0	$ -
Corinna	1	$1,675	$188,500	2	$81,782
Corinth	4	$1,790	$515,000	0	$ -
Dexter	10	$18,595	$2,260,700	1	$ -
Dixmont	1	$856	$119,000	0	$ -
Drew Plantation	1	$639	$68,400	1	$5,851
East Millinocket	0	$ -	$ -	6	$3,992
Eddington	2	$480	$290,000	1	$ -
Enfield	9	$5,987	$1,202,800	3	$2,531
Garland	1	$2,067	$72,000	0	$ -
Glenburn	37	$22,883	$5,829,600	13	$50,137
Greenbush	18	$10,833	$1,722,700	5	$22,457
Grindstone	4	$1,010	$644,600	14	$164,643
Hampden	16	$7,973	$3,328,900	3	$21,028
Hermon	4	$2,486	$518,500	4	$2,641
Holden	3	$1,194	$743,000	0	$ -
Howland	22	$14,570	$1,578,700	6	$88,055
Hudson	25	$15,445	$3,097,900	2	$1,659
Kenduskeag	7	$5,275	$909,800	1	$3,597
Levant	4	$3,057	$441,300	0	$ -
Lincoln	22	$14,800	$2,975,500	2	$ -

Lowell	1	$1,189	$290,000	0	$ -
Mattamiscontis	1	$348	$350,000	0	$
Mattawamkeag	5	$3,033	$391,200	4	$4,455
Maxfield	3	$882	$293,000	0	$ -
Medway	9	$3,112	$1,074,900	24	$120,787
Milford	28	$18,478	$3,701,400	51	$335,182
Millinocket	10	$5,562	$1,029,090	9	$22,574
Mount Chase	2	$2,005	$227,700	0	$ -
Newport	7	$2,717	$1,796,300	0	$ -
Old Town	44	$38,356	$5,776,800	16	$92,741
Orono	30	$23,669	$5,523,400	11	$160,893
Orrington	6	$4,954	$858,300	0	$ -
Passadumkeag	16	$11,995	$1,150,100	9	$17,220
Patten	3	$1,774	$176,400	0	$ -
Plymouth	4	$2,192	$557,400	0	$ -
Stacyville	1	$189	$9,700	4	$30,532
Stetson	4	$2,496	$469,300	0	$ -
T03 R01 NBPP	1	$361	$280,000	0	$
Winn	2	$648	$57,500	0	$0
Penobscot County	459	$354,608	$67,544,100	225	$1,600,289

Source: NFIP insurance report

Roads

Generally, the largest expense to municipalities in a flooding event is damage to roadways. For this exercise, roadway damages were defined by length of roadway located within the 100-year flood plain, as well as the local cost of repairs and replacement to these roads. Penobscot County Unorganized Territory department estimated that it would cost approximately $300,000 per mile of paved roadway to replace a road that was washed away.

The following table is a worst-case scenario, if all roads and their approximate length in the identified flood zones are lost to flooding.

POTENTIAL TRANSPORTATION SYSTEM LOSSES FROM FLOOD EVENT			
	Length in Flood Zone (miles)	**Replacement Cost (per mile)**	**Total Potential Damages**
Roads in Flood Zone	84.9230	$300,000	$ $25,476,900

Source: MEGIS and FIRM DATA

The following table depicts potential flood loss based on the worst flood event (1987) in recent history for Penobscot County. The actual loss figures from 1987 were adjusted for inflation by the 2021 Consumer Price Index located on https://www.bls.gov/data/inflation_calculator.htm to create a loss amount in 2021 dollars. The 2021dollar amount for the entire loss in Penobscot County was then divided by the 2020 U.S. Census total population of 152,199 for Penobscot County to determine an estimated loss per capita, which equals $13.22. Then the 2021 Adjusted Loss column and the Estimated Per Capita loss were compared and the greater of the two numbers was utilized to determine the Greatest Potential Loss.

	1987 Flooding Actual Loss	**2021 Adjusted Loss**	**Estimated Loss Per Capita**	**Greatest Potential Loss**
Penobscot County (UT)	$3,245.00	$7,784.66	$17,053.80	$17,053.80
Alton	$3,431.00	$8,230.87	$10,959.38	$10,959.38
Argyle	$0.00	$0.00	$3,371.10	$3,371.10
Bangor	$19,495.00	$46,767.96	$419,744.66	$419,744.66
Bradford	$11,086.00	$26,595	$15,652.48	$26,595
Bradley	$2,465.00	$5,913.47	$20,253.04	$20,253.04
Brewer	$0.00	$0.00	$127,863.84	$127,863.84
Burlington	$0.00	$0.00	$4,931.06	$4,931.06
Carmel	$110,441.00	$264,944.85	$37,901.74	$264,944.85
Carroll Plantation	$0.00	$0.00	$1,824.36	$1,824.36
Charleston	$13,956.00	$33,480.05	$20,504.22	$33,480.05
Chester	$0.00	$0.00	$7,257.78	$7,257.78
Clifton	$0.00	$0.00		$11,104.80

			$11,104.80	
Corinna	$19,517.00	$46,820.73	$29,361.62	$46,820.73
Corinth	$4,327.00	$10,380.35	$38,338	$38,338
Dexter	$37,110.00	$89,025.85	$50,275.66	$89,025.85
Dixmont	$38,994.00	$93,545.51	$16,009.42	$93,545.51
Drew Plantation	$0.00	$0.00	$343.72	$343.72
East Millinocket	$0.00	$0.00	$20,781.84	$20,781.84
Eddington	$0.00	$0.00	$29,004.68	$29,004.68
Enfield	$0.00	$0.00	$18,970.70	$18,970.70
Etna	$3,055.00	$7,328.86	$16,207.72	$16,207.72
Exeter	$10,879.00	$26,098.42	$12,730.86	$26,098.42
Garland	$11,534.00	$27,669.74	$13,563.72	$27,669.74
Glenburn	$0.00	$0.00	$61,446.56	$61,446.56
Greenbush	$8,567.00	$20,551.99	$19,089.68	$20,551.99
Hampden	$8,296.00	$19,901.87	$101,912.98	$101,912.98
Hermon	$1,672.00	$4,011.08	$85,414.42	$85,414.42
Holden	$3,934.00	$9,437.56	$43,321.94	$43,321.94
Howland	$95,916.00	$230,099.79	$14,462.68	$230,099.79
Hudson	$3,523.00	$8,451.58	$18,719.52	$18,719.52
Kenduskeag	$2,227.00	$5,342.51	$18,177.50	$18,177.50
Kingman	$0.00	$0.00	$1,811.14	$1,811.14
Lagrange	$0.00	$0.00	$8,394.70	$8,394.70
Lakeville	$0.00	$0.00	$1,374.88	$1,374.88
Lee	$0.00	$0.00	$12,109.52	$12,109.52
Levant	$11,713.00	$28,099.16	$38,866.80	$38,866.80
Lincoln	$0.00	$0.00	$64,156.66	$64,156.66
Lowell	$0.00	$0.00		$4,864.96

			$4,864.96	
Mattawamkeag	$0.00	$0.00	$7,879.12	$7,879.12
Maxfield	$24,191.00	$58,033.53	$1,176.58	$58,033.53
Medway	$0.00	$0.00	$15,692.14	$15,692.14
Milford	$6,628.00	$15,900.39	$39,501.36	$39,501.36
Millinocket	$0.00	$0.00	$54,387.08	$54,387.08
Mount Chase	$0.00	$0.00	$2,472.14	$2,472.14
Newburgh	$42,657.00	$102,332.94	$21,085.90	$102,332.94
Newport	$205,889.00	$493,921.92	$41,418.26	$493,921.92
Old Town	$5,077.00	$12,179.58	$98,237.82	$98,237.82
Orono	$30,122.00	$72,261.83	$142,947.86	$142,947.86
Orrington	$9,281.00	$22,264.86	$50,394.64	$50,394.64
Passadumkeag	$5,492.00	$13,175.15	$4,706.32	$13,175.15
Patten	$0.00	$0.00	$11,646.82	$11,646.82
Penobscot Nation	$65,949.00	$158,209.80	$4,891.40	$158,209.80
Plymouth	$2,078.00	$4,985.06	$17,516.50	$17,516.50
Prentiss Plantation	$0.00	$0.00	$2,234.18	$2,234.18
Seboeis Plantation	$0.00	$0.00	$528.80	$528.80
Springfield	$0.00	$0.00	$3,873.46	$3,873.46
Stacyville	$0.00	$0.00	$5,023.60	$5,023.60
Stetson	$5,104.00	$12,244.35	$15,678.92	$15,678.92
Veazie	$10,735.00	$25,752.96	$23,981.08	$25,752.96
Webster Plantation	$0.00	$0.00	$898.96	$898.96
Winn	$0.00	$0.00	$5,274.78	$5,274.78
Woodville	$0.00	$0.00	$2,657.22	$2,657.22
Total	$808,433.00	$2,011,744.23	$2,012,239.08	$3,395,685,.69

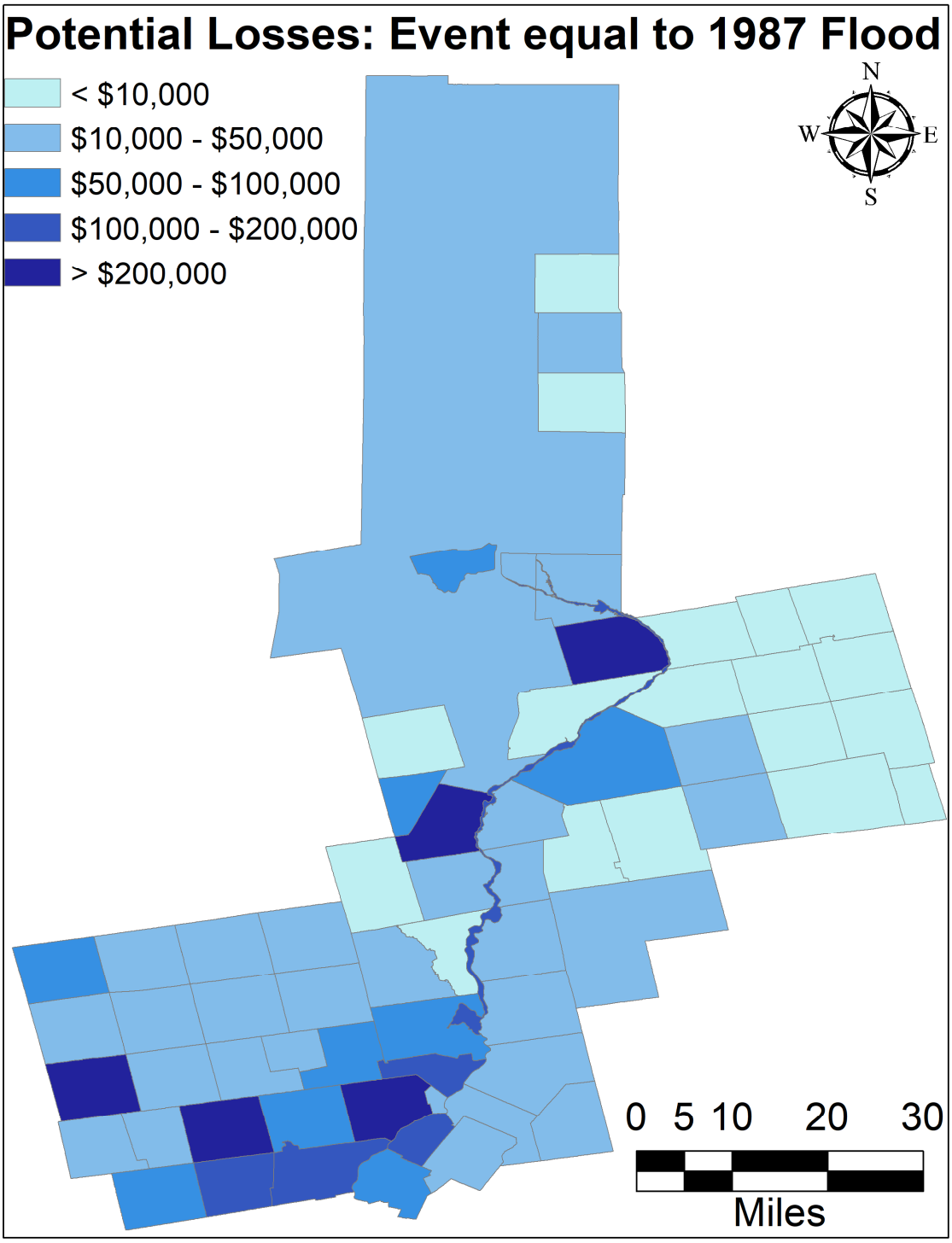
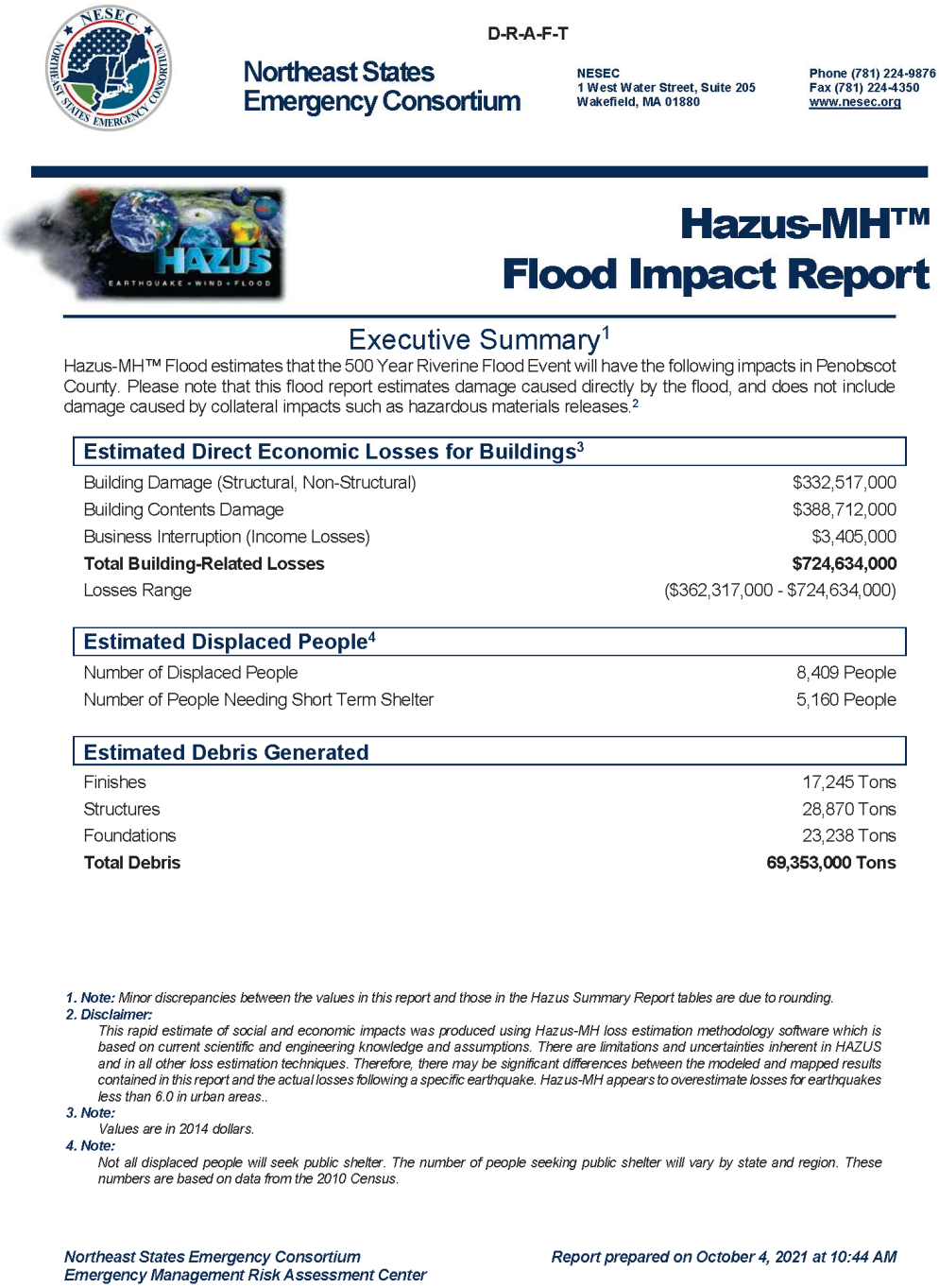


Figure depicts potential losses due to a flooding event equal in magnitude to the Flood of 1987. In general, the majority of losses occurred in the southern, central, and western parts of the county along the mainstem and major tributaries of the Penobscot River.

NESEC Hazus Flood Impact Analysis Reports: The purpose of Hazus Impact Analysis Reports is to provide emergency managers and other government decision makers with an estimate of the potential impact of moderate to large hazardous events affecting Penobscot

County. Hazus model reports by the Northeast States Emergency Consortium (NESEC)[28] provide a rough estimate of potential damage and other human and economic impacts resulting from hypothetical natural disaster scenarios.



D-R-A-F-T

Northeast States Emergency Consortium

NESEC
1 West Water Street, Suite 205
Wakefield, MA 01880

Phone (781) 224-9876
Fax (781) 224-4350
www.nesec.org

Hazus-MH™ Flood Impact Report

Executive Summary[1]

Hazus-MH™ Flood estimates that the 500 Year Riverine Flood Event will have the following impacts in Penobscot County. Please note that this flood report estimates damage caused directly by the flood, and does not include damage caused by collateral impacts such as hazardous materials releases.[2]

Estimated Direct Economic Losses for Buildings[3]	
Building Damage (Structural, Non-Structural)	$332,517,000
Building Contents Damage	$388,712,000
Business Interruption (Income Losses)	$3,405,000
Total Building-Related Losses	**$724,634,000**
Losses Range	($362,317,000 - $724,634,000)

Estimated Displaced People[4]	
Number of Displaced People	8,409 People
Number of People Needing Short Term Shelter	5,160 People

Estimated Debris Generated	
Finishes	17,245 Tons
Structures	28,870 Tons
Foundations	23,238 Tons
Total Debris	**69,353,000 Tons**

1. **Note:** *Minor discrepancies between the values in this report and those in the Hazus Summary Report tables are due to rounding.*
2. **Disclaimer:**
   This rapid estimate of social and economic impacts was produced using Hazus-MH loss estimation methodology software which is based on current scientific and engineering knowledge and assumptions. There are limitations and uncertainties inherent in HAZUS and in all other loss estimation techniques. Therefore, there may be significant differences between the modeled and mapped results contained in this report and the actual losses following a specific earthquake. Hazus-MH appears to overestimate losses for earthquakes less than 6.0 in urban areas..
3. **Note:**
   Values are in 2014 dollars.
4. **Note:**
   Not all displaced people will seek public shelter. The number of people seeking public shelter will vary by state and region. These numbers are based on data from the 2010 Census.

Northeast States Emergency Consortium
Emergency Management Risk Assessment Center

Report prepared on October 4, 2021 at 10:44 AM

Figure 4.9: Penobscot County Flooding Impact
Source: Northeast States Emergency Consortium

Hazus was developed by FEMA to aid in the calculation, mapping, and communication of model disaster data. These reports, developed by the Northeast States Emergency Each

[28] NESEC Impact Analysis: http://nesec.org/

Hazus model uses inventory information (buildings, infrastructure, and population), hazard extent and intensity data, and damage functions to estimate the impacts of disasters. Estimated impacts vary by model, but include building damages, economic losses, displaced households, casualties, debris, and the loss of function for essential facilities.

The Flood Impact Analysis Report was generated based on the impacts of a major flooding event that probabilistically has a 1 in 500 (0.2%) chance of occurring in a year. This model differs from historic data and the LCHMP Planning Team models in that there may be no comparable event in recorded history for Penobscot County.

SEVERE WINTER STORM

The primary damage losses that are expected during a Severe Winter Storm would be to overhead utility lines and local roads. In calculating the damage costs, the Planning Team assumed that all local roads would be covered in snow or ice or blocked with tree and utility line debris.

The valuations of the Central Maine Power and Versant Power were used to determine the number of miles of transmission lines and $200,000 was used as an average replacement cost per unit of electrical power lines. It was assumed that it would cost approximately $2,000 per mile to replace telephone lines, which were assumed to be along each of the roads in town belonging to the State or the Town. It was assumed that all local roads would be covered in snow or ice or blocked with tree and utility line debris. It was further estimated that it would cost approximately $500 per mile for road debris clearance or snow removal. The website "inflationdata.com" was used to determine the inflation rate for Maine between July 2005 and July 2010. The rate (11.57%) was then utilized to adjust the numbers from the 2005 plan to provide cost estimates for the 2011 plan. Again, for the 2016 plan the same website was used to calculate the inflation rate for the period of July 2010 through July 2015. The established rate of 9.47% was then used to adjust the prior numbers to provide cost estimates for this plan update.

PENOBSCOT COUNTY
POTENTIAL LOSSES FROM SEVERE WINTER STORM

Critical Facility	Function Lost	Quantity	Damage Cost
Electrical Power Lines	Electricity		$664,125,684
Telephone Lines	Communication	2520.46	$686,460
Paved Road Surfaces	Transportation	1353.009	$825,703
Gravel Road Surfaces	Transportation	374.87	$228,924

The following is the individual break down of maximum potential critical infrastructure damage for each participating community. The above calculation is the sum of all individual communities within the county. Pieces of information for this calculation were not available at the time of submitting this plan, this information was obtained from the community survey and not all information was available. Information for Electric Power

damage costs for communities was obtained from Maine Revenue Services 2005 distribution and transmission state valuation and adjusted for inflation.

The following table depicts potential severe winter storm loss based on the worst storm event (1998) in recent history for Penobscot County. The actual loss figures from 1998 were adjusted for inflation by the 2009 Consumer Price Index of 2.145 (the 2010 figure was not available) to create a loss amount in 2009 dollars. The 2009 dollar amount for the entire loss in Penobscot County was then divided by the total population of Penobscot County to determine an estimated loss per capita. Then the 2009 Adjusted Loss column and the Estimated Per Capita loss were compared and the greater of the two numbers was utilized to determine the Greatest Potential Loss.

	1998 Ice Storm Actual Loss	2009 Adjusted Loss	Estimated Loss Per Capita	Greatest Potential Loss
PENOBSCOT CTY	$ 63,467	$ 83,519	$ 11,298	$ 83,519
Alton	$ 17,838	$ 23,474	$ 30,634	$ 30,634
Argyle		$ -	$ 8,799	$ 8,799
Bangor	$ 966,845	$ 1,272,321	$1,108,859	$ 1,272,321
Bradford	$ 19,878	$ 26,158	$ 46,820	$ 46,820
Bradley	$ 9,199	$ 12,105	$ 50,368	$ 50,368
Brewer	$ 233,705	$ 307,544	$ 332,372	$ 332,372
Burlington	$ 20,519	$ 27,002	$ 13,506	$ 27,002
Carmel	$ 92,171	$ 121,293	$ 94,255	$ 121,293
Carroll Plantation	$ 2,858	$ 3,761	$ 4,925	$ 4,925
Charleston	$ 45,066	$ 59,305	$ 50,622	$ 59,305
Chester	$ 17,055	$ 22,444	$ 18,286	$ 22,444
Clifton	$ 6,224	$ 8,190	$ 27,918	$ 27,918
Corinna	$ 43,249	$ 56,914	$ 84,261	$ 84,261
Corinth	$ 39,520	$ 52,006	$ 99,396	$ 99,396
Dexter	$ 42,012	$ 55,286	$ 133,542	$ 133,542
Dixmont	$ 138,472	$ 182,222	$ 38,745	$ 182,222
Drew Plantation	$ 4,436	$ 5,838	$ 1,992	$ 5,838
East Millinocket	$ 35,993	$ 47,365	$ 61,376	$ 61,376
Eddington	$ 21,536	$ 28,340	$ 80,314	$ 80,314
Enfield	$ 20,524	$ 27,009	$ 55,836	$ 55,836
Etna	$ 29,281	$ 38,532	$ 37,622	$ 38,532
Exeter	$ 23,751	$ 31,255	$ 35,631	$ 35,631
Garland	$ 28,121	$ 37,006	$ 35,269	$ 37,006
Glenburn	$ 39,987	$ 52,621	$ 173,555	$ 173,555
Greenbush	$ 29,064	$ 38,247	$ 52,142	$ 52,142
Greenfield		$ -	$ -	
Hampden	$ 174,317	$ 229,393	$ 250,646	$ 250,646
Hermon	$ 83,789	$ 110,262	$ 195,462	$ 195,462
Holden	$ 63,001	$ 82,906	$ 110,803	$ 110,803
Howland	$ 28,330	$ 37,281	$ 48,051	$ 48,051
Hudson	$ 56,452	$ 74,288	$ 52,939	$ 74,288
Kenduskeag	$ 26,162	$ 34,428	$ 43,597	$ 43,597
Kingman		$ -	$ 7,351	$ 7,351

Lagrange	$ 11,936	$ 15,707	$ 26,035	$ 26,035
Lakeville	$ 5,764	$ 7,585	$ 2,136	$ 7,585
Lee	$ 17,886	$ 23,537	$ 30,960	$ 30,960
Levant	$ 56,872	$ 74,841	$ 97,731	$ 97,731
Lincoln	$ 57,142	$ 75,196	$ 191,913	$ 191,913
Lowell	$ 6,225	$ 8,192	$ 11,261	$ 11,261
Mattawamkeag	$ 16,423	$ 21,612	$ 29,801	$ 29,801
Maxfield	$ 21,801	$ 28,689	$ 3,150	$ 28,689
Medway	$ 11,286	$ 14,852	$ 52,287	$ 52,287
Milford	$ 67,467	$ 88,783	$ 112,903	$ 112,903
Millinocket	$ 39,940	$ 52,559	$ 176,234	$ 176,234
Mount Chase	$ 6,619	$ 8,710	$ 8,763	$ 8,763
Newburgh	$ 64,432	$ 84,789	$ 56,307	$ 84,789
Newport	$ 78,629	$ 103,472	$ 114,098	$ 114,098
Old Town	$ 181,302	$ 238,585	$ 278,093	$ 278,093
Orono	$ 268,967	$ 353,947	$ 347,037	$ 353,947
Orrington	$ 109,645	$ 144,287	$ 134,955	$ 144,287
Passadumkeag	$ 9,152	$ 12,044	$ 16,367	$ 16,367
Patten	$ 7,875	$ 10,363	$ 39,759	$ 39,759
Penobscot Nation	$ 34,195	$ 44,999	$ 19,409	$ 44,999
Plymouth	$ 55,197	$ 72,637	$ 48,739	$ 72,637
Prentiss Plantation		$ -	$ 7,459	$ 7,459
Seboeis Plantation		$ -	$ 1,485	$ 1,485
Springfield	$ 8,106	$ 10,667	$ 13,506	$ 13,506
Stacyville		$ -	$ 13,724	$ 13,724
Stetson	$ 16,374	$ 21,547	$ 38,890	$ 38,890
Veazie	$ 78,857	$ 103,772	$ 70,827	$ 103,772
Webster Plantation		$ -	$ 2,824	$ 2,824
Winn	$ 5,319	$ 7,000	$ 15,281	$ 15,281
Woodville		$ -	$ 14,267	$ 14,267
MSAD #48	$ 31,002	$ 40,797	$ -	$ 40,797
Acadia Hospital	$ 5,150	$ 6,777	$ -	$ 6,777
Eastern ME Med Ctr	$ 145,912	$ 192,013	$ -	$ 192,013
Manna Inc	$ 17,104	$ 22,508	$ -	$ 22,508
Community Hlth & Cl	$ 9,511	$ 12,516	$ -	$ 12,516
Brewer Hse Auth	$ 31,559	$ 41,530	$ -	$ 41,530
Hope Hse Inc	$ 1,915	$ 2,520	$ -	$ 2,520
Penob Christ. Schl	$ 132	$ 174	$ -	$ 174
Union #34	$ 6,812	$ 8,964	$ -	$ 8,964
MSAD # 30	$ 1,541	$ 2,028	$ -	$ 2,028
Union #91	$ 7,349	$ 9,671	$ -	$ 9,671
Lee Academy	$ 2,677	$ 3,523	$ -	$ 3,523
MSAD #22	$ 39,291	$ 51,705	$ -	$ 51,705
MSAD #46	$ 4,321	$ 5,686	$ -	$ 5,686
N Penob Tech R3	$ 515	$ 678	$ -	$ 678
MSAD #38	$ 5,535	$ 7,284	$ -	$ 7,284
MSAD #23	$ 5,773	$ 7,597	$ -	$ 7,597
MSAD #31	$ 5,774	$ 7,598	$ -	$ 7,598
Union #90	$ 19,563	$ 25,744	$ -	$ 25,744
MSAD #63	$ 1,628	$ 2,142	$ -	$ 2,142

Brewer Sch Dept	$ 2,091	$ 2,752	$ -	$ 2,752
Bangor Water Dist	$ 35,663	$ 46,931	$ -	$ 46,931
MSAD #25	$ 5,874	$ 7,730	$ -	$ 7,730
MSAD #67	$ 3,197	$ 4,207	$ -	$ 4,207
Old Town Water Dist	$ 7,175	$ 9,442	$ -	$ 9,442
Bangor Hse Auth	$ 9,616	$ 12,654	$ -	$ 12,654
Bangor Childrens Home	$ 1,068	$ 1,405	$ -	$ 1,405
Old Town Hse Auth	$ 3,667	$ 4,826	$ -	$ 4,826
Pt Nat Hlth Dept	$ 39,442	$ 51,904	$ -	$ 51,904
Totals	$ 4,111,090	$ 5,409,993	$	$ 6,516,404

The following table depicts potential severe winter storm loss based on the worst storm event (1998) in recent history for Penobscot County. The actual loss figures from 1998 were adjusted by the inflation rate from 1998 to 2014 (the 2015 figure is not yet available) to create a loss amount in 2014 dollars. The 2014 dollar amount for the entire loss in Penobscot County was then divided by the total population of Penobscot County to determine an estimated loss per capita. Then the 2014 Adjusted Loss column and the Estimated Per Capita loss were compared and the greater of the two numbers was utilized to determine the Greatest Potential Loss.

	1998 Ice Storm Actual Loss	**2014 Adjusted Loss**	**Estimated Loss Per Capita**	**Greatest Potential Loss**
PENOBSCOT CTY	$63,467	$92,179	$31,458.29	$92,179
Alton	$17,838	$25,908	$34,522.67	$34,523
Argyle		$0	$10,744.69	$10,745
Bangor	$966,845	$1,404,246	$1,281,566.68	$1,281,567
Bradford	$19,878	$28,871	$50,038.47	$50,038
Bradley	$9,199	$13,361	$57,873.95	$57,874
Brewer	$233,705	$339,433	$367,802.15	$367,802
Burlington	$20,519	$29,802	$14,080.59	$29,802
Carmel	$92,171	$133,869	$108,377.90	$133,869
Carroll Plantation	$2,858	$4,151	$5,934.80	$5,935
Charleston	$45,066	$65,454	$54,654.42	$65,454
Chester	$17,055	$24,771	$21,179.07	$24,771
Clifton	$6,224	$9,040	$35,725.14	$35,725
Corinna	$43,249	$62,815	$85,259.35	$85,259
Corinth	$39,520	$57,399	$111,636.21	$111,636
Dexter	$42,012	$61,018	$151,085.15	$151,085

Dixmont	$138,472	$201,117	$45,810.41	$45,810
Drew Plantation	$4,436	$6,443	$1,784.32	$6,443
East Millinocket	$35,993	$52,276	$66,834.33	$66,834
Eddington	$21,536	$31,279	$86,306.66	$86,307
Enfield	$20,524	$29,809	$62,334.75	$62,335
Etna	$29,281	$42,528	$48,331.73	$48,332
Exeter	$23,751	$34,496	$42,358.15	$42,358
Garland	$28,121	$40,843	$42,862.41	$42,862
Glenburn	$39,987	$58,077	$178,199.02	$178,199
Greenbush	$29,064	$42,213	$57,835.16	$57,835
Greenfield		$0	$38.79	$ 38.79
Hampden	$174,317	$253,178	$281,495.49	$281,495
Hermon	$83,789	$121,695	$210,084.00	$210,084
Holden	$63,001	$91,503	$119,316.54	$119,317
Howland	$28,330	$41,146	$48,137.78	$48,138
Hudson	$56,452	$81,991	$59,580.69	$81,991
Kenduskeag	$26,162	$37,998	$52,288.26	$52,288
Kingman		$0	$6,749.38	$6,749
Lagrange	$11,936	$17,336	$207.10	$17,336
Lakeville	$5,764	$8,372	$4,072.90	$8,372
Lee	$17,886	$25,978	$35,763.93	$35,764
Levant	$56,872	$82,601	$110,588.90	$110,589
Lincoln	$57,142	$82,993	$197,244.67	$197,245
Lowell	$6,225	$9,041	$13,886.65	$13,887
Mattawamkeag	$16,423	$23,853	$26,648.39	$26,648
Maxfield	$21,801	$31,664	$3,762.58	$31,664
Medway	$11,286	$16,392	$52,327.05	$52,327
Milford	$67,467	$97,989	$119,083.80	$119,084
Millinocket	$39,940	$58,009	$174,785.54	$174,786
Mount Chase	$6,619	$9,613	$7,796.69	$9,613
Newburgh	$64,432	$93,581	$60,162.53	$93,581
Newport	$78,629	$114,201	$127,035.65	$127,036
Old Town	$181,302	$263,323	$304,109.77	$304,110

Orono	$268,967	$390,648	$401,936.92	$401,937
Orrington	$109,645	$159,248	$144,801.25	$159,248
Passadumkeag	$9,152	$13,292	$14,507.28	$14,507
Patten	$7,875	$11,438	$39,448.93	$39,449
Penobscot Nation	$34,195	$49,665	$23,661.60	$49,665
Plymouth	$55,197	$80,168	$53,529.53	$80,168
Prentiss Plantation		$0	$8,300.96	$8,301
Seboeis Plantation		$0	$1,357.63	$1,358
Springfield	$8,106	$11,773	$15,864.91	$15,865
Stacyville		$0	$15,360.65	$15,361
Stetson	$16,374	$23,782	$46,624.99	$46,625
Veazie	$78,857	$114,532	$74,437.07	$114,532
Webster Plantation		$0	$3,297.11	$3,297
Winn	$5,319	$7,725	$15,787.33	$15,787
Woodville		$0	$9,619.80	$9,620
MSAD #48	$31,002	$45,027	$ -	$45,027
Acadia Hospital	$5,150	$7,480	$ -	$7,480
Eastern ME Med Ctr	$145,912	$211,923	$ -	$211,923
Manna Inc	$17,104	$24,842	$ -	$24,842
Community Hlth & Cl	$9,511	$13,814	$ -	$13,814
Brewer Hse Auth	$31,559	$45,836	$ -	$45,836
Hope Hse Inc	$1,915	$2,781	$ -	$2,781
Penob Christ. Schl	$132	$192	$ -	$192
Union #34	$6,812	$9,894	$ -	$9,894
MSAD # 30	$1,541	$2,238	$ -	$2,238
Union #91	$7,349	$10,674	$ -	$10,674

Lee Academy	$2,677	$3,888	$ -	$3,888
MSAD #22	$39,291	$57,066	$ -	$57,066
MSAD #46	$4,321	$6,276	$ -	$6,276
N Penob Tech R3	$515	$748	$ -	$748
MSAD #38	$5,535	$8,039	$ -	$8,039
MSAD #23	$5,773	$8,385	$ -	$8,385
MSAD #31	$5,774	$8,386	$ -	$8,386
Union #90	$19,563	$28,413	$ -	$28,413
MSAD #63	$1,628	$2,365	$ -	$2,365
Brewer Sch Dept	$2,091	$3,037	$ -	$3,037
Bangor Water Dist	$35,663	$51,797	$ -	$51,797
MSAD #25	$5,874	$8,531	$ -	$8,531
MSAD #67	$3,197	$4,643	$ -	$4,643
Old Town Water Dist	$7,175	$10,421	$ -	$10,421
Bangor Hse Auth	$9,616	$13,966	$ -	$13,966
Bangor Childrens Home	$1,068	$1,551	$ -	$1,551
Old Town Hse Auth	$3,667	$5,326	$ -	$5,326
Pt Nat Hlth Dept	$39,442	$57,286	$ -	$57,286
Totals	$4,111,090	$5,970,947	$	$6,928,265

SEVERE SUMMER STORMS (THUNDERSTORMS, LIGHTNING AND HAIL):

The following table depicts potential severe summer storm loss based on the recent 2017 October Windstorm that was a federally declared disaster. The 2017-dollar amount for the entire loss in Penobscot County was divided by the total population of the 2010 U.S.

Census for Penobscot County to determine an estimated loss per capita. The actual loss figures from 2017 were adjusted for inflation by the 2021 Consumer Price Index to create an adjusted loss amount in 2021 dollars. Finally, 2021dollar amount for the entire loss in Penobscot County was then divided by the 2020 U.S. Census total population of 152,199 for Penobscot County to determine an estimated loss per capita, which equals $9.19.

	2017 Wind Storm Actual Loss	2017 Cost Per Capita	2021 Adjusted Expenses	Estimated Loss Per Capita
PENOBSCOT CTY	$189,337.85	1.23	$ 211,163.22	$ 11,855.10
Alton	-	-		$ 7,618.51
Argyle	-	-		$ 2,343.45
Bangor	$356,544.00	10.79	$ 397,643.58	$ 291,810.07
Bradford	-	-		$ 10,880.96
Bradley	-	-		$ 14,079.08
Brewer	$ 73,783.25	7.78	$ 82,288.40	$ 88,885.68
Burlington	-	-		$ 3,427.87
Carmel	$ 21,000.00	7.52	$ 23,420.71	$ 26,347.73
Carroll Plantation	-	-		$ 1,268.22
Charleston	-	-		$ 14,253.69
Chester	-	-		$ 5,045.31
Clifton	$ 5,000.00	5.43	$ 5,576.36	$ 7,719.60
Corinna	-	-		$ 20,410.99
Corinth	-	-		$ 26,651.00
Dexter	$ 23,978.00	6.16	$ 26,741.99	$ 34,949.57
Dixmont	$ 17,480.00	14.80	$ 19,494.96	$ 11,129.09
Drew Plantation	-	-		$ 238.94
East Millinocket	-	-		$ 14,446.68
Eddington	$ 8,701.83	3.91	$ 9,704.91	$ 20,162.86
Enfield	-	-		$ 13,187.65
Etna	-	-		$ 11,266.94
Exeter	-	-		$ 8,849.97
Garland	-	-		$ 9,428.94
Glenburn	$ 17,500.00	3.81	$ 19,517.26	$ 42,715.12
Greenbush	-	-		$ 13,270.36
Hampden	$ 54,015.40	7.44	$ 60,241.87	$ 70,845.71
Hermon	$ 31,500.00	5.82	$ 35,131.07	$ 59,376.59
Holden	$ 4,129.30	1.34	$ 4,605.29	$ 30,115.63
Howland	-	-	-	$ 10,053.86
Hudson	$ 8,826.46	5.75	$ 9,843.90	$ 13,013.04
Kenduskeag	$ 7,560.00	5.61	$ 8,431.46	$ 12,369.74
Kingman	-	-	-	$ 1,259.03
Lagrange	-	-	-	$ 5,835.65
Lakeville	-	-	-	$ 955.76
Lee	-	-	-	$ 8,418.04
Levant	$ 8,228.61	2.89	$ 9,177.14	$ 27,018.60
Lincoln	$ 9,045.53	1.78	$ 10,088.23	$ 44,599.07
Lowell	-	-		$ 3,381.92
Mattawamkeag	-	-		$ 5,477.24

Maxfield	-	-		$ 817.91
Medway	-	-		$ 10,908.53
Milford	$ 3,800.00	1.24	$ 4,238.03	$ 28,204.11
Millinocket	-	-		$ 37,807.66
Mount Chase	-	-		$ 1,718.53
Newburgh	$ 2,372.50	1.53	$ 2,645.98	$ 14,658.05
Newport	$ 13,975.35	4.27	$ 15,586.32	$ 28,792.27
Old Town	$323,356.10	41.24	$ 360,630.04	$ 68,290.89
Orono	$ 13,013.00	1.26	$ 14,513.04	$ 102,771.77
Orrington	$ 15,021.00	4.02	$ 16,752.50	$ 35,032.28
Passadumkeag	-	-		$ 3,271.64
Patten	-	-		$ 8,096.39
Penobscot Nation	$ 25,592.00	41.95	$ 28,542.04	$ 3,400.30
Plymouth	-	-		$ 12,176.75
Prentiss Plantation	-	-		$ 1,553.11
Seboeis Plantation	-	-		$ 367.60
Springfield	-	-		$ 2,692.67
Stacyville	-	-		$ 3,492.20
Stetson	-	-		$ 10,899.34
Veazie	$ 20,817.37	10.85	$ 23,217.03	$ 16,670.66
Webster Plantation	-	-		$ 624.92
Winn	-	-		$ 3,666.81
Woodville	-	-		$ 1,847.19
Totals	$ 1,254,577.55	-	$1,399,195.33	

NESEC Hazus Hurricane Impact Analysis Reports: The purpose of Hazus Impact Analysis Reports is to provide emergency managers and other government decision makers with an estimate of the potential impact of moderate to large hazardous events affecting Penobscot County. The Hurricane Impact Analysis Report was generated based on the impacts of a hypothetical Category 3 hurricane with storm parameters equal to the 1938 Hurricane[29], but that instead makes landfall on the coast of Maine. It is important to note that this event does not necessarily represent the greatest impact a hurricane could have on Penobscot County, Maine. Though the chances for a severe hurricane occurring in the Northeast are low to moderate, any hurricane that tracks along the East Coast has the potential to negatively impact Maine. This model differs from historic data and the 2017 windstorm event as there is no comparable event in recorded history for Penobscot County.

[29] 1938 Hurricane NWS article: https://www.weather.gov/okx/1938HurricaneHome

D-R-A-F-T

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Hazus-MH™ Hurricane Impact Report

Executive Summary[1]

Hazus-MH™ Hurricane estimates that the Maine Worst Case Hurricane Scenario that has the parameters of the 1938 Hurricane but makes landfall in Maine will have the following impacts in Penobscot County. Please note that this hurricane report estimates damage caused directly by the hurricane, and does not include damage caused by collateral impacts such as hazardous materials releases.[2]

Estimated Direct Economic Losses for Buildings[3]

Building Damage (Structural, Non-Structural)	$310,971,000
Building Contents Damage	$90,947,000
Business Interruption (Income Losses)	$55,176,000
Total Building-Related Losses	**$457,094,000**
Losses Range	($228,547,000 - $914,188,000)

Estimated Displaced Households & People[4]

Number of Displaced Households	486 Households
Number of People Needing Short Term Shelter	117 People

Estimated Debris Generated

Reinforced Concrete and Steel	140 Tons
Brick, Wood, Glass, Plaster and Other	41,657 Tons
Eligible Tree Debris	63,877 Tons
Other Tree Debris	1,389,759 Tons
Total Debris	**1,495,433 Tons**

1. Note: Minor discrepancies between the values in this report and those in the Hazus Summary Report tables are due to rounding.

2. Disclaimer:
This rapid estimate of social and economic impacts was produced using Hazus-MH loss estimation methodology software which is based on current scientific and engineering knowledge and assumptions. There are limitations and uncertainties inherent in HAZUS and in all other loss estimation techniques. Therefore, there may be significant differences between the modeled and mapped results contained in this report and the actual losses following a specific earthquake. Hazus-MH appears to overestimate losses for earthquakes less than 6.0 in urban areas..

3. Note:
Values are in 2014 dollars.

4. Note:
Not all displaced people will seek public shelter. The number of people seeking public shelter will vary by state and region. These numbers are based on data from the 2010 Census.

Northeast States Emergency Consortium
Emergency Management Risk Assessment Center

Report prepared on October 4, 2021 at 11:05 AM

WILDFIRE

The primary damage losses that are expected in Penobscot County during any wildfire event would be destruction of single-family residential structures and loss of forest resources. In calculating the damage costs, it was assumed all homes located in the Wildland/Urban Interface would be destroyed in a worst-case scenario. To figure the percentage of homes potentially affected by wildfire, percentages were assigned to the community based on community size, land cover and the total number of fires in the last twelve years. Approximately seventy-five percent of Penobscot County is forested, indicating that the county is very rural with moderate land cover.

The total number of housing units 71,534 (in 2020 census: 74,878) in Penobscot County (including unorganized territory) was used as a base number to estimate potential losses. Since 75.08 percent of the County is forested; the total housing units were multiplied by 0.7508 for an estimated 56,218 housing units. Using the table below to determine the extent of damages to those 56,218 housing units assuming a worst-case scenario, 85 percent of 56,218 households yields a total number of 47,785 housing units potentially being destroyed by wildfire. This number was then multiplied by the county's median housing value of $102,065 ($144,700 from ACS 2019).

Community Size		**Land Cover**		**Number of Fires from 1995-2003**	
Very Rural	+25%	High(75+%)	+25%	Over 30	+35%
Semi-Rural	+10%	Mod (60-75%)	+15%	20-29	+25%
Sub Urban	+5%	Low (>60%)	+10%	10-19	+15%
				1-9	+5%

PENOBSCOT COUNTY POTENTIAL LOSSES FROM WILDFIRE					
	Critical Facility	**Percentage of County In Urban Interface**	**Function Lost**	**Level of Damage**	**Damage Costs**
Penobscot County	Homes	75.08	Residential	85%	$6,914,489,500

The table on the following pages displays the damages caused by wildfire potential in each community. Following the same method of calculation as above, each community's potential vulnerability is established and financial losses estimated due to a catastrophic wildfire event in the community.

Municipality	**Percentage of Municipality in Wild Land Urban Interface**	**Number of Homes in Community**	**Function Lost**	**Number of Homes in Urban Interface**	**Level of Des.**	**Number of Homes Lost**	**Median Home Cost**	**Total Financial Loss due to Catastrophic Fire in $**

Alton	60.91	309	Residential	188	45	85	96030	8,162,550
Argyle	85	95	Residential	81	65	52	70000	3,640,000
Bangor	41.68	13713	Residential	5716	50	2858	139200	397,833,600
Bradford	77.57	434	Residential	337	55	185	102070	18,882,950
Bradley	65.22	514	Residential	335	55	184	104840	19,290,560
Brewer	53.3	3844	Residential	2049	50	1024	150380	153,989,120
Burlington	82.56	142	Residential	117	65	76	74650	5,673,400
Carmel	72.36	932	Residential	674	65	438	126220	55,284,360
Carroll Plantation	86.62	54	Residential	47	55	26	51700	1,344,200
Charleston	100	431	Residential	431	55	237	101970	24,166,890
Chester	100	205	Residential	205	55	113	99890	11,287,570
Clifton	84.66	308	Residential	261	50	130	109590	14,246,700
Corinna	60	842	Residential	505	40	202	105630	21,337,260
Corinth	62.53	959	Residential	600	40	240	104640	25,113,600
Dexter	66.32	1615	Residential	1071	30	321	91080	29,236,680
Dixmont	76.51	411	Residential	314	55	173	119690	20,706,370
Drew Plantation	66.31	119	Residential	79	55	43	63300	2,721,900
East Millinocket	71.84	780	Residential	560	30	168	71780	12,059,040
Eddington	74.16	820	Residential	608	55	334	149650	49,983,100
Enfield	70	612	Residential	428	55	236	99690	23,526,840
Etna	66.47	392	Residential	261	75	195	105340	20,541,300
Exeter	70.2	389	Residential	273	45	123	100290	12,335,670
Garland	66.43	379	Residential	252	45	113	90680	10,246,840
Glenburn	74.72	1479	Residential	1105	50	553	116130	64,219,890
Greenbush	68.55	520	Residential	356	55	196	84150	16,493,400
Hampden	72.49	2433	Residential	1764	55	970	171920	166,762,400
Hermon	66.34	1666	Residential	1105	45	497	131670	65,439,990
Holden	53.03	1153	Residential	611	60	367	155430	57,042,810
Howland	65	559	Residential	363	40	145	92470	13,408,150
Hudson	75.03	508	Residential	381	55	210	106230	22,308,300
Kenduskeag	60.03	470	Residential	282	55	155	100980	15,651,900
Lakeville	67.39	85	Residential	57	55	32	103060	3,297,920
Lagrange	73.03	286	Residential	209	55	115	84940	9,768,100
Lee	70.67	299	Residential	211	75	158	93260	14,735,080
Levant	77.76	784	Residential	610	45	274	166410	45,596,340
Lincoln	67.73	2108	Residential	1428	70	999	100070	99,969,930
Lowell	77.26	123	Residential	95	65	62	99690	6,180,780
Mattawamkeag	75.86	340	Residential	258	65	168	73260	12,307,680
Medway	83.28	587	Residential	489	55	269	72070	19,386,830
Milford	35	1180	Residential	413	35	145	124990	18,123,550
Millinocket	83.89	2295	Residential	1925	40	770	66330	51,074,100
Mount Chase	56.79	105	Residential	60	55	33	83060	2,740,980
Newburgh	67.99	557	Residential	379	55	208	127710	26,563,680
Newport	45	1269	Residential	571	35	200	130690	26,138,000
Old Town	75.32	3425	Residential	2580	30	774	110390	85,441,860

Orono	50.7	2691	Residential	1364	40	546	164450	89,789,700
Orrington	50.03	1394	Residential	697	60	418	179570	75,060,260
Passadumkeag	52.64	174	Residential	92	40	37	97320	3,600,840
Patten	68.57	468	Residential	321	65	209	83060	17,359,540
Penobscot Nation	49.44	215	Residential	106	40	43	66800	2,872,400
Plymouth	83.37	469	Residential	391	75	293	104840	30,718,120
Prentiss Plantation	66.18	87	Residential	58	55	32	38300	1,225,600
Springfield	60.08	150	Residential	90	55	50	71580	3,579,000
Stacyville	100	161	Residential	161	85	137	67720	9,277,640
Stetson	77.32	383	Residential	296	65	192	102370	19,655,040
Veazie	82.37	722	Residential	595	35	208	125730	26,151,840
Winn	83.98	172	Residential	144	65	94	74050	6,960,700
Woodville	67.03	99	Residential	66	45	30	96320	2,889,600

The total number of housing units according to the 2020 U.S. Census, was 76,352 in Penobscot County (including unorganized territory) was used as a base number to estimate potential losses. Since 75.08 percent of the County is forested; the total housing units were multiplied by 75.08 percent represents an estimated 57,325 housing units. Using the table below to determine the extent of damages to those 57,325 housing units assuming a worst-case scenario 57,325 was multiplied by 85 percent indicated a total number of 48,726 housing units potentially being destroyed by wildfire. This number was then multiplied by the county's median housing value of $144,700.

PENOBSCOT COUNTY POTENTIAL LOSSES FROM WILDFIRE					
	Critical Facility	**Percentage of County In Urban Interface**	**Function Lost**	**Level of Damage**	**Damage Costs**
Penobscot County	Homes	75.08	Residential	85%	$7,050,652,200

Municipality	**Percentage of Municipality in Wild Land Urban Interface**	**Number of Homes in Community 2020 Census**	**Function Lost**	**Number of Homes in Urban Interface**	**Level of Des.**	**Number of Homes Lost**	**Total Financial Loss due to Catastrophic Fire in $**
Alton	60.91	402	Residential	245	45	106	14,531,009

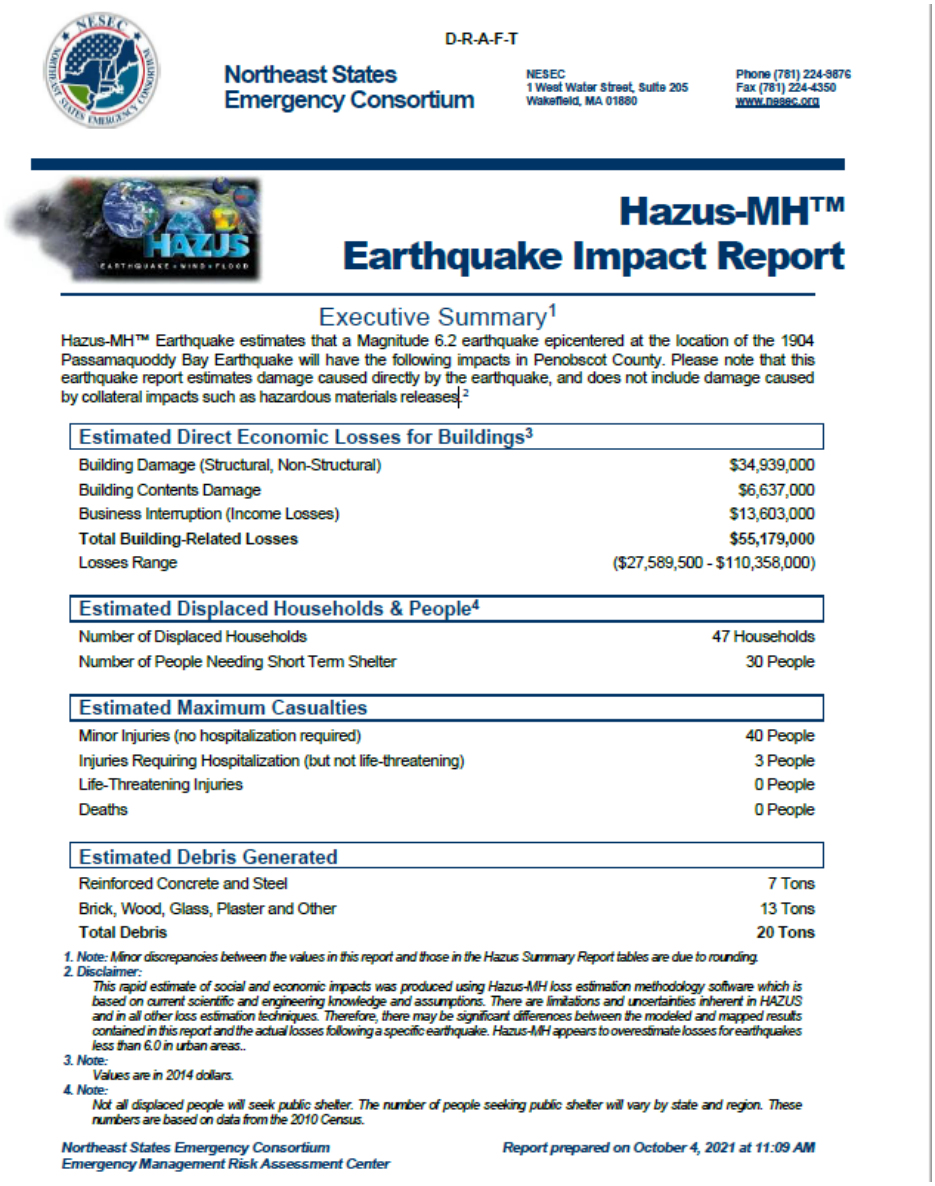
Argyle	85	135	Residential	124	65	81	11,107,571
Bangor	41.68	15,510	Residential	6533	50	3266	449,791,762
Bradford	77.57	561	Residential	452	55	249	34,249,874
Bradley	65.22	804	Residential	469	55	258	35,514,550
Brewer	53.3	4,224	Residential	2376	50	1188	163,558,752
Burlington	82.56	385	Residential	338	65	220	30,297,084
Carmel	72.36	1,232	Residential	855	65	556	76,553,197
Carroll Plantation	86.62	131	Residential	120	55	66	9,053,029
Charleston	100	610	Residential	546	55	300	41,351,310
Chester	100	252	Residential	266	55	146	20,145,510
Clifton	84.66	478	Residential	396	50	198	27,278,976
Corinna	60	1,105	Residential	645	40	258	35,526,600
Corinth	62.53	1,225	Residential	771	40	308	42,466,399
Dexter	66.32	2,365	Residential	1420	30	426	58,656,532
Dixmont	76.51	622	Residential	426	55	234	32,275,281
Drew Plantation	66.31	18	Residential	24	55	13	1,807,916
East Millinocket	71.84	907	Residential	626	30	188	25,848,758
Eddington	74.16	1,140	Residential	769	55	423	58,243,184
Enfield	70	966	Residential	656	55	361	49,674,587
Etna	66.47	531	Residential	372	75	279	38,373,613
Exeter	70.2	487	Residential	345	45	155	21,358,220
Garland	66.43	594	Residential	367	45	165	22,722,169
Glenburn	74.72	2,048	Residential	1508	50	754	103,815,445
Greenbush	68.55	701	Residential	497	55	273	37,639,348
Hampden	72.49	3,154	Residential	2196	55	1208	166,347,914
Hermon	66.34	2,369	Residential	1466	45	660	90,847,754
Holden	53.03	1,355	Residential	785	60	471	64,843,811
Howland	65	574	Residential	415	40	166	22,877,478
Hudson	75.03	775	Residential	590	55	324	44,663,641
Kenduskeag	60.03	598	Residential	360	55	198	27,278,232
Lakeville	67.39	451	Residential	305	55	168	23,120,131
Lagrange	73.03	395	Residential	278	55	153	21,017,523
Lee	70.67	507	Residential	386	75	289	39,849,506
Levant	77.76	1,234	Residential	891	45	401	55,218,846
Lincoln	67.73	2,865	Residential	1941	70	1359	187,106,658
Lowell	77.26	347	Residential	243	65	158	21,782,742
Mattawamkeag	75.86	480	Residential	309	65	201	27,634,687

Medway	83.28	636	Residential	548	55	301	41,501,447
Milford	35	1,489	Residential	485	35	170	23,362,526
Millinocket	83.89	2,915	Residential	2169	40	868	119,490,299
Mount Chase	56.79	276	Residential	169	55	93	12,773,942
Newburgh	67.99	690	Residential	448	55	246	33,933,377
Newport	45	1,938	Residential	795	35	278	38,300,567
Old Town	75.32	3,829	Residential	2760	30	828	114,035,346
Orono	50.7	3,625	Residential	1566	40	626	86,262,055
Orrington	50.03	1,587	Residential	806	60	484	66,631,675
Passadumkeag	52.64	248	Residential	104	40	41	5,711,840
Patten	68.57	517	Residential	387	65	252	34,676,072
Penobscot Nation	49.44	365	Residential	132	40	53	7,243,593
Plymouth	83.37	572	Residential	513	75	385	52,951,726
Prentiss Plantation	66.18	195	Residential	122	55	67	9,272,463
Springfield	60.08	289	Residential	169	55	93	12,785,946
Stacyville	100	265	Residential	224	85	190	26,218,080
Stetson	77.32	683	Residential	480	65	312	42,976,470
Veazie	82.37	897	Residential	728	35	255	35,093,228
Winn	83.98	246	Residential	176	65	115	15,784,923
Woodville	67.03	119	Residential	92	45	41	5,690,314

Earthquake

The Hazus Earthquake Impact Analysis Report was generated based on the hypothetical impacts of an earthquake based on the 1904 MW 6.2 Passamaquoddy Bay Earthquake. Please note that this earthquake report estimates damage caused directly by the earthquake, and does not include damage caused by collateral impacts such as hazardous materials releases. The damages modeled in this report are currently unprecedented for an earthquake in Maine having no historic equivalent.

A large magnitude earthquake such as this could cause upward of $27-110M in direct damages and economic losses to Penobscot County, with 47 households displaced, more than 40 injured people, and 20 tons of debris. Please refer to the full report in the Penobscot County MJHMP Appendix.



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Hazus-MH™ Earthquake Impact Report

Executive Summary[1]

Hazus-MH™ Earthquake estimates that a Magnitude 6.2 earthquake epicentered at the location of the 1904 Passamaquoddy Bay Earthquake will have the following impacts in Penobscot County. Please note that this earthquake report estimates damage caused directly by the earthquake, and does not include damage caused by collateral impacts such as hazardous materials releases.[2]

Estimated Direct Economic Losses for Buildings[3]	
Building Damage (Structural, Non-Structural)	$34,939,000
Building Contents Damage	$6,637,000
Business Interruption (Income Losses)	$13,603,000
Total Building-Related Losses	**$55,179,000**
Losses Range	($27,589,500 - $110,358,000)

Estimated Displaced Households & People[4]	
Number of Displaced Households	47 Households
Number of People Needing Short Term Shelter	30 People

Estimated Maximum Casualties	
Minor Injuries (no hospitalization required)	40 People
Injuries Requiring Hospitalization (but not life-threatening)	3 People
Life-Threatening Injuries	0 People
Deaths	0 People

Estimated Debris Generated	
Reinforced Concrete and Steel	7 Tons
Brick, Wood, Glass, Plaster and Other	13 Tons
Total Debris	**20 Tons**

1. Note: Minor discrepancies between the values in this report and those in the Hazus Summary Report tables are due to rounding.
2. Disclaimer:
This rapid estimate of social and economic impacts was produced using Hazus-MH loss estimation methodology software which is based on current scientific and engineering knowledge and assumptions. There are limitations and uncertainties inherent in HAZUS and in all other loss estimation techniques. Therefore, there may be significant differences between the modeled and mapped results contained in this report and the actual losses following a specific earthquake. Hazus-MH appears to overestimate losses for earthquakes less than 6.0 in urban areas..
3. Note:
Values are in 2014 dollars.
4. Note:
Not all displaced people will seek public shelter. The number of people seeking public shelter will vary by state and region. These numbers are based on data from the 2010 Census.

Northeast States Emergency Consortium
Emergency Management Risk Assessment Center

Report prepared on October 4, 2021 at 11:09 AM

Drought

The greatest impact of drought has been identified as agricultural losses. The 2017 Agricultural Census prepared by the United States Department of Agriculture provides economic information on net annual average income of all farms in Penobscot County[30]. A total of 105,452 acres of cropland were harvested in Penobscot County, with $50,915,000 in commodity sales. An extremely severe drought causing complete loss in commodities would therefore result in a $50 million sales loss. Droughts resulting in less widespread loss of crops would result in smaller losses:

- 10% loss in commodity sales: $45.8 million
- 50% loss in commodity sales: $25.5 million
- 75% loss in commodity sales: $12.7 million

[30] USDA Ag Census for Penobscot County: https://www.nass.usda.gov/Quick_Stats/CDQT/chapter/2/table/1/state/ME/county/019/year/2017

ASSESSING VULNERABILITY – ANALYSING DEVELOPMENT TRENDS

11. Assessing Vulnerability: Analyzing Development Trends	
Requirement §201.6(c)(2)(ii)(C): The plan should describe vulnerability in terms of providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use descriptions.	
Element	**A.** Does the new or updated plan describe land uses and development trends?

Penobscot County is Maine's third-most populous County. Land use within the County ranges from densely populated urbanized areas to suburban residential areas to farm and rural forestland in the northern unorganized territories. The County contains Bangor, which is Maine's third-most populous city.

As can be seen by the population table in Section 1, Introduction, overall population growth in the county between 2010 and 2020 decreased by 1.2% However, there seemed to be a shift for residents looking to move to more rural areas of the county as some rural communities experienced growth rates of up to 50% during this period, while larger communities experienced substantial reduction in population. A clear trend in the county is that much of the residential growth is occurring in the suburban and rural communities.

As the population of the suburban towns grows, so too does the demand for land that encroaches on historically forested and riparian areas. New population growth in these areas may contribute to hazard affects particularly when buffers between human activities and wild lands are not protected. This has placed a burden on the suburban towns as they deal with urban interface fire issues and expansion of infrastructure into these more remote areas.

Mitigation options used for future land-use decisions are being incorporated into municipality development and community planning goals. Because of these options and ordinances, little development in hazard prone areas has taken place affecting the vulnerability of the jurisdictions. Regional cooperation is required in order to analyze land use practices, which may exacerbate hazards, and to implement strategies to deal with the changing demographics. At the community level, land use planning goals include ensuring the efficient allocation and management of resources and protection of the environment through compliance with federal,state and local laws and regulations.

The larger communities in the county have completed comprehensive plans and land use ordinances with designated growth areas with the intent of directing growth into the most appropriate areas. The State of Maine previously passed legislation in 2012 that communities with a population of 4,000 or more must enforce the state's building

codes[31], consisting of the 2015 International Building Code, 2015 International Residential Code, 2015 International Existing Building Code, and 2015 International Energy Conservation Code.

Smaller, rural communities rarely have extensive land controls and rely on state laws (such as shoreland zoning and subdivision regulations) to guide their development. All but 7 of the county's organized communities participate in the National Flood Insurance Program. Additionally, the state's shoreland zoning law restricts development adjacent to water bodies which helps to minimize the impacts of flooding on new residential structures.

Overall, due to economic decline within the area, Penobscot County has experienced minimal change since the prior plan.
Hazard Mitigation Plans must include an assessment of changes in regional development that may impact the vulnerability of people and property to hazards. A remote method of tracking development in a community is to use the State of Maine's E911 Addresses Feature. Developed to support emergency services, this database provides an authoritative, frequently updated record of addressable structures and other landmark locations for the entire state[32]. Changes in development reported here are assumed to be an upper limit estimate due to variable improvements in record keeping, where the true amount of development is likely to be less than reported. Data from 2019 onwards is preferred because record keeping tends to stabilize at that time.

According to this study, only a small percentage of development in Penobscot County has occurred in flood-prone areas. As this table demonstrates, the total number of addressable structures has increased by 3.02% from January 2019 to September 2021. Of this increase in development, 14 (0.79%) of these new addressable structures are located in special flood hazard areas (SFHAs). These results suggest that municipal flood plain ordinances and shoreland zoning ordinances are effective mechanisms for reducing development in flood-prone areas. However, consistent monitoring, evaluation, and updating of these mechanisms will be important for anticipating potential changes in the location and extent of future hazards.

Region	Number of addressable structures		Change in addressable structures	% change in addressable structures
	2019	***2021***		
Penobscot County	45,905	58,680	1,773	**3.02%**
				% of total change in addressable structures
Special Flood Hazard Areas (SFHA)	589	593	14	*0.79%*

MULTI-JURISDICTIONAL RISK ASSESSMENT

[31] Maine Uniform Building and Energy Code: https://www.maine.gov/dps/fmo/building-codes
[32] Maine E911 Address database: https://maine.hub.arcgis.com/datasets/c1de8b6877114e109980972b4250a883_0/about

12. Multi-Jurisdictional Risk Assessment	
Requirement §201.6(c)(2)(iii): For multi-jurisdictional plans the risk assessment section must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.	
Element	**A.** Does the new or updated plan include a risk assessment for each participating jurisdiction as needed to reflect unique or varied risks?

Penobscot County is a large, diverse area consisting of 60 organized communities and unorganized territory with a total land mass of about 3,345 square miles. About 75% of the county is forested and the urban area represents about 2% of the land area.

Based on the 2020 U.S. Census, Penobscot County's density was about 45.5 people per square mile and 22.8 housing units per square mile.

PTEMA used the municipal risk surveys as well as historical data to determine that the greatest risk within the county is flooding, followed by severe winter storms, severe summer storms and wildfire. See risk section table under "Hazard Summary by Jurisdiction".

Due primarily to the Penobscot River, flooding impacts a majority of the county. Although some communities do not abut the river, they still are a part of the watershed and are impacted.

Severe winter and summer storms have the ability to affect every community to varying extents depending upon the exact track of the storm. These storms can cause major damages and inconveniences to the people throughout the county.

Wildfires are primarily dangerous only for the "fringe" of the urban areas; but could be devastating to a rural community that is surrounded by forested acreage.

Each community may not be directly affected by the results of flooding, or winter or summer storms, or a wildfire, but the connection between each community and how they rely on each other is so great that any damages in one community can cause a ripple effect within is surrounding communities.

PENOBSCOT COUNTY MAPS

Following are base maps of the 60 cities and towns in Penobscot County. Data was obtained from the Maine Office of GIS, Maine DEP, Maine Geological Survey, Maine Department of Transportation that were compiled and provided by the Maine Emergency Management Agency in 2021. Each figure shows the municipal boundary, topographic relief, floodplains, critical facilities and principal roads.

The primary flood analysis data used was the FEMA FIRM flood zone areas. The Army Corps of Engineers SLOSH data for Penobscot County was obtained and examined for storm surge inundation areas. These areas appeared to follow roughly with the FEMA FIRM data.

MUNICIPAL CRITICAL FACILTIY BASE MAPS