APPENDIX E. SUPPLEMENTARY DATA

E.1 Earthquake

Many sources provided historical information regarding previous occurrences and losses associated with earthquakes throughout New York State. Therefore, with so many sources reviewed for the purpose of this HMP, loss and impact information for many events could vary depending on the sources. According to the New York State 2014 HMP, between 1973 and 2012, 189 earthquakes were epicentered in New York State. Of those 189 earthquakes, four were reported in Putnam County.

Between 1954 and 2014, New York State was included in one earthquake-related major disaster (DR) or emergency (EM) declaration. Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. However, not all counties were included in the disaster declaration. Putnam County was not included in any DRs or EMs (FEMA, 2014).

For this HMP, known earthquakes events that have impacted New York State and Putnam County between 1950 and 2014 are identified in Table E.1-1. Many sources were researched for historical information regarding earthquake events in Putnam County; therefore, Table E.1-1 may not include all earthquake events that have impacted the County.

Table E.1-1. Earthquake Events Impacting Putnam County, 1950 to 2014

Dates of Event	Event Type	Location	FEMA Declaration Number	County Designated?	Losses / Impacts
May 23, 1971	Earthquake 3.5 – 4.1	Blue Mountain Lake, NY	N/A	N/A	No reference and/or no damage reported.
June 7, 1974	Earthquake 3.0	Wappingers Falls, NY	N/A	N/A	Windows broken
June 9, 1975	Earthquake 3.5	Plattsburgh, NY	N/A	N/A	Chimneys and fireplaces cracked
December 30, 1979	Earthquake 2.5	Armonk, NY	N/A	N/A	No reference and/or no damage reported.
January 17, 1980	Earthquake 2.9	Peekskill, NY	N/A	N/A	No reference and/or no damage reported.
February 2, 1983	Earthquake 3.0	Scarsdale-Lagrangeville	N/A	N/A	Chimneys cracked
January 26, 1985	Earthquake 2.2	Greenville, NY	N/A	N/A	No reference and/or no damage reported.
October 1985	Earthquake 4.0	Greenburgh, between Ardsley and Yonkers	N/A	N/A	Tremors shook the metropolitan area and were felt in Philadelphia, southern Canada, and Long Island
October 19, 1985	Earthquake 2.0	Greenville, NY	N/A	N/A	No reference and/or no damage reported.

Table E.1-1. Earthquake Events Impacting Putnam County, 1950 to 2014

Dates of Event	Event Type	Location	FEMA Declaration Number	County Designated?	Losses / Impacts
October 19, 1985	Earthquake 3.6	Greenville, NY	N/A	N/A	No reference and/or no damage reported.
October 21, 1985	Earthquake 2.8	Greenville, NY	N/A	N/A	No reference and/or no damage reported.
January 4, 1986	Earthquake 1.8	Greenville, NY	N/A	N/A	No reference and/or no damage reported.
April 22, 1986	Earthquake 2.7	Greenville, NY	N/A	N/A	No reference and/or no damage reported.
December 20, 1986	Earthquake 1.9	Greenville, NY	N/A	N/A	No reference and/or no damage reported.
November 1988	Earthquake 6.0	90 miles north of Quebec, Canada	N/A	N/A	This earthquake was felt in the Lower Hudson Valley and in New York City.
June 1991	Earthquake 4.4	West of Albany	N/A	N/A	Rattled homes throughout the area
April 12, 1991	Earthquake 2.0-2.7	Westchester County, NY and Fairfield, CT	N/A	N/A	Last just five seconds and caused no damage
August 22, 2000	Earthquake 2.5	Carmel, NY	N/A	N/A	Numerous residents in Putnam County reported having felt this earthquake.
January 17, 2001	Earthquake 2.4	Upper East Side of Manhattan, NY	N/A	N/A	No reference and/or no damage reported.
April 20, 2002	Earthquake 5.2	Au Sable Forks, NY	DR-1415	No	Some roads, bridges, chimneys and water lines damaged in Clinton and Essex Counties. Many buildings in the area had cracked walls and foundations, broken windows and small items knocked from shelves. Maximum intensity (VII) at Au Sable Forks. Felt from New Brunswick and Maine to Ohio and Michigan and from Ontario and Quebec to Maryland.
January 2003	Earthquake 1.2 and 1.4	Hastings-on-Hudson	N/A	N/A	No reference and/or no damage reported.
March 2006	Earthquake 1.1 and 1.3	Rockland, NY	N/A	N/A	Two earthquakes struck Rockland County. The first, 1.1, struck 3.3 miles southwest of Pearl River and the second, 1.3, was centered in the West Nyack-Blauvelt-Pearl River area.
February 18, 2009	Earthquake 2.3	Greater New York Area	N/A	N/A	No reference and/or no damage reported.
June 23, 2013	Earthquake 2.1	Greater New York Area	N/A	N/A	No reference and/or no damage reported.
February 1, 2014	Earthquake 1.8	Rye Brook, NY	N/A	N/A	No reference and/or no damage reported.

Table E.1-1. Earthquake Events Impacting Putnam County, 1950 to 2014

Dates of Event	Event Type	Location	FEMA Declaration Number	County Designated?	Losses / Impacts
May 11, 2014	Earthquake 1.7	Heritage Hills, NY	N/A	N/A	No reference and/or no damage reported.
July 5, 2014	Earthquake 2.5	5.2 miles from Peekskill	N/A	N/A	No reference and/or no damage reported.

Source(s): NYS DHSES, 2014; USGS, 2014; Kim, 1999; Stover and Coffman, 1989; Journal News Online 2011; PIX11 News 2014 ; FEMA 2014
CT Connecticut
DR Major Disaster Declaration (FEMA)
FEMA Federal Emergency Management Agency
N/A Not Applicable
NY New York
USGS U.S. Geological Survey

E.2 Extreme Temperature

Many sources provided historical information regarding previous occurrences and losses associated with extreme temperatures throughout New York State and Putnam County. With so many sources reviewed for the purpose of this HMP, loss and impact information for many events could vary. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP.

The Midwest Regional Climate Center (MRCC) operates an online annual temperature extremes database of the Continental U.S., otherwise known as "MRCC Cooperative Observer Station Annual Temperature Record Data Set". The data set contains the annual maximum and minimum temperature records for stations in the U.S. Each station has a cooperative observer system i.d. number (coop number), and those examined for this HMP had a running length of more than five years. In New York State, there are 269 stations that were observed; however, only one station in Putnam County (Town of Carmel). Not every city, town and/or village in New York State contains a station (MRCC, 2012).

There may be some potential problems with the data collected at the stations. The records were created by MRCC at the request of a user. The values of the all-time records for stations with brief histories are limited in accuracy and could vary from nearby stations with longer records. Although the data sets have been through quality control, there is still a need for more resources to quality control extremes. The record sets are for single stations in the cooperative observer network and are limited to the time of operation of each station under one coop number. The records for a place may need to be constructed from several individual station histories. Some of the data may vary from NWS records due to NWS using multiple stations and additional sources like record books (MRCC, Date Unknown). Based on the data provided by MRCC, Table E.2-1 presents the extreme cold (minimum) and hot (maximum) temperature records for Putnam County from 1888 to 2003.

Table E.2-1. MRCC Temperature Extremes – Putnam County

Station ID	Name	Begin	End	Max (oF)	Max Date	Min (oF)	Min Date	Avg Max	Avg Min
301207	Carmel_1_SW	1888	2003	103	7/9/1936	-24	1/22/1961	50.8	29.8

Source: MRCC, 2012
Notes: Begin Year is when the data collection began; End Year is when the data collection stopped.

Between 1954 and 2014, New York State was not included in any major disaster declarations or emergency declarations due to extreme temperatures. Information regarding specific details of temperature extremes in

Putnam County is scarce; therefore, previous occurrences and losses associated with extreme temperature events are limited. Table E.2-2 summarizes the extreme temperature events in the County.

Table E.2-2. Extreme Temperature Events between 1950 and 2014

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
July 4-6, 1999	Heat	N/A	N/A	Heat indices reached 110 degrees. 33 people in the New York Metro area were killed; none were in Putnam County.
January 17-18, 2000	Extreme Cold/Wind Chill	N/A	N/A	Wind chills reached -20 to -30 degrees. No injuries or fatalities were reported in Putnam County.
January 21, 2000	Extreme Cold/Wind Chill	N/A	N/A	Wind chills reached -25 to -35 degrees. No injuries or fatalities were reported in Putnam County.
January 27-28, 2000	Extreme Cold/Wind Chill	N/A	N/A	Wind chills reached -25 to -35 degrees. No injuries or fatalities were reported in Putnam County.
August 8-10, 2001	Heat	N/A	N/A	Heat indices across the region peaked at 105 to 110 degrees. Four deaths and one injury were attributed to the heat; none in Putnam County.
July 2-4, 2002	Heat	N/A	N/A	Heat indices across the region peaked at 105 to 110 degrees. No injuries or fatalities were reported in Putnam County.
July 29-31, 2002	Heat	N/A	N/A	Heat indices across the region peaked at 100 to 105 degrees. No injuries or fatalities were reported in Putnam County.
January 15, 2004	Extreme Cold/Wind Chill	N/A	N/A	Wind chills reached as low as -26 degrees throughout the region. No injuries or fatalities were reported in Putnam County.
August 1-3, 2006	Heat	N/A	N/A	Heat indices in the region ranged from 105 to 115 degrees. 42 people died from the heat; none were in Putnam County.
July 22-23, 2011	Heat	N/A	N/A	Heat indices across the region peaked at 115 degrees. 20 people in the New York Metro area were killed; none were in Putnam County.
July 18, 2012	Heat	N/A	N/A	Heat index reached 107 degrees. No injuries or fatalities were reported in Putnam County.
September 11, 2013	Heat	N/A	N/A	Heat index reached 105 degrees. No injuries or fatalities were reported in Putnam County.
January 4, 2014	Extreme Cold	N/A	N/A	A pipe burst in the new County Courthouse.

Source(s): *NOAA-NCDC 2014; Putnam County 2014*
FEMA *Federal Emergency Management Agency*
NOAA-NCDC *National Oceanic Atmospheric Administration – National Climate Data Center*
NYS *New York State*

Agriculture-related disasters are quite common. The Secretary of Agriculture is authorized to designate counties as disaster areas to make emergency loans (EM) to producers suffering losses in those counties and in counties that are contiguous to a designated county. Table E.2-3 presents USDA declared disasters involving extreme temperatures that impacted Putnam County.

Table E.2-3. USDA Declared Disasters

Incidence Period	Event Type	County Designated?*	Losses / Impacts
May 1 – end of crop year 2005	Rain, Flooding, Hail, Winds, Lightning, and Low Temperatures	No (Putnam a contiguous county)	Physical and production losses

Incidence Period	Event Type	County Designated?*	Losses / Impacts
May 3-17, 2005	Cold Temperatures, Frost, and Freezes	No (Putnam a contiguous county)	Production losses
April 28 to May 28, 2008	Frost and Freeze	No (Putnam a contiguous county)	Production losses
February 15 to May 12, 2010	Frost, freeze, high winds, hail, excessive snow, excessive rain and cold temperatures	No (Putnam a contiguous county)	Production losses
April 1 to August 30, 2011	Excessive rain, flooding, flash flooding, hail, high winds, below normal temperatures and tornadoes	No (Putnam a contiguous county)	Production losses
July 10 to August 25, 2011	Excessive heat and rain	No (Putnam a contiguous county)	Production losses
March 1, 2012 and continuing	Frosts & Freeze	No (Putnam a contiguous county)	Physical and production losses attributed to frost and freezing temperatures
June 1 to October 24, 2012	Drought and Excessive Heat	Yes	Production losses were attributed to drought and excessive heat
December 22, 2013 to April 17, 2014	Freeze	Yes	Production

Source: USDA, 2014

**Disaster event occurred within the county.*

M *Presidential Major Disaster Declaration*

N *Administrative Physical Loss Notification*

S *Secretarial National Disaster Determination*

USDA *United States Department of Agriculture*

E.3 Flood

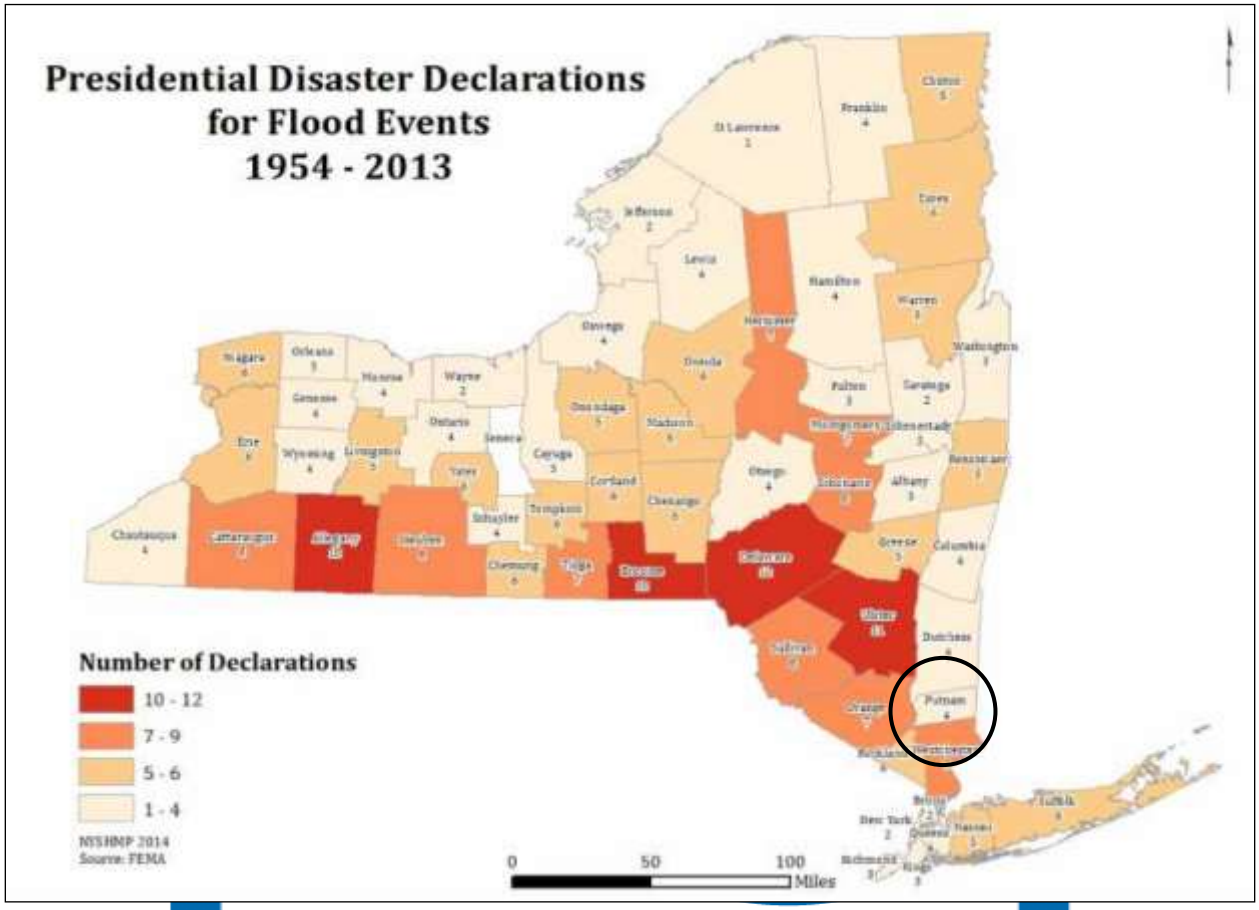
Many sources provided historical information regarding previous occurrences and losses associated with flooding events throughout New York State and areas within Putnam County. With so many sources reviewed for the purpose of this HMP, loss and impact information for many events could vary depending on the source. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP. The NYS HMP indicated that New York State experienced 52 major flood events that resulted in a FEMA disaster declaration between 1954 and 2013. The State also experienced 101 undeclared flood occurrences dating back to 1635 (NYS DHSES, 2014).

Between 1953 and 2013, New York State was included in 41 flood major disaster (DR) or emergency (EM) declaration. These declarations were classified as one or a combination of the following: coastal storms, high tides, heavy rain, flash flooding, flood, flooding, hurricane, wave action, ice storm, Nor'Easter, inland flooding, tornadoes, landslides, and winds. Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. However, not all counties were included in the disaster declarations and emergencies. Of those events, the NYS HMP and other sources indicate that Putnam County has been declared as a disaster or emergency area as a result of nine flood events (FEMA, 2014).

Figure E.3-1 shows the FEMA disaster declarations (DR) (and does not indicate emergency (EM) declarations) for flooding events in New York State, from 1954 to 2013. This figure indicates that Putnam County was

included in four disaster declarations. However, this differs from information obtained from FEMA, which indicated Putnam County was included in 9 declarations.

Figure E.3-1. Presidential Disaster Declarations for Flooding Events, 1954 to 2013



Source: NYS DHSES, 2014
Note: The black oval indicates the approximate location of Putnam County.

For this HMP, known flooding events that have impacted Putnam County between 1950 and 2014 are identified in Table E.3-1. With flooding documentation for New York State and Putnam County being so extensive, not all sources have been identified or researched. Therefore, Table E.3-1 may not include all events that have occurred in the County.

Table E.3-1. Flooding Events in Putnam County Between 1950 and 2014

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
September 11-14, 1971	Severe Storms and Flooding (Tropical Storm Doria)	DR-311	Yes	Doria brought heavy rain to the New York City and southeastern portion of the State. Four-day precipitation totals ranged from 4.5 to seven inches. Flooding was widespread in the area of heaviest rainfall. Heavy property damage was experienced in Westchester County, eastern Orange County, and the Catskill-Hudson sector of the mid-Hudson Valley. Locally severe damage from road washouts and deposition of mud, rocks, and debris occurred near the slopes of Mt. Beacon in Dutchess County. This storm caused seven deaths and $147.6 million in damage throughout its path. New York State experienced approximately $7.4 million in total eligible damages. Damage estimates in Putnam County were not available.
September 25-27, 1975	Severe Storms, Heavy Rain, Landslides, Flooding (Hurricane Eloise)	DR-487	Yes	A week long rainfall event resulted in considerable flooding in the area. Hardest hit counties included: Broome, Cayuga, Chemung, Chenango, Madison, Onondaga, Oswego, and Tioga. Rainfall totals ranged from four to seven inches, with totals over 10 inches in southeastern New York State (including Putnam County). New York State experienced approximately $25 million in property damages and two fatalities. Damage estimates in Putnam County were not available.
January 19-20, 1996	Severe Storms, Flooding	DR-1095	Yes	The storm brought heavy rains and caused significant snowmelt. Street and poor drainage flooding became a major problem due to the rains and snowmelt. River and stream flooding occurred in the afternoon of the 19th and continued through the next day. Several roofs collapsed during the new few days in response to an extremely heavy load of water brought on a previous blizzard and the heavy rains. Flooding was so widespread and severe that the event was known was the Deluge of '96. The storm and related flooding temporarily closed many roads, closed businesses, and killed 10 people throughout the State. Total damages in New York State reached $160 million. In Putnam County, flooding blocked a major north-south highway, Route 9, and also blocked roads near Cold Spring. Damage estimates in Putnam County were not available.
July 13, 1996	Flood	N/A	N/A	Torrential rain caused flooding of low lying and poor drainage areas, streams, and rivers across the area. No rainfall reports were available from Putnam County.
October 8-9, 1996	Heavy Rains and Flooding (Remnants of Tropical Storm Josephine)	N/A	N/A	The remnants of Tropical Storm Josephine moved rapidly northeast and passed east of Long Island on the 9th. It produced one to three inches of rain that caused localized flooding of streets and poor drainage areas across the region. It also brought gusty winds, with gusts ranging from 40 to 50 mph. Damage estimates in Putnam County were not available.
October 19, 1996	Severe Storms, Flooding, Heavy Rains, High Winds (also known as a Nor'Easter)	DR-1146	No	High winds and heavy rain impacted the area on the 19th which downed numerous trees and power lines. Peak wind gusts ranged from 30 mph to 55 mph. Strong east winds blowing over a long distance caused tides to average three to six feet above normal. Three to five inches of rain fell, with isolated higher amounts. Damage estimates in Putnam County were not available.

Table E.3-1. Flooding Events in Putnam County Between 1950 and 2014

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
September 16-18, 1999	Hurricane Floyd	DR-1296; EM-3149	Yes	New York State experienced approximately $62.2 million in eligible damages as a result of property damage and debris accumulation (NYSDPC). Orange, Putnam, Rockland and Westchester Counties were declared disaster areas. For these 4 counties, the initial cost estimates were $14.6 million dollars. In Putnam County, damages were estimated at $1.9 million. Serious widespread flooding of low-lying and poor drainage areas resulted in the closure of many roads and basement flooding across the entire region. Maximum rainfall rates from one to around two inches per hour lasted for at least three consecutive hours across parts of the Lower Hudson Valley from 2 pm until 6 pm on the 16th. Rainfall in Putnam County ranged from 11.73 inches at the George Fischer M.S. Weather Station in Carmel to 13.70 inches at Brewster. Strong and gusty winds combined with torrential rain downed many trees, tree limbs, and power lines across the area. Significant power outages resulted.
September 21, 1999	Flash Flood	N/A	N/A	As a cold front approached the area, a line of heavy showers produced torrential rain that caused a small stream to overflow its banks on Stoneleigh Avenue in Carmel.
August 11, 2000	Flash Flood	N/A	N/A	Slow moving thunderstorms produced rainfall rates estimated at around two inches per hour, which caused significant flooding of low-lying and poor drainage areas. In Huntington, significant flooding occurred along parts of Route 25 and Melville Road. In Yorktown Heights, serious flooding was reported on Commerce Street and Route 118. In Putnam Valley, flooding occurred on Peekskill Hollow Road.
August 20, 2001	Urban/Small Stream Flood	N/A	N/A	Heavy rainfall led to localized flooding of roadways and highways.
May 13 – June 17, 2004	Severe Storms and Flooding	DR-1534	Yes	Streets closed throughout the County.
September 8, 2004	Flash Flood	DR-1564	No	Torrential rains caused extensive flash flooding in Cold Spring. South Mountain Pass Road was extensively damaged from flash floods. It was completely washed out. Rainfall amounts ranging from an inch to up to 6 inches were common across the area. This caused extensive flash flooding across the region, resulting in rescues of people from homes and cars.
September 28, 2004	Flash Flood	N/A	N/A	Flash flooding was the cause of highways and roads being closed. The remnants of Hurricane Jeane dropped anywhere between three and six inches across Southeastern New York State on September 28th. This resulted in numerous occurrences of flash flooding across the area.
April 2-4, 2005	Severe Storms and Flooding	DR-1589	Yes	New York State experienced approximately $66.2 million in eligible damages. FEMA approved more than $5 million in disaster aid to the State to help fund recovery efforts in several counties and jurisdictions. Putnam County received over $57,000 in public assistance due to the flooding.
October 8, 2005	Flash Flood	N/A	N/A	The heaviest rain fell north of New York City across the Lower Hudson Valley. Heavy rain resulted in significant flooding on some rivers, most small brooks and

Table E.3-1. Flooding Events in Putnam County Between 1950 and 2014

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
				streams, and throughout urban areas in low lying and poor drainage areas. Significant flooding was reported in Cold Springs.
April 14-18, 2007	Severe Storms and Inland and Coastal Flood (also identified as a Nor'Easter)	DR-1692	Yes	A Nor'Easter occurred during April 15th and 16th. It brought heavy rain and high winds that caused widespread and significant river, stream, and urban flooding of low lying and poor drainage areas. Many small rivers, streams, and brooks rose over their banks within 12 hours of the heavy rainfall. New York State experienced millions in eligible damages. FEMA gave out more than $61 million in assistance to affected counties within the State. The Taconic State Parkway and I-84 intersection near Miller Hill Road was flooded.
July 23, 2008	Flash Flood	N/A	N/A	Torrential rainfall and flash flooding occurred. Water rescues were performed on Rte. 6 near Lake Mahopac in Mahopac.
July 27, 2008	Flash Flood	N/A	N/A	Mud Pond Road, along with portions of Route 6 and Croton Falls Road were flooded over and impassable in Mahopac.
September 6, 2008	Flash Flood	N/A	N/A	Periods of torrential rain from heavy showers and thunderstorms caused flash flooding in many locations, which included urban, small stream and river flooding. Stoneyleigh Ave. was closed between Hughson Rd. and Drewville Rd. in Carmel due to flooding.
August 28, 2011	Flood (Hurricane Irene)	DR-4020; EM-3328	Yes	Copious amounts of tropical moisture within the storm produced extended periods of heavy rainfall, which resulted in widespread moderate to major flooding across the area.
July 28, 2012	Flash Flood	N/A	N/A	Heavy rain caused two feet of water to accumulate on Rt. 311 at Cushman Rd. in Towners.
October 28, 2012	Flood (Hurricane Sandy)	DR-4085; EM-3351	Yes	Hurricane Sandy caused 60 deaths and widespread property damages of over $42 billion. Widespread power outages affected over two million people and lasted for up to two weeks. Putnam County received more than $1.5 million in public assistance to fund emergency efforts, remove debris, and rebuild infrastructure.
May 23, 2013	Heavy Rain and Flood	N/A	N/A	2.16 inches of rain fell in Putnam County.
July 14-15, 2014	Heavy Rain and Flash Flooding	N/A	N/A	Severe thunderstorms hit the area, bringing lightning strikes, hail, downed trees and flooding in homes. Heavy rain flooded major roads in parts of the Tri-State area. A flash flood watch was issued for New York City, Long Island, Westchester, Rockland, and Putnam Counties. Between 1.23 inches and 3.10 inches of rain fell in Putnam County

Source(s): *FEMA 2014; NOAA-NCDC 2014; Chas Sells Inc.; USACE; MARFC; Kocin; Herbert; Revkin 1996; NYSDHSES 2014; SHELDUS 2013*

Note (1): Monetary figures within this table were U.S. Dollar (USD) figures calculated during or within the approximate time of the event. If such an event would occur in the present day, monetary losses would be considerably higher in USDs as a result of increased U.S. Inflation Rates.

DR *Federal Disaster Declaration*
EM *Federal Emergency Declaration*
FEMA *Federal Emergency Management Agency*
IA *Individual Assistance*
K *Thousand ($)*
M *Million ($)*

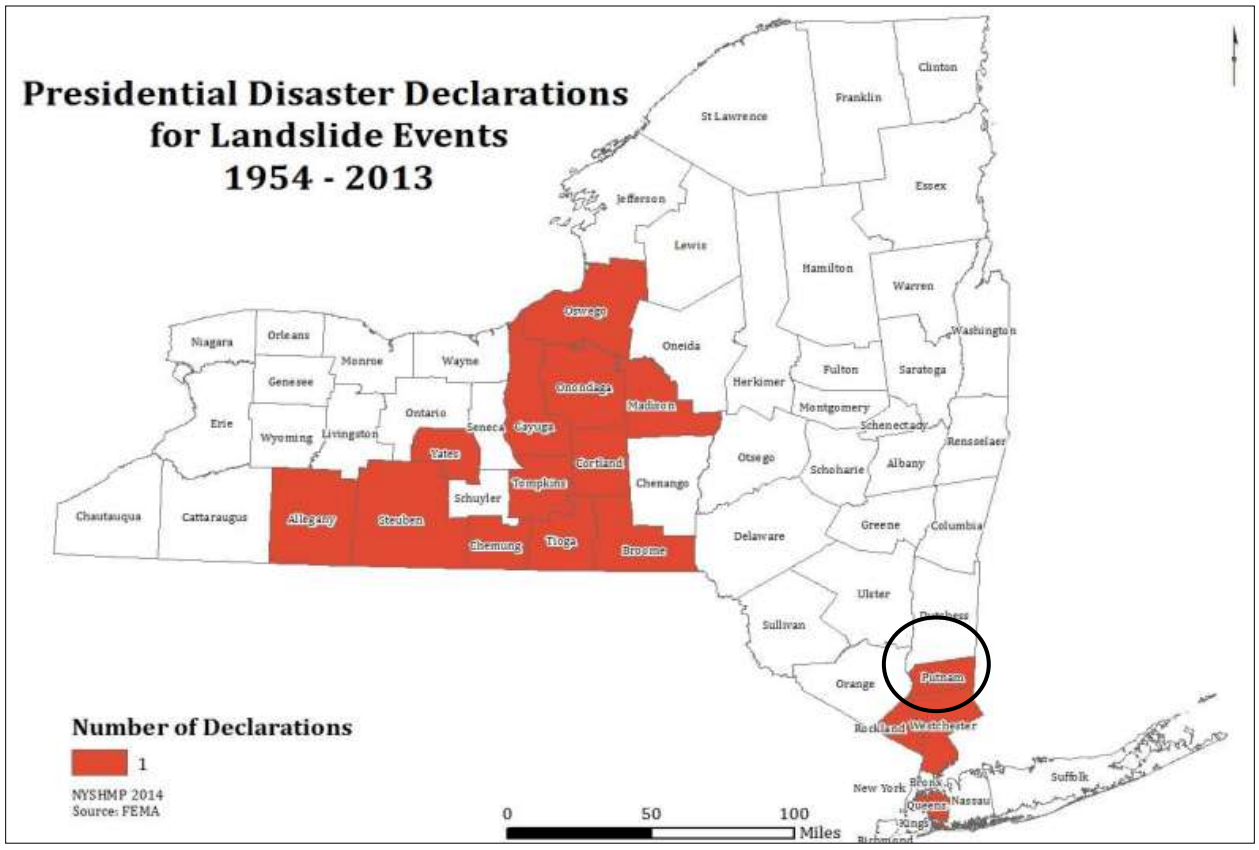
MARFC	*Middle Atlantic River Forecast Center*
N/A	*Not applicable*
NCDC	*National Climate Data Center*
NOAA	*National Oceanic Atmospheric Administration*
NWS	*National Weather Service*
NYS DHSES	*New York State Division of Homeland Security & Emergency Services*
PA	*Public Assistance*
SHELDUS	*Spatial Hazard Events and Losses Database for the U.S.*
USACE	*U.S. Army Corps of Engineers*

E.4 Land Failure

Between 1953 and 2014, New York State was included in one landslide major disaster declaration. It was classified as a severe storm, heavy rain, landslides and flooding. Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. However, not all counties were included in the disaster declarations and emergencies. Of those events, the NYS HMP and other sources indicate that Putnam County has been declared as a disaster or emergency area as a result of one landslide declaration (FEMA, 2014).

Figure E.4-1 shows the FEMA disaster declarations (DR) (and does not indicate emergency (EM) declarations) for landslide events in New York State, from 1954 to 2013. This figure indicates that Putnam County was included in one disaster declaration which is in agreement with FEMA data.

Figure E.4-1. Presidential Disaster Declarations for Flooding Events, 1954 to 2013



Source: NYS DHSES, 2014
Note: The black oval indicates the approximate location of Putnam County.

For this HMP, known landslide events that have impacted Putnam County between 1950 and 2014 are identified. Many sources were researched for historical information regarding land failure events in Putnam County; however, little information was found. Major land failure events that have impacted the County are summarized in Table E.4-1.

Table E.4-1. Land Failure Events in Putnam County

Dates of Event	Event Type	FEMA Declaration Number	County Declared?	Losses / Impact
October 2, 1975	Storms, Rain, Landslides and Flooding	DR-487	Yes	A week long rainfall event resulted in considerable flooding in the area. Hardest hit counties included: Broome, Cayuga, Chemung, Chenango, Madison, Onondaga, Oswego, and Tioga. Rainfall totals ranged from four to seven inches, with totals over 10 inches in southeastern New York State (including Putnam County). New York State experienced approximately $25 million in property damages and two fatalities. Damage estimates in Putnam County were not available.
August 7, 1990	Landslide	N/A	N/A	$1,000 in property damages
December 16, 2009	Sinkhole	N/A	N/A	Kent and Lake Carmel firefighters were called to rescue a horse that got its leg stuck in a sinkhole
August 28-30, 2011	Hurricane Irene	DR-4020	Yes	Rain from Hurricane Irene caused erosion and a mud slide that partially closed Route 9D in Philipstown, just north of Cold Spring

Sources: SHELDUS; Groom; FEMA 2014
NYSDPC New York State Disaster Preparedness Commission
USGS U.S. Geological Survey

E.5 Severe Storm

Many sources provided historical information regarding previous occurrences and losses associated with hurricane events throughout New York State and Putnam County. With so many sources reviewed for the purpose of this HMP, loss and impact information for many events could vary depending on the source. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP.

The NYS HMP indicated that Putnam County has experienced 27 hailstorm events between 1960 and 2012. Those events caused 1 injury and over $60,000 in property damage and over $6,400 in crop damage. Between 1960 and 2012, the County experienced 87 high wind events that caused 13 injuries, over $5.7 million property damage and over $17,600 in crop damage. Between 1960 and 2012, the County experienced 8 hurricane events that caused 2 injuries, over $5.8 million property damage and over $4 million in crop damage. Of those 122 events, at least[1] 22 of them have occurred between 2010 and 2012 (no fatalities or injuries, $113,750 in property damage) (NYS DHSES, 2014).

Between 1954 and 2014, FEMA declared that New York State experienced 51 severe storm-related disasters (DR) or emergencies (EM) classified as one or a combination of the following disaster types: severe storms, heavy rain, tropical storm, hurricane, high winds, and tornado. Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. However, not all counties were included in the disaster declarations. Of those events, the NYS HMP and other sources indicate that Putnam County has been declared as a disaster area as a result of eight severe storm events (FEMA, 2014).

For this 2014 Plan, known severe storm events that have impacted Putnam County between 2005 and 2013 are identified in Table E.5-1. With severe storm documentation for New York State and Putnam County being so extensive, not all sources have been identified or researched. Only events that caused fatalities, injuries, or recorded damages are included. Therefore, Table E.5-1 may not include all events that have occurred in the County.

[1] Hurricane figures for 2010-2012 specifically are not reflected in the NYS HMP.

Table E.5-1. Severe Storm Events between 1950 and 2014

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
August 9, 1968	Tornado	N/A	N/A	An F1 tornado caused $25,000 in damages.
July 29, 1971	Tornado	N/A	N/A	An F2 tornado caused $250,000 in damages over 4.5 miles.
September 11-14, 1971	Severe Storms and Flooding (Tropical Storm Doria)	DR-311	Yes	Doria brought heavy rain to the New York City and southeastern portion of the State. Four-day precipitation totals ranged from 4.5 to seven inches. Flooding was widespread in the area of heaviest rainfall. Heavy property damage was experienced in Westchester County, eastern Orange County, and the Catskill-Hudson sector of the mid-Hudson Valley. Locally severe damage from road washouts and deposition of mud, rocks, and debris occurred near the slopes of Mt. Beacon in Dutchess County. This storm caused seven deaths and $147.6 million in damage throughout its path. New York State experienced approximately $7.4 million in total eligible damages. Damage estimates in Putnam County were not available.
September 25-27, 1975	Severe Storms, Heavy Rain, Landslides, Flooding (Hurricane Eloise)	DR-487	Yes	A week long rainfall event resulted in considerable flooding in the area. Hardest hit counties included: Broome, Cayuga, Chemung, Chenango, Madison, Onondaga, Oswego, and Tioga. Rainfall totals ranged from four to seven inches, with totals over 10 inches in southeastern New York State (including Putnam County). New York State experienced approximately $25 million in property damages and two fatalities. Damage estimates in Putnam County were not available.
July 10, 1989	Tornado	N/A	N/A	An F2 tornado injured 2 people and caused $25 M in damages over 1/2 mile. 50 housing units in the King's Grant townhouse complex in Carmel were severely damaged. The tornado then damaged 6-12 residences in Brewster Heights.
June 29, 1990	Tornado	N/A	N/A	$25,000 in property damages over 1/2 mile.
September 3, 1993	Lightning; TSTM Wind	N/A	N/A	Numerous trees and power lines were downed during the event. These storms also produced torrential rains and frequent cloud to ground lightning. One strike started a fire at a high school.
September 22, 1994	High Wind	N/A	N/A	These winds downed several trees and ripped off hundreds of branches which in turn downed power lines. Nearly 18,000 homes lost power for several hours.
November 7, 1994	High Wind	N/A	N/A	Numerous branches and some power lines were blown down. At some locations the winds were strong enough to down a couple of trees.
May 24, 1995	TSTM Wind	N/A	N/A	A line of thunderstorms moving across the region generated damaging winds. Numerous trees and power lines were downed. In Middle Hope a woman was killed and her daughter injured when a 50- by 25-foot section of a roof landed on their Jeep Cherokee after being ripped off a nearby condominium. In Scotchtown, high winds also ripped the roof off a house, but no injuries were reported.
August 31, 1995	TSTM Wind	N/A	N/A	A severe thunderstorm moving through the county downed several trees and power lines.

Table E.5-1. Severe Storm Events between 1950 and 2014

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
January 19-20, 1996	Severe Storms, Flooding	DR-1095	Yes	The storm brought heavy rains and caused significant snowmelt. Street and poor drainage flooding became a major problem due to the rains and snowmelt. River and stream flooding occurred in the afternoon of the 19th and continued through the next day. Several roofs collapsed during the new few days in response to an extremely heavy load of water brought on a previous blizzard and the heavy rains. Flooding was so widespread and severe that the event was known was the Deluge of '96. The storm and related flooding temporarily closed many roads, closed businesses, and killed 10 people throughout the State. Total damages in New York State reached $160 million. In Putnam County, flooding blocked a major north-south highway, Route 9, and also blocked roads near Cold Spring. Damage estimates in Putnam County were not available.
February 25, 1996	High Wind	N/A	N/A	Winds gusted from 50 to nearly 70 MPH and caused numerous trees and power lines to fall. One fatality and one injury were reported.
August 23, 1996	TSTM Wind	N/A	N/A	High winds knocked down several trees which also fell on power lines. Route 6 was closed between Brewster, NY and Danbury, CT due to numerous downed trees. In addition, wind damage was also reported just north of the village of Cold Spring. Numerous shingles were torn off about eight houses.
September 16-18, 1996	Heavy Rain	N/A	N/A	Heavy rain caused street and poor drainage flooding along with significant within bank rises of local area rivers. Winds that gusted from 40 to 50 MPH caused tree limbs and branches to fall. High winds also caused scattered power outages.
October 8-9, 1996	Heavy Rains and Flooding (Remnants of Tropical Storm Josephine)	N/A	N/A	The remnants of Tropical Storm Josephine moved rapidly northeast and passed east of Long Island on the 9th. It produced one to three inches of rain that caused localized flooding of streets and poor drainage areas across the region. It also brought gusty winds, with gusts ranging from 40 to 50 mph. Damage estimates in Putnam County were not available.
October 19, 1996	Severe Storms, Flooding, Heavy Rains, High Winds (also known as a Nor'Easter)	DR-1146	No	High winds and heavy rain impacted the area on the 19th which downed numerous trees and power lines. Peak wind gusts ranged from 30 mph to 55 mph. Strong east winds blowing over a long distance caused tides to average three to six feet above normal. Three to five inches of rain fell, with isolated higher amounts. Damage estimates in Putnam County were not available.
July 3, 1997	TSTM Wind	N/A	N/A	A severe thunderstorm moved east across Putnam Valley. It straddled the Southern Putnam and Northern Westchester County Border. It produced high winds that downed trees.
July 7, 1997	TSTM Wind	N/A	N/A	Scattered severe thunderstorms produced high winds and heavy rain. High winds downed trees and power lines in Unionville, Goshen, and New Windsor of Orange County and in Carmel of Putnam County. Car accidents caused by slippery pavement resulted in 7 injuries near Lake Carmel of Purnam County. High winds also downed a tree that fell on a multi-

Table E.5-1. Severe Storm Events between 1950 and 2014

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
				family house in Springfield Gardens. Numerous families were displaced from the destroyed house. Trees and powerlines were also downed in Woodmere.
July 9, 1997	TSTM Wind	N/A	N/A	Numerous trees fell on powerlines in Lake Carmel and Brewster of Putnam County. A funnel cloud was also sighted in Putnam County. Patterson and Putnam Lake were also hit hard. The school, "Green Chimneys Children's Services," on Putnam Lake Road in Brewster suffered about $30,000 in damages.
May 29, 1998	Lightning; TSTM Wind	N/A	N/A	High winds caused widespread damage to trees and power lines in Putnam County. In addition, lightning struck and ignited a fire that damaged a home on Corey Lane in Cold Springs. The extent of the damage is unknown.
May 31, 1998	Hail; TSTM Wind	N/A	N/A	High winds downed many trees onto power lines, into houses, and onto cars. Frequent lightning strikes caused numerous brush and structure fires and downed trees onto power lines and houses. There were significant interruptions of power for up to 48 hours following these storms.
June 20, 1998	TSTM Wind	N/A	N/A	High winds downed tree limbs, hail up to one-half inch in diameter, and heavy downpours were experienced at Mahopac. Another thunderstorm produced lightning that struck a house in Hewlett. Lightning destroyed about 75 percent of the house.
September 16-18, 1999	Hurricane Floyd	DR-1296; EM-3149	Yes	New York State experienced approximately $62.2 million in eligible damages as a result of property damage and debris accumulation (NYSDPC). Orange, Putnam, Rockland and Westchester Counties were declared disaster areas. For these 4 counties, the initial cost estimates were $14.6 million dollars. In Putnam County, damages were estimated at $1.9 million. Serious widespread flooding of low-lying and poor drainage areas resulted in the closure of many roads and basement flooding across the entire region. Maximum rainfall rates from one to around two inches per hour lasted for at least three consecutive hours across parts of the Lower Hudson Valley from 2 pm until 6 pm on the 16th. Rainfall in Putnam County ranged from 11.73 inches at the George Fischer M.S. Weather Station in Carmel to 13.70 inches at Brewster. Strong and gusty winds combined with torrential rain downed many trees, tree limbs, and power lines across the area. Significant power outages resulted.
November 2, 1999	High Wind	N/A	N/A	High winds downed numerous tree limbs, trees, wires, and power lines. Some of these fell on and damaged cars. During the peak, Con Edison reported 69,000 customers without power across the area. Damage was widespread across the area.
December 11, 1999	High Wind	N/A	N/A	Estimated wind gusts of at least 58 mph downed numerous trees and utility poles across Putnam and Northern Westchester Counties. Tree limbs were strewn across and blocked many roads in this area. Local electric utility companies reported almost 1500 customers without power as a result of these high winds.
May 10, 2000	Lightning	N/A	N/A	A man was injured when he was struck by lightning in Port Jervis. During an evening thunderstorm, lightning struck and damaged a building in Garrison. The amount of property damage was unknown.

Table E.5-1. Severe Storm Events between 1950 and 2014

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
June 2, 2000	TSTM Wind	N/A	N/A	Based on a storm survey performed by NWS staff, an F1 tornado occurred around 7:05 pm EDT in the continental village region of the town of Cortlandt, about 3 miles north of Peekskill on the Westchester and Putnam Counties border. Damage occurred to about 20 houses, with 7 houses incurring moderate damage. Numerous trees of 1 1/2 to 2 feet in diameter were snapped, mainly about 20 to 25 feet above the ground. Three telephone poles were snapped in the middle. In Putnam County, several trees and power lines were downed in Carmel and Brewster.
June 11, 2000	TSTM Wind	N/A	N/A	Downed trees in Walden and trees and power lines in Carmel, Riverhead, Greenwood Lake and Palisades.
December 12, 2000	High Wind	N/A	N/A	High winds downed many trees onto houses, cars, power lines, and streets. In urban areas, high winds downed signs, collapsed scaffolds, and caused five partial building collapses. 1 fatality and 6 injuries were reported. Significant property damage and power outages.
December 17, 2000	TSTM Wind	N/A	N/A	High winds downed several trees and power lines throughout the county. Large trees fell across Route 6N in Mahopac Falls, which caused a partial road closure.
June 17, 2001	Lightning	N/A	N/A	In Putnam County, lightning struck a home that ignited a fire. The house suffered considerable damage, but no injuries were reported.
July 1, 2001	TSTM Wind	N/A	N/A	Damaging winds in excess of 50 mph caused numerous large trees to topple, and led to scattered power outages. Frequent cloud to ground lightning strikes also accompanied these thunderstorms.
May 31, 2002	TSTM Wind	N/A	N/A	As a severe thunderstorm moved east, it produced high winds that downed several tree limbs in Patterson.
June 26, 2002	TSTM Wind	N/A	N/A	As severe thunderstorms moved across the region, they produced high winds and heavy rain. High winds downed many trees and power lines across the region.
July 9, 2002	Lightning	N/A	N/A	About 1,400 customers lost power; approximately $500,000 in property damages.
August 2, 2002	TSTM Wind	N/A	N/A	In Carmel, severe winds toppled a tree on top of a vehicle parked in a driveway. Approximately 25,000 customers suffered a power interruption.
September 28, 2003	Heavy Rain	N/A	N/A	Closure of Mill Road in Philipstown.
October 27, 2003	TSTM Wind	N/A	N/A	This storm produced damaging winds that knocked several large tree limbs down. As a cold front approached the East coast, scattered showers and isolated thunderstorms developed just out ahead of the frontal boundary. Aided by a 50 to 60 knot jet located just above the boundary layer, a few thunderstorms became severe by mixing down these winds

Table E.5-1. Severe Storm Events between 1950 and 2014

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
				to the surface. The strong vertical wind profile also created enough shear to produce a weak tornado.
November 13, 2003	High Wind	N/A	N/A	High winds downed numerous trees and power lines, which resulted in widespread power outages throughout the area. Thousands of power outages were confirmed by local utility companies. 1 fatality was reported.
May 13 – June 17, 2004	Severe Storms and Flooding	DR-1534	Yes	Streets closed throughout the County.
April 2-4, 2005	Severe Storms and Flooding	DR-1589	Yes	New York State experienced approximately $66.2 million in eligible damages. FEMA approved more than $5 million in disaster aid to the State to help fund recovery efforts in several counties and jurisdictions. Putnam County received over $57,000 in public assistance due to the flooding.
June 6, 2005	TSTM Wind	N/A	N/A	A line of thunderstorms formed along the cold front, some of which produced wind damage such as knocking over large trees and downing power lines. Frequent lightning occurred as well.
July 27, 2005	TSTM Wind	N/A	N/A	As the thunderstorms moved into the Lower Hudson Valley, they became severe and knocked down several trees which caused power outages.
January 18, 2006	High Wind	N/A	N/A	Wind gusts approaching 70 mph downed many trees and power lines, which caused widespread power outages.
February 17, 2006	High Wind	N/A	N/A	High wind gusts downed several trees, power lines, and wires across the region. A roof was torn off from a building and another building partially collapses in Brewster.
June 1, 2006	TSTM Wind	N/A	N/A	Trees and power lines downed by thunderstorm winds.
July 18, 2006	Hail	N/A	N/A	Severe thunderstorms produced damaging winds and large hail across many locations. High winds downed many whole trees, large tree branches, and power lines. News radio WCBS reported up to 150,000 power outages across the tri-state region. A few trees fell on houses and cars.
July 28, 2006	TSTM Wind	N/A	N/A	Severe thunderstorms produced damaging winds and large hail across many locations. High winds downed many whole trees, large tree branches, and power lines. News radio WCBS reported up to 150,000 power outages across the tri-state region. A few trees fell on houses and cars.
August 3, 2006	TSTM Wind	N/A	N/A	A cluster of severe thunderstorms moved east across the Lower Hudson Valley. High winds downed trees and power lines.

Table E.5-1. Severe Storm Events between 1950 and 2014

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
April 14-18, 2007	Severe Storms and Inland and Coastal Flood (also identified as a Nor'Easter)	DR-1692	Yes	A Nor'Easter occurred during April 15th and 16th. It brought heavy rain and high winds that caused widespread and significant river, stream, and urban flooding of low lying and poor drainage areas. Many small rivers, streams, and brooks rose over their banks within 12 hours of the heavy rainfall. New York State experienced millions in eligible damages. FEMA gave out more than $61 million in assistance to affected counties within the State. The Taconic State Parkway and I-84 intersection near Miller Hill Road was flooded.
June 1, 2007	TSTM Wind	N/A	N/A	Trees were downed across Route 9D.
June 2, 2007	TSTM Wind	N/A	N/A	Downed trees and power lines.
July 19, 2007	TSTM Wind	N/A	N/A	Downed trees along Woods Street in South Mahopac.
May 31, 2008	TSTM Wind	N/A	N/A	Multiple tree limbs were reported down across Route 22, blocking traffic.
June 14, 2008	TSTM Wind	N/A	N/A	Numerous trees and power lines were reported down in Fishkill. Approximately $5,000 in property damages.
August 11, 2008	Lightning	N/A	N/A	Lightning struck a 19th century barn on Burdick Road in Milltown, destroying the barn and an antique truck in the barn. Approximately $75,000 in property damages.
February 12, 2009	High Wind	N/A	N/A	There were several thousand power outages across southeast New York. New York State Electric and Gas Corp. reported several thousand customers without power due to downed power lines in the morning.
June 24, 2010	TSTM Wind	N/A	N/A	A tree fell onto a car at Little Stony Point in Hudson Highlands State Park. Approximately $10,500 in property damages.
September 22, 2010	TSTM Wind	N/A	N/A	Multiple trees were reported down on US Highway 9 in Graymoor. Approximately $5,000 in property damages.
June 22, 2011	Heavy Rain	N/A	N/A	1 fatality due to a motor vehicle accident
August 1, 2011	TSTM Wind	N/A	N/A	A tree was reported down between Route 301 and Old Route 301 near Kent Cliffs. Approximately $6,000 in property damages.
August 8, 2011	TSTM Wind	N/A	N/A	Trees were reported down in Glenclyffe, including along Route 9D and Route 403. Approximately $3,000 in property damages.
August 19, 2011	TSTM Wind	N/A	N/A	Multiple trees and wires were reported down throughout Carmel. Approximately $17,500 in property damages.

Table E.5-1. Severe Storm Events between 1950 and 2014

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
August 21, 2011	TSTM Wind	N/A	N/A	One tree was reported down in Mahopac. In addition, large branches and limbs were reported down on Sheryl Lane and Russ Road. Approximately $5,000 in property damages.
August 28, 2011	Hurricane Irene	DR-4020; EM-3328	Yes	Copious amounts of tropical moisture within the storm produced extended periods of heavy rainfall, which resulted in widespread moderate to major flooding across the area.
July 26, 2012	TSTM Wind	N/A	N/A	Multiple trees were reported down around Lake Carmel. Approximately $3,000 in damages was reported.
September 8, 2012	TSTM Wind	N/A	N/A	A tree was reported down on Reservoir Road near the intersection of Lower Mine Road. Approximately $1,000 in property damages.
October 28, 2012	Flood (Hurricane Sandy)	DR-4085; EM-3351	Yes	Hurricane Sandy caused 60 deaths and widespread property damages of over $42 billion. Widespread power outages affected over two million people and lasted for up to two weeks. Putnam County received more than $1.5 million in public assistance to fund emergency efforts, remove debris, and rebuild infrastructure.
May 23, 2013	Heavy Rain and Flood	N/A	N/A	2.16 inches of rain fell in Putnam County.
July 14-15, 2014	Heavy Rain and Flash Flooding	N/A	N/A	Severe thunderstorms hit the area, bringing lightning strikes, hail, downed trees and flooding in homes. Heavy rain flooded major roads in parts of the Tri-State area. A flash flood watch was issued for New York City, Long Island, Westchester, Rockland, and Putnam Counties. Between 1.23 inches and 3.10 inches of rain fell in Putnam County

Sources: *FEMA, 2014; NOAA-NCDC, 2014; NWS, 2014; SHELDUS, 2014*
Note: *Monetary figures within this table were U.S. Dollar (USD) figures calculated during or within the approximate time of the event. If such an event would occur in the present day, monetary losses would be considerably higher in USDs as a result of inflation.*

DR *Federal Disaster Declaration*
EM *Federal Emergency Declaration*
FEMA *Federal Emergency Management Agency*
IA *Individual Assistance*
K *Thousand ($)*
M *Million ($)*
Mph *Miles Per Hour*
NCDC *National Climate Data Center*
NOAA *National Oceanic Atmospheric Administration*
NYS *New York State*
NWS *National Weather Service*
PA *Public Assistance*
SHELDUS *Spatial Hazard Events and Losses Database for the U.S.*
TSTM *Thunderstorms*

TORRO Scale

Table E.5-2. TORRO Hailstorm Intensity Scale

TORRO Hailstorm Intensity Scale	Intensity Category	Typical Hail Diameter (mm)	Typical Damage Impacts
H0	Hard Hail	5	No damage
H1	Potentially Damaging	5-15	Slight general damage to plants, crops
H2	Significant	10-20	Significant damage to fruit, crops, vegetation
H3	Severe	20-30	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	25-40	Widespread glass damage, vehicle bodywork damage
H5	Destructive	30-50	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Destructive	40-60	Bodywork of grounded aircraft dented, brick walls pitted
H7	Destructive	50-75	Severe roof damage, risk of serious injuries
H8	Destructive	60-90	(Severest recorded in the British Isles) Severe damage to aircraft bodywork
H9	Super Hailstorms	75-100	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
H10	Super Hailstorms	>100	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

Source: TORRO 2020

Table E.5-3. Beaufort Wind Scale

Force	Wind (Knots)	WMO Classification	Appearance of Wind Effects on Land
0	Less than 1	Calm	Calm, smoke rises vertically
1	1-3	Light Air	Smoke drift indicates wind direction, still wind vanes
2	4-6	Light Breeze	Wind felt on face, leaves rustle, vanes begin to move
3	7-10	Gentle Breeze	Leaves and small twigs constantly moving, light flags extended
4	11-16	Moderate Breeze	Dust, leaves, and loose paper lifted, small tree branches move
5	17-21	Fresh Breeze	Small trees in leaf begin to sway
6	22-27	Strong Breeze	Larger tree branches moving, whistling in wires
7	28-33	Near Gale	Whole trees moving, resistance felt walking against wind
8	34-40	Gale	Twigs breaking off trees, generally impedes progress
9	41-47	Strong Gale	Slight structural damage occurs, slate blows off roofs
10	48-55	Storm	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	56-63	Violent Storm	
12	64+	Hurricane	

Source: National Weather Service, 2020

E.6 Severe Winter Storm

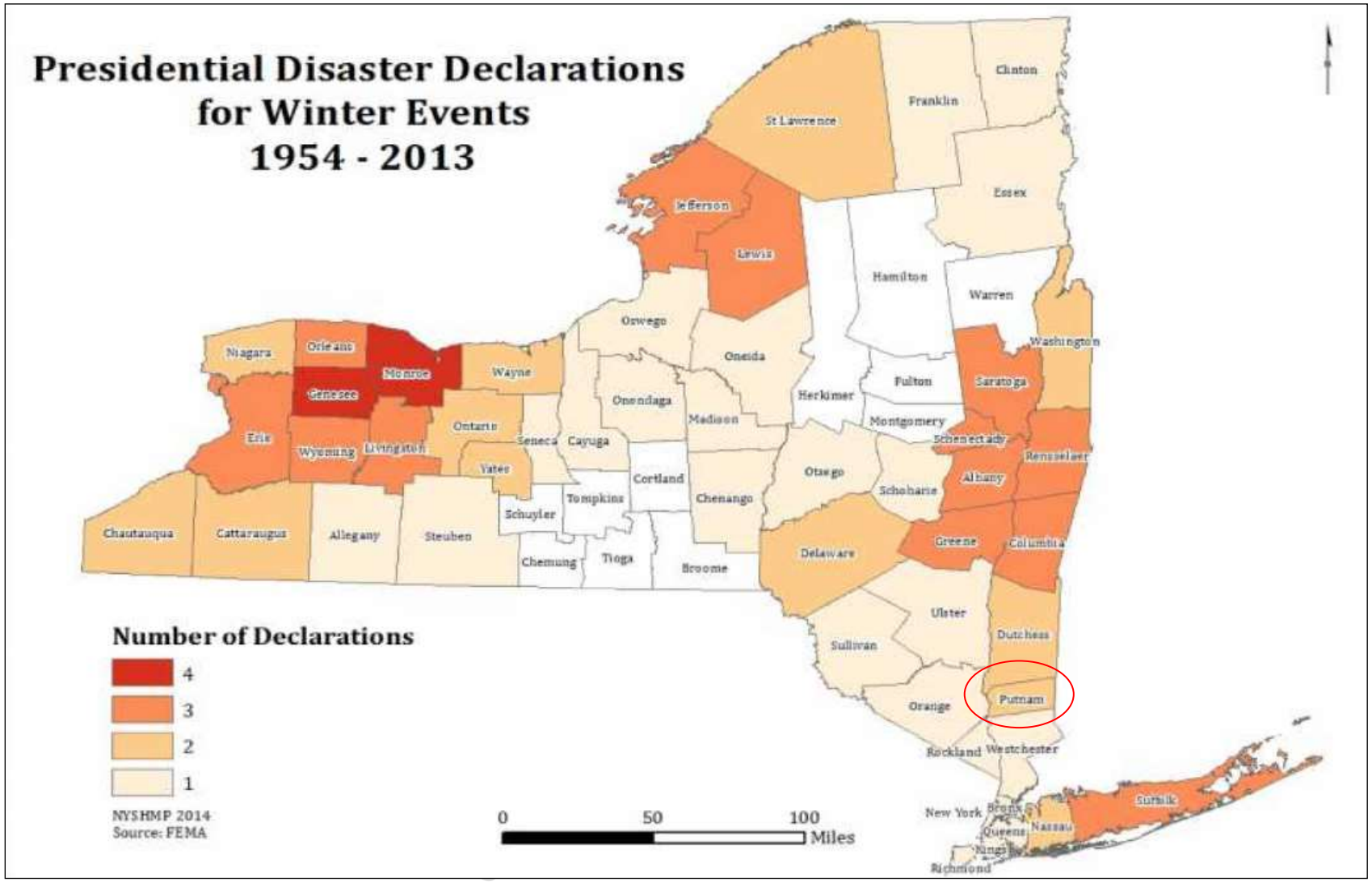
Many sources provided historical information regarding previous occurrences and losses associated with severe winter storms and extreme cold events throughout New York State and Putnam County. With so many sources reviewed for the purpose of this HMP, loss and impact information for many events could vary depending on the source. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP.

Between 1954 and 2014, FEMA declared that New York State experienced 22 winter storm-related disasters (DR) or emergencies (EM) classified as one or a combination of the following disaster types: ice storm, severe storm, flooding, snowstorm, severe winter storm, blizzard, and winter storm. Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. However, not all counties were included in the disaster declarations. Of those events, the NYS HMP and other sources indicate that Putnam County has been declared as a disaster area as a result of five winter storm-related events (FEMA, 2014).

Figure E.6-1 shows the FEMA disaster declarations (DR) for "winter storms" and "blizzards" in New York State, from 1953 to 2013. This figure indicates that Putnam County has been included in two disaster declarations. Since the date of this figure, Putnam County has been included in no other FEMA disaster declarations due to winter weather. However, FEMA records indicate that the County has been included in five disasters.

For this plan, known winter storm events that have impacted and caused damages in Putnam County between 1993 and 2013 are identified in Table E.6-1. With winter storm documentation for New York State and Putnam County being so extensive, not all sources have been identified or researched. Therefore, Table E.6-1may not include all events that have occurred in the County.

Figure E.6-1. Presidential Disaster Declarations in New York State from Winter Snow Storms and Blizzards (1954 to 2013)



Source: *NYS DHSES, 2014*

Note: *The red oval indicates the approximate location of Putnam County. Putnam County has been included in two winter storm/blizzard disaster declaration in New York State between 1954 and 2013.*

Table E.6-1. Winter Storm Events Between 1950 and 2014

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
October 1987	Severe Winter Storm	DR-801	Yes	No losses and/or impacts have been identified for this event.
January 3, 1993	Freezing Rain	N/A	N/A	Freezing rain and freezing drizzle resulted in over a thousand traffic accidents throughout the area. $5 million in property damages were reported.
March 1, 1993	Snow	N/A	N/A	Due to the weight of the snow that fell during the month of March, there were numerous reports of barns and roofs of buildings being damaged or collapsing. $500,000 in property damages were reported.
March 13-17, 1993	Severe Blizzard	EM-3107	Yes	This blizzard resulted in total eligible damages of approximately $8.5 million through New York State. County-specific damage information was not available.
September 20, 1993	Frost	N/A	N/A	$5 million in crop loss.
January 12, 1994	Snow/Ice Storm	N/A	N/A	Snowfall totals ranged between four and eight inches. A dangerous coating of ice followed as the snow changed to sleet and freezing rain before ending. Traffic throughout the area was significantly affected.
January 17, 1994	Heavy Snow	N/A	N/A	Accumulations ranged between 6 and 12 inches however some isolated amounts of 17 inches were reported. This brought traffic to a standstill throughout the area. In addition, trees and power lines were snapped from the weight of the snow. This closed roads and knocked power off to thousands of residents.
February 8, 1994	Snow/Ice Storm	N/A	N/A	After depositing between six and nine inches, snow began to mix then change to sleet and freezing rain. This added a dangerous coating of ice which caused major transportation problems.
February 11, 1994	Snow/Ice Storm	N/A	N/A	A strong high pressure system over Canada kept very cold air in place across the region. Elsewhere a low pressure center moved northeastward along the Atlantic coast. Snow accumulated between 6 and 14 inches before it mixed or changed to sleet and/or freezing rain in some locations. The wintery mix caused major transportation problems throughout the region.
February 23, 1994	Snow/Ice Storm	N/A	N/A	The region saw between three and five inches of snow before a dangerous coating of ice was added as the snow changed to sleet and/or freezing rain. Major transportation problems developed as roadways became extremely hazardous.
March 3, 1994	Snow/Ice Storm	N/A	N/A	Several locations reported gust of around 60 mph. These winds brought down large branches and some relatively small trees. These in turn brought down numerous power lines which left thousands of residents without power. In addition, snow and ice accumulated between five and eight inches. This caused significant transportation problems for trains, planes, and motorists.
February 27-28, 1995	Ice Storm	N/A	N/A	Freezing rain and drizzle during the night and early morning hours caused a significant disruption of transportation. Numerous traffic accidents were reported as roadways became extremely hazardous due to ice. The ice also coasted trees and caused numerous branches to break off.

Table E.6-1. Winter Storm Events Between 1950 and 2014

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
January 7-8, 1996	Blizzard	DR-1083	Yes	The major effects from this storm in New York State were felt across the southeastern sections of the State, resulting in property damages ranging from $21.3 to $70 million. Property damage information for Putnam County was not available.
March 31, 1997	Winter Storm	N/A	N/A	Strong gusty winds (to at least 40 mph) combined with heavy wet snow caused numerous trees and power lines to fall. Many roads were closed due to fallen trees and power lines. In Putnam County, snow measured from 6 inches at Croton Falls to 18 inches at both Carmel and Brewster.
November 13-14, 1997	Mixed Precipitation	N/A	N/A	A mixture of snow, sleet, and freezing rain created hazardous weather conditions across the area. Precipitation accumulated on roads, making both driving and walking hazardous. Several, mostly minor, traffic accidents occurred. Freezing rain also accumulated on trees, causing some tree limbs to fall on power lines that resulted in scattered power outages.
January 15-16, 1998	Ice Storm	DR-1196	No	1/2 to 1 inch of mainly liquid precipitation fell. Precipitation developed as light snow, and changed to freezing rain. Icing became widespread and significant. As ice accumulated on roads, there was widespread and significant traffic accidents that led to numerous injuries across the area. Several parts of roads were closed due to severe icing.
January 15, 1999	Winter Storm	EM-3166	No	Significant icing caused widespread disruptions to mass transit and traffic. Ice also accumulated on trees and power lines and caused significant power outages in Putnam County.
March 14-15, 1999	Heavy Snow	N/A	N/A	Snowfall amounts generally ranged from 6 to 11 inches across the lower Hudson Valley and Long Island. Heavy wet snow downed many tree limbs and power lines across the region. In Putnam County, amounts ranged from 6 to 9 inches.
January 25, 2000	Winter Storm	N/A	N/A	Snowfall rates up to 2 inches per hour occurred during the peak of the morning rush hour. White-out conditions caused massive traffic interruptions. As warm air in the lower levels wrapped around this storm, snow changed to freezing rain and sleet. Snowfall in Putnam County ranged from 7 inches at Croton Falls to 8 inches at both Carmel and Brewster.
February 18-19, 2000	Winter Storm	N/A	N/A	Snowfall became heavy, falling at the rate of at least 1 inch per hour from around 10 am across the entire area until around 4 pm across Orange and Putnam Counties. This first round of heavy precipitation was followed by up to a 1/8th-inch thick ice coating, which caused serious and widespread traffic disruptions. Snowfall in Putnam County ranged from 3 inches at Lake Carmel to 6 inches at Croton Falls. 1 fatality was reported.
December 14, 2000	Ice Storm	N/A	N/A	A mixture of freezing rain and sleet created treacherous travel for the morning commute on December 14th. Power outages resulted as tree limbs fell due to significant ice accretion. Ice accumulated at least one quarter inch throughout the area, with some locations receiving up to one half inch of ice.

Table E.6-1. Winter Storm Events Between 1950 and 2014

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
January 21, 2001	Winter Storm	N/A	N/A	Ice accumulations ranged from 0.25 to 0.50 inches. This accretion of ice on tree limbs caused some tree branches to fall, and led to power outages. 8.1 inches of snow was measured at Fahnestock State Park.
February 25, 2001	Ice Storm	N/A	N/A	Total ice accumulations ranged from 1/4 to 1/3-inch, which resulted in some power outages. In Middletown, a blown transformer on Wawayanda Avenue, near the Mount Carmel School, took out power in much of downtown.
March 5-6, 2001	Winter Storm	N/A	N/A	The combination of very heavy wet snow and strong winds with this prolonged coastal storm produced scattered power outages across southeast New York. Many schools and businesses were closed for several days due to the hazardous nature of this storm. Snowfall in Putnam County ranged from 6 inches at Carmel, to 14 inches at Mahopac.
February 17-18, 2003	Heavy Snow	EM-3184	Yes	Record heavy snowfalls crippled mass transit. Putnam County received between 15.5 inches at West Mahopac to 20.0 inches at Carmel. The storm caused $20 million in damages throughout the region.
December 5-7, 2003	Heavy Snow	N/A	N/A	There were major impacts to mass transit operations during the evening's "rush" hours. Snowfall in Putnam County ranged from 8.3 inches at Pearl River to 15.0 inches at Kent.
January 28, 2004	Heavy Snow	EM-3195	No	A light mixture of snow, sleet, and freezing rain spread north across the area. A light coating of ice on area roads made traveling extremely hazardous toward evening. As the precipitation rate increased during the evening, the mixture changed to a steady snow, which became heavy at times. Snowfall in Putnam County ranged from 7.0 inches at Carmel to 8.0 inches at Patterson.
February 6, 2004	Winter Storm	N/A	N/A	Significant ice accumulations on the wet snow pack led to hazardous road conditions and many traffic accidents across the region.
January 6, 2005	Winter Storm	N/A	N/A	A 4 to 6 inch snowfall was followed by up to 0.25 inches of ice. This created widespread hazardous travel conditions across the region, which disrupted mass transit.
January 11, 2005	Winter Storm	N/A	N/A	A 5 to 7 inch snowfall was followed by up to between 0.25 and 0.50 inches of ice. This created widespread hazardous travel conditions across the region, which disrupted mass transit.
March 2, 2006	Winter Storm	N/A	N/A	Snowfall totals ranged from 3 to 5 inches. During the early afternoon hours the snow mixed with sleet and freezing drizzle. This event had a high impact as it affected both the morning and early evening commutes. Many traffic accidents were reported across the region.
December 19-20, 2008	Severe Winter Storm	DR-1827; EM-3299	DR- No EM- Yes	8.5 inches of snow fell in Mahopac. Public assistance throughout the State totaled over $11 million. Information on damages in Putnam County was not available.
January 6-7, 2009	Ice Storm	N/A	N/A	Ice accumulations in Putnam County ranged from 0.50 inches in Mahopac to 0.60 inches in Putnam Lake and Carmel. Emergency management officials in Putnam County reported trees and wires down during the late morning hours.

Table E.6-1. Winter Storm Events Between 1950 and 2014

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
December 26-27, 2010	Severe Winter Storm and Snowstorm	DR-1957	No	Snow measured 20 to 30 inches across the NYC metro and Lower Hudson Valley. The heavy snow was accompanied by area wide winds of 25 to 40 mph and gusts in excess of 60 mph, resulting in near whiteout conditions with blowing and drifting snow and making all forms of travel extremely difficult to nearly impossible. 8,500 customers in Putnam County lost power.
January 18, 2011	Winter Storm	N/A	N/A	Between 2 and 4 inches of snow and sleet fell across the region, with one quarter to one half of an inch of ice accumulation on top of that. This made for dangerous road conditions.
January 26-27, 2011	Heavy Snow	N/A	N/A	Snow totals of 15-20 inches were reported across much of the region. Amtrak suspended its passenger rail service from New York to Boston and cut service between New York and Albany.
February 1-2, 2011	Winter Storm	N/A	N/A	3 to 7 inches of snow and sleet fell across interior portions of the Lower Hudson valley, with 1 to 3 inches across southern portions of the Lower Hudson Valley, the NYC metro, and Long Island. The highest ice amounts were found across southern portions of the Lower Hudson Valley, the NYC Metro and the northern half of Long Island with between 3/10th and 6/10ths of an inch of ice. Between 1/10 and 3/10ths of an inch occurred elsewhere.
October 29-30, 2011	Heavy Snow	N/A	N/A	Widespread tree damage and power outages occurred due to 7 to 12 inches of heavy wet snow. The heavier amounts fell in the higher elevations.
January 2-3, 2014	Heavy Snow	N/A	N/A	Up to 6 inches of snow fell in Brewster, Kent Cliffs, and Mahopac. County offices were closed.

Sources: NCDC, 2014; FEMA, 2014; Kocin & Uccellini, 2004; McFadden, 2006; Kennedy, 1996
Note: Monetary figures within this table were U.S. Dollar (USD) figures calculated during or within the approximate time of the event. If such an event would occur in the present day, monetary losses would be considerably higher in USDs as a result of inflation.

DR *Disaster Declaration*
EM *Emergency Declaration*
FEMA *Federal Emergency Management Agency*
HMP *Hazard Mitigation Plan*
N/A *Not Applicable*
NCDC *National Climatic Data Center*
NOAA *National Oceanic and Atmospheric Administration*
NWS *National Weather Service*
PA *Public Assistance*
SHELDUS *Spatial Hazard Events and Losses Database for the United States*
TSTM *Thunderstorm*

E.7 Wildfire

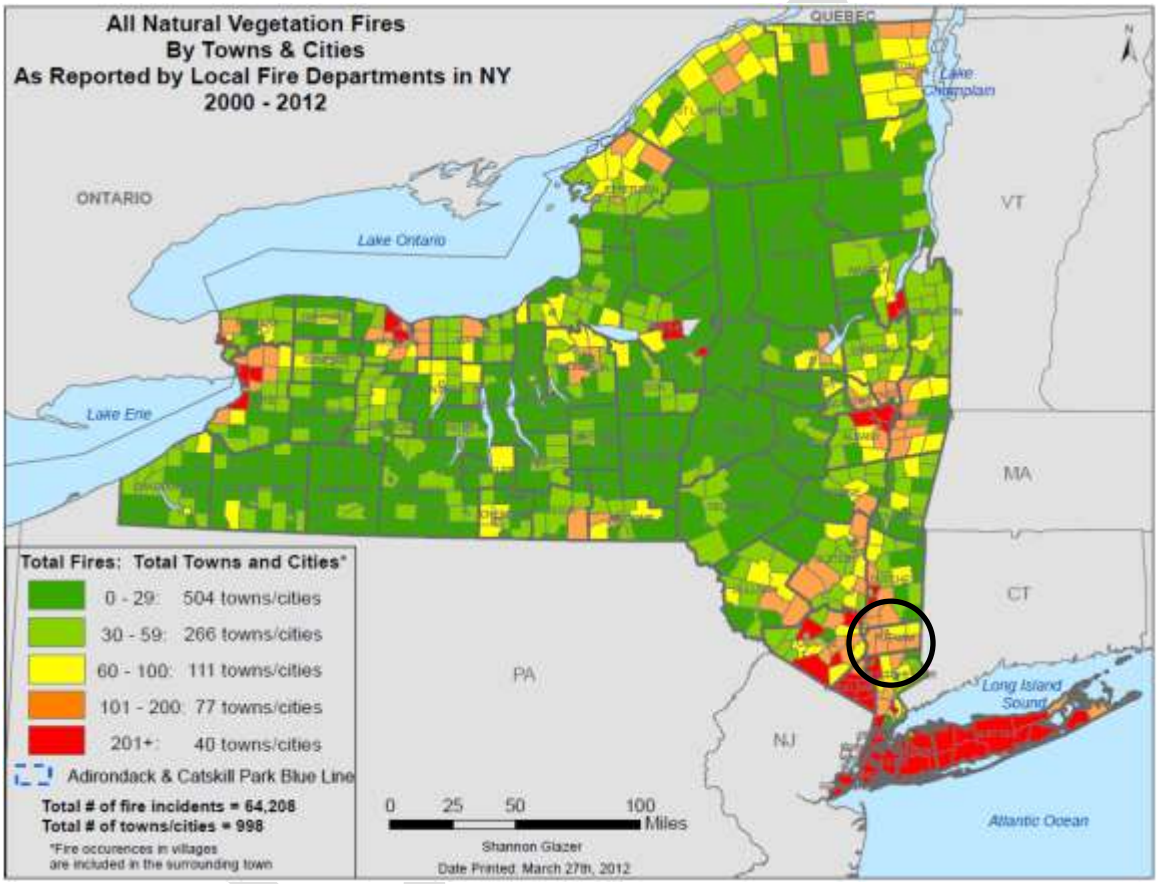
The short-term effects of wildfires can include destruction of timber, forest, wildlife habitats, scenic vistas, and watersheds. Business and transportation disruption can also occur in the short-term. Long-term effects can include reduced access to recreational areas, destruction of community infrastructure and cultural and economic resources (USGS, 2006).

Wildfire occurrence in New York State is based on two data sources – the New York State Forest Ranger force and the New York State Office of Fire Prevention and Control. The New York State Forest Ranger is a division of the NYSDEC. It has fought fires and retained records for over 125 years. Between 1989 and 2012, Ranger Division records indicate that rangers suppressed 6,971 wildfires that burned a total of 67,273 acres (NYSDEC,

2013). NYS Office of Fire Prevention and Control (OFP&C) indicates that from 2002 through 2012, fire departments throughout New York responded to 64,208 wildfires, brush fires, grass fires or other outdoor fires (NYSDEC, 2013).

According to the Ranger Division wildfire occurrence data from 1988 through 2012, 95-percent of wildfires in the State were human-caused. Debris burning accounted for 35-percent; arson accounted for 17-percent; campfires accounted for 13-persent; children accounted for 5-percent; smoking, equipment, and railroads accounted for 30-percent; and lightning accounted for 5-percent of all wildfires (NYSDEC, 2013). Figure E.7-1 illustrates the occurrences of wildfires in New York State, between 2000 and 2012.

Figure E.7-1. Wildfire Occurrences in New York State, 2000-2012



Source: *NYSDEC, 2013*
Note: *The black oval indicates the location of Putnam County.*

In 2013, the NYSDEC reported that 1,059 acres burned due to 126 wildfire events. There were 19 prescribed burns that burned a total of 453 acres (NYSDEC, 2014).

Table E.7-1 shows the wildfire statistics for the NYSDEC's Division of Forest Protection's Region 3, Zone B area (which includes Putnam County) for 2007 through 2013 (NYSDEC, 2014). Details for events specific to Putnam County were not available.

Table E.7-1. Region 3, Zone B Wildfire Statistics

Cause	Year 2007	2008	2009	2010	2011	2012	2013
Debris		3	3	2			
Campfire			1	2		3	5
Lightning							
Arson			4	6	1	1	1
Other	3	6	2	4		3	5
Total # of Fires	3	9	10	14	1	7	11
0.1 to 0.9 acres		1					
< 0.25 acres	1			1			
0.25 to 9.9 acres			6	12	1	5	5
1 to 9.9 acres		4					
10 to 99.9 acres	2	3	4	1		1	4
> 100 acres		1				1	2
Total Acres of Fires	153	2945	228	53	2	507.6	672.6
Total Cost of Fires	$99	$222,961	$-	$871	$-	$439	$2,338

Source: NYSDEC 2014

For this 2014 Plan Update, known wildfire events that have impacted Putnam County between 1950 and May 2014 are identified in Table E.7-2. The National Climatic Data Center's Storm Events Database includes no records of wildfires in Putnam County from 1950 through February 2014. The University of South Carolina's SHELDUS database includes only one record of a wildfire in Putnam County between 1960 and the present. Table E.7-2 may not include a complete record of all wildfire events that have occurred in the County.

Table E.7-2. Wildfire Events between 1950 and May 2014

Dates of Event	Event Type	FEMA Declaration Number	Location / County Designated?	Losses / Impacts
April 20, 1962	Wildfire	N/A	N/A	$8,000 in property damages
April 22, 2014	Brush Fire	N/A	N/A	A wind-swept brush fire burned over 12 acres of a mountain overlooking Morefar Golf Club in the Town of Southeast. The fire most likely started when high tension wires rubbed against tree branches. About 75 firefighters from five departments were called.
April 25, 2014	Brush Fire	N/A	N/A	A brush fire burned an area behind the Milltown Cemetery in the Town of Brewster.

Sources: SHELDUS; NCEHTF; FEMA; NYS DHSES; NYSDEC
Note: Monetary figures within this table were U.S. Dollar (USD) figures calculated during or within the approximate time of the event. If such an event would occur in the present day, monetary losses would be considerably higher in USDs as a result of inflation.

EM — *Emergency Declaration*
FEMA — *Federal Emergency Management Agency*
FM — *Fire Management Assistance Declaration*
HMP — *Hazard Mitigation Plan*
K — *Thousand ($)*
M — *Million ($)*
N/A — *Not Applicable*
NCEHTF — *The Nature Conservancy Eastern Heritage Task Force*
NCDC — *National Climatic Data Center*

NOAA	*National Oceanic and Atmospheric Administration*
NWS	*National Weather Service*
PA	*Public Assistance*