5.4.3 Extreme Temperature

This section provides a profile and vulnerability assessment for the extreme temperature hazard.

5.4.3.1 Hazard Profile

This section provides profile information, including description, extent, location, previous occurrences and losses, and the probability of future occurrences.

Description

Extreme temperature includes both heat and cold events, which can have a significant impact to human health, commercial/agricultural businesses, and primary and secondary effects on infrastructure (such as burst pipes and power failure). What constitutes "extreme cold" or "extreme heat" can vary across different areas of the country, based on the population's experience.

Extreme Cold

Extreme cold events occur when temperatures drop well below normal in an area. For example, near-freezing temperatures are considered "extreme cold" in regions relatively unaccustomed to winter weather. Conversely, "extreme cold" might be used to describe temperatures below 0° F in regions that are subjected to temperatures below freezing on more of a regular basis. For the purposes of this HMP, extreme cold temperatures are characterized when the ambient air temperature drops to approximately 0 degrees Fahrenheit (ºF) or below (National Weather Service [NWS] 2013). Extensive exposure to extreme cold temperatures can cause frostbite or hypothermia and can become life-threatening. Extreme cold also can cause emergencies in susceptible populations, such as those without shelter, those who are stranded, or those who live in a home that is poorly insulated or without heat (such as mobile homes). Infants and the elderly are most susceptible to the effects of extreme changes in temperatures and are particularly at risk, but anyone can be affected (Centers of Disease Control and Prevention [CDC] 2009). In New York State, extreme cold days are defined to reflect the State's regional climate variations. Extreme cold days in the State are individual days with minimum temperatures at or below 32° F (New York State Energy Research and Development Authority [NYSERDA] 2014).

Several health hazards are related to extreme cold temperatures and include wind chill, frostbite, and hypothermia.

- *Wind chill* is not the actual temperature but rather how wind and cold feel on exposed skin. As the wind increases, heat is carried away from the body at an accelerated rate, driving down the body temperature.
- *Frostbite* is damage to body tissue caused by extreme cold. A wind chill of -20°F will cause frostbite in just 30 minutes. Frostbite can cause a loss of feeling and a white or pale appearance in extremities.
- *Hypothermia* is a condition brought on when the body temperature drops to less than 95°F, and it can be deadly. Warning signs of hypothermia include uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness, and apparent exhaustion.

Extreme Heat

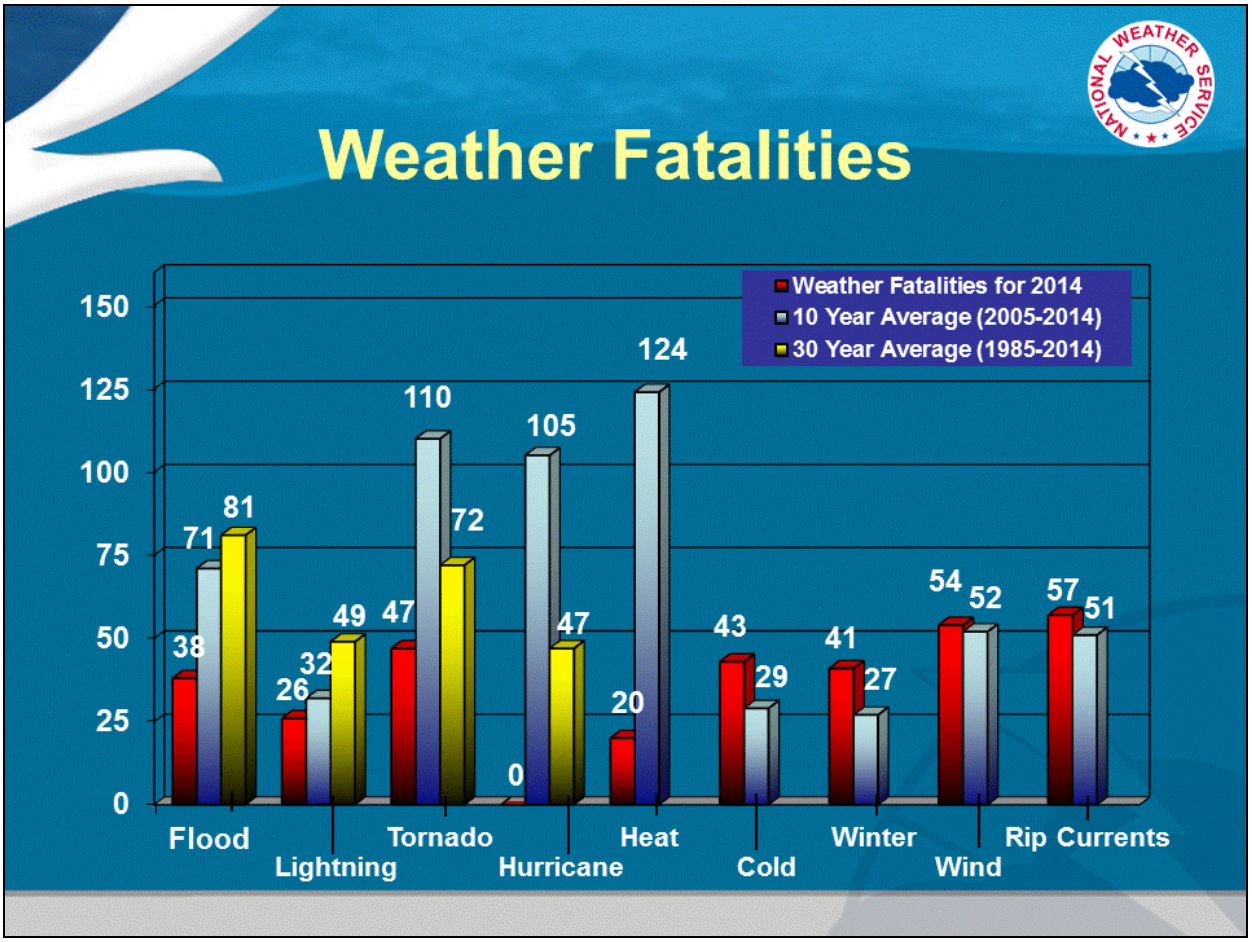
Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for a region and that last for several weeks (CDC 2009). Humid or muggy conditions occur when a "dome" of high atmospheric pressure traps hazy, damp air near the ground. An extended period of extreme heat of 3 or more consecutive days is typically called a heat wave and is often accompanied by high humidity (NWS

2013). In New York State, high temperatures and heat waves are defined in several ways to reflect the diversity of conditions experienced across the State. Extreme hot days in New York State are defined as individual days with maximum temperatures at or above 90° F. Heat waves are defined as 3 consecutive days with maximum temperatures above 90° F (NYSERDA 2014).

Depending on severity, duration, and location; extreme heat events can create or provoke secondary hazards including, but not limited to, dust storms, droughts, wildfires, water shortages, and power outages. These secondary hazards could result in a broad and far-reaching set of impacts throughout a local area or an entire region. Impacts could include significant loss of life and illness; economic costs in transportation, agriculture, production, energy, and infrastructure; and losses of ecosystems, wildlife habitats, and water resources (NYS DHSES 2014).

Extreme heat is the number one weather-related cause of death in the U.S. On average; more than 120 people die each year from excessive heat. In 2014, New York State reported 20 heat-related fatalities (NWS 2015). Figure 5.4.3-1 shows the number of weather fatalities based on a 10-year average and a 30-year average. Heat caused the highest average of weather related fatalities between 2005 and 2014.

Figure 5.4.3-1. Average Number of Weather Related Fatalities in the U.S.



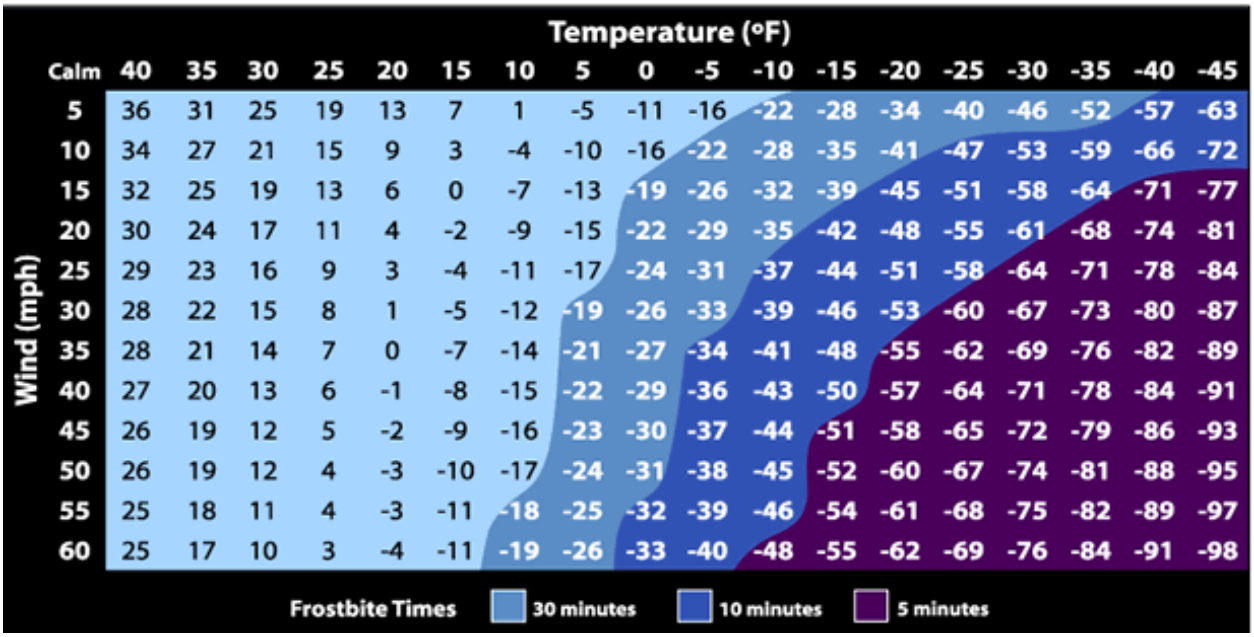
Source: NWS 2015

Extent

Extreme Cold

The extent (severity or magnitude) of extreme cold temperatures is generally measured through the Wind Chill Temperature (WCT) Index. The index uses advances in science, technology, and computer modeling to provide an accurate, understandable, and useful formula for calculating the dangers from wind chill. For details regarding the WCT, refer to: http://www.nws.noaa.gov/om/winter/windchill.shtml. The WCT is presented in Figure 5.4.3-2.

Figure 5.4.3-2. NWS Wind Chill Index

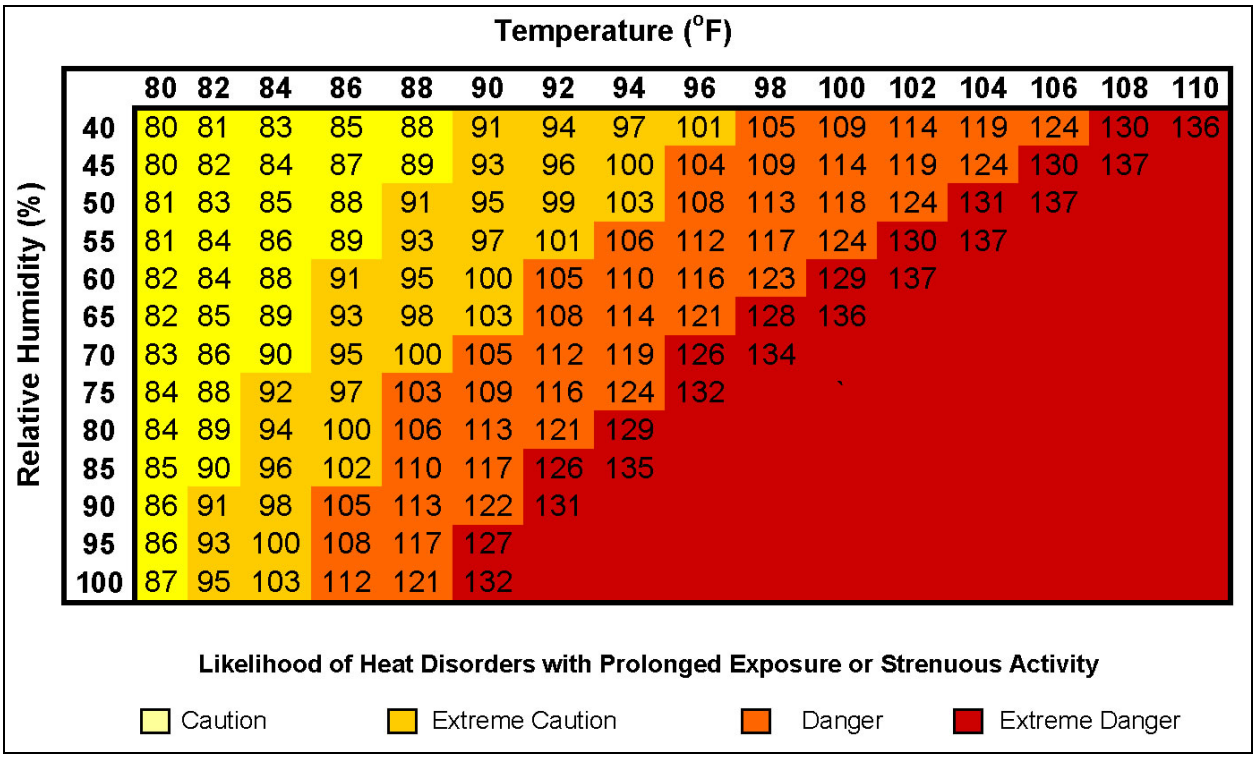


Source: NWS 2001

Extreme Heat

The extent of extreme heat temperatures is generally measured through the Heat Index, identified in Table 5.4.3-1. Created by the NWS, the Heat Index is a chart that accurately measures apparent temperature of the air as it increases with the relative humidity. The temperature and relative humidity are needed to determine the Heat Index. Once both values have been identified, the Heat Index is the corresponding number of both values (as seen in Table 5.4.3-1). This index provides a measure of how temperatures actually feel; however, the values are devised for shady, light wind conditions. Exposure to full sun can increase the index by up to 15 degrees (NYS DHSES 2014).

Table 5.4.3-1. NWS Heat Index Chart



Source: NWS Date Unknown

Table 5.4.3-2 describes the adverse effects of prolonged exposure to heat and humidity on an individual.

Table 5.4.3-2. Adverse Effects of Prolonged Exposures to Heat on Individuals

Category	Heat Index	Health Hazards
Extreme Danger	130 °F – Higher	Heat Stroke / Sunstroke is likely with continued exposure.
Danger	105 °F – 129 °F	Sunstroke, muscle cramps, and/heat exhaustion possible with prolonged exposure and/or physical activity.
Extreme Caution	90 °F – 105 °F	Sunstroke, muscle cramps, and/heat exhaustions possible with prolonged exposure and/or physical activity.
Caution	80 °F – 90 °F	Fatigue possible with prolonged exposure or physical activity.

Source: NYS DHSES 2014

The National Weather Service (NWS) provides alerts when Heat Indices approach hazardous levels. Table 5.4.3-3 explains these alerts. In the event of an extreme heat advisory, the NWS does the following:

- Includes Heat Index values and city forecasts
- Issues special weather statements including who is most at risk, safety rules for reducing risk, and the extent of the hazard and Heat Index values
- Provides assistance to state and local health officials in preparing Civil Emergency Messages in severe heat waves (NYS DHSES 2014).

Table 5.4.3-3. National Weather Service Alerts

Alert	Criteria
Heat Advisory	Issued 12 to 24 hours before the onset of the following conditions: heat index of at least 100°F but less than 105°F for at least two hours per day
Excessive Heat Watch	Issued by the NWS when heat indices of 105°F or greater are forecast in the next 24 to 72 hours
Excessive Heat Warning	Issued within 12 hours of the onset of the following criteria: heat index of at least 105°F for more than 3 hours per day for 2 consecutive days, or heat index more than 115°F for any period of time

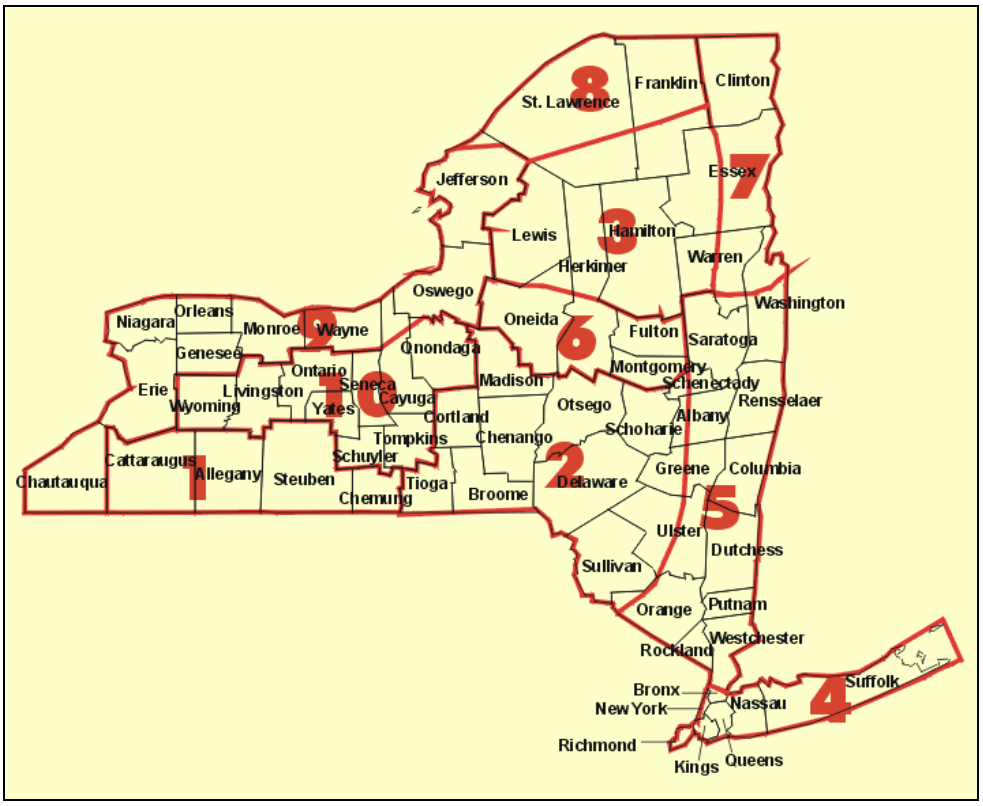
Source: NYS DHSES 2014

Location

According to the New York State Hazard Mitigation Plan 2014 Update, the location of New York State and the typical air masses, combined with the atmospheric circulation, provides general climatic controls for the region, making the entire State susceptible to extreme temperatures. Changes in land elevations, the landscape, and its close proximity to large bodies of water play a significant role in the temperatures of New York State. Extended periods of either extreme cold or warm temperatures are a result of movement of great high pressure systems into and through the eastern United States (NYS DHSES 2014).

New York State is divided into 10 climate divisions: Western Plateau, Eastern Plateau, Northern Plateau, Coastal, Hudson Valley, Mohawk Valley, Champlain Valley, St. Lawrence Valley, Great Lakes, and Central Lakes. According to NOAA's National Climatic Data Center (NCDC), "Climatic divisions are regions within each state that have been determined to be reasonably climatically homogeneous" (NWS 2005; NCDC 2010). Monroe County is located within the Great Lakes Climate Division. Figure 5.4.3-3 depicts the climate divisions in New York State.

Figure 5.4.3-3. New York State Climate Divisions



Source: *NWS, 2005*
Note: *(1) Western Plateau; (2) Eastern Plateau (Catskill Mountains); (3) Northern Plateau (Adirondack Mountains); (4) Coastal; (5) Hudson Valley; (6) Mohawk Valley; (7) Champlain Valley; (8) St. Lawrence Valley; (9) Great Lakes; and (10) Central Lakes.*

Extreme Cold Temperatures

Extreme cold temperatures occur throughout most of the winter season and generally accompany most winter storm events throughout the State. The New York State Climate (NYSC) Office of Cornell University indicates that cold temperatures prevail over the State whenever arctic air masses under high barometric pressure flow southward from central Canada or from Hudson Bay (Cornell University Date Unknown). Temperature readings have been recorded at the Greater Rochester International Airport since May 1929 and have been used to represent climatic conditions in Monroe County and the greater Genesee Valley. Conditions in the region are strongly modified by the proximity of the Great Lakes. According to historical conditions from this recording station, Monroe County's average annual low temperatures is 39.5°F (U.S. Climate Data, 2015). On average, temperatures fall below 0°F an average of 6 nights each winter, and temperatures below -10°F are uncommon (NWS Buffalo 2015). As provided by U.S. Climate Data, average high and low temperatures during the winter months around Monroe County are identified in Table 5.4.3-4.

Table 5.4.3-4. Average High and Low Temperature Range for Winter Months in Monroe County

Month	Average High	Average Low	Record Low Event(s)
November	48ºF	33ºF	5ºF, 1971
December	37ºF	24ºF	-16ºF, 1942
January	32ºF	18ºF	-17ºF, 1994
February	34ºF	19ºF	-22ºF, 1934
March	43ºF	26ºF	-9ºF, 2014

Source: *U.S. Climate Data, 2015*

Extreme Heat

Extreme heat temperatures of varying degrees exist throughout the State for most of the summer season, except for areas at high altitudes. Monroe County's average summer temperatures are between 70 and 72°F. Temperatures at any one place in the county normally exceed 90°F roughly nine times each summer. It is uncommon for air temperatures to reach triple digits; however, higher temperatures combined with humidity may lead to conditions that feel much hotter (NWS Buffalo, 2015).

As provided by U.S. Climate Data, average high and low temperatures during the summer months around Monroe County are identified in Table 5.4.3-5.

Table 5.4.3-5. Average High and Low Temperature Range for Summer Months in Monroe County

Month	Average High	Average Low	Record High Event(s)
May	68ºF	46ºF	94ºF, 1987
June	77ºF	56ºF	100ºF, 1953
July	81ºF	61ºF	102ºF, 1936
August	79ºF	60ºF	99ºF, 1948
September	72ºF	52ºF	99ºF, 1953

Source: U.S. Climate Data, 2015

Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with extreme temperatures throughout New York State and Monroe County. With so many sources reviewed for 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 the MRCC's Application Tools Environment (cli-MATE), which provides access to climate data and value-added tools. This application can be used to look up information that includes raw climate data, rankings of climate information, thresholds, growing season tools, maps, and graphs. The maximum and minimum temperatures and the maximum average and minimum average for the stations in Monroe County were queried for information between January 1, 1990, and June 15, 2015, for this hazard profile. Based on the cli-MATE application and the data provided by MRCC, Table 5.4.3-6 presents the extreme cold (minimum) and hot (maximum) temperature records for the Greater Rochester International Airport from 2006 to 2015.

Table 5.4.3-6. MRCC Temperature Extremes – Monroe County

Year	Max (°F)	Max Date	Min (°F)	Min Date	Avg Max (°F)	Avg Min (°F)
2006	94	Aug 1-2	5	Feb 28	59.9	43.0
2007	96	Jul 9	0	Jan 26	58.3	40.2
2008	93	Jul 8	2	Feb 28	57.9	40.0
2009	90	Aug 17	0	Jan 17	56.0	38.1
2010	94	Jul 7	-4	Jan 10	57.8	41.0
2011	98	Jul 21	-8	Jan 23-24	59.6	42.0
2012	97	Jul 17	2	Jan 15-16	60.9	42.7
2013	93	Jul 19	-4	Dec 17	59.6	42.0
2014	92	Sep 5	-9	Mar 6	56.5	38.8
2015	*		-11*	Feb 20-21	49.5	30.2

Source: MRCC 2015
*Notes: * The annual data is incomplete, and not used for the calculation of the summary statistics.*

Between 1954 and 2015, New York State has not been included in any major disaster (DR) or emergency (EM) declarations as a result of extreme temperatures.

United States Department of Agriculture (USDA) crop losses provide another indicator of the severity of previous events. Agriculture-related disasters are quite common. Additionally, crop losses can have a significant impact on the economy by reducing produce sales and purchases. These impacts may have long-term consequences, particularly if crop yields are low the following years as well.

The Secretary of Agriculture from USDA is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. USDA records indicate that Monroe County has experienced crop losses from extreme temperature events. Between 2012 and 2015, Monroe County was included in three USDA declarations involving extreme temperatures. In March 2012, the county was designated a contiguous county in USDA Disaster S3250, which resulted from frosts, freezes, unseasonable warm temperatures, and excessive heat, and was later designated as a primary county in Disaster S3249 resulting from frosts and freezes. Later, in June of that year, Monroe County was again designated a contiguous county to USDA Disaster S3427 related to drought and excessive heat (USDA 2015). Table 5.4.3-7 presents the crop losses from extreme temperature events in Monroe County, as reported by the USDA. This table includes information from 1993 to 2014.

Table 5.4.3-7 USDA Crop Losses from Extreme Temperature in Monroe County

Year	Crop Type	Cause of Loss	Losses
2014	Apples	Freeze	$146,756
2014	Apples	Frost	$3,870
2014	Apples	Frost	$15,916
2014	Sweet corn	Heat	$3,373
2013	Apples	Freeze	$10,626
2013	Corn	Heat	$30,056
2012	All other crops	Freeze	$32,890
2012	Apples	Freeze	$695,583
2012	Apples	Freeze	$229,267
2012	Apples	Frost	$26,843
2012	Green peas	Heat	$79,286
2011	Apples	Frost	$34,104
2011	Cabbage	Heat	$3,967
2011	Cabbage	Heat	$27,080
2011	Corn	Heat	$1,392.5
2011	Corn	Heat	$23,078
2011	Corn	Heat	$44,376
2011	Green peas	Heat	$39,019
2011	Sweet corn	Heat	$3,718
2010	Apples	Frost	$8,732.77
2010	Apples	Frost	$6,434
2010	Cabbage	Heat	$93,851.3
2010	Cabbage	Heat	$56,237.5
2010	Green peas	Heat	$55,167
2010	Oats	Heat	$649.74
2010	Processing beans	Heat	$51,566
2010	Sweet corn	Heat	$57,051
2010	Sweet corn	Heat	$29,111.40
2009	All other crops	Frost	$6,848
2008	All other crops	Frost	$5,311
2008	All other crops	Heat	$58,486
2008	All other crops	Heat	$235,801
2008	All other crops	Heat	$26,119
2007	All other crops	Frost	$6,136
2007	All other crops	Frost	$3,604
2007	All other crops	Heat	$218,007
2007	All other crops	Heat	$2,411
2006	All other crops	Freeze	$39,100
2006	All other crops	Heat	$114,497
2006	All Other Crops	Heat	$54,693
2006	All Other Crops	Heat	$12,447
2005	All Other Crops	Frost	$2,061
2005	All Other Crops	Heat	$14,401
2005	All Other Crops	Heat	$7,872
2005	All Other Crops	Heat	$23,891
2005	All Other Crops	Heat	$27,348
2005	All Other Crops	Heat	$20,879
2003	All Other Crops	Heat	$12,273
2003	All Other Crops	Heat	$216,610
2003	All Other Crops	Heat	$20,120
2002	All Other Crops	Frost	$9,712

Year	Crop Type	Cause of Loss	Losses
2002	All Other Crops	Heat	$535
2001	All Other Crops	Heat	$41,700
1997	All Other Crops	Heat	$34,606
1994	All Other Crops	Frost	$13,426
1993	All Other Crops	Heat	$7,528

Source: USDA 2015

Extreme temperature events were summarized from 2005 to 2015 for this 2017 HMP. Please note that not all events that have occurred in Monroe County are included based on the extent of documentation and because not all sources may have been identified or researched. Loss and impact information 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. Table 5.4.3-8 presents extreme temperature events that have affected Monroe County.

Table 5.4.3-8. Extreme Temperature Events between 2005 and 2015

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
December 2013 – March 2014	Frost / Freeze	N/A	N/A	The winter of 2013-2014 was one of the coldest in recent history for New York State. Temperatures finished below normal every month for the Rochester climate station, with the average temperature between November and April being 30.3°F, which was 3.4°F below normal. The January through March timeframe finished more than 4 degrees below normal. The Rochester station recorded seven new daily low temperature records: November 13 and 24, December 17, January 3 (low max and low min records), and 7, and March 6. The long winter of sub-zero temperatures led to deep winter freezes, severely damaging farms, orchards, and vineyards across upstate New York. A survey of damaged farms by Cornell University reported primary bud damage as high as 85 percent in the Finger Lakes region and 97 percent in Lake Erie region. This event resulted in a USDA Disaster Declaration (S3672), and Monroe County was included as a contiguous county in this declaration. USDA reported 2014 indemnity losses in Monroe County of more than $160,000 to its apple crop caused by frosts and freezes. Another $10,626 was paid to apple crops as a result of the freeze in 2013, which may have been a result of the 2013-2014 winter season.
June 2012	Drought / Excessive Heat	N/A	N/A	Temperatures averaged above normal in June for the Great Lakes climate division of New York State, where it was the 18th warmest June since 1895. At the same time, the climate division posted below normal rainfall for the fourth out of the 5 previous months. This event resulted in a USDA Disaster Declaration (S3427), and Monroe County was included as a contiguous county in this declaration. The county was considered to be abnormally dry for this time of year. USDA crop losses reported in Monroe County for 2012 related to excessive heat totaled $79,286.
March – April, 2012	Frosts, Freezes	N/A	N/A	After a winter of record high temperatures, many crops in New York blossomed earlier than usual and were destroyed when exposed to early spring freezing temperatures occurring between March 1 and April 30. In March 2012, the county was designated a contiguous county in USDA Disaster (S3250) which resulted from frosts, freezes, unseasonable warm temperatures, and excessive heat, and was later designated as a primary county in Disaster S3249 resulting from frosts and freezes. USDA crop losses reported in Monroe County for 2012 related to freeze and frost totaled $984,583.
January 22, 2011	Freeze and Extreme Cold	N/A	N/A	Monroe County experienced losses caused by a freeze and extreme cold event that occurred January 22, 2011. Conditions caused hundreds of farmers to suffer significant production losses around the region. USDA crop losses reported in Monroe County for 2011 related to frost totaled $34,104 in apple crops.
July 5-8, 2010	Extreme Heat	N/A	N/A	Four days of 90-degree temperatures and higher in the City of Rochester prompted the following: • Rochester City “Cool Sweep” program opened fire hydrants and extended swimming pool and beach hours • Operations adjustments for Department of Public Works (DPW) projects and construction workers, fire

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
				fighters • Air Quality Advisory or Alert issued on July 4, 5, and 7. • The Humane Society issued reminders about pet safety in extreme heat conditions. • County Executive extended hours of operation for swimming at Ontario Beach Park • County Health Department planning for potential need to open a Special Needs Shelter at Monroe Community Hospital and issued a reminder of heat-related health symptoms and safety tips for high temperatures (Monroe County News Release, July 6, 2010) • Rochester Gas and Electric (RG&E) partnered with the Red Cross to distribute 250 electric fans at no charge to seniors and individuals or families receiving Social Security Income (SSI) or Social Security Disability (SSD) assistance. • USDA crop losses reported in Monroe County for 2010 related to heat totaled $343,634, with the greatest losses affecting the sweet corn crop.
January 2009	Extreme low temperatures	N/A	N/A	The January temperature averaged more than 5 five degrees colder than normal, with 18 of the first 23 days recorded below freezing, breaking the previous 30-year record of 16.4 of 30 days in January. USDA crop losses reported in Monroe County for 2009 related to frost totaled $6,848.
February 3 -7, 2007	Extreme low temperatures	N/A	N/A	January 28 began the longest stretch (22 days) of below-freezing temperatures in more than 25 years, and February was the coldest recorded in 14 years. This cold came from the same storm that affected a wide swath of the northern United Sates from the north Plains through the Great Lakes, with temperatures as low as minus 42 degrees. At least four cold-related deaths were recorded. Across this period from February 3 to 7, temperatures ranged from lows of 3 to 10 degrees below zero, with steady winds of 20-plus mph and gusts in the 40 mph range. The National Weather Service, Buffalo Office, issued a Wind Chill Advisory beginning on the 5th and ending the morning of the 6th. The following disruptions to community routine were reported during the weekdays (February 5 to 7): • Many schools closed • Spencerport School District buses became stranded when their diesel fuel jelled, clogging fuel filters. No injuries, just significant transportation delays. • 700 AAA calls for service (double the norm) for dead batteries, stranded vehicles, and other cold weather-related problems. • Requests from the Open Door Mission in the City of Rochester for donations of warm clothing for the homeless • Traffic problems that were a result of ineffective snow melting • Amtrak passenger trains cancelled on the 4th and 5th, resumed with delays on the 6th.
January 26 – 30, 2007	Extreme low temperatures	N/A	N/A	Cold temperatures on the 26th prompted school closings, were blamed for traffic accidents as it was too cold for road salt to be effective, and prompted homeless shelters to extend hours of operation. Temperatures during this period were in the single digits.

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
August 1-2, 2006	Extreme Heat	N/A	N/A	The National Weather Service, Buffalo Office issued an "Excessive Heat Warning" beginning August 1 at noon until August 2 in anticipation of high humidity combining with hot temperatures to make it feel like 105 degrees or greater (NWS Urgent- Weather Message, August 1, 2006, 0351 hours). Temperatures and their corresponding heat index were 94 degrees, 106 heat index on August 1 and 98 degrees 105 heat index on August 2. • Power status as reported by RG&E: o August 1: Outage for 1,500 customers; power consumption set new record at 1,744 megawatts o August 2: Outage for 1,500 customers (These were new outages - the previous day's outages had already been restored.) • Activity influenced by this extreme temperature condition included: o County Health Department and Red Cross opening and staffing four cooling centers within the county o County Health Department opening and staffing a "Special Needs Cooling Center" for mobility impaired o City enforced the "Cool Sweep" (fire hydrants) program and extended swimming pool hours o Homeless Shelters adjusted hours of operation for access during the daytime hours o Cancellations included" school district summer schools, community special events, summer day camps, Buffalo Bills Summer Camp Training Schedule; Finger Lakes Race Track (horse races) o Operations adjusted for DPW projects and construction workers, fire fighters o Sidewalk vendors altered and/or cancelled their lunch wagon services o The Governor waived fees for NYS Parks and NYSDEC sites on August 2 o Hospitals reported about a dozen heat-related Emergency Room visits o The Humane Society treated one dog suffering heatstroke
July 14 – 18, 2006	Extreme Heat	N/A	N/A	Temperatures began in the mid-to-high 80s with a corresponding heat index in the high 80s. Rochester General Hospital treated six patients with heat-related illnesses between the 15th and the 17th. RG&E customers set a 1-day usage record of an estimated 1,630 megawatts. The NWS reported that July 2006 was the hottest July in the City of Rochester since 1955.
Summer 2005	Extreme Heat	N/A	N/A	The summer of 2005 was the warmest summer since 1973, and the fifth-warmest summer on record. The City of Rochester saw 13 days with temperatures in the 90s, with a high of 94 degrees on August 4). The summer also set five records for power use. The peak came July 18, when 1,626 megawatts of power were used. The summer recorded the fifth warmest June, the 20th-warmest July, and the 10th-warmest August in Rochester's history.
July 12 – 13, 2005	Extreme Heat	N/A	N/A	This extreme heat event caused power outages throughout the county. The extended periods of heat and humidity, combined with an increase in air conditioning loads, put a significant stress on the power system. RG&E reported outages on July 12, which was caused by equipment malfunctions, some of which could have been heat related.
January 21 –	Extreme low	N/A	N/A	Record low temperatures were set on the 21st (-10 degrees) and 22nd (-nine degrees), with below normal

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
27, 2005	temperatures			low's on the 23rd, 24th, 26th, 27th and 28th. There was an extended cold period from January 17 to February 2, with temperatures at zero or below on eight of these overnights.

Source(s): NOAA-NCDC 2015; USDA 2015; U.S. Drought Monitor 2015; Monroe County News Release 2010; The Democrat and Chronicle Various Articles 2005, 2006, 2007, 2009, 2010,

DPW *Department of Public Works*
FEMA *Federal Emergency Management Agency*
NOAA-NCDC *National Oceanic Atmospheric Administration – National Climate Data Center*
MPH *Miles per Hour*
NYS *New York State*
NYSDEC *New York State Department of Conservation*
NWS *National Weather Service*
RG&E *Rochester Gas and Electric*
SSD *Social Security Disability*
SSI *Social Security Income*
USDA *United States Department of Agriculture*

Probability of Future Events

According to the New York State HMP 2014 Update, there is an overall 6 percent average future probability that an extreme heat occurrence will affect the State at any given year. Extreme cold events have a 7 percent average future probability of occurrence (NYS DHSES 2014).

Several extreme temperature events occur each year throughout Monroe County. It is estimated that the county will continue to experience extreme temperatures annually that may induce secondary hazards such potential snow, hail, ice or wind storms, thunderstorms, drought, human health impacts, utility failure, and transportation accidents, as well as many other anticipated impacts.

The hazards of concern identified for Monroe County were ranked in Section 5.3. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Committee, the probability of occurrence for extreme temperatures in Monroe County is considered "frequent" (hazard event that is likely to occur within 25 years).

Climate Change Impacts

Climate change is beginning to affect both people and resources in New York State, and these impacts are projected to continue growing. Impacts related to increasing temperatures and sea level rise are already being felt in the State. ClimAID: the Integrated Assessment for Effective Climate Change in New York State (ClimAID), was undertaken to provide decision-makers with information on the State's vulnerability to climate change and to facilitate development of adaptation strategies informed by both local experience and scientific knowledge (NYSERDA 2011).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Monroe County is part of geographical Region 1, Western New York and the Great Lakes Plain. Some of the issues in this region, affected by climate change, include relatively low rainfall and increased risk of summer drought, high-value crops could need irrigation, and improved conditions for grapes projected (NYSERDA 2014).

Temperatures in New York State are warming, with an average rate of warming over the past century of 0.25° F per decade. Average annual temperatures are projected to increase across New York State by 2° F to 3.4° F by the 2020s, 4.1° F to 6.8° F by the 2050s, and 5.3° F to 10.1° F by the 2080s. By the end of the century, the greatest warming is projected to be in the northern section of the State. In Region 1, it is estimated that temperatures will increase by 4.3ºF to 6.3ºF by the 2050s and 5.7ºF to 9.6ºF by the 2080s (baseline of 47.7ºF) (NYSERDA 2014). Extreme events are also projected to increase, as illustrated in Table 5.4.3-9 below:

Table 5.4.3-9. Extreme Event Projections for Region 1

Event Type (2020s)	Low Estimate (10th Percentile)	Middle Range (25th to 75th Percentile)	High Estimate (90th Percentile)
Days over 90 °F (8 days)	12	14-17	19
# of Heat Waves (0.7 heat waves)	2	2	2
Duration of Heat Waves (4 days)	4	4	4
Days below 32 °F (133 days)	99	103 to 111	116

Sources: NYSERDA 2014

5.4.3.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the hazard area identified. The entire county has been identified as exposed for the extreme temperature events. Therefore, all assets in the county (population, structures, critical facilities, and lifelines), as described in the County Profile (Section 4), are exposed and potentially vulnerable. The following text evaluates and estimates the potential impact of extreme temperatures on Monroe County, including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact on: (1) life, health and safety of residents, (2) general building stock, (3) critical facilities (4) economy, and (5) future growth and development
- Effect of climate change on vulnerability
- Change of vulnerability as compared with that presented in the 2011 Monroe County Hazard Mitigation Plan
- Further data collections that will assist understanding of this hazard over time

Overview of Vulnerability

Extreme temperatures generally occur for a short period of time but can cause a range of impacts, particularly to vulnerable populations that may not have access to adequate cooling or heating. This natural hazard can also cause impacts to agriculture (crops and animals), infrastructure (for example, through pipe bursts associated with freezing, and from power failure) and the economy.

Data and Methodology

At the time of this plan, insufficient data are available to model the long-term potential impacts of extreme temperature on Monroe County. Over time, additional data will be collected to allow better analysis for this hazard. Available information and a preliminary assessment are provided below.

Impact on Life, Health and Safety

The entire population of Monroe County is exposed to extreme temperature events. Refer to Section 4 for a summary of population statistics for the county.

Extreme temperature events have potential health impacts including injury and death. According to the Centers for Disease Control and Prevention, populations most at risk to extreme cold and heat events include the following: (1) the elderly, who are less able to withstand temperatures extremes because of their age, health conditions, and limited mobility to access shelters; (2) infants and children up to 4 years of age; (3) individuals who are physically ill (such as with heart disease or high blood pressure), (4) low-income persons who cannot afford proper heating and cooling; and (5) members of the general public who may overexert during work or exercise during extreme heat events or experience hypothermia during extreme cold events (CDC 2006).

According to NOAA's 2001 Winter Storms The Deceptive Killers, approximately 50 percent of the deaths related to extreme cold temperatures happen to people over 60 years old, more than 75 percent of those deaths are male, and about 20 percent occur in the home (NYS DHSES 2014).

Exposure to excessive heat can post a number of health risks to individuals. Table 5.4.3-10 identifies various health hazards related to extreme heat conditions.

Table 5.4.3-10. Health Effects of Extreme Heat

Health Hazard	Symptoms
Sunburn	Redness and pain. In severe cases: swelling of skin, blisters, fevers, and headaches
Dehydration	Excessive thirst, dry lips, and slightly dry mucous membranes
Heat Cramps	Painful spasms, usually in muscles of legs and abdomen, and possible heavy sweating
Heat Exhaustion	Heavy sweating; weakness; cold, pale and clammy skin; weak pulse; possible fainting and vomiting
Heat Stroke	High body temperature (104ºF or higher), hot and dry skin, rapid and strong pulse, and possible coma

Source: NYS DHSES 2014

Meteorologists can accurately forecast extreme heat event and the severity of the associated conditions with several days of lead time. These forecasts provide an opportunity for public health and other officials to notify vulnerable populations, implement short-term emergency response actions, and focus on surveillance and relief efforts on those at greatest risk. Adhering to extreme temperature warnings can significantly reduce the risk of temperature-related deaths.

Impact on General Building Stock

All of the building stock in the county is exposed to the extreme temperature hazard. Refer to Section 4, which summarizes the building inventory in Monroe County. Extreme heat generally does not affect buildings; however, losses may be associated with overheating of heating, ventilation, and air conditioning (HVAC) systems. Extreme cold temperature events can damage buildings through freezing and bursting pipes and freeze/thaw cycles. Additionally, manufactured homes (mobile homes) and antiquated or poorly constructed facilities may have inadequate capabilities to withstand extreme temperatures.

Impact on Critical Facilities

All critical facilities in the county are exposed to the extreme temperature hazard. Impacts to critical facilities are the same as were described for general building stock. Additionally, it is essential that critical facilities remain operational during natural hazard events. Extreme heat events can sometimes cause short periods of utility failures, commonly referred to as "brown-outs," created by increased usage from air conditioners, appliances, and similar equipment. Similarly, heavy snowfall and ice storms, associated with extreme cold temperature events, can interrupt power as well. Backup power is recommended for critical facilities and infrastructure.

Impact on Economy

Extreme temperature events also have impacts on the economy, including loss of business function and damage and loss of inventory. Business owners may be faced with increased financial burdens due to unexpected repairs caused to the building (pipes bursting), higher than normal utility bills, or business interruption caused by power failure (loss of electricity and telecommunications).

The agricultural industry is most at risk in terms of economic impact and damage caused by extreme temperature events. Extreme heat events can result in drought and dry conditions and directly affect livestock and crop production.

Future Growth and Development

As discussed in Sections 4 and 9, areas targeted for future growth and development have been identified across Monroe County. Any areas of growth could be affected by the extreme temperature hazard because the entire county is exposed and potentially vulnerable. Please refer to the specific areas of development indicated in

tabular form and/or on the hazard maps included in the jurisdictional annexes in Volume II, Section 9 of this plan.

Effect of Climate Change on Vulnerability

Climate is defined not simply as average temperature and precipitation but also by the type, frequency, and intensity of weather events. Both globally and at the local scale, climate change has the potential to alter the prevalence and severity of extremes such as extreme temperature events. While predicting shifts in extreme temperature events under a changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future impacts of climate change on human health, society and the environment (U.S. Environmental Protection Agency [EPA], 2015).

Change of Vulnerability

Overall, the county's vulnerability has not changed since the 2011 HMP, and the entire county will continue to be exposed and vulnerable to extreme temperature events.

Additional Data and Next Steps

For future plan updates, the county can track data on extreme temperature events, obtain additional information on past and future events, particularly in terms of any injuries, deaths, shelter needs, pipe freeze, agricultural losses, and other impacts. These data will help to identify any concerns or trends that would require development and refinement of mitigation measures. In time, quantitative modeling of estimated extreme heat and cold events may be feasible as data are gathered and improved.