

# THE TOWN OF PALMER HAZARD MITIGATION PLAN UPDATE



**Adopted by the Palmer Board of Selectmen on October 11, 2016**

Prepared by:

**The Palmer Hazard Mitigation Committee**

and

**Pioneer Valley Planning Commission**

## **Acknowledgements**

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Linda Leduc, Town Planner  
Angela Panaccione, Conservation Agent  
Alan Roy, Chief of Palmer Fire and Rescue  
Gerry Skowronek, Director Department of Public Works

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## List of Acronyms

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FEMA	Federal Emergency Management Agency
MEMA	Massachusetts Emergency Management Agency
PVPC	Pioneer Valley Planning Commission
EPA	Environmental Protection Agency
DEP	Massachusetts' Department of Environmental Protection
NWS	National Weather Service
HMGP	Hazard Mitigation Grant Program
FMA	Flood Mitigation Assistance Program
SFHA	Special Flood Hazard Area
CIS	Community Information System
DCR	Massachusetts Department of Conservation and Recreation
FERC	Federal Energy Regulatory Commission
TRI	Toxics Release Inventory
FIRM	Flood Insurance Rate Map
NFIP	National Flood Insurance Program
CRS	Community Rating System
BOS	Board of Selectmen
DPW	Department of Public Works
LEPC	Local Emergency Planning Committee
EMD	Emergency Management Director
Con Com	Conservation Commission
Ag Com	Agricultural Commission
EOC	Emergency Operations Center
CEM Plan	Comprehensive Emergency Management Plan
EMA	Emergency Management Agency
RACES	Radio Amateur Civil Emergency Service
WMECO	Western Massachusetts Electric Company
HAZMAT	Hazardous Materials

# 1: PLANNING AREA

## Introduction

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The Federal Emergency Management Agency (FEMA) and the Massachusetts Emergency Management Agency (MEMA) define Hazard Mitigation as any sustained action taken to reduce or eliminate long-term risk to people and property from natural hazards such as flooding, storms, high winds, hurricanes, wildfires, earthquakes, etc. Mitigation efforts undertaken by communities will help to minimize damages to buildings and infrastructure, such as water supplies, sewers, and utility transmission lines, as well as natural, cultural and historic resources.

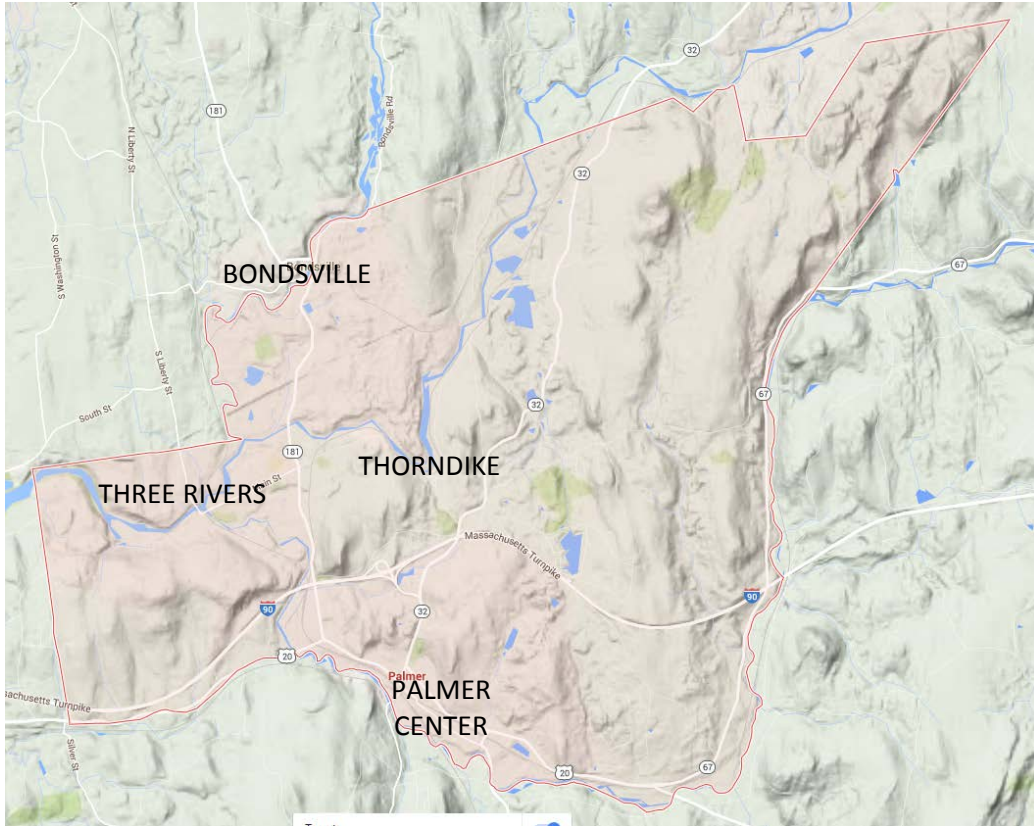
Planning efforts, like the one undertaken by the Town of Palmer and the Pioneer Valley Planning Commission, make mitigation a proactive process. Future property damage and loss of life can be reduced or prevented by a mitigation program that addresses the unique geography, demography, economy, and land use of a community within the context of each of the specific potential natural hazards that may threaten a community.

Preparing and updating a Local Hazard Mitigation Plan every five years can save the community money and facilitate post-disaster funding. Costly repairs or replacement of buildings and infrastructure, as well as the high cost of providing emergency services and rescue/recovery operations, may be avoided or significantly lessened if a community implements the mitigation measures detailed in the Plan. Moreover, FEMA requires that a community adopt a pre-disaster mitigation plan as a condition for mitigation funding, including the Hazard Mitigation Grant Program (HMGP), the Flood Mitigation Assistance Program (FMA), and the Pre-Disaster Mitigation Program (PDM).

## Planning Area

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Palmer's municipal boundaries formed the planning area for the original plan and remain appropriate as the planning area for this update since it allows for a consistent planning, outreach, and implementation process. Palmer is located in eastern Hampden County in Western Massachusetts, seventeen miles from downtown Springfield, and seventy-three miles from the metropolitan center of Boston. The Town is just over 32 square miles, and is bordered by Monson to the south, Wilbraham and Ludlow to the west, Belchertown and Ware to the north, and Warren and Brimfield to the east. It encompasses the confluence of the Ware, Quaboag, and Swift Rivers, which forms the headwaters of the Chicopee River.



Source: Google Maps

## 2016 Update Planning Process

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Updates of Local Hazard Mitigation Plans are necessary every five years for communities to remain eligible for FEMA mitigation project funding. Updates serve as opportunities to review and revise plans, allowing it to reflect changes in development since last plan, record progress in local mitigation efforts, and establish any changes in priorities. Palmer's original Hazard Mitigation Plan was adopted by Town Council on December 13, 2010. The planning process for the 2016 update included the following tasks:

- Reviewing and incorporating plans and other information, including changes in development in the last five years since the Town's first Hazard Mitigation planning process.
- Updating the natural hazards that may impact the community from the previous plan.
- Conducting a Vulnerability/Risk Assessment to identify the infrastructure at the highest risk for being damaged by the identified natural hazards, particularly flooding.
- Identifying and assessing the policies, programs, and regulations the community is currently implementing to protect against future disaster damages.
- Identifying deficiencies in the current Hazard Mitigation strategies and establishing goals for updating, revising, or adopting new strategies.
- Reformatting the Plan document to better reflect the framework recommended by FEMA's *Local Mitigation Planning Handbook*.
- Adopting and implementing the final updated Hazard Mitigation Plan.

A key product of this update process was the development of an Action Plan with a Prioritized Implementation Schedule.

## 2: PLANNING TEAM

Mirroring the original Hazard Mitigation Plan for Palmer, this update relies on a Hazard Mitigation Committee to direct the process, with numerous avenues for stakeholder and public input.

### **Hazard Mitigation Committee**

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To update Palmer's Hazard Mitigation Plan, the previous Hazard Mitigation Committee was reconvened. The Committee consisted of 6 members:

- Donald Elliot, Emergency Management Director
- Andrew Golas, Assistant Town Manager
- Linda Leduc, Town Planner
- Angela Panaccione, Conservation Agent
- Alan Roy, Chief of Palmer Fire and Rescue
- Gerry Skowronek, Director Department of Public Works

Members were asked to attend meetings, coordinate with public involvement, collect data, and make decisions on plan process and content, and review draft plans. While not all members of the Hazard Mitigation Committee were able to attend each meeting, all members collaborated on the plan and were updated on progress by fellow Committee members as necessary. Members also acted as liaisons to local leadership and the public

Meetings of the Hazard Mitigation Committee were held at Palmer's Town Hall on the following dates:

- April 5, 2016, 10:00 a.m.
- April 19, 2016, 10:00 a.m.
- April 26, 2016, 10:00 a.m.
- May 3, 2016, 10:00 a.m.
- May 10, 2016, 10:00 a.m.

Agendas and sign-in sheets for each meeting can be found in Appendix A.



## 3: OUTREACH STRATEGY

At its kickoff meeting, the Hazard Mitigation Committee reviewed the original Plan's outreach strategy and created a strategy for updating the plan and engaging local knowledge of hazard mitigation activities, including participation by stakeholders and the public.

### **Participation by Stakeholders**

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A variety of stakeholders were provided with opportunities to be involved in the update of Palmer's Hazard Mitigation Plan. The different categories of stakeholders that were involved, and the engagement activities that occurred, are described below.

#### **Local and regional agencies involved in hazard mitigation activities**

Because of their positions within the Town, membership of the Hazard Mitigation Committee provided direct knowledge of local hazard mitigation activities and capabilities. In addition, the planning process was facilitated by the Pioneer Valley Planning Commission, the regional planning agency for 43 towns and cities in Massachusetts' Hampden and Hampshire Counties. PVPC regularly engages with the Town of Palmer as part of its regional planning efforts, including:

- Developing the Pioneer Valley Regional Land Use Plan, *Valley Vision 2*, which advocates for sustainable land use throughout the region and consideration for the impact of flooding and other natural hazards on development.
- Developing the *Pioneer Valley Climate Action and Clean Energy Plan*, which assesses the impact that climate change will have on the region and recommends strategies for mitigation that can be implemented by local municipalities and businesses.
- Collaborating with state agencies, such as the Department of Conservation and Recreation, to maintain inventories of critical infrastructure throughout the region.

#### **Agencies that have the authority to regulate development**

The Palmer Planning Board is the primary Town agency responsible for regulating development in town. Communication with the Planning Board was ensured through the participation of Palmer's Town Planner on the Hazard Mitigation Committee. Other members of the Palmer Hazard Mitigation Committee have direct connections to municipal commissions, boards, and committees that have the authority to regulate development, including the Conservation Commission and Town Council.

As the regional planning authority, the Pioneer Valley Planning Commission also works with agencies that regulate development in Palmer, including state agencies such as Department of Conservation and Recreation and MassDOT. This regular involvement ensured that operational policies, mitigation strategies, and identified hazards from these entities were incorporated into the Palmer Hazard Mitigation Plan.



## **Neighboring Jurisdictions**

Participation by the Pioneer Valley Planning Commission ensured that neighboring communities were informed of Palmer's Hazard Mitigation Plan update process, and were encouraged to comment. PVPC staff regularly present to their Executive Committee and Commission concerning new projects and funding opportunities. In addition, PVPC is actively involved in the Western Region Homeland Security Advisory Council (WRHSAC). WRHSAC, which includes representatives from municipal fire, police, and public works departments, along with hospitals and regional transit authorities from the four counties of western Massachusetts, is responsible for allocating emergency preparedness funding from the US Department of Homeland Security. Meetings of WRHSAC regularly involve discussion about how to improve emergency preparedness in western Massachusetts, and hazard mitigation activities are included in this discussion.

In addition, PVPC included a summary article on the status of hazard mitigation planning in the region in the quarterly *Regional Reporter*. This is mailed to area Chambers of Commerce, all member municipalities, area colleges and universities, and other key stakeholders in the region. In this way, businesses, educational institutions and other key stakeholders were educated about and informed of Palmer's hazard mitigation planning work.

## **Participation by the Public, Businesses, and Other Interests**

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The Hazard Mitigation Committee determined that the most effective outreach strategy for engaging with the public, businesses, and neighboring communities was at a public meeting. Two public planning meetings were held, on May 10, 2016 and June 6, 2016, at Palmer's Town Hall. Notice of public meetings was posted at Palmer Town Hall and in the local newspaper, in compliance with the Commonwealth of Massachusetts' open meeting law. Meeting notices are in Appendix A.

## **Town Council Meeting**

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Via the Hazard Mitigation Committee, Town Council members were kept informed of the update process. Palmer's Town Council held a public hearing on the updated Hazard Mitigation Plan on June 13, 2016, before the plan was sent to MEMA for provisional approval.

## 4: COMMUNITY CAPABILITIES

Palmer has a unique set of authorities, policies, programs, and resources available for reducing long-term hazard vulnerability through mitigation planning.

### Planning and Regulatory

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Palmer's Community Plan establishes the overall land use and infrastructure goals for the Town. The most recent update of the Community Plan was completed and adopted in 2005. Along with other goals aimed at improving the health, safety, and welfare of the Town, the Plan's goals clearly state the need for permanent protection of riparian areas, steep slopes, and wetlands from development.

Palmer's Zoning By-Law is the primary tool the town uses to manage development and direct growth to suitable and desired areas. A Site Plan/Special Permit Approval procedure is established for specific uses and structures, and subdivisions. There are 13 base districts (three residential, three business, three industrial, and four mixed-use village center districts). In addition, there are two overlay districts particularly relevant to natural hazard mitigation:

- F – Floodplain Overlay District - The floodplain overlay applies to areas within the one-hundred-year flood as shown on Flood Insurance Rate Maps. The overlay district severely restricts uses within the floodplain. If new development is proposed for the floodplain, structures must be flood proof and every effort must be made to prevent the loss of floodwater storage capacity.
- Water Supply Protection - This purpose of this overlay district is to protect and preserve Palmer's groundwater resources from damaging pollution or degradation by regulating certain uses within the district. The regulations state specific prohibited and restricted uses, regulate drainage, and detail site plan requirements and special permit approval criteria.

Palmer's Subdivision Regulations control the subdivision of land and design of infrastructure serving new developments, such as roads, stormwater, and utilities. Since the initial Hazard Mitigation Plan, Palmer has also enacted a Stormwater Management Ordinance, establishing requirements and procedures to control stormwater runoff impacts during and after construction.

Development in Palmer is subject to Massachusetts' State Building, Electrical, Plumbing and Gas Codes. These codes provide minimum standards to safeguard life or limb, health, property, and public welfare by regulating and controlling the design, construction, quality of materials, use and occupancy, location and maintenance of all buildings, structures and certain equipment.

In 2013, Palmer adopted a revised Wetlands Ordinance and in 2015 adopted Wetlands Regulations that further clarify that Wetlands Ordinance. Together, these documents identify and protect wetlands, related water resources, and adjoining land areas by controlling activities deemed to have a significant effect on water supply, groundwater, flood control, erosion control, storm damage prevention, and habitat. The Regulations also establish the process for review and regulation of these activities.

Palmer participates in the National Flood Insurance Program (NFIP). The program is managed through the floodplain protections placed within the Zoning By-Law, Wetlands Ordinance, and Building Codes as

described above – these meet or exceed NFIP requirements. The latest available Flood Insurance Rate Maps (July 16, 2013) are used in determining the Flood Overlay District, and regulatory resources such as the Wetlands Ordinance further floodplain management requirements of the NFIP. As of April 2016, 30 properties in the town (17 residential, 13 non-residential) have flood insurance policies. Palmer does not have any Repetitive Loss Properties, according to the NFIP. The Town will maintain compliance with the NFIP throughout the next 5-year hazard mitigation planning cycle by monitoring its Flood Plain Overlay District and ensuring that the district accurately reflects the 100-year floodplain and FEMA Flood Insurance Rate Map.

## **Administrative and Technical**

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Palmer’s municipal staff and appointed boards and commissions are primarily responsible for mitigation planning and action implementation.

The five-member Palmer Planning Board is charged with reviewing subdivision, site plan, and special permit applications as determined by the zoning by-law. The Board’s review criteria ensure that the basic safety and welfare of the people of Palmer are protected; they include specific evaluations relevant to natural hazards. In addition, the Board reviews and recommends proposed changes to the Zoning By-Law or Subdivision regulations, and conducts updates to the Town’s Community Plan. The Board consists of 5 volunteer members, and conducts its public meetings bi-monthly.

The Palmer Conservation Commission is a seven-member board of volunteers charged with the protection of the community’s natural resources. The Commission is responsible for administering the state and local Wetlands Ordinance. The Conservation Commission also reviews all Forest Cutting Plans within the town and any project within areas of protected rare/endangered species and/or priority habitat governed by the National Heritage Endangered Species Program (NHESP), a division of Massachusetts Fisheries & Wildlife. The Conservation Commission also advises other municipal officials and boards on conservation issues that relate to their areas of responsibility.

Several Town Department have a hand in hazard mitigation planning and enforcement. The Building Department is tasked with administration and enforcement of the State Building, Electrical, Plumbing and Gas Codes and the enforcement of the Zoning By-laws of the Town of Palmer. The Town Planner provides staff support to the Planning Board and the Conservation Agent provides support to the Conservation Commission. The Department of Public Works oversees the Town’s roadway, park, and wastewater infrastructure. The Community Development Department is charged with revitalization efforts, including building and repairing infrastructure vital to the health and safety of the residents. The Fire Department processes and reviews burn permit applications.

Beyond the municipality, the Pioneer Valley Planning Commission works with agencies that regulate development in Palmer, including state agencies such as Department of Conservation and Recreation and MassDOT.

## **Financial Capabilities**

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Palmer’s recurring financial resources for mitigation are mostly limited to those capital and operating funds collected from property taxes and fees. Without outside resources, the limited nature of this

revenue may limit mitigation actions to low-cost activities. The Community Plan does call for the adoption of the state's Community Preservation Act, a tool that establishes dedicated funding for open space and other hazard mitigation-related projects, but as of 2016 this Act has not been adopted.

## **Education and Outreach Capabilities**

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Public education and outreach efforts concerning hazards and mitigation efforts are conducted by Town staff when in contact with the public. For example, when Flood Insurance maps for the Town were updated in 2013, staff provided the public with information concerning the new maps and what any changes may mean for property owners. The Conservation Commission has held meetings concerning flooding and educating the public about ways to reduce beaver impacts. The Fire Department reminds applicants for burn permits about fire safety.

## 5: COMMUNITY ASSETS

This chapter identifies the community assets at risk to hazards in Palmer. Identified first are a description of **Current Development** that has occurred or is expected between the last Hazard Mitigation Plan and the current update. Next, the town's **Critical Facilities** which are essential for emergency response to and recovery from a disaster, are listed. Following these, community assets considered essential to the character and function of the Town are identified, including **people, the economy, buildings and cultural resources, infrastructure, and the natural environment.**

### Current Development

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Palmer has experienced little new development since the last Hazard Mitigation Plan process. A combination of a stable population and economy, combined with the general real estate recession has not spurred much in the way of private development. Census records show only 14 residential buildings containing 21 housing units constructed since 2010 – quite a drop from pre-recession levels when these figures would represent half a typical year. Looking ahead, Committee members do not report any sizable new developments on the horizon. Notable non-residential developments include the abandonment of Palmer's only airport (foreclosed in the 2000's), and the renaming of Wing Memorial Hospital to Baystate Wing Hospital following Baystate's purchase. On the public side, the Town has completed construction of a new Police Station in the town's government complex, which acts as the Emergency Operations Center. All told, the development pattern has not impacted the Town's vulnerability to hazards.

### Critical Facilities

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A Critical Facility is defined as a building, structure, or location which is vital to the hazard response effort. These facilities maintain an existing level of protection from hazards for the community and would create a secondary disaster if a hazard were to impact it. The Critical Facilities listed here were identified by the Hazard Mitigation Committee in the 2010 Hazard Mitigation Plan using two sources:

- Palmer's Comprehensive Emergency Management Plan, and
- Critical infrastructure mapping undertaken by PVPC under contract with the Western Region Homeland Security Advisory Council, which is charged by the Executive Office of Public Safety and Security to administer and coordinate the State Homeland Security Grant for western Massachusetts.

The 2016 Plan Committee reviewed the list and contributed updates. The following facilities are identified as Critical for response and protection from hazard events:

#### Emergency Operations Center

- *Primary:* Palmer Police Station (built 2014 as E.O.C.) – 4419 Main Street, Palmer
- *Secondary:* Palmer Fire Station – 12 Walnut Street, Palmer
- Three Rivers Fire District 2 Radio Repeater Site,

#### Fire Stations

- Palmer Fire Station – 12 Walnut Street, Palmer
- Bondsville Fire Station – 3174 Main Street, Bondsville

- Three Rivers Fire Station – 50 Springfield Street, Three Rivers

#### **Police Station**

- Palmer Town Police Department – 4419 Main Street, Palmer

#### **Department of Public Works**

- Palmer DPW – 1015 Bridge Street, Palmer

#### **Water Districts**

- Palmer Water Department – 30 Reservoir Street, Palmer
- Three Rivers Water Department – 2031 Main Street, Three Rivers
- Bondsville Water Department, 3147 Main Street, Bondsville
- Thorndike Water Department, 4070 Church Street, Thorndike

#### **Emergency Fuel Stations**

- MassHighway Depot – Park Street
- Palmer DPW – 1015 Bridge Street
- Amerigas – 1162 Park Street

#### **Facilities with Backup Power**

- Town Administration Building – 4417 Main Street, Palmer - emergency generator to serve Emergency Operations Center and Police Department
- Palmer Fire Station – 12 Walnut Street, Palmer
- Bondsville Fire Station – 3174 Main Street, Bondsville
- Three Rivers Fire Station – 50 Springfield Street, Three Rivers
- Palmer DPW – 1015 Bridge Street, Palmer (2 portable generators)
- Palmer Waste Water Treatment Plant – 1 Norbell Street, Three Rivers
- Converse Middle School – 24 Converse Street, Palmer
- Old Mill Pond School – 4107 Main Street, Thorndike
- Palmer High School – 4105 Main Street, Thorndike
- Pathfinder Regional Vocational Technical High School – 240 Sykes St., Three Rivers
- St. Thomas, 1076 Thorndike Street, Palmer \*
- Baystate Wing Hospital and Medical Centers – 40 Wright Street, Palmer

#### **Emergency Shelters**

- Converse Middle School – 24 Converse Street, Palmer\*
  - Faith Baptist Christian Academy – 251 Shearer Street, Palmer
  - Old Mill Pond School – 4107 Main Street, Thorndike\*
  - Palmer High School – 4105 Main Street, Thorndike\*
  - Pathfinder Regional Vocational Technical High School – 240 Sykes St., Three Rivers\*
  - St. Peter & Paul Church – 2383 Main Street, Three Rivers
  - St. Thomas, 1076 Thorndike Street, Palmer
- \*Shelters also have generators.

### **Helicopter Landing Sites (Lifeflight-Lifestar preapproved)**

- Palmer Fire District 1
  - CrossRoads, Intersection Rt. 20 & Rt. 67
  - Rt.67 / Boston Rd. — West of Washington St.
  - King Brook Farm / Pat Turley Residence
  - Route 20 Batting Cages, Park Street
  - Pioneer Plaza, Park & Breckenridge Street
  - Sanderson McCloud Field, South Main Street
  - Converse Middle School (Legion Field): enter from either Walnut St. or Converse St.
  - Cedar Foods, Wilbraham Street
  - Big Y / Ames Parking Lot, Thorndike Street
  - Wing Memorial Hospital, (Pre-Approved Lifeflight), Wright Street
  - Burleigh Park, Old Warren Road
  - Palmer High School, Main Street, Thorndike
  - St. Joe's Field, Pine Street, Thorndike
- Three Rivers, Fire District 2
  - K-Mart, Enter From: 1 Calkins Street, 2 Wibraham Street
  - Laviolette Field, Belanger Street
  - Pulaski Park, Belchertown Road
  - Pathfinder Reg. Voc. Tech. High School, Rt. 181
  - Pathfinder Reg. Voc. Tech. High School, Panek Street
  - St. Peter & Paul Church Parking Lot, Rt. 181
- Bondsville, Fire District 3
  - St. Peter & Paul Cemetery, Fuller Street

### **Communications**

- Palmer Police Station – 4419 Main Street, Palmer
- Bald Peak Fire Repeater, Hovey Hill Road, Palmer
- Cell Tower, 80 Stimson Street, Palmer
- Cell Tower, Wilbraham Street, Palmer
- Cell Tower, south end of Peterson, Palmer
- Cell Tower, off Robinson, Palmer
- Antennae, water tank at top of Breckenridge Street, Palmer
- Three Rivers Fire District 2 Radio Repeater Site, Pathfinder Regional Vocational School, 240 Sykes St.

### **Hospitals**

- Baystate Wing Hospital and Medical Centers – 40 Wright Street, Palmer
- Palmer Ambulance – Shearer Street Extension

### **Primary Evacuation Routes**

- Route 32 (most reliable, can go north and get to Ware)
- Route 90 (most reliable for east or west travel)
- Route 181 (prone to flooding)
- Route 67 (prone to flooding)
- Route 20 (least reliable, problematic with flood events)



### **Bridges/Culverts Located on Evacuation Routes**

- Bridge Street - Chicopee River, Three Rivers
- Main Street - Quaboag River, Three Rivers
- Palmer Street - Quaboag River, Palmer
- Route 181/Palmer Street - Ware River, Palmer
- East Main Street - Ware River Canal, Thorndike
- Main Street - Ware River, Thorndike
- Church Street - Ware River Canal, Thorndike
- Church Street - Ware River, Thorndike
- State Street - Ware River, Thorndike (replaced 2015)
- Route 20/Wilbraham Street - Quaboag River, Palmer
- Route 67/Boston Road - Kings Brook, Palmer (replaced 2015)
- Interstate 90, Eastbound - Quaboag River, Palmer
- Interstate 90, Westbound - Quaboag River, Palmer
- Route 20 @ corner of Breckenridge
- Route 20 @ ¼ of a mile west under RR crossing, Palmer
- South Main Street @ Fox, Palmer
- Route 32 @ Fish Hatchery, Palmer
- Railroad-owned culvert on Breckenridge under rail bridge
- Mason Street @ Park Street

### **Essential (Non-Critical) Assets:**

#### **People**

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Palmer counted 12,140 residents and 5,099 households in the 2010 U.S. Census. This was a 2.8% decrease from the population recorded in the 2000 Census. As Palmer's overall population has stagnated and declined in the last 50 years, residential concentrations have diffused. Still, much of the resident population remains concentrated in Palmer's four villages: Three Rivers, Thorndike, Bondsville and Depot Village (aka Palmer Center). These areas lie on valley plains along the rivers that cut through the Central Massachusetts uplands. Outside these centers, the Town is forested or farmed, with dispersed housing and other low-density land uses. There are no significant visiting populations in Palmer.

Because of their locations in and near floodplains, Palmer's four population concentrations are particularly vulnerable to floods. Severe snowstorms, and in some locations, dam failures and hazardous materials also present vulnerabilities. Outlying houses are vulnerable to wildfires.

Specific complexes with dense residential populations (generally 5 or more units) include the following:

#### **Apartment Complexes**

- 1302 South Main Street, Palmer
- 1295-1307 South Main Street, Palmer
- 1089 Park Street, Palmer
- 1035 Central Street, Palmer

- 1 Shearer Street, Palmer
- 98-104 Springfield Street, Three Rivers
- 2014-2020 Palmer Street, Three Rivers
- 25-39 Front Street, Three Rivers
- 9-19 Kelley Street, Three Rivers
- 9-15 Springfield Street, Three Rivers
- 4014 School Street, Thorndike

Facilities with people who are uniquely vulnerable during emergencies and might require expanded or special emergency resources include the following:

### **Special Needs Populations / Children**

- Bright Beginnings Child Care Center – 15 Linda Street, Three Rivers
- Camp Ramah – 39 Bennett Street, Thorndike
- Camp Stanica – Phillip Street, Bondsville
- Converse Middle School – 24 Converse Street, Palmer
- Cute Kids Daycare – 24 Lawrence Street, Palmer
- Faith Baptist Church Academy – 251 Shearer Street, Palmer
- Learning Factory – 62 Springfield Street, Three Rivers
- Old Mill Pond Elementary School – 4107 Main Street
- Palmer Green Estates – 1 Beacon Drive, Palmer
- Palmer Head Start – 4107 Main Street
- Palmer Healthcare Center – 250 Shearer Street, Palmer
- Palmer High School – 4105 Main Street, Thorndike
- Pathfinder Regional Vocational Technical High School – 240 Sykes St., Three Rivers
- Quaboag Children’s Center – 60 Central Street, Palmer
- Rainbow Connection Nursery School and Day Care – 17 Highland Street, Palmer
- St. Thomas (daycare), 1076 Thorndike Street, Palmer
- Scantic Valley YMCA Old Mill Pond School’s Out – 4107 Main Street
- Home daycares, each with a capacity of eight:
  - Chartier, Shari – N. Main Street
  - Jones, Sharon – Old Farm Road
  - Lis, Lynn Marie – Mount Dumplin Road
  - Pranaitis, Debra S. – School Street
  - Senecal, Deborah A. – Park Street
  - Ziemian, Sharon A. – Old Farm Road

### **Elderly Housing/Assisted Living**

- Kirkwood Place Elderly Housing Independent Living – 4216 Main Street, Thorndike
- Laurel Manor/Palmer Housing Authority – 13 Fletcher Street, Palmer
- Palmer Green Estates – 1 Beacon Drive, Palmer
- Palmer House Alzheimer’s Center, 250 Shearer Street, Palmer

## Economy

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On top of an agricultural and forestry base economy, Palmer retains a fair amount of industrial and transportation employers, though this is reduced from the heyday in the early 20<sup>th</sup> Century when the town's villages were hubs for textile manufacturing, trade, and rail transportation. Today, economic and population growth has stagnated and employment has diversified into retail and other services, and somewhat diffused away from the village centers. Today, smaller industrial and commercial enterprises take advantage of the town's rail and auto access, locating in the former mill complexes or in a more recently developed industrial park.

Initially sited in proximity to water power, many of Palmer's centers of employment are located in or near floodplains, and are thus vulnerable to flooding. Severe snowstorms, and in some locations, dam failures and hazardous materials also present vulnerabilities.

**Major employers** include the following:

- Carpenter Metals – Route 20, Palmer
- Sanderson McCloud – South Main Street, Palmer
- Maple Tree Industries – Wilbraham Street, Palmer
- Hastings – Chamber Road, Three Rivers
- Mustang Seats – Springfield Street, Three Rivers
- Palmer Industrial Park – Fuller Road, Bondsville
- Baystate Wing Hospital and Medical Centers – 40 Wright Street, Palmer
- Palmer Foundry – Mt. Dumpling Road
- Big Y / Ocean State Job Lot – 1180 Thorndike Street

## Buildings and Cultural Resources

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Of the developed land in Palmer, residential uses are the most prolific at approximately 3,110 acres, followed by agricultural land at approximately 1,295 acres. Land used for industry constitutes a relatively large 470 acres, with commercial use occupying just 142 acres. Land characterized as urban open/public land constitutes 243 acres, and there are 111 acres of outdoor recreational land.

The majority of buildings in Palmer occur in or nearby the Town's four villages, Three Rivers, Thorndike, Bondsville, and Depot Village or Palmer Center. Buildings also line roads connecting the villages and the large through-roads such as Routes 20, 67, 32, and 181.

Development trends are quiet in this former industrial town. During the six years since the previous Hazard Mitigation Plan, Palmer has seen little significant development. In general, Palmer's floodplain overlay zoning district, combined with Conservation Commission oversight, severely limits new development in hazard areas. In addition, areas of rugged terrain, steep slopes, and unsuitable soils also act as constraints on development.

Many of the hazards identified in this plan are regional risks and, as such, all development falls into the hazard area. The exception to this is flooding and inundation in the event of a dam failure. According to the Community Information System (CIS) of FEMA, there were 32 structures located within the Special

Flood Hazard Area (SFHA) in Palmer. For the high hazard dams, inundation zones are mapped as part of the Emergency Action Plans required of dam owners by the Commonwealth of Massachusetts.

Buildings and cultural resources considered essential (but not critical) to the everyday operation of Palmer include the following:

### **Schools**

- Converse Middle School – 24 Converse Street, Palmer
- Faith Baptist Church Academy – 251 Shearer Street, Palmer
- Old Mill Pond Elementary School - 4107 Main Street, Thorndike
- Palmer High School - 4105 Main Street, Thorndike
- Pathfinder Regional Vocational Technical High School – 240 Sykes St., Three Rivers
- St. Thomas, 1076 Thorndike Street, Palmer

### **Churches**

- Crossway Christian Church, 1130 South Main Street, Palmer
- Faith Baptist Church – 251 Shearer Street
- Second Baptist Church – 1050 Thorndike Street, Palmer (bldg is empty)
- Second Congregational Church – 1080 Pleasant Street, Palmer
- Saint Bartholomew, Main Street, Bondsville (closed)
- St. Paul’s Universalist Church, 1060 Central Street, Palmer
- Saint Thomas, 1076 Thorndike Street, Palmer
- Divine Mercy, Main Street, Palmer

### **Public Buildings/Areas**

- Bondsville Post Office – 3069 Main Street, Bondsville
- Palmer District Court – 235 Sykes Street, Thorndike
- Palmer Post Office – 1057 Park Street, Palmer
- Thorndike Post Office – 36 Church Street, Thorndike
- Three Rivers Post Office – 2020 Bridge Street, Three Rivers
- Roger Reed State Salmon Hatchery – Route 32, Thorndike
- Town Administration Building – 4417 Main Street, Palmer
- Palmer Public Library, 1455 North Main Street, Palmer
- Palmer Historical and Cultural Center – 2072 Main Street, Three Rivers

### **Historic Buildings/Sites**

- Four Corners Cemetery, Main Street, Thorndike
- Palmer Center Cemetery, Flint Street, Palmer
- Oak Knoll Cemetery , Thorndike Street, Palmer
- Palmer Center Cemetery, Route 32 and Warren Street
- Palmer Memorial Hall, 1029 Central Street , Palmer (State Register)
- Thorndike Mills, Church Street, Thorndike
- Thorndike Street High School, Park Street and Converse Street, Palmer
- Three Rivers Cemetery, Main Street, Three Rivers
- Union Station/Steaming Tender Restaurant, 28 Depot Street, Palmer (State Register)
- Wright Wire Mills, Route 20, Palmer

- King Brook Farm, Route 67, Palmer
- Harry Johnson House, Route 67, Palmer
- U.S. Post Office, Palmer Main Branch, Park and Central streets (State Register)

## Infrastructure

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Palmer’s infrastructure consists of transportation, water, sewer, power, and communications infrastructure. Since many of these are critical facilities for emergency response, they are listed in the first part of this chapter. Other infrastructure assets are detailed here.

### Roads and Highways

Palmer’s four villages are connected along two main routes – Route 181 (also named Sykes Street south of Palmer Center, and Palmer Street northward) traveling north-south through Town, and Main Street traveling east-west. Palmer also has direct access to the Massachusetts Turnpike (Interstate 90) at Exit 8. Other main routes include State Routes 67, 20, and 32.

Locations with stream crossings and essential culverts include the following:

- Quaboag Valley Mobile Home Park
- Route 181 @ Burgundy Brook, Bondsville
- Nipmuck Road, Palmer
- Emery Street (3), Bondsville
- Foster Street, Bondsville
- Main Street, Bondsville
- High Street, Thorndike (by Junction Store)
- Center Street, Thorndike (on evacuation route)
- Bacon Road, Palmer
- West Ware Road, Palmer
- Route 20 @ corner of Breckenridge, Palmer (on evacuation route)
- Route 20 @ ¼ of a mile west under RR crossing, Palmer (on evacuation route)
- South Main Street @ Fox, Palmer (on evacuation route)
- Route 32 @ Fish Hatchery, Palmer (on evacuation route)

### Rail

Palmer was once known as the “Town of Seven Railroads.” Today, there are three active rail lines remaining within the Town, which are used predominately for commercial shipping. These are controlled by Mass Central, CSX, and the Boston & Maine (PanAm Railways).

### Public Transportation

The Pioneer Valley Transit Authority (PVTA) provides the Palmer Shuttle. Stops include Wing Memorial Hospital, Palmer Industrial Park, Kirk Place, Tenczar Grocery, Mapletree Industrial Center.

## **Sewer Service**

Palmer's sewer system services 50% of the residences within the town. A major problem with the town sewer system was the combined system, which at one point had 26 overflow points of direct discharge to the Chicopee, Quaboag, Swift and Ware Rivers. Working under a federal mandate to implement a plan to address this problem, these CSOs have been eliminated in the last 12 years. The remainder of the Town relies on private septic systems.

## **Public Drinking Water Supply**

Palmer consists of four private water companies – Palmer, Three Rivers, Bondsville, and Thorndike – which serve approximately 50% of the town's potential customers within the four villages. The water lines were mainly established to service the older mill housing and have not been expanded to cover much more than the centers of the villages over the years. The remainder of the Town relies on private wells. The previous plan identified the following water infrastructure essential to the everyday operation of Palmer:

### **Supply**

#### *Palmer Water District*

- Galaxy Wellfield #1 and Gravel Pack Well #2, Salem Street (under water with flood);
- Upper and Lower Graves Brook Reservoir, off Breckenridge Street – 30 Reservoir Street

#### *Three Rivers*

- Groundwater wells located near the Ware River on Route 181 near Pathfinder Regional Vocational High School (under water with flood)

#### *Bondsville*

- River Road, Belchertown

### **Drinking Water Treatment Plants**

#### *Palmer Water District*

- Graves Brook Reservoir Treatment Facility, 30 Reservoir Road, Palmer
- Granular Activated Carbon Treatment Plant – Salem Street

#### *Three Rivers*

- 280 Sykes Street (corrosion control only)

### **Water Storage**

#### *Palmer Water District*

- 750,000 gallon steel water storage tank – top of Breckenridge Street
- 1 million gallon clearwell, Graves Brook Reservoir Treatment Facility, 30 Reservoir Street, Palmer

#### *Three Rivers*

- 1.5 million gallon water tanks – Baptist Hill

#### *Bondsville*

- Tank top of High Street, Bondsville

#### *Thorndike*

- Tank on Center Street (supplies Diamond International Corp.)

### **Waste Water Treatment Plants**

- Palmer Waste Water Treatment Plant – 1 Norbell Street, Three Rivers

## **Natural Environment**

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Palmer’s natural resources are varied – from the four rivers and their valleys to the surrounding hills and all the undeveloped land within town limits. The vast majority of the Town’s 32.7 square miles is undeveloped land, totaling close to 14,260 acres. Water bodies comprise another 470 acres.

### **Forests**

The majority (68%) of Palmer is undeveloped forestland, at approximately 14,260 acres. Much of the forest is hardwood, consisting of red and white oak, red and sugar maple, cherry, ash, and birch. The majority conifers are white pine and hemlock, with some spots of cedar, red pine, and, rarely, spruce. There are also a few hundred acres of cropland, pastureland, and open land, providing additional vegetation types and habitat opportunities.

### **Water Resources**

Four rivers pass through Palmer are significant resources to the Town: the Quaboag River (designated a Scenic River since 1985), Swift River, and Ware River join to form the Chicopee River, which flows west from the town. At one time these rivers were a vital economic resource via waterpower for the textile mills, which were built upon their banks. Today they serve in a different capacity as a resource for recreation, conservation, and flood control. Boating and/or canoeing, fishing and swimming are popular water recreational sports on the rivers, while picnicking, bird watching, scenic viewing and hiking the green belt areas are popular activities in adjacent land.

There are three lakes and five ponds in Palmer: Forest Lake is the largest at 44 acres and is accessible to the public; both Lake Thompson with 32 acres, and Crystal Lake with 16 acres are privately owned. The five ponds in town are: Round Pond, Ice House Pond, Allen’s Pond, Knox Pond (a glacier kettle hole), and Lily Pond.

### **Floodplains and Wetlands**

Much of Palmer’s developed area sits on floodplains, the relatively flat, lowland areas adjacent to a river, lake or stream. Floodplains serve an important stormwater function, acting like “sponges” to absorb and slowly release floodwaters back to surface waters and groundwater. Although periodic flooding is a natural occurrence in floodplains, past development and alteration of these areas can result in a costly and frequent hazard. In addition to damage of buildings directly in the floodplain, development can result in a loss of natural water storage capacity and can increase flood levels for areas not normally in the flood path. Wetlands perform similar roles in managing stormwater, as well as providing critical habitat.



## 6: RISK ASSESSMENT

This chapter conducts a risk assessment for the various hazards facing Palmer. For the analysis, the planning team identified the community assets (identified in the previous chapter) which are located in hazard areas and assessed their value or importance against the magnitude and probability of future events.

The Hazard Mitigation Committee referred to the 2013 Massachusetts Hazard Mitigation list of hazards as a starting point for determining the relevant hazards in Palmer. The table below illustrates a comparison between the relevant hazards in the state plan and in Palmer’s plan update.

Comparison of Hazard identified in the 2013 Massachusetts Hazard Mitigation Plan and the Palmer Hazard Mitigation Plan Update	
2013 Massachusetts Hazard Mitigation Plan	Town of Palmer Relevance
Coastal Hazards	The Town of Palmer is not located on the coast and therefore not at risk of coastal hazards.
Dam Failure	Dam Failure is a risk to Palmer
Drought (Severe Weather)	Drought is a risk to Palmer.
Earthquake	Earthquakes are a risk to Palmer.
Extreme Temperature (Severe Weather)	Extreme Temperature is not considered a risk to Palmer.
Flood (including Ice Jam)	Flooding is a risk to Palmer.
High Wind (Severe Weather)	High Wind is a risk to Palmer and is included in the Severe Thunderstorm/Wind/Tornado category.
Hurricane/Tropical Storm	Hurricanes are a risk to Palmer.
Ice Storm (Severe Winter Weather)	Ice Storms are a risk to Palmer and included in the category Severe Snowstorms/Ice Storms.
Landslide	Landslides are not a risk to Palmer.
Major Urban Fires	Major Urban Fires are not considered a risk to Palmer. However, wildfires and brush fires are considered a risk.
Nor’easter	Nor’easters are a risk to Palmer and included in the category Severe Snowstorms/Ice Storms.
Snow & Blizzard (Severe Winter Weather)	Snow & Blizzards are a risk to Palmer and included in the category Severe Snowstorms/Ice Storms.
Thunderstorm (Severe Weather)	Thunderstorms are a risk to Palmer and included in the category Severe Thunderstorms/Wind/Tornadoes.
Tornado (Severe Weather)	Tornadoes are a risk to Palmer and included in the category Severe Thunderstorms/Wind/Tornadoes.
Tsunami	The Town of Palmer is not located on the coast or near the coast for tsunami to be a risk.
Wildland Fire	Wildland Fire is considered a risk to the Town of Palmer.

In conducting the assessment, the planning team defined each potential hazard in terms of its **location** of impact, **extent** or magnitude, **previous occurrences**, and **probability of future events**. The risk for each hazard is then presented in terms of its overall **impact** on the Town, and the **vulnerability** of the Town to these events. These terms are defined and rated thusly:

Location

Location refers to the geographic areas within the planning area that are affected by the hazard. Some hazards affect the entire planning area universally, while others apply to a specific portion, such as a floodplain or area that is susceptible to wild fires. Classifications are based on the area that would potentially be affected by the hazard, on the following scale:

Percentage of Town Impacted by Natural Hazard	
Land Area Affected by Occurrence	Percentage of Town Impacted
Large	More than 50% of the town affected
Medium	10 to 50% of the town affected
Small	Less than 10% of the town affected

Extent

Extent describes the strength or magnitude of a probable hazard. Where appropriate, extent is described using an established scientific scale or measurement system. Other descriptions of extent include water depth, wind speed, and duration.

Previous Occurrences

Previous hazard events that have occurred are described. Depending on the nature of the hazard, events listed may have occurred on a local, state-wide, or regional level.

Probability of Future Events

The likelihood of occurrence for each hazard was classified according to the following scale:

Frequency of Occurrence and Annual Probability of Given Natural Hazard	
Frequency of Occurrence	Probability of Future Events
Very High	70-100% probability in the next year
High	40-70% probability in the next year
Moderate	10-40% probability in the next year
Low	1-10% probability in the next year
Very Low	Less than 1% probability in the next year

Impact

Impact refers to the effect that a hazard may have on the people and property in the community, based on the assessment of extent described above. Impacts are classified according to the following scale:

Impacts, Magnitude of Multiple Impacts of Given Natural Hazard	
Impacts	Magnitude of Multiple Impacts
Catastrophic	Multiple deaths and injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of facilities for 30 days or more.
Critical	Multiple injuries possible. More than 25% of property in affected area damaged or destroyed. Complete shutdown of facilities for more than 1 week.
Limited	Minor injuries only. More than 10% of property in affected area damaged or destroyed. Complete shutdown of facilities for more than 1 day.
Minor	Very few injuries, if any. Only minor property damage and minimal disruption on quality of life. Temporary shutdown of facilities.

For each hazard, approximate losses are estimated, calculated using FEMA’s *Understanding Your Risks: Identifying Hazards and Estimating Losses*. Calculations focus mostly on the value of structures in Palmer:

**Total value of all structures in Palmer (2016): \$657,299,200**

**Median value of a home in Palmer (2013): \$188,832**

**Average household size(2010): 2.2 persons**

The calculations do not include human losses, land value, or the contents of the structures. The damage calculations are intended as rough estimates reflecting worst-case scenarios.

Vulnerability

Based on the above metrics, a vulnerability rating was determined for each hazard. The rating is qualitative and is based, in part, on local knowledge of past experiences with each type of hazard. Of course, the size and impacts of a natural hazard can be unpredictable. The ratings are based on a scale of 1 through 5 as follows:

- 1 – Highest risk
- 2 – High risk
- 3 – Medium risk
- 4 – Low risk
- 5 – Lowest risk

## Risk Assessment Summary Matrix

The following table summarizes the hazards facing Palmer, including their vulnerability rating:

Type of Hazard	Location	Previous Occurrences	Probability of Future Events	Impact	Vulnerability
Flooding: General	Large	Yes	Low	Critical	3-Medium Risk
Flooding: Localized	Small	Yes	Very High	Critical	3-Medium Risk
Snowstorms/ Ice Storms	Large	Yes	High	Limited	3-Medium Risk
Hurricanes/ Tropical Storms	Large	Yes	Low	Critical	3-Medium Risk
Thunderstorms/ Wind/ Tornadoes	Small	Microbursts only	<u>Thunderstorms:</u> Moderate <u>Winds:</u> Moderate <u>Tornadoes:</u> Very Low	Catastrophic	<u>Thunderstorms:</u> 2- High Risk <u>Winds:</u> 2- High Risk <u>Tornadoes:</u> 4 – Low Risk
Wildfire / Brushfire	Medium	Yes	Moderate	Limited	4 – Low Risk
Earthquakes	Large	No	Very Low	Minor to Critical	4 – Low Risk
Dam Failure / Levee Breach	Medium	Yes	Very Low	Catastrophic	5 – Very Low Risk
Drought	Large	No	Low	Minor	5 – Very Low Risk
Hazardous Materials	Medium	No	Low	Minor	5 – Very Low Risk

## Critical Facilities Impact Summary Matrix

The following table summarizes the potential critical facilities impacted by each hazard type:

Critical Facilities and Evacuation Routes Potentially Affected by Hazard Areas			
Hazard Type	Hazard Area	Critical Facilities Affected	Evacuation Routes Affected
Flooding	Route 20 and Route 67 at Palmer/Warren Town Line; Area surrounding Route 181; Ludlow Dam Area; Emery Street Area; Route 32 south of Fay's Bridge Water Street, Palmer Foundry Street, Palmer	Palmer DPW, 1015 Bridge Street, Palmer <ul style="list-style-type: none"> <li>▪ Palmer Waste Water Treatment Plant, 1 Norbell Street, Three Rivers</li> <li>▪ Galaxy Wellfield</li> </ul>	Routes 20, 90, 181, and 32 (@ southern end)
Severe Snowstorms / Ice Storms	Entire Town	None	Routes 67, 20, 90, 181
Severe thunderstorms / wind /tornadoes	Area adjacent to Routes 20 and Routes 181	All Facilities	Routes 67, 20, 90, 181
Hurricanes	Area adjacent to Routes 20 and Routes 181	All Facilities	Routes 67, 20, 90, 181
Wildfire/Brushfire	Forested areas surrounding Fox Hill, Pottaquatic Mountain (bounded by routes 67, 90, and 32)	Woodland Hill Academy in Ware, Malbouf Road	Route 67
Earthquakes	Entire Town	All Facilities	Routes 67, 20, 90, 181
Dam Failure	Depends on dam	All 4 Water Districts	Depends on dam
Drought	Entire Town	Depends on incident	Routes 90, 181, 20
Hazardous Materials	Known Haz. Mat. Sites, rail corridors	Depends on incident	Routes 20, 181

## Flooding

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The average annual precipitation for Palmer and surrounding areas in northwestern Massachusetts is 46 inches, distributed throughout the year. There are three major types of storms that bring precipitation to Palmer. Continental storms that originate from the west continually move across the region. These storms are typically low-pressure systems that may be slow-moving frontal systems or more intense, fast-moving storms. Precipitation from coastal storms, also known as nor'easters, constitute the second major storm type and travel into New England from the south. In the late summer or early fall, the most severe type of these coastal storms, hurricanes, may reach Massachusetts and result in significant amounts of rainfall. The third type of storm is the result of local convective action. Thunderstorms that form on warm, humid summer days can cause locally significant rainfall.

### Location

*General floods*, caused by precipitation over a longer time period in a particular river basin, largely affect areas within or near the NFIP-mapped flood zones. In Palmer, these floods typically occur on floodplains along the minor and major watercourses that run across the town. Approximately 958 acres of land are within Zone A or areas subject to inundation by a 1-percent-annual chance flood, commonly called a "100 year flood zone" and 409 acres of land are within areas subject to inundation by a .02-percent-annual chance flood, commonly called a "the 500-year floodplain", giving this hazard a "large" area of impact. Particularly vulnerable are the built-up areas along Routes 67 and 20 in the floodplain of the Quaboag River, and built-up areas along the Ware River.

- Areas along Route 67 and the Quaboag River. The roadway of Route 67, where it enters Palmer from West Warren to its intersection with Route 20, is built in the floodplain of the Quaboag River.
- Areas along Route 20 and the Quaboag River. The roadway of Route 20 and many intersecting roads—from Route 67 at the Palmer/Warren Town Line, past Route 32 South at Fay's Bridge, the DPW facility on Bridge Street, the Maple Tree Industrial Park, all the way to Wilbraham Street—are located in the floodplain of the Quaboag River. Areas along Foundry Street and Water Street are particularly vulnerable.
- Areas along the Ware River. Route 181 where it crosses the Ware River in Thorndike, Main Street and Church Street, and River Street in Thorndike, and Summer Street, where it crosses the Ware River are all built in the floodplain of the Ware River. Three Rivers water supply area is vulnerable, as is River and State streets in Bondsville near the old airport. Town of Palmer Wastewater Treatment Facility is in close proximity of floodplain, off Norbell Street in Three Rivers section.

*Localized floods* are the product of heavy, localized precipitation in a short time period over a given location. Palmer often experiences localized minor flooding at locations close to waterways, drainage problems, or problem culverts. In addition, there are many areas with no record of previous flood incidents that could be affected in the future by heavy rain and runoff given Palmer's location at the confluence of three rivers. Culverts in more rural parts of town are also sometimes impacted by beaver activity, producing localized flooding. Specific sites which susceptible to localized flooding in the past are described below, identified due to known past occurrences in the respective area.

- Areas along Route 20 and the Quaboag River, particularly Foundry Street and Water Street. During the flood of 2005, floodwaters were a problem for 6 residences along Water Street that had 1 to 2 feet of water in their basements. Floodwaters also impacted several non-residential

buildings, including the DPW. Damages amounted to approximately \$1 million. Kelly Oil Co. had a bulk tank that started to float, initiating action from the Fire Department and the Massachusetts Department of Environmental Protection. Kelly Oil has since reconfigured their tanks. CSX rail lines were under water.

- Wilbraham Street. Flooding occurs due to the low elevation of the roadway and the roadway’s proximity to the Quaboag River. The 2005 flood caused damage to buildings in the area. During that flood event a manhole cover on the main sewer line came off so that floodwaters poured into the sewer line and had to be pumped along with sewage. Such a large quantity of excess water – some estimates 7 million gallons – damaged the pumps at the pumping stations. In addition, two Massachusetts Electric workers had to be rescued from their truck when they tried to drive through flood water that reached the level of their windshield.
- Route 32 South by Fay’s Bridge. Several factors seem to contribute to flooding at Fay’s Bridge. These factors include a tributary feeding into the Quaboag River just upstream of the bridge, the narrowing of the Quaboag River at this juncture, the low elevation of the bridge itself. For the most part, there is a floodplain onto which floodwaters can spill, including a driving range and fields. However, waters flooded out Route 32 in the 2005 flood.

**Extent**

General flooding typically extends only within the 100-year flood plain, which was recently remapped by FEMA. While Palmer’s built environment centers on the river system, most of the structures in town were built outside the flood plains. Currently, 32 structures are located within the Special Flood Hazard Area (SFHA). Land use controls serve to prevent future development of floodplains.

Localized flooding, typically caused by blocked or insufficient drainage infrastructure, extends only high enough for stormwater to find a way around the obstacle. This can inundate low-lying roadways with several inches or more of water and affect nearby yards and structures.

**Previous Occurrences**

The major floods recorded in Western Massachusetts during the 20th century have been the result of rainfall alone or rainfall combined with snowmelt. Palmer has experienced many flooding events over the last decade, but generally these are smaller floods with minor impacts on roads and residents’ yards. However, town-wide flooding with a 100-year storm in 1955 caused severe damage to roads, bridges, and buildings. Approximately 60% of the town had to be rebuilt. Following the 100-year flood of 1955, when much of Palmer had to be rebuilt, the Town undertook a major flood control project at the confluence of the Swift, Ware and Quaboag rivers, which forms the Chicopee River in Three Rivers. In particular, the channel of the Chicopee River was significantly deepened and widened to increase the river’s ability to pass large storm flows, and to lessen impacts on roads, bridges and buildings.

Floods Causing Significant Damage in Palmer 1915-2015	
Date	Description
1955	100-year flood
2005	11 inches of rain in 3 days
8/27/2011	Hurricane Irene



In addition to the floodplains mapped by FEMA for the 100-year and 500-year flood, Palmer often experiences minor flooding at isolated locations due to specific drainage problems, typically undersized or blocked culverts. These occur all over Town, and have been mapped on the Potential Hazards/Critical Facilities Map. Most of these flood hazard areas were identified due to known past occurrence in the respective area. However, there are many areas with no record of previous flood incidents that could be affected in the future by heavy rain and runoff. Additionally, culverts and other drainage infrastructure can be impacted by beaver activity, so localized flooding can potentially occur at any culvert crossing (noted on maps).

### ***Probability of Future Events***

The probability of future general flooding is “low”: flood insurance maps show the 100-year (1% chance) and 500-year (.2%) flood zones identified by FEMA flood maps. In Palmer, there are several 100-year floodplain areas – primarily along the Ware River, Kings Brook, Quaboag River, and Swift River. There are smaller 500-year floodplains mapped as well, along Forest Lake, the Palmer Street Marshes, and the confluence of the Swift, Ware and Chicopee Rivers. In actuality, flooding occurs more frequently than the maps indicate because the current FEMA-defined flood zones are based on historical patterns of rainfall intensity and frequency, and do not take into account the impacts that climate change is having on Palmer. In the past few decades, New England has seen an increase in the number of extreme rainfall events, defined as large amounts of rain in a short period of time. In Massachusetts, the increase since 1948 has been 81 percent (Environment America Research & Policy Center, 2012). In the last five years, there has also been an increased occurrence of tornadoes and large storms that generate strong wind gusts. It is likely that the currently designated 10-year, 25-year, 100-year and 500-year floodplains will flood more frequently due to climate change, and future map revisions will enlarge areas covered by these designations.

Unlike general flooding, the probability of localized flooding is “very high”, since smaller amounts of rainfall and specific local conditions such as vegetation or beaver activity can create this kind of flooding.

### ***Impacts: General Flooding***

There are approximately 958 acres of land within the FEMA mapped 100-year floodplain and 409 acres of land within the 500-year floodplain within the Town of Palmer. According to the Community Information System (CIS) of FEMA, there were 320 structures (all residential) located within the Special Flood Hazard Area (SFHA) in Palmer.

Utilizing the Town’s median home value of \$188,900 (American Community Survey, 2009-2013), up to \$60,448,000 worth of damage could occur within the Special Flood Hazard Area, with approximately 704 people impacted. [Note: this is more than 9% total value of town and more than 6% town population.] The damage estimate is a rough estimate and likely reflects a worst-case scenario – computing more detailed damage assessments based on assessor’s records is a labor-intensive task and beyond the scope of this project. Impacts to the specific areas identified above are as follows:

#### Areas along Route 67 and the Quaboag River

There are no critical facilities identified along this corridor and no residential structures in this area that have been affected or could be affected by a flood incident.

- Vulnerability assessment: costs only to repair of roadway.

#### Areas along Route 20 and the Quaboag River

- 2 critical facilities in neighborhood (Department of Public Works and Galaxy Wellfield and pumping station)
- Approximately 9 residential structures in this area that have been affected or could be affected by a flood incident;
- Vulnerability assessment: \$1,699,000 (assuming 100% damage to 100% of the structures);
- This figure does not include costs for repairing or replacing the 8 businesses and town facilities, any power lines, telephone lines, and contents of structures.

#### Areas along the Ware River

- 1 critical facility in neighborhood;
- Approximately 40 residential structures in this area that have been affected or could be affected by a flood incident;
- Vulnerability assessment: \$7,553,000 (assuming 100% damage to 100% of the structures);
- This figure does not include costs for repairing or replacing the 8 businesses and town facilities, any power lines, telephone lines, and contents of structures.

### ***Impacts: Localized Flooding***

Impacts on specific areas susceptible to localized flooding are described below. To determine the vulnerability of the Town to localized flood events, the property within identified areas was outlined using the polygon function in Connect CTY, which allowed structures to be identified and tallied.

#### Areas along Route 20 and the Quaboag River, particularly Foundry Street and Water Street

In 2005, the DPW suffered \$150,000 worth of damage, while the Maple Tree Industrial Park and Turley Publications also saw significant damage of \$200,000.

- 1 critical facility in neighborhood;
- Approximately 6 residential structures in this area that have been affected or could be affected by a flood incident;
- Vulnerability assessment: \$283,000 (assuming 50% damage to 50% of the structures);
- Cost for repairing or replacing business and town facilities, any power lines, telephone lines, and contents of structures are not included.

#### Wilbraham Street

Flooding occurs due to the low elevation of the roadway and the roadway's proximity to the Quaboag River, however there are few critical facilities other than the roadway itself.

- No critical facilities in neighborhood;
- No residential structures in this area could be affected by a flood incident;
- Costs for repairing or replacing two businesses, and New England Central Railroad's overpass have not been determined.

#### Route 32 South by Fay's Bridge

For the most part, a natural floodplain handles flooding here, but water can reach higher heights during intense rainfall events, such as in 2005.

- 1 critical facility in neighborhood (Osterman Gas bulk storage tanks is built on fill in this area);

- Approximately 3 residential structures in this area that have been affected or could be affected by a flood incident;
- Vulnerability assessment: \$960,000 (assuming 100% damage to 100% of the structures);
- Cost for repairing or replacing business and town facilities, any power lines, telephone lines, and contents of structures are not included.

### ***Vulnerability***

Based on the above analysis, Palmer has a hazard index rating of “3 – Medium Risk” for both general and localized flooding.

## **Severe Snowstorms / Ice Storms**

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Snow is characterized as frozen precipitation in the form of six-sided ice crystal. In order for snow to occur, temperatures in the atmosphere (from ground level to cloud level) must be at or below freezing. The strongest form of a severe snow storm is a blizzard. Blizzards are characterized by frequent wind gusts above 35 miles per hour, limited to no visibility due to falling snow and extreme cold that lasts longer than three hours. Ice storms are liquid rain that falls and freezes upon contact with cold objects. There must be an ice build-up of greater than ¼ inch for it to be considered an ice storm. When more than a ½ inch of ice build-up is forecasted a winter storm warning can be triggered.

Snowfall in Palmer averages 40 inches per season. Severe winter storms can pose a significant risk to property and human life because the rain, freezing rain, ice, snow, cold temperatures and wind associated with these storms can disrupt utility service, phone service, and make roadways extremely hazardous. The weight from multiple snowfall events can test the load ratings of building roofs and potentially cause significant damage. Multiple freeze-thaw cycles can also create large amounts of ice and make for even heavier roof loads. Severe winter storms can also be deceptive killers, with associated traffic accidents, hypothermia, and exertion-related incidents from shoveling. Infrastructure and other property are also at risk from the associated flooding that can occur following heavy snow melt.

### ***Location***

Winter weather occurs regionally and thus impacts the entire town. Members of the Planning Team indicated there are no specific problems in any part of town due to winter weather.

### ***Extent***

The Northeast Snowfall Impact Scale (NESIS) developed by Paul Kocin of The Weather Channel and Louis Uccellini of the National Weather Service (Kocin and Uccellini, 2004) characterizes and ranks high-impact Northeast snowstorms. These storms have large areas of 10-inch snowfall accumulations and greater. NESIS has five categories: Extreme, Crippling, Major, Significant, and Notable. The index differs from other meteorological indices in that it uses population information in addition to meteorological measurements. Thus NESIS gives an indication of a storm's societal impacts.

NESIS scores are a function of the area affected by the snowstorm, the amount of snow, and the number of people living in the path of the storm. The aerial distribution of snowfall and population information are combined in an equation that calculates a NESIS score which varies from around one for smaller storms to over ten for extreme storms. The raw score is then converted into one of the five NESIS categories. The largest NESIS values result from storms producing heavy snowfall over large areas that include major metropolitan centers.

**Northeast Snowfall Impact Scale Categories**

Category	NESIS Value	Description
1	1—2.499	Notable
2	2.5—3.99	Significant
3	4—5.99	Major
4	6—9.99	Crippling
5	10.0+	Extreme

Source: <http://www.ncdc.noaa.gov/snow-and-ice/rsi/nesis>

**Previous Occurrences**

Based on data available from the National Oceanic and Atmospheric Administration, there are 47 winter storms since 1958 that have registered on the NESIS scale. Of these, approximately 26 storms resulted in snow falls in the Pioneer Valley of at least 10 inches. These storms are listed in the table on the next page, in order of their NESIS severity.

**Winter Storms Producing Over 10 inches of Snow in Palmer, 1958-2014**

Date	NESIS Value	NESIS Category	NESIS Classification
3/4/2013	3.05	2	Significant
2/7/2013	4.35	3	Major
10/29/2011	1.75	1	Notable
1/9/2011	5.31	3	Major
2/23/2010	5.46	3	Major
3/15/2007	2.54	2	Significant
1/21/2005	6.8	4	Crippling
2/15/2003	7.5	4	Crippling
3/31/1997	2.29	1	Notable
2/2/1995	1.43	1	Notable
2/8/1994	5.39	3	Major
3/12/1993	13.2	5	Extreme
1/25/1987	1.19	1	Notable
2/10/1983	6.25	4	Crippling
4/6/1982	3.35	2	Significant
2/5/1978	5.78	3	Major
1/19/1978	6.53	4	Crippling
2/18/1972	4.77	3	Major
12/25/1969	6.29	4	Crippling
2/22/1969	4.29	3	Major

2/8/1969	3.51	2	Significant
2/5/1967	3.5	2	Significant
2/2/1961	7.06	4	Crippling
1/18/1961	4.04	3	Major
12/11/1960	4.53	3	Major
3/2/1960	8.77	4	Crippling
2/14/1958	6.25	4	Crippling

Source: <http://www.ncdc.noaa.gov/snow-and-ice/rsi/nesis>

In addition, the NOAA National Climatic Data Center reports 91 SNOW & ICE event(s) in Hampden County, Massachusetts between 01/01/1950 and 11/30/2009. Local officials in Palmer highlighted the ice storm of October, 2011 – while the NESIS categorization was a Category 1, or “Notable” storm, the presence of leaves on trees in this early storm caused large amounts of downfalls, with a loss of power in the town for 4 days, including the local radio system (the regional system provided a backup). The Town opened an emergency shelter for 8 days, yet many homeowners chose to stay put, leading to higher instances of fires and inhalation incidents from use of interior generators and un-used fireplaces.

### ***Probability of Future Events***

Based upon the availability of records for Hampden County, the likelihood that a severe snow storm will affect Palmer is “high” (between 40 and 70 percent in any given year).

Research on climate change indicates that there is great potential for stronger, more frequent storms as the global temperature increases. More information about the effect of Climate Change can be found in the Pioneer Valley Planning Commission’s Climate Action Plan, available at [www.sustainableknowledgecorridor.org](http://www.sustainableknowledgecorridor.org).

The Massachusetts State Climate Change Adaptation Report has additional information about the impact of climate change and can be accessed at [www.mass.gov/eea/air-water-climate-change/climate-change/climate-change-adaptation-report.html](http://www.mass.gov/eea/air-water-climate-change/climate-change/climate-change-adaptation-report.html).

### ***Impact***

The Town faces a “limited” impact or less than 10 percent of total property damaged, from snowstorms. Using an estimated value of \$657,299,200 for all property in the town and an estimated 5 percent of damage to 10 percent of residential structures, approximately \$3,286,000 worth of damage could occur from a severe snowstorm. This is a rough estimate and likely reflects a worst-case scenario. Computing more detailed damage assessments based on assessor’s records is a labor-intensive task and beyond the scope of this project. The cost of repairing or replacing the roads, bridges, utilities, and contents of structures is not included in this estimate.

### ***Vulnerability***

Based on the above assessment, Palmer has a hazard index rating of “3 — medium risk” from snowstorms and ice storms.

## Hurricanes / Tropical Storms

Hurricanes are defined as any closed circulation developing around a low-pressure center in which the winds rotate counter-clockwise in the Northern Hemisphere and whose diameter averages 10 to 30 miles across. The primary damaging forces associated with these storms are high-level sustained winds and heavy precipitation. Hurricanes are violent rainstorms with strong winds that can reach speeds of up to 200 miles per hour and which generate large amounts of precipitation. Hurricanes generally occur between June and November and can result in flooding and wind damage to structures and above-ground utilities.

### Location

Because of the hazard’s regional nature, all of Palmer is at risk from hurricanes, meaning the location of occurrence is “large.” Ridgetops are more susceptible to wind damage. Areas susceptible to flooding are also likely to be affected by heavy rainfall.

### Extent

As a hurricane develops, barometric pressure at its center falls and winds increase. If the atmospheric and oceanic conditions are favorable, it can intensify into a tropical depression. When maximum sustained winds reach or exceed 39 miles per hour, the system is designated a tropical storm, given a name, and is closely monitored by the National Hurricane Center in Miami, Florida. When sustained winds reach or exceed 74 miles per hour the storm is deemed a hurricane. Hurricane intensity is further classified by the Saffir-Simpson Hurricane Wind Scale, which rates hurricane wind intensity on a scale of 1 to 5, with 5 being the most intense.

Hurricane Damage Classifications			
Storm Category	Damage Level	Description of Damages	Wind Speed (MPH)
1	MINIMAL Very dangerous winds will produce some damage	No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Also, some coastal flooding and minor pier damage. An example of a Category 1 hurricane is Hurricane Dolly (2008).	74-95
2	MODERATE Extremely dangerous winds will cause extensive damage	Some roofing material, door, and window damage. Considerable damage to vegetation, mobile homes, etc. Flooding damages piers and small craft in unprotected moorings may break their moorings. An example of a Category 2 hurricane is Hurricane Francis in 2004.	96-110
3	EXTENSIVE Devastating damage will occur	Some structural damage to small residences and utility buildings, with a minor amount of curtain wall failures. Mobile homes are destroyed. Flooding near the coast destroys smaller structures, with larger structures damaged by floating debris. Terrain may be flooded well inland. Hurricane Ivan (2004) is an example.	111-129

4	EXTREME Catastrophic damage will occur	More extensive curtain wall failures with some complete roof structure failure on small residences. Major erosion of beach areas. Terrain may be flooded well inland. An example of a Category 4 hurricane is Hurricane Charley (2004).	130-156
5	CATASTROPHIC Catastrophic damage will occur	Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Flooding causes major damage to lower floors of all structures near the shoreline. Massive evacuation of residential areas may be required. An example of a Category 5 hurricane is Hurricane Andrew (1992).	157+

Source: National Hurricane Center, 2012

### ***Previous Occurrences***

Hurricanes that have affected Palmer are shown in the following table.

Major Hurricanes and Tropical Storms Affecting Palmer		
Hurricane/Storm Name	Year	Saffir/Simpson Category (when reached MA)
Great Hurricane of 1938	1938	3
Great Atlantic Hurricane	1944	1
Carol	1954	3
Edna	1954	1
Diane	1955	Tropical Storm
Donna	1960	Unclear, 1 or 2
Groundhog Day Gale	1976	Not Applicable
Gloria	1985	1
Bob	1991	2
Floyd	1999	Tropical Storm
Irene	2011	Tropical Storm
Sandy	2012	Post-Tropical Storm

Generally, Palmer’s location in Western Massachusetts reduces the risk of extremely high winds that are associated with hurricanes, although it can experience some high wind events. The Hurricane of 1938, blew roofs off many homes, downed power and phone lines, and downed many trees onto homes and businesses. For most other hurricanes or severe wind events, the Town has experienced small blocks of downed timber and uprooting of trees onto structures. Hurricanes can and do create flooding, and



except for the Hurricanes of 1938 and 1955 (Diane), damages from flooding have been minor according to Hazard Mitigation team members.

While “Superstorm” Sandy in late October of 2012 had severe impacts on much of the Northeastern United States, there was minimal damage that occurred due to the storm locally in Palmer. Roads were not flooded or washed out and residents did not encounter long-term displacement due to the storm's impacts. In nearby areas of western Massachusetts, there were modest impacts, with localized flooding and downed power lines. Overall, western Massachusetts was able to send emergency response resources to other states where the storm had a larger impact.<sup>1</sup>

### ***Probability of Future Events***

Palmer’s location in western Massachusetts reduces the risk of extremely high winds that are associated with hurricanes, although it can experience some high wind events. Based upon past occurrences, it is reasonable to say that there is a “low” probability (1 percent to 10 percent in any given year) of hurricanes in Palmer. Climate change is projected to result in more severe weather, including increased occurrence of hurricanes and tropical storms. Because of this, the occurrence of hurricanes will increase in the future.

### ***Impact***

The Town faces a “limited” impact from hurricanes, with 10 percent or less of Palmer affected. Using a total value of all structures in Palmer of \$657,299,200 and an estimated 10 percent of damage to 5 percent of all structures, the estimated amount of wind damage from a hurricane is \$3,287,803. Estimating that flooding would create 10 percent of damage to 20 percent of structures, the resulting damage would be \$13,146,210. The cost of repairing or replacing the roads, bridges, utilities, and contents of structures is not included in this estimate.

### ***Vulnerability***

Based on the above analysis, Palmer has a hazard index rating of “3 – Medium Risk” from hurricanes.

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<sup>1</sup> "Western Massachusetts escapes Hurricane Sandy's wrath, but impact elsewhere still being felt." [http://www.masslive.com/news/index.ssf/2012/10/western\\_massachusetts\\_escapes.html](http://www.masslive.com/news/index.ssf/2012/10/western_massachusetts_escapes.html). October 30, 2012. Accessed March 6, 2015.

## **Severe Wind / Tornadoes**

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A thunderstorm is a storm with lightning and thunder, usually producing gusty winds, heavy rain, and sometimes hail. For non-tropical events over land, the NWS issues a Wind Advisory (sustained winds of 31 to 39 mph for at least 1 hour or any gusts 46 to 57 mph) or a High Wind Warning (sustained winds 40+ mph or any gusts 58+ mph). Effects from high winds can include downed trees and/or power lines and damage to roofs, windows, etc. High winds can cause scattered power outages, and disruptions to shipping and aviation.

Tornadoes typically form in the spring and summer during severe thunderstorm events. Within Massachusetts, tornadoes have occurred most frequently in Worcester County and in communities west of Worcester, including towns in eastern Hampshire County. High wind speeds, hail, and debris generated by tornadoes can result in loss of life, downed trees and power lines, and damage to structures and other personal property.

Of additional concern are microbursts, which often do tornado-like damage and can be mistaken for tornadoes. In contrast to the upward rush of air in a tornado, air blasts rapidly downward from thunderstorms to create microbursts.

### ***Location***

Per the Massachusetts Hazard Mitigation Plan, the entire Town is at risk of high winds, severe thunderstorms, and tornadoes. The plan also identifies Palmer and the surrounding communities as having a high frequency of tornado occurrence within the state. However, the actual area affected by thunderstorms, wind, or tornadoes is “small,” with less than 10 percent of the Town affected.

### ***Extent***

Effective January 5, 2010, the NWS modified the hail size criterion to classify a thunderstorm as ‘severe’ when it produces damaging wind gusts in excess of 58 mph (50 knots), hail that is 1 inch in diameter or larger (quarter size), or a tornado (NWS, 2013). An average thunderstorm is 15 miles across and lasts 30 minutes; severe thunderstorms can be much larger and longer. Southern New England typically experiences 10 to 15 days per year with severe thunderstorms.

Microbursts are typically less than three miles across and can last anywhere from a few seconds to several minutes. Microbursts cause damaging winds up to 170 miles per hour in strength and can be accompanied by precipitation.

In a relatively short period of time and with little or no advance warning, a tornado can attain rotational wind speeds in excess of 250 miles per hour and can cause severe devastation along a path that ranges from a few dozen yards to over a mile in width. The path of a tornado may be hard to predict because they can stall or change direction abruptly. Tornadoes are measured using the enhanced F-Scale, shown with the following categories and corresponding descriptions of damage:

Enhanced Fujita Scale Levels and Descriptions of Damage			
EF-Scale Number	Intensity Phrase	3-Second Gust (MPH)	Type of Damage Done
EF0	Gale	65–85	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages to sign boards.
EF1	Moderate	86–110	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
EF2	Significant	111–135	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
EF3	Severe	136–165	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
EF4	Devastating	166–200	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.

**Previous Occurrences**

Because thunderstorms and wind affect the town regularly on an annual basis, there are not significant records available for these events. Per the Massachusetts Hazard Mitigation Plan, there are approximately 10 to 30 days of thunderstorm activity in the state each year.

No known tornados have touched down in Palmer, but the town is located in a section of the state that has been identified as having the highest density of tornadoes in the Commonwealth (Worcester County and communities west). In Western Massachusetts, the majority of sighted tornadoes have occurred in a swath east of Palmer, known as “tornado alley.” Sixteen incidents of tornado activity (all F2<sup>2</sup> or less) occurred in Hampden County between 1959 and 2015. Most notable was the very long-lived tornado of June 2011 that touched down in West Springfield and continued 39 miles through Springfield, Wilbraham, Monson (just south of Palmer), Brimfield, Southbridge, and Charlton.

In August of 2006, microbursts caused minor localized damage with downed trees, limbs, and power lines.

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<sup>2</sup> F2 refers to the commonly used Fujita Tornado Damage Scale which ranks tornados F0-F5 depending on estimated wind speeds and damages, with F5 the most severe.

### **Probability of Future Events**

One measure of tornado activity is the tornado index value. It is calculated based on historical tornado events data using USA.com algorithms. It is an indicator of the tornado level in a region – a higher tornado index value means a higher chance of tornado events. Data was used for Hampden County to determine its Tornado Index Value:

<b>Tornado Index for Hampden County</b>	
Hampden County	138.23
Massachusetts	87.60
United States	136.45

Source: USA.com

<http://www.usa.com/hampden-county-ma-natural-disasters-extremes.htm>

Based upon the available historical record, as well as Palmer’s location in a high-density cluster of state-wide tornado activity, there is a “very low” probability (less than 1 percent chance in any given year) of a tornado affecting the Town. To date, no tornadoes have touched down or tracked through Palmer.

As per the Massachusetts Hazard Mitigation Plan, there are approximately 10 to 30 days of thunderstorm activity in the state each year. Thus, there is a “moderate” probability (10 percent to 40 percent chance in any given year) of a severe thunderstorm or winds affecting the Town. Microbursts and damaging winds are expected to become more frequent and more violent as the earth’s atmosphere warms, due to predictions of climate change from global warming, giving them a “moderate” probability.

### **Impact**

Overall, Palmer faces a “limited” impact from severe thunderstorms, winds, or tornadoes, with 10 percent or less of the Town affected, though potential for locally catastrophic damage is a factor in these hazards. A tornado that hits a residential area would cause far more damage than a tornado with a travel path that ran along the town’s forested uplands. Most buildings in the town have not been built to Zone 1, Design Wind Speed Codes. The first edition of the Massachusetts State Building Code went into effect on January 1, 1975 – approximately 27% of the town’s housing was constructed prior to this date. Using a total value of all structures in Palmer of \$657,299,200 and an estimated 10 percent of damage to 5 percent of all structures, the estimated amount of damage from a tornado is \$3,286,000. The cost of repairing or replacing the roads, bridges, utilities, and contents of structures is not included in this estimate.

### **Vulnerability**

Based on the above assessment, Palmer has a hazard index rating of “2- high risk” from severe thunderstorms and winds, and a “4 – low risk” from tornadoes.

## **Wildfires / Brushfires**

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Wildfires are typically larger fires, involving full-sized trees as well as meadows and scrublands. Brushfires are uncontrolled fires that occur in meadows and scrublands, but do not involve full-sized trees. Typical causes of brushfires and wildfires are lightning strikes, human carelessness, and arson. Both wildfires and brushfires can consume homes, other buildings and/or agricultural resources. The impact of wildfires and brushfires are as follows:

- Impact to benefits that people receive from the environment, such as food/water and the regulation of floods and drought
- Impact on local heritage, through the destruction of natural features
- Impact to the economy, due to damage to property and income from land following a wildfire
- Impact through the destruction of people and property

FEMA has classifications for 3 different classes of wildfires:

- Surface fires are the most common type of wildfire, with the surface burning slowly along the floor of a forest, killing or damaging trees.
- Ground fires burn on or below the forest floor and are usually started by lightning
- Crown fires move quickly by jumping along the tops of trees. A crown fire may spread rapidly, especially under windy conditions.

### ***Location***

A majority of Palmer's land area is forested and in agriculture. The Conservation Commission has noted that some of the town's forest land contains high fuel content with more potential to burn, and can be difficult to access for extinguishing purposes. In addition, the town has several railroad corridors exposed to drier conditions and sparks from rail activity, and nearby residents are known to dump leave debris along rail corridors. The area of town that could be affected by wildfire is categorized as "medium," at between 10 percent to 50 percent of the total area.

### ***Extent***

Wildfires can cause widespread damage to the areas that they affect. They can spread very rapidly, depending on local wind speeds and be very difficult to get under control. Fires can last for several hours up to several days. In Palmer, a brushfire or wildfire would be a matter of concern in drought conditions. A large wildfire could damage much of the land mass, including vital watershed lands, in a short period of time. The presence of Palmer's professional Fire Department, and availability of other fire departments in the region could help mitigate the extent of a fire's damage.

Based on major wildfires that have occurred in western Massachusetts, it is estimated that such a fire could likely destroy around 50 to 500 acres of forested area. Wildfire ratings and extents are shown in the table below:

Wildfire Ratings and Descriptions		
Rating	Basic Description	Detailed Description
CLASS 1: Low Danger (L) Color Code: Green	Fires not easily started	Fuels do not ignite readily from small firebrands. Fires in open or cured grassland may burn freely a few hours after rain, but wood fires spread slowly by creeping or smoldering and burn in irregular fingers. There is little danger of spotting.
CLASS 2: Moderate Danger (M) Color Code: Blue	Fires start easily and spread at a moderate rate	Fires can start from most accidental causes. Fires in open cured grassland will burn briskly and spread rapidly on windy days. Woods fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel – especially draped fuel -- may burn hot. Short-distance spotting may occur, but is not persistent. Fires are not likely to become serious and control is relatively easy.
CLASS 3: High Danger (H) Color Code: Yellow	Fires start easily and spread at a rapid rate	All fine dead fuels ignite readily and fires start easily from most causes. Unattended brush and campfires are likely to escape. Fires spread rapidly and short-distance spotting is common. High intensity burning may develop on slopes or in concentrations of fine fuel. Fires may become serious and their control difficult, unless they are hit hard and fast while small.
CLASS 4: Very High Danger (VH) Color Code: Orange	Fires start very easily and spread at a very fast rate	Fires start easily from all causes and immediately after ignition, spread rapidly and increase quickly in intensity. Spot fires are a constant danger. Fires burning in light fuels may quickly develop high-intensity characteristics - such as long-distance spotting - and fire whirlwinds, when they burn into heavier fuels. Direct attack at the head of such fires is rarely possible after they have been burning more than a few minutes.
CLASS 5: Extreme (E) Color Code: Red	Fire situation is explosive and can result in extensive property damage	Fires under extreme conditions start quickly, spread furiously and burn intensely. All fires are potentially serious. Development into high-intensity burning will usually be faster and occur from smaller fires than in the Very High Danger class. Direct attack is rarely possible and may be dangerous, except immediately after ignition. Fires that develop headway in heavy slash or in conifer stands may be unmanageable while the extreme burning condition lasts. Under these conditions, the only effective and safe control action is on the flanks, until the weather changes or the fuel supply lessens.

### **Previous Occurrences**

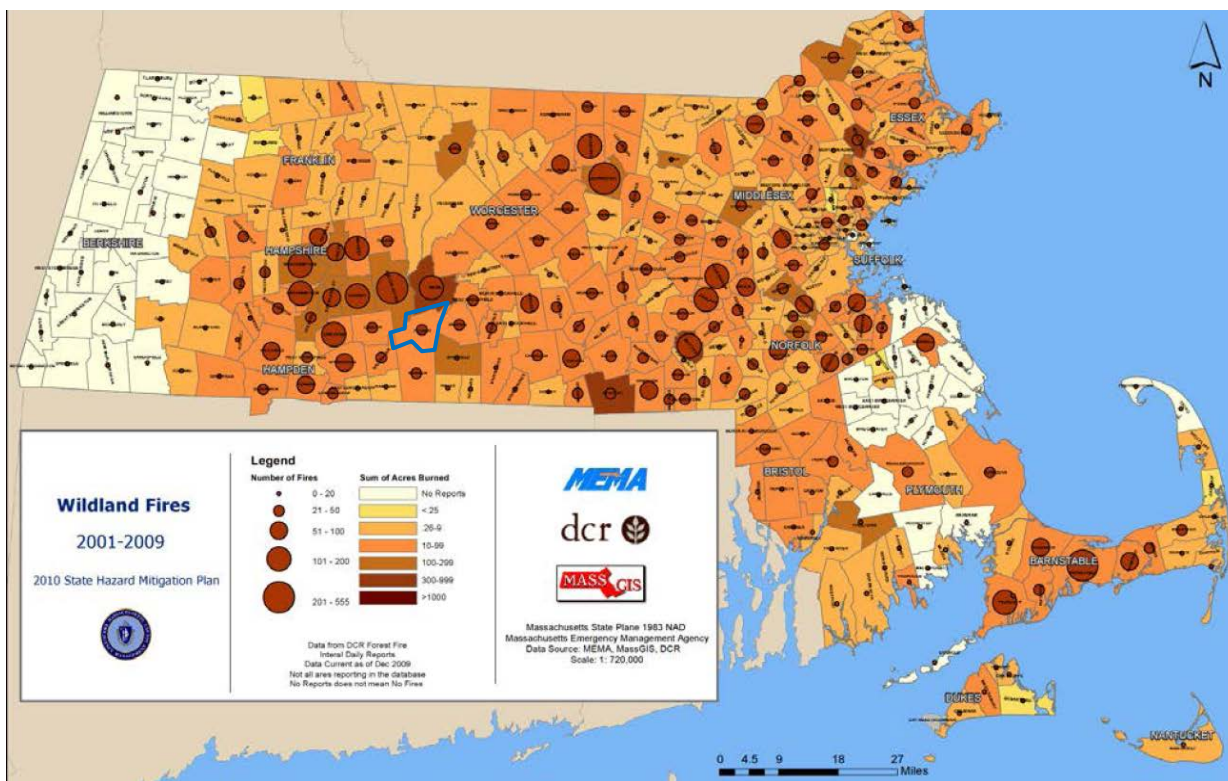
Significant fire events include: a 1943 wildfire that involved some 1,000 acres along Pettaquatic Road; a 1960s wildfire on Warren Road caused by an eagle going into a power line and involving some 500 to 600 acres; and a 1979 wildfire on Kings Mountain that involved some 125 acres;. More recently a 2000 wildfire on West Ware Road engulfed 30 acres. Two or three smaller incidents were reported occurring since 2010. According to the Palmer Fire Department, there are approximately 30 unauthorized burns

(or brushfires) per year, on average. As a point of comparison, approximately 465 open burning permits are issued annually.

Within the Pioneer Valley of Western Massachusetts, several wildfires have occurred during the past 20 years, as shown in the list below:

- 1995 – Russell, 500 acres burned on Mt. Tekoa
- 2000 – South Hadley, 310 acres burned over 14 days in the Lithia Springs Watershed
- 2001 – Ware, 400 acres burned
- 2010 – Russell, 320 acres burned on Mt. Tekoa
- 2012 – Eastern Hampden County, dry conditions and wind gusts created a brush fire in Brimfield, and burned 50 acres

The Mass. Hazard Mitigation Plan shows incidents of wildland fires in the state, 2001-09:



Source: Massachusetts Hazard Mitigation Plan

### Probability of Future Events

Similar to the Massachusetts Hazard Mitigation Plan, the Palmer Hazard Mitigation Committee found it is difficult to predict the likelihood of wildfires in a probabilistic manner because the number of variables involved. Based on previous occurrences, the Committee determined the probability of future events to be “moderate” (10 percent to 40 percent probability in the next year).

Climate scenarios project summer temperature increases between 2 and 5 degrees Celcius and precipitation decreases of up to 15 percent. Such conditions would exacerbate summer drought and further promote high-elevation wildfires, releasing stores of carbon and further contributing to the

buildup of greenhouse gases. Forest response to increased atmospheric carbon dioxide—the so-called “fertilization effect”—could also contribute to more tree growth and thus more fuel for fires, but the effects of carbon dioxide on mature forests are still largely unknown. Climate change is also predicted to bring increased wind damage from major storms, as well as new types of pests to the region. Both increased wind and the introduction of new pests could potentially create more debris in wooded areas and result in a larger risk of fires.

### ***Impact***

While a large wildfire could damage much of the forested area of Palmer, these areas are sparsely populated by people, meaning that wildfire affected areas are not likely to cause damage to property. For this reason, the Town faces a “limited” impact from wildfires, with very few damages likely to occur.

Using a total value of all structures in Palmer of \$657,299,200 and an estimated 50 percent of damage to 1 percent of all structures, the estimated amount of damage from a forest fire is \$3,286,000. The cost of repairing or replacing the roads, bridges, utilities, and contents of structures is not included in this estimate.

### ***Vulnerability***

Based on the above assessment, Palmer has a hazard risk index of “4 – low risk” from wildfires.



## Earthquakes

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An earthquake is a sudden, rapid shaking of the ground that is caused by the breaking and shifting of rock beneath the Earth's surface, usually along established faults in the Earth's crust. Earthquakes can occur suddenly, without warning, at any time of the year. New England experiences an average of 30 to 40 earthquakes each year although most are not noticed by people.<sup>3</sup> Ground shaking from earthquakes can rupture gas mains and disrupt other utility service, damage buildings, bridges and roads, and trigger other hazardous events such as avalanches, flash floods (dam failure) and fires. Un-reinforced masonry buildings, buildings with foundations that rest on filled land or unconsolidated, unstable soil, and mobile homes not tied to their foundations are at risk during an earthquake.<sup>4</sup>

### Location

Because of the regional nature of the hazard, the entire Town of Palmer is susceptible to earthquakes. This makes the location of occurrence "large," or over 50 percent of the total area.

### Extent

The magnitude of an earthquake is measured using the Richter Scale, which measures the energy of an earthquake by determining the size of the greatest vibrations recorded on the seismogram. On this scale, one step up in magnitude (from 5.0 to 6.0, for example) increases the energy more than 30 times. The intensity of an earthquake is measured using the Modified Mercalli Scale. This scale quantifies the effects of an earthquake on the Earth's surface, humans, objects of nature, and man-made structures on a scale of I through XII, with I denoting a weak earthquake and XII denoting an earthquake that causes almost complete destruction.

Richter Scale Magnitudes and Effects	
Magnitude	Effects
< 3.5	Generally not felt, but recorded.
3.5 - 5.4	Often felt, but rarely causes damage.
5.4 - 6.0	At most slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions.
6.1 - 6.9	Can be destructive in areas up to about 100 kilometers across where people live.
7.0 - 7.9	Major earthquake. Can cause serious damage over larger areas.
8 or >	Great earthquake. Can cause serious damage in areas several hundred kilometers across.

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<sup>3</sup> Northeast States Emergency Consortium Web site: [www.nesec.org/hazards/earthquakes.cfm](http://www.nesec.org/hazards/earthquakes.cfm).

<sup>4</sup> Federal Emergency Management Agency Web site: [www.fema.gov/hazards/earthquakes/quake.shtm](http://www.fema.gov/hazards/earthquakes/quake.shtm).

Modified Mercalli Intensity Scale for and Effects			
Scale	Intensity	Description Of Effects	Corresponding Richter Scale
I	Instrumental	Detected only on seismographs.	
II	Feeble	Some people feel it.	< 4.2
III	Slight	Felt by people resting; like a truck rumbling by.	
IV	Moderate	Felt by people walking.	
V	Slightly Strong	Sleepers awake; church bells ring.	< 4.8
VI	Strong	Trees sway; suspended objects swing, objects fall off shelves.	< 5.4
VII	Very Strong	Mild alarm; walls crack; plaster falls.	< 6.1
VIII	Destructive	Moving cars uncontrollable; masonry fractures, poorly constructed buildings damaged.	
IX	Ruinous	Some houses collapse; ground cracks; pipes break open.	< 6.9
X	Disastrous	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread.	< 7.3
XI	Very Disastrous	Most buildings and bridges collapse; roads, railways, pipes and cables destroyed; general triggering of other hazards.	< 8.1
XII	Catastrophic	Total destruction; trees fall; ground rises and falls in waves.	> 8.1

Source: US Federal Emergency Management Agency

**Previous Occurrences**

The most recent earthquakes to affect Palmer, and the collective number of earthquakes in New England are shown in the following tables:

Largest Earthquakes Affecting Palmer, MA, 1925 – 2015		
Location	Date	Magnitude
Ossipee, NH	December 20, 1940	5.5
Ossipee, NH	December 24, 1940	5.5
Dover-Foxcroft, ME	December 28, 1947	4.5
Kingston, RI	June 10, 1951	4.6
Portland, ME	April 26, 1957	4.7
Middlebury, VT	April 10, 1962	4.2
Near NH Quebec Border, NH	June 15, 1973	4.8
West of Laconia, NH	Jan. 19, 1982	4.5
Plattsburg, NY	April 20, 2002	5.1
Bar Harbor, NH	October 3, 2006	4.2
Hollis Center, ME	October 16, 2012	4.6

Source: Northeast States Emergency Consortium website, [www.nesec.org/hazards/earthquakes.cfm](http://www.nesec.org/hazards/earthquakes.cfm)

New England States Record of Historic Earthquakes		
State	Years of Record	Number Of Earthquakes
Connecticut	1668 - 2007	137
Maine	1766 - 2007	544
Massachusetts	1668 - 2007	355
New Hampshire	1638 - 2007	360
Rhode Island	1776 - 2007	38
Vermont	1843 - 2007	73
New York	1840 - 2007	755
<i>Total Number of Earthquakes within the New England states between 1638 and 1989 is 2262.</i>		

*Source: Northeast States Emergency Consortium website, [www.nesec.org/hazards/earthquakes.cfm](http://www.nesec.org/hazards/earthquakes.cfm)*

### **Probability of Future Events**

One measure of earthquake activity is the Earthquake Index Value. It is calculated based on historical earthquake events data using USA.com algorithms. It is an indicator of the earthquake activity level in a region. A higher earthquake index value means a higher chance of earthquake events. Data was used for Hampden County to determine the Earthquake Index Value as shown in the table below.

Earthquake Index for Hampden County	
Hampden County	0.24
Massachusetts	0.70
United States	1.81

*Source: USA.com*

Based upon existing records, there is a “very low” frequency (less than 1 percent probability in any given year) of an earthquake in Palmer.

### **Impact**

Massachusetts introduced earthquake design requirements into their building code in 1975 and improved building code for seismic reasons in the 1980s. However, these specifications apply only to new buildings or to extensively-modified existing buildings. Buildings, bridges, water supply lines, electrical power lines and facilities built before the 1980s may not have been designed to withstand the forces of an earthquake. This is particularly true for a large number of the buildings in Palmer – a third of which were built prior to 1980 and could likely be completely destroyed by a significant earthquake. The seismic standards have also been upgraded with the 1997 revision of the State Building Code. Liquefaction of the land near water could also lead to extensive destruction.

The Town faces a “critical” impact from significant earthquakes, with more than 25 percent of Palmer affected. While a significant earthquake, estimated to be approximately of magnitude 6.1 or higher, would cause the destructive impacts described above, a smaller earthquake would have only “minor” impacts, with little damage to property. As shown in the table of the Richter Scale above, an earthquake of 6.0 or lower would result in at most slight damage to well-designed buildings. Earthquakes between 3.5 and 5.4 would be felt but rarely cause damage, and earthquakes smaller than 3.5 would not be noticed.

Using a total value of all structures in Palmer of \$657,299,200 and an estimated 100 percent of damage to 25 percent of all structures (“critical” impact), the estimated amount of damage from an earthquake is \$164,325,000. The cost of repairing or replacing the roads, bridges, utilities, and contents of structures is not included in this estimate.

### ***Vulnerability***

Based on the above analysis, Palmer has a hazard index rating of “4 – Low Risk” from earthquakes.

## **Dam Failure / Levee Breach**

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Dams and levees and their associated impoundments provide many benefits to a community, such as water supply, recreation, hydroelectric power generation, and flood control. However, they also pose a potential risk to lives and property. Dam or levee failure is not a common occurrence, when a dam or levee fails, the potential energy of the stored water behind the dam is released rapidly. Most dam or levee failures occur when floodwaters above overtop and erode the material components of the dam.

Many dams in Massachusetts were built during the 19<sup>th</sup> Century without the benefit of modern engineering design and construction oversight, and can fail because of structural problems due to age, lack of proper maintenance, or structural damage caused by an earthquake or flooding.

The Massachusetts Department of Conservation and Recreation Office of Dam Safety is the agency responsible for regulating dams in the state. Regulated dams are in excess of 6 feet in height (regardless of storage capacity) or have more than 15 acre feet of storage capacity (regardless of height). Dam safety regulations enacted in 2005 transferred significant responsibilities for dams from the State of Massachusetts to dam owners, including the responsibility to conduct dam inspections.

The state has three hazard classifications for dams:

- **High Hazard:** Dams located where failure or improper operation will likely cause loss of life and serious damage to homes, industrial or commercial facilities, important public utilities, main highways, or railroads.
- **Significant Hazard:** Dams located where failure or improper operation may cause loss of life and damage to homes, industrial or commercial facilities, secondary highways or railroads or cause interruption of use or service of relatively important facilities.
- **Low Hazard:** Dams located where failure or improper operation may cause minimal property damage to others. Loss of life is not expected.

The inspection schedule for dams is as follows:

- Low Hazard dams – 10 years
- Significant Hazard dams – 5 years
- High Hazard dams – 2 years

The time intervals represent the maximum time between inspections. More frequent inspections may be performed at the discretion of the state. Dams and reservoirs licensed and subject to inspection by the Federal Energy Regulatory Commission (FERC) are excluded from the provisions of the state regulations provided that all FERC-approved periodic inspection reports are provided to the DCR. All other dams are subject to the regulations unless exempted in writing by DCR.

### ***Location***

Based on DCR sources and local knowledge, there are 15 dams in Palmer. Of these, none is ranked as high hazard, five are ranked as significant hazard, and three are ranked as low hazard. The remainder are non-jurisdictional – the storage capacity of the impoundment and height of dam are such that they need not be regulated. The failure of a high hazard dam could affect a “medium” amount of the land area in Palmer, or between 10 and 50 percent of the total land area. The table below identifies dams within the town, state id, name of owner, condition, last inspection date, and hazard risk classification:

Dams and Dikes in Palmer or Affecting Palmer					
Dam name/ date built	ID	Owner	Condition/last inspected	Regulatory Authority	Hazard Potential
Bondsville Lower Dam/1900	MA00561	Unknown	Fair 5/22/2012	Office of Dam Safety	Significant
Bondsville Upper Dam/1900	MA00560	Belchertown Land Trust	Poor 11/20/2013	Office of Dam Safety	Significant
Diamond International Corp. Upper Dam/1876 †	MA00562	Energy Thorndike, Inc.	Satisfactory 12/8/2009	Office of Dam Safety	Significant
Diamond International Corp. Lower Dam/1872 †	MA00563	Energy Thorndike, Inc.	Fair 6/15/2007	Office of Dam Safety	Significant
Forest Lake Dam/1900	MA00559	Linda Resser	Fair 7/29/2009	Office of Dam Safety	Low
Lizak #2 Basin Dam/	MA01960	Heritage Hills Farms, Inc.		Non-Jurisdictional**	N/A
Lizak #3 Basin Dam/	MA01961	Heritage Hills Farms, Inc.		Non-Jurisdictional**	N/A
Lizak Pond Dam	MA01959	DFG - Dept. of Fish and Game		Non-Jurisdictional**	N/A
Mango Pond Dam*/	MA01958	DOT - Dept. of Transportation	Fair 7/22/2009	Office of Dam Safety	Low
Palmer Lower Reservoir Dam	MA03381	Town of Palmer, Palmer Fire District #1	N/A	Non-Jurisdictional**	N/A
Palmer Reservoir Upper Dam/1900	MA00557	Palmer Fire District #1	Satisfactory 11/6/2014	Office of Dam Safety	Significant
Sasur Pond Dam/	MA02374	John and Maxine Sasur		Non-Jurisdictional**	N/A
State Fish Hatchery Lower Dam/1900	MA02538	DFG - Dept. of Fish and Game	Good June 1987	Non-Jurisdictional**	N/A
State Fish Hatchery Upper Dam/1900	MA02537	DFG - Dept. of Fish and Game	Fair June 1987	Non-Jurisdictional**	N/A
Thompson Lake Dam/1900	MA00558	Lake Thompson Civic Assoc.	Fair 6/17/2009	Office of Dam Safety	Low
V.V. McNitt Dam/1900	MA01957	Osterman Gas		Non-Jurisdictional**	N/A

Source: Massachusetts Department of Conservation and Recreation, Office of Dam Safety, 10/5/2015.

† Licensed by the Federal Energy Regulatory Commission.

\* Palmer's DPW Director indicates that this dam is nothing more than a dropped inlet.

\*\* Jurisdictional determinations made by DCR based on storage capacity of impoundment / dam height.

### Extent

Dam or levee breaches often lead to catastrophic consequences as the water rushes in a torrent downstream flooding an area engineers refer to as an "inundation area." The number of casualties and the amount of property damage will depend upon the timing of the warning provided to downstream

residents, the number of people living or working in the inundation area, and the number of structures in the inundation area. Dams in Massachusetts are assessed according to their risk to life and property. The state has three hazard classifications for dams – High, Significant, and Low. The above table rates each of Palmer’s dams. None is ranked as high hazard and five are ranked as significant hazard.

Beyond the Town’s boundaries, the Winsor Dam and the Goodnough Dike, maintained by the state at the 50,000+ acre Quabbin Reservoir, present perhaps the greatest possible threat to the residents of Palmer. The 1993 Emergency Action Plan (EAP) for the Quabbin Reservoir indicates, “The sudden failure of the Winsor Dam or Goodnough Dike would result in a major disaster of unforeseen magnitude....” The Emergency Action Plan indicates that the flood wave begins with a leading edge, followed by the arrival of a peak flood that is then followed by a lengthy flood recession. Following is a table showing the EAP estimates for areas of Palmer:

Dam Break Analysis from Quabbin Reservoir Emergency Action Plan, 1993			
Area	Leading Edge Arrival Time	Peak Flood Arrival Time	Max. Surface Water Elevation
<b>Bondsville</b>	1 hour	2 hours	<b>425 feet</b>
<b>Three Rivers</b>	1 hour	5.5 hours	<b>376 feet</b>
<b>Palmer</b>	<b>2 hours</b>	<b>5.5 hours</b>	<b>375 feet</b>

***Previous Occurrences***

Palmer has a history of two dam failures, both occurring during the flood of 1955. The Palmer Reservoir Upper Dam owned by the Fire District gave way, flooding a development of 40 to 50 homes with two to three feet of water. The dam was later rebuilt. During that same time, flood waters overtopped the Thompson Lake Dam, washing out Smith Street and Route 32 at the location of the fish hatchery. The spillway on the dam was expanded to improve capacity after this event. In 2005’s large rain event, town officials opened drains in the Palmer Reservoir dams to lessen pressure, causing localized flooding downstream.

***Probability of Future Events***

As Palmer’s high hazard dams age, and if maintenance is deferred, the likelihood of a dam bursting will increase, but currently the frequency of dam failures is “very low” with a less than 1 percent chance of a dam bursting in any given year.

***Impact***

Because of the location of critical facilities in the valley bottoms, the Town faces a “critical” impact from failure of dams or levees with a high hazard level, with a collective 30 percent of Palmer affected.

The estimated property loss of each high- and significant hazard dam in Palmer is shown below. Other dams are not expected to have a risk to property and people. Costs are based on the total value of all property in Palmer of \$657,299,200, with 50% of value damaged.

While the state does not evaluate the hazard level of levees, the Hazard Mitigation Committee assessed the levee system and determined the percent of Town affected by their failure to be up to 25 percent.

High and Significant Hazard Dams in, or Affecting, Palmer			
Dam	Hazard Potential	Percent of City Affected	Cost
Diamond International Corp. Upper Dam/1876	Significant	15%	\$42,297,000
Diamond International Corp. Lower Dam/1872	Significant	10%	\$32,865,000
Palmer Reservoir Upper Dam/1900	Significant	20%	\$65,730,000
Bondsville Upper Dam/1900	Significant	15%	\$42,297,000
Bondsville Lower Dam/1900	Significant	10%	\$32,865,000

***Vulnerability***

Based on this analysis, Palmer has an overall hazard index rating of “5 – very low risk” from dam failure or levee breach.



## Drought

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Drought is a normal, recurrent feature of climate. It occurs almost everywhere, although its features vary from region to region. In the most general sense, drought originates from a deficiency of precipitation over an extended period of time, resulting in a water shortage for some activity, group, or environmental sector. Reduced crop, rangeland, and forest productivity; increased fire hazard; reduced water levels; increased livestock and wildlife mortality rates; and damage to wildlife and fish habitat are a few examples of the direct impacts of drought. Of course, these impacts can have far-reaching effects throughout the region and even the country.

### **Location**

Because of this hazard’s regional nature, a drought would impact the entire town, meaning the location of occurrence is “large” or over 50 percent of the Town affected.

### **Extent**

The severity of a drought would determine the scale of the event and would vary among city residents depending on whether the residents’ water supply is derived from a private well or the public water system. The U.S. Drought Monitor records information on historical drought occurrence. Unfortunately, data could only be found at the state level. The U.S. Drought Monitor categorizes drought on a D0-D4 scale as shown below.

U.S. Drought Monitor		
Classification	Category	Description
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered
D1	Moderate Drought	Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested
D2	Severe Drought	Crop or pasture losses likely; water shortages common; water restrictions imposed
D3	Extreme Drought	Major crop/pasture losses; widespread water shortages or restrictions
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies

Source: US Drought Monitor, <http://droughtmonitor.unl.edu/classify.htm>

### **Previous Occurrences**

In Massachusetts, six major droughts have occurred statewide since 1930.<sup>5</sup> To date, Palmer has not been impacted by any previous droughts in the state. They ranged in severity and length, from three to eight years. In many of these droughts, water-supply systems were found to be inadequate. Water was piped in to urban areas, and water-supply systems were modified to permit withdrawals at lower water levels. The following table indicates previous occurrences of drought since 2000, based on the US Drought Monitor:

Annual Drought Status	
Year	Maximum Severity
2000	No drought
2001	D2 conditions in 21% of the state
2002	D2 conditions in 99% of the state
2003	No drought
2004	D0 conditions in 44% of the state
2005	D1 conditions in 7% of the state
2006	D0 conditions in 98% of the state
2007	D1 conditions in 71% of the state
2008	D0 conditions in 57% of the state
2009	D0 conditions in 44% of the state
2010	D1 conditions in 27% of the state
2011	D0 conditions in 0.01% of the state
2012	D2 conditions in 51% of the state
2013	D1 conditions in 60% of the state
2014	D1 conditions in 54% of the state
2015	D1 conditions in 100% of the state

*Source: US Drought Monitor*

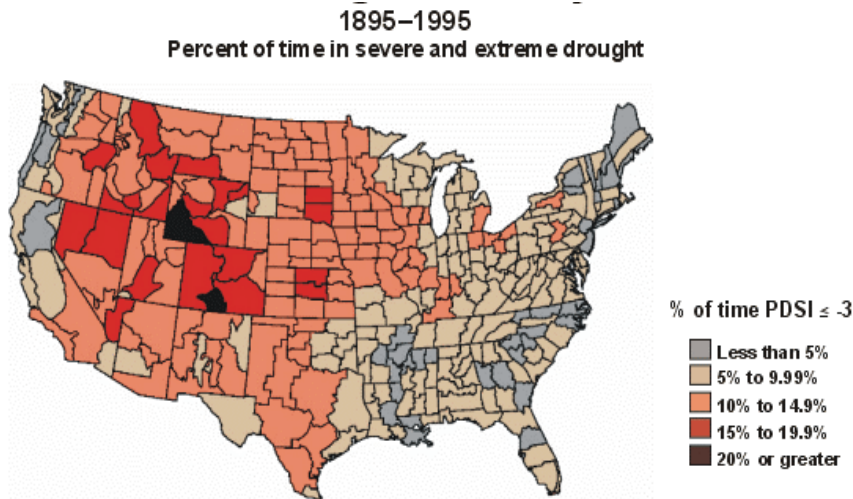
### **Probability of Future Events**

In Palmer, as in the rest of the state, drought occurs at a “low” probability (1 to 10 percent in the next year). Based on past events and current criteria outlined in the Massachusetts Drought Management Plan, it appears that western Massachusetts may be more vulnerable than eastern Massachusetts to severe drought conditions. However, many factors, such as water supply sources, population, economic factors (i.e., agriculture based economy), and infrastructure, may affect the severity and length of a drought event. When evaluating the region’s risk for drought on a national level, utilizing a measure called the Palmer Drought Severity Index, Massachusetts is historically in the lowest percentile for severity and risk of drought, according to the National Drought Mitigation Center.

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<sup>5</sup> *US Geological Survey Water-Supply Paper 2375. “National Water Summary 1989 – Floods and Droughts: Massachusetts.” Prepared by S. William Wandle, Jr., US Geological Survey.*

Due to the water richness of western Massachusetts, Palmer is unlikely to be adversely affected by anything other than a major, extended drought. While such a drought would require water saving measures to be implemented, there would be no foreseeable damage to structures or loss of life resulting from the hazard.



### ***Impact***

The impact of droughts is categorized by the U.S. Drought Monitor include:

- Slowing or loss of crops and pastures
- Water shortages or restrictions
- Minor to significant damage to crops, pastures;
- Low water levels in streams, reservoirs, or wells

However, the Town's local aquifer supply would help to reduce the effects of widespread drought on the local water supply. The impact of a drought is thus "minor," with little damage to people or property likely to occur.

### ***Vulnerability***

Based on the above assessment, Palmer has a hazard index rating of "5 – very low risk" from drought.

## Man-Made Hazards: Hazardous Materials

Hazardous materials are chemical substances, which if released or misused can pose a threat to the environment or health. These chemicals come in the form of explosives, flammable and combustible substances, poisons, and radioactive materials. Hazardous materials in various forms can cause death, serious injury, long-lasting health effects, and damage to buildings, homes, and other property. Many products containing hazardous chemicals are used and stored in homes and businesses routinely. These products are also shipped daily on the nation's highways, railroads, waterways, and pipelines.

### Location

Hazardous materials are a consideration at 18 facilities in Palmer (3 sites have been removed from the list since 2010). Most of these facilities in town are considered Tier II Hazardous Materials storage facilities. The Toxics Release Inventory (TRI) is a publicly available EPA data base that contains information on specific toxic chemical releases and other waste management activities reported annually by certain industry groups as well as federal facilities. Facilities are listed in the table below and shown on the Past & Potential Hazards/Critical Facilities Map.

Hazardous Materials Sites in Palmer, MA	
Industry	Address
American Dry Ice Corporation *	19 Second Street, Palmer Industrial Park, Palmer
GAC Water Treatment Plant*	Off Salem Street, Palmer
Gravel Pack Well #1*	Off Salem Street, Palmer
Gravel Pack Well #2*	Off Salem Street, Palmer
Mustang Motorcycles, Inc. #	4 Springfield Street, Three Rivers
Noonan Energy Corporation*	1488 North Main Street, Palmer
Noonan Energy Corporation*	70 Foundry Street, Palmer
Osterman Gas *	1 Blanchard St, Palmer, MA
Palmer #503 National Grid Substation*	9 Fuller Street, Thorndike
Palmer Foundry Inc. *#	22 Mt. Dumplin Road, Palmer
Palmer Paving Corp. *	25 Blanchard St, Palmer, MA
Palmer Water Pollution Control *	1 Norbell Street, Three Rivers
Profiles, Inc. #	7 First Street, Palmer
Rathbone Precision Metals, Inc. *#	1241 Park Street, Palmer
Thorndike #523 National Grid Substation*	Park Street off Route 20
Baystate Wing Memorial Hospital	40 Wright Street, Palmer
USPS-Palmer, Main Post Office *	Park Street, Palmer
Verizon Palmer Co. *	1028 Pleasant Street, Palmer

\* = Tier II Facility      # = TRI Facility

In addition, Palmer is host to the Massachusetts Turnpike, several principal state roads, and three rail corridors. The latter are known to frequently carry hazardous materials such as propane, ammonia, and ethanol. Because of this, the area of impact is described as “medium.”

### ***Extent***

The extent of impact from a release of hazardous material varies widely, depending on the nature of the materials involved, the method of release (an explosion or spill into a river will have greater consequences than a spill onto solid surface), nearby uses and exposures, and the time until clean-up. Palmer relies on Springfield’s HazMat team for responding to incidents involving hazardous materials through a mutual aid agreement.

### ***Previous Occurrences***

There is no history of any major accidents involving some sort of oil or chemical spill, but transportation of chemicals and bio-hazardous materials by vehicle transport both on the railroad and on Route 181, or the Massachusetts Turnpike (and Route 20 when the Turnpike is closed) is a concern. Members of the Planning Committee remember a CSX derailment in the mid-late 1990s bringing an emergency response, though fortunately nothing was spilled.

### ***Probability of Future Events***

Given the number of businesses using and storing hazardous materials, and the frequent transportation of materials via rail and road through Palmer, there is a possibility of a hazard event occurring, though this is deemed as “low” given the safety precautions in place.

### ***Impact***

Generally this hazard affects individual industrial sites and transportation corridors. Noting the existing safety measures in place, preventative and response, the overall impact of this hazard is considered “minor.” However, depending on the chemicals involved and if groundwater or surface water is infiltrated, impacts could be much larger.

### ***Vulnerability***

Based on the above assessment, Palmer has a hazard index rating of “5 – very low risk” from hazardous materials.

## Potential Climate Change Impacts

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Climate change is already causing natural hazards to have more of an impact on Palmer, with hotter summers, wetter winters, more severe storms, and more frequent flooding. In the future, climatic changes are projected to result in Palmer experiencing higher temperatures and more precipitation. There will also be wider variability in weather extreme and more days of extreme heat, more heat waves, more floods, more droughts, and more tornados, hurricanes and heavy storms.

For each of the hazard types described above, we have tried to incorporate potential impacts of climate change, relying on the following sources:

- The 2007 report of the Northeast Climate Impacts Assessment (NECIA)
- The Pioneer Valley Planning Commission's *Our Next Future: An Action Plan for Building a Smart, Resilient Pioneer Valley*, which includes climate change projections
- The Massachusetts Climate Change Adaptation Report
- The Massachusetts Multi-Hazard Mitigation Plan

Generally, expected impacts include the following:

### ***Increased Flooding***

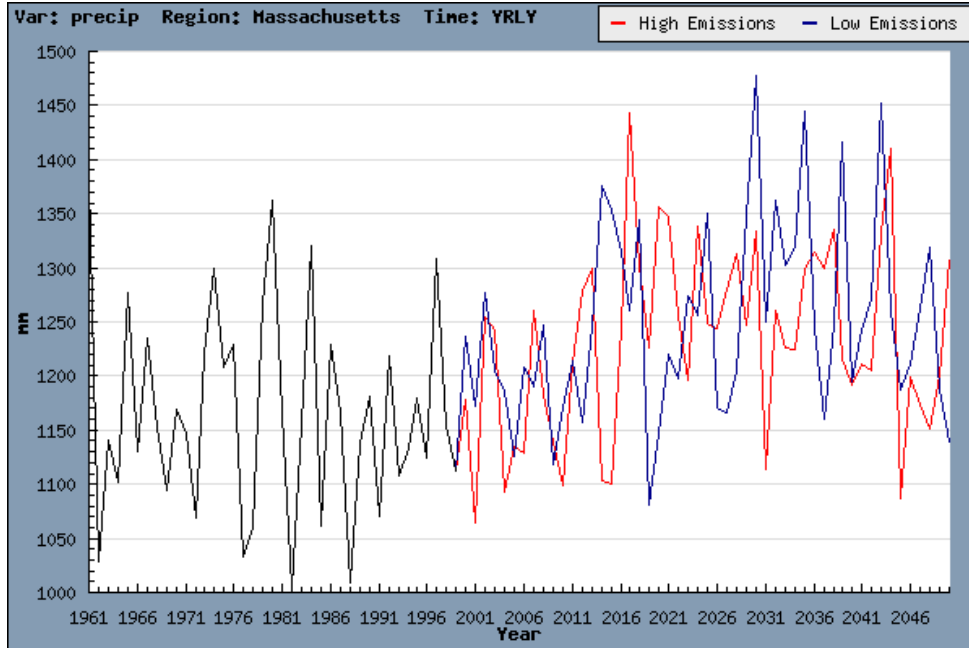
By the end of the 21<sup>st</sup> century, annual precipitation is expected to increase by 14 percent – however, this increase will be a result of more winter precipitation – an increase of 30 percent– while summer precipitation will actually slightly decrease. Most of this winter precipitation is projected to be in the form of rain rather than snow. This will result in a continuation of the current trend of an overall decrease in total snowfall, as well as the number of days that have snow cover. The increased amount of large precipitation events and overall increase in rainfall will likely result in more flooding in the region.

Increased flooding will have the following projected impacts to people and property:

- More damage to areas within FEMA flood zone designation. Many of these areas already flood consistently, and so climate change will be potentially very damaging. The socioeconomic status of residents in the floodplains is lower than the Town as a whole, meaning that flooding will have a greater impact on lower income residents.
- Increased occurrences of localized flooding, in areas designated on the Hazard Identification map. The Town of Palmer believes this to be a minor risk.
- Increased stress on the Town's flood pumps and levee system.
- Increased instances of standing water will lead to increased mosquito populations and greater risk of disease vectors.

In order to prepare for changes in severe weather and flooding, the Town of Palmer has adopted the 500-year floodplain standard in place of a 100-year floodplain, since it is expected that storms currently considered to be 500-year floods will occur more frequently in the future. As additional climate change research is completed, the Town will continue to refine its flooding estimates.

### Massachusetts Rainfall 1961-2050



Rainfall has increased approximately 10% during the past 50 years, and is expected to continue to increase. *Source: NECIA*

#### Expected Climatic Variations Due to Climate Change

Category	Current (1961-1990 avg.)	Predicted Change 2040-2069	Predicted Change 2070-2099
Average Annual Temperature (°F)	46°	50° to 51°	51° to 56°
Average Winter Temperature (°F)	23°	25.5° to 27°	31° to 35°
Average Summer Temperature (°F)	68°	69.5° to 71.5°	74° to 82°
Days over 90 °F	5 to 20 days	-	30 to 60 days
Days over 100 °F	0 to 2 days	-	3 to 28 days
Annual Precipitation	41 inches	43 to 44 inches	44 to 47 inches
Winter Precipitation	8 inches	8.5 to 9 inches	9 to 10.4 inches
Summer Precipitation	11 inches	10.9 to 10.7 inches	10.9 to 11 inches

*Sources: Massachusetts Climate Adaptation Report 2011, NECIA*

#### Increased Temperatures

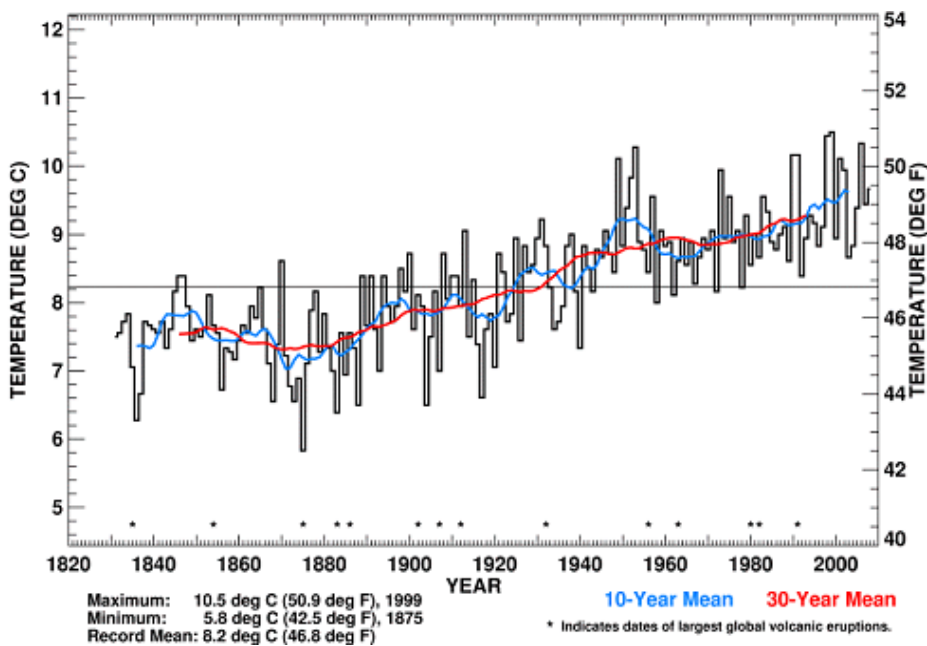
Average temperatures in the Pioneer Valley have been increasing over time in the Pioneer Valley due to climate change, and this trend is likely to continue in the future. Higher temperatures due to climate change will likely have an effect on future drought risk in Palmer. The climate of the Pioneer Valley is strongly influenced by the weather patterns of the larger Northeast United States, where average temperatures have been increasing since the late 1800s. The overall average annual temperature increase in this area has been approximately .9 degrees C (1.5°F) since approximately 1900.

According to records of the United States Historical Climatology Network, most of this temperature increase has occurred recently, with an average increase of about 0.2 degrees C (0.5°F) per decade since 1970. These higher average temperatures have primarily been the result of warmer winters (December through March), during which there has been an increase of 1.3°F per decade since 1970. In addition to average temperature increases, the number of extremely hot and record heat days has also increased: the number of days with temperatures of 90°F and higher throughout the Northeast has doubled during the past 45 years. The northern portion of the Northeast currently sees about 5 days per year with temperatures over 90°F and no days over 100°F, while the southern portion sees up to 20 days over 90°F and 2 days over 100°F.

Increased temperatures will have the following projected impacts to people and property:

- Increased temperatures will put stress on current food production and require farming operations to adjust by planting new varieties of crops.
- Changes are also likely to introduce new insect species, pests, and invasive plant species to the region, which will result in further threats to food production and also adversely affect natural systems and biodiversity. Additional prominence of ticks may potentially also lead to more occurrence of Lyme disease.
- Increased energy usage in order to cool buildings in the summer and long-term electrical needs will increase.
- Greater stress on special populations, such as senior citizens, without access to air conditioning during heat waves.

**Northeast U.S. Region Annual Average Temperatures 1831-2008**



From 1831 to 2008, there was a trend in temperatures steadily increasing at the National Weather Service’s Blue Hill Observatory, the home of the oldest continuously recorded weather records in the U.S. *Source: Michael J. Iacono, Atmospheric and Environmental Research, Inc./ Blue Hill Observatory, MA. Plot includes temperature data for 1831–1884 from Milton and Canton that were adjusted to the Blue Hill summit location.*



## ***Severe Weather***

Temperature and precipitation changes in the region will lead to increased severe and extreme weather events, including:

- Slight decrease in summer precipitation that will result in an increase in the number of droughts. Short-term (1 to 3 month) droughts are likely to increase in their frequency in the Northeast to the level of once per year. According to the CT Climate Adaptation Report, "Facing Our Future," the occurrence of drought in that state is already increasing, with shallower lakes drying up.<sup>6</sup>
- Decreased rainfalls will potentially create more occurrences of wildfires.
- Less dependable rainfall will also impact the Pioneer Valley's food systems, in the form of less dependable rainfall and require the region's farming operations to evolve.
- Increased occurrences of major snowstorms, especially during times previously considered unseasonably warm. Should storms occur when there are still leaves on trees, there could be great damage due to broken limbs, as happened during the snowstorm of 2011.
- Increased occurrences of severe thunderstorms and hurricanes, which will result in more wind damage from major storms and greater flooding.

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<sup>6</sup> *State of Connecticut Department of Environmental Protection. Facing Our Future: Adapting to Connecticut's Changing Climate. March 2009.*

## Other Hazards

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In addition to the hazards identified above, the Hazard Mitigation Team reviewed the full list of hazards listed in the Massachusetts Hazard Mitigation Plan. Due to the location and context of the Town, coastal erosion, landslides, ice jams, and tsunamis, were determined to not be a threat.

Extreme temperatures, while identified in the state Hazard Mitigation Plan, was determined by the Palmer Hazard Mitigation Committee to not currently be a primary hazard to people, property, or critical infrastructure in Palmer. While extreme temperatures can result in increased risk of wildfire, this effect is addressed as part of the “Wildfire/Brushfire” hazard assessment. As described in the hazard assessment of climate change, extreme temperatures are likely to have a larger effect on the Town in the future. The Hazard Mitigation Committee will continue to assess the impact of extreme temperature and update the Hazard Mitigation Plan accordingly.

Landslides, while identified in the State Hazard Mitigation Plan, were determined by the Palmer Hazard Mitigation Committee to not be a primary hazard to people, property, or critical infrastructure in Palmer. The town’s topography does contain some steeply sloped areas, but these and lesser slopes are covered with mature forests, reducing the probability and impact of landslides. The Hazard Mitigation Committee will continue to monitor development and any land clearing in town and will update the plan to include landslides if they believe the risk is heightened due to these practices.

## 7: MITIGATION STRATEGIES

The following goal continues to serve as a framework for Palmer’s hazard mitigation efforts:

*To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to the following hazards: flooding, severe snowstorms/ice storms, severe thunderstorms, hurricanes, tornadoes, wildfires/brushfires, earthquakes, dam failures, and drought.*

### **Prioritized Implementation Strategies**

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The 2010 Hazard Mitigation Plan evaluated all of the Town’s existing policies and practices related to natural hazards, identified potential gaps in protection, and developed a set of hazard mitigation strategies to implement.

For this update, the Committee has noted those strategies which have been completed and determining if the remaining strategies are still relevant given any changed circumstances. Since the last plan, there has been a good deal of progress in establishing an Emergency Operations Center and other preparedness efforts, so priorities have somewhat shifted to improving land use regulations and public outreach efforts. To this end, the Committee proposed new implementation strategies where appropriate, coordinating with Town documents such as the Open Space and Recreation Plan, Community Development Plan, and relevant by-laws. Strategies were also selected which posed positive cost/benefits, using the figures developed in the Risk Assessment of Chapter 5.

In the following sections, strategies are organized by the following:

- Local Plans and Regulations
- Structure and Infrastructure Projects
- Natural Systems Protection
- Education and Awareness Programs

### **Status**

No mitigation strategies from the former plan are being abandoned. Where mitigation strategies from the former plan were completed, completion dates are noted and those strategies are highlighted in grey. Where mitigation strategies from the former plan are being carried forward, or new mitigation strategies are proposed, new completion dates are assigned.

### **Responsible Parties**

Abbreviations used in the tables:

CC = Conservation Commission

DPW = Department of Public Works

EMD = Emergency Management Director

PB = Planning Board

TC = Town Council

## ***Cost Estimates***

The strategies is provided with an estimated cost, using categories since precise financial estimates are not known at this time, or depend on staff and volunteer labor. Generally, categories are as follows:

- **Low** – cost less than \$50,000
- **Medium** – cost between \$50,000 – \$100,000
- **High** – cost over \$100,000

Cost estimates take into account the following resources:

- City staff time for grant application and administration (at a rate of \$25 per hour)
- Consultant design and construction cost (based on estimates for projects obtained from city and general knowledge of previous work in city)
- City staff time for construction, maintenance, and operation activities (at a rate of \$25 per hour)

## ***Prioritization***

The following categories are used to define the priority of each mitigation strategy:

- **Low** – Strategies that would not have a significant benefit to property or people, address only one or two hazards, or would require funding and time resources that are impractical
- **Medium** – Strategies that would have some benefit to people and property and are somewhat cost effective at reducing damage to property and people
- **High** – Strategies that provide mitigation of several hazards and have a large benefit that warrants their cost and time to complete

Categories were assigned with the following considerations:

- **Application to multiple hazards** – Strategies are given a higher priority if they assist in the mitigation of several natural hazards.
- **Time required for completion** – Projects that are faster to implement, either due to the nature of the permitting process or other regulatory procedures, or because of the time it takes to secure funding, are given higher priority.
- **Estimated benefit** – Strategies which would provide the highest degree of reduction in loss of property and life are given a higher priority.
- **Cost effectiveness** – Priority is given to low-cost strategies. Strategies that have identified potential funding streams, such as the Hazard Mitigation Grant Program, are also given higher priority.

### Local Plans and Regulations

The following mitigation strategies seek to influence the way land and buildings are developed and maintained:

Mitigation Strategy	Hazards Mitigated	Status	Responsible Parties	Estimated Cost	Potential Funding Source	Priority
Update Earth Removal Ordinance to collect assurance bond and close-out bond, and introduce more monitoring and enforcement.	Flooding	Completed	PB	N/A	N/A	N/A
Increase enforcement of Earth Removal Ordinance by requiring monitoring well inspections 3 times per year.	Flooding	2017	PB	Low	Town Staff/ Applicants	Medium
Revise hazardous materials definitions in Water Supply Protection District zoning for clarification, using DEP state model.	Haz. Mat.	2021	PB, Water Districts, Fire, EMD	Low	Town Staff	High
Revise zoning regulations to right-size required amounts of parking, reduce minimum size of parking spaces, incorporate low-impact development approaches	Flooding	2017	PB	Low	Town Staff	Medium
Introduce better background checks on developers, and more inspections for subdivision and special permit development. (Town now holds pre-construction meetings & requires inspections before, during, after construction)	Flooding	Completed	PB, Building Dept.	N/A	N/A	N/A
Require "as-built" drawings for all subdivisions and larger developments.	All	2021	PB, Building Dept.	Low	Town Staff	Medium
Implement relevant goals and policies in Open Space and Recreation Plan.	Flooding, Wind, Fire	2021	CC, PB, TC, Assessor	Medium	Town Staff, DEP, other as relevant	Medium
Increase enforcement of burning regulations, having fines in place for offenders.	Fire	2017	Fire Dept.	Low	Town Staff	High

### **Structure and Infrastructure Projects**

The following implementation items concern changes to physical infrastructure to protect them from hazards or decrease the impact of hazards:

<b>Mitigation Strategy</b>	<b>Hazards Mitigated</b>	<b>Status</b>	<b>Responsible Parties</b>	<b>Estimated Cost</b>	<b>Potential Funding Source</b>	<b>Priority</b>
Establish True Emergency Operations Center.	All	Completed 2014	Town Manager, TC, EMD	N/A	N/A	N/A
Work with Community Emergency Response Team to equip and maintain emergency response trailer.	All	Completed, maintenance ongoing	EMD	Low	Town Staff	Low
Update priority list of culvert replacements and other construction projects to effectively manage flooding.	Flooding	2017	DPW, CC	High	Town Staff, DOT, DEP, other infrastructure grants	High
Implement relevant goals and policies in Open Space and Recreation Plan.	Flooding, Wind, Fire	2021	CC, PB, TC, Assessor	Medium	Town Staff, Volunteers, DEP, others as relevant	Medium
Ensure all identified shelters have sufficient back-up utility service in the event of power failure.	Snow, Earthquake, Wind, Hurricane	Completed 2012	EMD, Fire, Police	N/A	N/A	N/A
Obtain most recent maps of inundation areas and evacuation routes for high hazard dams; install evacuation route signage.	Dam Failure	Completed 2012	EMD	N/A	N/A	N/A

### **Natural Systems Protection**

The following implementation items seek to preserve and restore the functions of natural systems:

Mitigation Strategy	Hazards Mitigated	Status	Responsible Parties	Estimated Cost	Potential Funding Source	Priority
Implement relevant goals and policies in Open Space and Recreation Plan.	Flooding, Wind, Fire	2021	CC, PB, TC, Assessor	Medium	Town Staff, Volunteers, DEP, other as relevant	Medium
Work with National Grid to receive notification of street tree trimming and require replacement trees.	Snow	2021	Forest Warden	Low	Town Staff	Low
Improve management of town-owned forest lands to reduce burn potential.	Fire	Ongoing	Forest Warden, CC	Medium	Town Staff, volunteers, DEP, Town Funds	Medium
Work with affected property owners to educate and install “beaver deceiver” style outflow devices.	Flooding	Ongoing	CC	Low	Town Staff, Volunteers	Medium

### **Education and Awareness Programs**

The following implementation items seek to inform and educate citizens, property owners, and officials about hazards and mitigation efforts:

Mitigation Strategy	Hazards Mitigated	Status	Responsible Parties	Estimated Cost	Potential Funding Source	Priority
Understand procedures for emergency notification to local television stations to supplement Connect-CTY notification system.	All	Completed 2010	EMD	Medium	N/A	N/A
Collect, periodically update, and disseminate information on emergency information via town website on what to include in a ‘home survival kit,’ how to prepare homes and other structures to withstand flooding and high winds, and the proper evacuation procedures to follow during a natural disaster.	All	Completed 2011, updates ongoing	EMD	Low	Town Staff, Volunteers	Medium

Mitigation Strategy	Hazards Mitigated	Status	Responsible Parties	Estimated Cost	Potential Funding Source	Priority
Work to attain regional status for Local Emergency Planning Committee and certification for all hazards emergency planning.	All	Ongoing	EMD	Low	Town Staff, Volunteers	Low
Conduct workshop for large parcel owners regarding tax policies of open space / agricultural designation and other land protection.	Flooding, Wind, Fire	2017	CC	Low	Town Staff, Volunteers	Medium
Educate citizens living in floodplains about NFIP, pending availability of funding.	Flooding	Ongoing	Building Dept., CC	Low	Town Staff, Volunteers	Medium
Consider participating in the NFIP's Community Rating System, allowing FEMA to rate floodplain management efforts and potential reduce insurance premium costs for local property owners.	Flooding	2021	PB, CC	Low	Town Staff, Volunteers, FEMA	Low
Conduct annual meetings on emergency preparedness with utility companies (Verizon, Mobile Pipeline, Baystate Gas, Comcast, National Grid)	Snow, Hurricane, Wind	Ongoing	EMD	Low	Town Staff	Low
Work with State of Massachusetts to understand and get training relative to Emergency Action Plan for Winsor Dam and Goodnough Dike.	Dam Failure	Ongoing	EMD	Low	Town Staff, Volunteers	Low



# 8: PLAN REVIEW, EVALUATION, IMPLEMENTATION, AND ADOPTION

## Plan Adoption

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Upon completion of the draft Hazard Mitigation Plan, a public meeting was held on June 13, 2016 to receive comments. The draft Hazard Mitigation Plan was then submitted to the Massachusetts Emergency Management Agency (MEMA) and the Federal Emergency Management Agency for their review. Upon receiving conditional approval of the plan by FEMA, the plan was presented to the Palmer Town Council and adopted.

## Incorporation with Other Planning Documents

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Existing plans, studies, reports and municipal documents were incorporated throughout the planning process. This included a review and incorporation of significant information from the following key documents:

- **Community Development Plan** – this acts as the Town’s master plan, and was used to identify major land use trends, issues, and goals in Palmer.
- **Zoning Ordinance** –Zoning was used to gather identify those actions that the town is already taking that are reducing the potential impacts of a natural hazard (i.e. floodplain regulations) to avoid duplicating existing successful efforts.
- **Open Space and Recreation Plan** this Plan was used to identify the natural context within which the town mitigation planning would take place. This proved useful insofar as it identified water bodies, rivers, streams, infrastructure components (i.e. water and sewer, or the lack thereof), as well as population trends. This was incorporated to ensure that the Town’s mitigation efforts would be sensitive to the surrounding environment.
- **Massachusetts’ State Hazard Mitigation Plan** - This plan was used to insure that the town’s HMP was consistent with the State’s Plan.

After this plan has been approved by both FEMA and the local government, links to the plan will be emailed to all Town staff, boards, and committees, with a reminder to review the plan periodically and work to incorporate its contents, especially the action plan, into other planning processes and documents. In addition, during annual monitoring meetings for the Hazard Mitigation Plan implementation process, the Hazard Mitigation Committee will review whether any of these plans are in the process of being updated. If so, the Hazard Mitigation Committee will remind people working on these plans, policies etc. of the 2016 Hazard Mitigation Plan Update, and urge them to incorporate the plan into their efforts. The Hazard Mitigation Committee will also review current Town programs and policies to ensure that they are consistent with the mitigation strategies described in this plan. The Hazard Mitigation Plan will also be incorporated into updates of the Town's Community Development Plan and Open Space and Recreation Plan.

While it is the understanding of the Hazard Mitigation committee that the previous Hazard Mitigation plan has been integrated into other planning mechanisms in the Town, the Hazard Mitigation committee did not track this work. The committee is committed to doing so going forward.

## **Monitoring Implementation**

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The implementation of this plan began upon its approval by MEMA and FEMA and formal adoption by the Town Council. Those Town departments and boards responsible for ensuring the development of policies, ordinance revisions, and programs as described in Chapter 7 of the plan will be notified of their responsibilities immediately following approval.

The Palmer Hazard Mitigation Committee will oversee the implementation of the plan. The Committee will meet on an annual basis or as needed (i.e., following a natural disaster) to monitor the progress of implementation, evaluate the success or failure of implemented recommendations, and brainstorm for strategies to remove obstacles to implementation. Following these discussions, it is anticipated that the committee may decide to reassign the roles and responsibilities for implementing mitigation strategies to different Town departments and/or revise the goals and objectives contained in the plan. The committee will review and update the plan every year, beginning in the fall of 2016. Meetings of the committee will be organized and facilitated by the Emergency Management Director.

Meetings will involve evaluation and assessment of the plan, regarding its effectiveness at achieving the plan's goals and stated purpose. The following questions will serve as the criteria that is used to evaluate the plan:

### *Plan Mission and Goal*

- Is the Plan's stated goal and mission still accurate and up to date, reflecting any changes to local hazard mitigation activities?
- Are there any changes or improvements that can be made to the goal and mission?

### *Hazard Identification and Risk Assessment*

- Have there been any new occurrences of hazard events since the plan was last reviewed? If so, these hazards should be incorporated into the Hazard Identification and Risk Assessment.
- Have any new occurrences of hazards varied from previous occurrences in terms of their extent or impact? If so, the stated impact, extent, probability of future occurrence, or overall assessment of risk and vulnerability should be edited to reflect these changes.
- Is there any new data available from local, state, or Federal sources about the impact of previous hazard events, or any new data for the probability of future occurrences? If so, this information should be incorporated into the plan.

### *Existing Mitigation Strategies*

- Are the current strategies effectively mitigating the effect of any recent hazard events?
- Has there been any damage to property since the plan was last reviewed?
- How could the existing mitigation strategies be improved upon to reduce the impact from recent occurrences of hazards? If there are improvements, these should be incorporated into the plan.

### *Proposed Mitigation Strategies*

- What progress has been accomplished for each of the previously identified proposed mitigation strategies?
- How have any recently completed mitigation strategies affected the Town's vulnerability and impact from hazards that have occurred since the strategy was completed?
- Should the criteria for prioritizing the proposed mitigation strategies be altered in any way?
- Should the priority given to individual mitigation strategies be changed, based on any recent changes to financial and staffing resources, or recent hazard events?

### *Review of the Plan and Integration with Other Planning Documents*

- Is the current process for reviewing the Hazard Mitigation Plan effective? Could it be improved?
- Are there any Town plans in the process of being updated that should have the content of this Hazard Mitigation Plan incorporated into them?
- How can the current Hazard Mitigation Plan be better integrated with other Town planning tools and operational procedures, including the zoning bylaw, the Comprehensive Emergency Management Plan, and the Capital Improvement Plan?

Public participation will be a critical component of the Hazard Mitigation Plan maintenance process. The Hazard Mitigation Committee will hold all meetings in accordance with Massachusetts open meeting laws. Hard copies of the plan will be available in Palmer Town Hall.

With an anticipated adoption date in the fall of 2016, this plan will expire after 5 years, in 2021. At that time, the Committee will work with Pioneer Valley Planning Commission to conduct and update the Palmer Local Natural Hazards Mitigation Plan. In order to meet the required 2021 submission, the process to update the Natural Hazard Mitigation Plan Update should begin in early 2021. The updated plan will then be submitted to MEMA and FEMA in the fall of 2021.

## 9: APPENDICES

### **Appendix A – Documentation of the Planning Process**

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**Palmer Hazard Mitigation Committee Meeting Agendas/Sign-In Sheets**

**Public Meeting Sign-In Sheets**

**Press Releases**

# PALMER HAZARD MITIGATION PLAN UPDATE

## Meeting Notice

Palmer Hazard Mitigation Committee Meeting #1  
 Tuesday, April 5, 2016  
 10:00 am to 11:00 am  
 Palmer Town Hall

### AGENDA

- I. Introduction
- II. Hazard Mitigation Planning Overview
- III. Convene Planning Team
  - a. Additional Committee Members?
- IV. Review Planning Process
- V. Outreach Strategy
  - a. Dates for Committee meetings
  - b. Dates for Public Meetings
  - c. Date for Council presentation
- VI. Homework for next meeting – review Community Capabilities section.

### Sign-In Sheet:

COM. MITG #1

PALMER HAZARD MITIGATION PLAN UPDATE A  
 Tuesday, April 05, 2016

NAME	POSITION	EMAIL	PHONE
Linda Leduc	Town Planner Eco. Dev. Director	lleduc@townofpalmer.com	413-283-2605
Andrew Galas	Asst. Town Manager	AGalas@townofpalmer.com	413-283-2603
GERRY SKOWRONEK	DPW Director	gskowronek@townofpalmer.com	413-283-2671
ALAN ROY	FIRE CHIEF - DIST. 1	CHIEF@PALMERFIREDEPARTMENT.ORG	413-283-3861 x112
DONALD ELLIOTT	PALMER EMER. MGT.	donaled5930@Comcast.net	
Angela Panaccione	Conservation Agent	conservation@townofpalmer.com	(413) 283-2611

# PALMER HAZARD MITIGATION PLAN UPDATE

## Meeting Notice

Palmer Hazard Mitigation Committee Meeting #2  
 Tuesday, April 19, 2016  
 10:00 am to 11:00 am  
 Palmer Town Hall

### AGENDA

- I. Introduction
- II. Community Capabilities Review
  - a. Planning and Regulatory
  - b. Administrative and Technical
  - c. Financial
- III. Community Assets Review
  - a. Essential (emergency)
  - b. Non-Essential:
    - i. People/Economy
    - ii. Buildings/Cultural Resources
    - iii. Infrastructure
    - iv. Natural Environment
- IV. Homework for next meeting – review Hazards

#### Sign-In Sheet:

COM. MTG. #2

PALMER HAZARD MITIGATION PLAN UPDATE		
Tuesday, April 19, 2016		
NAME	POSITION	EMAIL / PHONE
STAWN RAIRIGHT	PUPC	srairigh@pupc.org
Linda Leduc	Town planner	lleduc@townofpalmer.com 283-2605
Angela Panaccione	Conservation Agent	conservation@townofpalmer.com
Andrew Golas	Asst. Town Manager	413-283-2611 Agolas@TownofPalmer.com
DON ELLIOTT	EMD	413 283-2603
ALAN Roy	PALMER FD	donald5900@Comcast.net chief@palmerfiredepartment.org

# PALMER HAZARD MITIGATION PLAN UPDATE

## Meeting Notice

Palmer Hazard Mitigation Committee Meeting #3  
Tuesday, April 26, 2016  
10:00 am to 11:00 am  
Palmer Town Hall

### AGENDA

- I. Introduction
- II. Complete Review of Community Assets
- III. Review Potential Hazards
  - a. Flooding
  - b. Snow
  - c. Hurricanes
  - d. Wind/Tornado
  - e. Wildfires
  - f. Earthquakes
  - g. Dam Failure
  - h. Drought
- IV. Prep for First Public Meeting
- V. Homework for next meeting – review Strategies section

### Sign-In Sheet:

Com. MTG #3

**PALMER HAZARD MITIGATION PLAN UPDATE**  
Tuesday, April 26, 2016

NAME	POSITION	EMAIL / PHONE
Andrew Golas	Asst. Town Manager	Agolas@TownofPalmer
Gerry Skowronek	DPW Director	gskow@townofpalmer.com
ALAN J. ROY	FIRE CHIEF	CHIEF@PALMERFIREDEPARTMENT.ORG
DON ELLIOTT	PALMER EMD	donald1920@Comcast.NET
Linda Leduc	Town planner	lleduc@townofpalmer

# PALMER HAZARD MITIGATION PLAN UPDATE

## Meeting Notice

Palmer Hazard Mitigation Committee Meeting #4  
Tuesday, May 3, 2016  
10:00 am to 11:00 am  
Palmer Town Hall

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### AGENDA

- I. Introduction
- II. Findings from First Public Meeting
- III. Complete Review of Hazards
- IV. Review Community Goals and Actions
- V. Prioritize Actions

### Sign-In Sheet:

MTG#4 MAY 3 10am	
NAME	ORG
Andrew Colas	Town of Palmer
Geno Stewart	Palmer DPW
Linda Leduc	Town planner
Angela Panaccione	Conservation Agent
Don ELLIOTT	PALMER LEMD



# PALMER HAZARD MITIGATION PLAN UPDATE

## Meeting Notice

Palmer Hazard Mitigation Committee Meeting #5  
Tuesday, May 10, 2016  
10:00 am to 11:00 am  
Palmer Town Hall

### AGENDA

- I. Introduction
- II. Complete Implementation Action Plan
- III. Map Review
- IV. Plan Maintenance Procedures
- V. Prep for Second Public Meeting and Council Presentation

### Sign-In Sheet:

PALMER HAZARD MITIGATION PLAN UPDATE		
Meeting #5: Tuesday, May 11, 2016		
NAME	POSITION	EMAIL / PHONE
Andrew Golas	ASST. Town Manager	Agolas@TownofPalmer.com
GERY SKOWONEK	DPW Director	gskowonek@TownofPalmer.com
SHAWN R AIRIGHT	PUPC	scraighe@pupc.org
DON ELLIOTT	EMD	donald5920@Comcast.net
ALAN ROY	PALMER F.D.	chief@palmerfiredepartment.org

## Public Meeting #1

### Sign-In Sheet:

PALMER HAZARD MITIGATION PLAN UPDATE	
Public Meeting #1: Tuesday, May 11, 2016	
NAME	STREET/NEIGHBORHOOD/VILLAGE
No PUBLIC ATTENDEES CAME, COMMITTEE MEMBERS ONLY	

## Public Meeting #2

### Sign-In Sheet:

PALMER HAZARD MITIGATION PLAN UPDATE	
Public Meeting #2: Monday, June 6, 2016	
NAME	STREET/NEIGHBORHOOD/VILLAGE
George Skowronek	Town of Palmer DPO
Andrew Golas	Town of Palmer
Don ELLIOTT	" " " EMD
ALAN Roy	PALMER FIRE - DIST. 1

# Town Council Presentation

## Agenda

16-153



**PALMER TOWN COUNCIL MEETING**  
**Monday June 13, 2016 @ 6:30 PM**  
**Town Council Meeting Room, Palmer Town Building**  
**Agenda**

16 JUN - 9 PM 4: 19  
TOWN OF PALMER, MA  
TOWN CLERK'S OFFICE

1. Roll Call
2. Pledge of Allegiance
3. Visitors Comments\*
4. Meeting Minutes
  - a) March 28, 2016
  - b) April 11, 2016
  - c) April 25, 2016
5. Old Business
  - a) 6:30 pm – Public Hearing - FY17 Budget Hearing
  - b) 1<sup>st</sup> Reading - Town Ordinance Recodification
  - c) Bergeron Land Donation - Authorization for Acceptance
6. New Business
  - a) Community Preservation Act Presentation
  - b) John King Marker Relocation
  - c) Hazard Mitigation Plan – 5 Year Update
  - d) Lawrence Street Zone Change Request
7. Subcommittee Reports
8. Town Manager's Report
9. Misc. Correspondence
10. Councilor's Roundtable
11. Adjournment of Formal Session

\*If you are here to speak on an agenda item we ask that you wait until the agenda item comes up for discussion. All other comments are welcome at that time

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This meeting will be televised live on Channel 15 and taped and shown on M-Pact on Thursday at 1:00 PM

## Press Release – PVPC Kick-off



### MEDIA RELEASE

CONTACT: Catherine Ratté, PVPC Principal Planner, (413) 781-6045 or [cratte@pvpc.org](mailto:cratte@pvpc.org)

FOR IMMEDIATE RELEASE  
August 10, 2015

### **Hazard Mitigation Plan Status in the Pioneer Valley**

Over the last 10 years, the Pioneer Valley Planning Commission has helped 41 communities in the Pioneer Valley develop hazard mitigation plans, making them eligible for grant opportunities from the Federal Emergency Management Agency (FEMA) and the Massachusetts Emergency Management Agency (MEMA).

Through the hazard mitigation planning process, communities assess their vulnerability to natural hazards, such as flooding, snowstorms, hurricanes, tropical storms, and tornadoes. They also prioritize a set of mitigation strategies that will help eliminate the long-term risk to human life and property from these hazards. Common mitigation strategies that are eligible for grant funding from FEMA and MEMA include localized flood reduction projects, structural retrofitting of existing buildings, culvert improvements, installation of emergency backup generators, and infrastructure retrofits.

PVPC provides guidance in all aspects of the development of hazard mitigation plans, including identification and mapping of natural hazards, collaboration with municipal officials to prioritize mitigation strategies, and public outreach.

PVPC has recently completed plan updates and/or the development of new plans for Agawam, Easthampton, Granville, Hampden, Longmeadow, Montgomery, Northampton, Southwick, Tolland, Wales, Ware, and Wilbraham. PVPC is actively working with Amherst, Belchertown, Blandford, Chester, Chesterfield, Chicopee, Cummington, East Longmeadow, Goshen, Granby, Hadley, Hatfield, Holland, Holyoke, Huntington, Ludlow, Monson, Palmer, South Hadley, Southampton, Westfield, Westhampton, and Williamsburg on their plans.

Hazard mitigation plans must be updated every five years. As a result, hazard mitigation planning work is continually underway in PVPC's 43 member municipalities. Area businesses, residents, and surrounding communities are encouraged to participate in the local community planning process.

For more information, please contact PVPC's Catherine Ratté at [cratte@pvpc.org](mailto:cratte@pvpc.org) or (413) 781-6045.

## Press Release – Public Meetings



### **MEDIA RELEASE**

CONTACT: Shawn Rairigh (413) 781-6045 or [srairigh@pvpc.org](mailto:srairigh@pvpc.org)

FOR IMMEDIATE RELEASE  
April 27, 2016

### **Palmer Sets Public Meetings for Hazard Mitigation Plan Update**

Palmer residents are invited to provide comments on the update of the Town of Palmer's Hazard Mitigation Plan at two public meetings, which will be held May 11, 2016 at 11 a.m. and June 6, 2016 at 6 p.m. Both meetings will take place at the Palmer Town Administration Building, 4417 Main Street, Palmer. All members of the public are welcome to attend the event. Local businesses, residents of neighboring communities, and municipal officials of neighboring communities are also encouraged to attend and provide their feedback.

The meetings will include an introduction to the Hazard Mitigation update process, an overview of past hazards in the Town, and a summary of mitigation initiatives. Municipal officials and PVPC staff will be available to answer questions and listen to comments.

The plan is being produced by the Town with assistance from the Pioneer Valley Planning Commission and is funded by the Federal Emergency Management Agency (FEMA) and the Massachusetts Emergency Management Agency (MEMA).

This planning effort is being undertaken to help the Town of Palmer assess the risks faced from natural hazards, identify action steps that can be taken to prevent damage to property and loss of life, and prioritize funding for mitigation efforts.

For more information, please contact PVPC's Shawn Rairigh at [srairigh@pvpc.org](mailto:srairigh@pvpc.org) or (413) 781-6045.



**TOWN OF PALMER**

**Town Council Agenda  
October 11, 2016**

Sponsor: Administration

**RESOLUTION NO.: 2017-04**

**PURPOSE:** To adopt the Palmer Hazard Mitigation Plan as Approved by MEMA & FEMA

.....  
**TOWN COUNCIL MEETING DATE: October 11, 2016**

WHEREAS, the Town of Palmer established a Committee to prepare the Palmer Hazard Mitigation plan; and

WHEREAS, several public planning meetings were held in May and June 2016 regarding the development and review of the Palmer Hazard Mitigation Plan; and

WHEREAS, the Palmer Hazard Mitigation Plan contains several potential future projects to mitigate hazard damage in the Town of Palmer; and

WHEREAS, the Palmer Town Council voted to formally approve and adopt the Palmer Hazard Mitigation Plan on October 11, 2016.

NOW, THEREFORE BE IT RESOLVED that the Palmer Town Council adopts the Palmer Hazard Mitigation Plan.

**DATED: October 11, 2016**

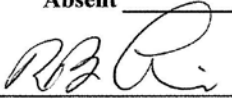
**Voted:**

Unanimous \_\_\_\_\_ Yes \_\_\_\_\_

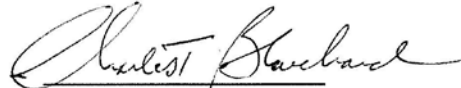
Yes   6   No   0  

Abstentions       0      

Absent       1      



**Robert Lavoie, Clerk  
Town Council**



**Charles T. Blanchard,  
Town Manager**