5.4.9 Severe Winter Storm

The following section provides the hazard profile (hazard description, extent, location, previous occurrences and losses, probability of future occurrences, and impact of climate change) and vulnerability assessment for the severe winter storm hazard in Genesee County.

5.4.9.1 Hazard Profile

Description

A winter storm is a weather event in which the main types of precipitation are snow, sleet or freezing rain. They can be a combination of heavy snow, blowing snow, and/or dangerous wind chills. There are three basic components needed to make a winter storm. Below freezing temperatures (cold air) in the clouds and near the ground are necessary to make snow and ice. Lift, something to raise the moist air to form clouds and cause precipitation, is needed. Examples of this is warm air colliding with cold air and being forced to rise over the cold dome or air flowing up a mountainside. The last thing needed to make a winter storm is moisture to form clouds and precipitation. Air blowing across a body of water, such as a large lake or the ocean (National Severe Storms Laboratory 2014).

Some winter storms are large enough to immobilize an entire region while others may only affect a single community. Winter storms are typically accompanied by low temperatures, high winds, freezing rain or sleet, and heavy snowfall. The aftermath of a winter storm can have an impact on a community or region for days, weeks, or even months; potentially causing cold temperatures, flooding, storm surge, closed and/or blocked roadways, downed utility lines, and power outages. For the purpose of this Hazard Mitigation Plan (HMP) update, and as deemed appropriate by Genesee County, the severe winter storm hazard includes heavy snow (snowstorms), blizzards, sleet, freezing rain, and ice storms. According to the 2014 New York State Hazard Mitigation Plan (NYS HMP), winter storms are frequent events for the State of New York and occur from late October until mid-April. These types of winter events or conditions are further defined below.

Heavy Snow

According to the National Snow and Ice Data Center (NSIDC), snow is precipitation in the form of ice crystals. It originates in clouds when temperatures are below the freezing point (32°F), when water vapor in the atmosphere condenses directly into ice without going through the liquid stage. Once an ice crystal has formed, it absorbs and freezes additional water vapor from the surrounding air, growing into a snow crystals or snow pallet, which then falls to the earth. Snow falls in different forms: snowflakes, snow pellets, or sleet. Snowflakes are clusters of ice crystals that form from a cloud. Snow pellets are opaque ice particles in the atmosphere. They form as ice crystals fall through super-cooled cloud droplets, which are below freezing but remain a liquid. The cloud droplets then freeze to the crystals. Sleet is made up of drops of rain that freeze into ice as they fall through colder air layers. They are usually smaller than 0.30 inches in diameter (NSIDC 2013).

Blizzards

A blizzard is a winter snowstorm with sustained or frequent wind gusts of 35 miles per hour (mph) or more, accompanied by falling or blowing snow reducing visibility to or below 0.25 mile. These conditions must be predominant over a 3-hour period to be considered a blizzard. Extremely cold temperatures are often associated with blizzard conditions, but are not a formal part of the definition. The hazard created by the combination of snow, wind, and low visibility significantly increases, however, with temperatures below 20°F. A severe blizzard is categorized as having temperatures near or below 10°F, winds exceeding 45 mph, and visibility reduced by snow to near zero. Storm systems powerful enough to cause blizzards usually form when the jet

stream dips far to the south, allowing cold air from the north to clash with warm air from the south. Blizzard conditions often develop on the northwest side of an intense storm system. The difference between the lower pressure in the storm and the higher pressure to the west creates a tight pressure gradient, resulting in strong winds and extreme conditions caused by the blowing snow (The Weather Channel 2014).

Ice Storms

An ice storm is an event when damaging accumulations of ice are expected during freezing rain situations. Significant ice accumulations are typically 1/4 inch or greater (NWS 2013). Heavy accumulations of ice can bring down trees, power lines, utility poles, and communication towers. Ice can disrupt communications and power for days. Even small accumulations of ice can be extremely dangerous to motorists and pedestrians (NWS 2009).

Extent

The magnitude or severity of a severe winter storm depends on several factors including a region's climatological susceptibility to snowstorms, snowfall amounts, snowfall rates, wind speeds, temperatures, visibility, storm duration, topography, and time of occurrence during the day (e.g., weekday versus weekend), and time of season.

The extent of a severe winter storm can be classified by meteorological measurements and by evaluating its societal impacts. NOAA's National Centers for Environmental Information (NCEI) is currently producing the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two-thirds of the United States. The RSI ranks snowstorm impacts on a scale from 1 to 5. It is based on the spatial extent of the storm, the amount of snowfall, and the interaction of the extent and snowfall totals with population (based on the 2000 Census). The NCEI has analyzed and assigned RSI values to over 500 storms since 1900 (NOAA-NCEI 2011). Table 5.4.9-1 presents the five RSI ranking categories.

Table 5.4.9-1. RSI Ranking Categories

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

Source: *NOAA-NCEI 2011*

Note: *RSI = Regional Snowfall Index*

The NWS operates a widespread network of observing systems such as geostationary satellites, Doppler radars, and automated surface observing systems that feed into the current state-of-the-art numerical computer models to provide a look into what will happen next, ranging from hours to days. The models are then analyzed by NWS meteorologists who then write and disseminate forecasts (NWS 2013).

The NWS uses winter weather watches, warnings and advisories to ensure that people know what to expect in the coming hours and days. A winter storm watch means that severe winter conditions (heavy snow, ice, etc.) may affect a certain area, but its occurrence, location and timing are uncertain. A winter storm watch is issued when severe winter conditions (heavy rain and/or significant ice accumulations) are possible within in the next day or two. A winter storm warning is issued when severe winter conditions are expected (heavy snow seven inches or greater in 12 hours or nine inches or greater in 24 hours; ice storm with ½ inch or more). A winter weather advisory is used when winter conditions (snow, sleet and/or freezing rain/ice) are expected to cause significant inconvenience and may be hazardous (snow and/or sleet with amounts of four to six inches; freezing

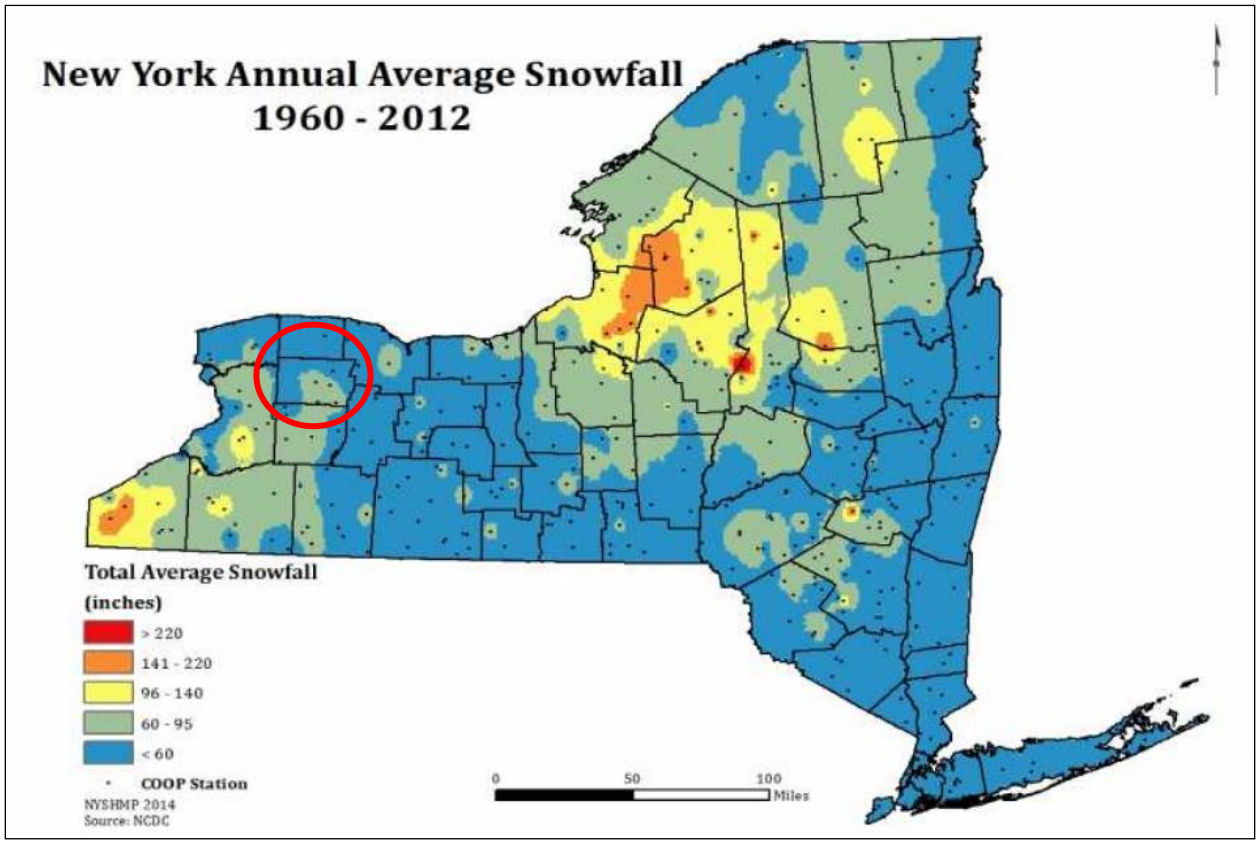
rain and drizzle in any accretion of ice on roads but less than ½ inch). A blizzard warning is issued when snow and strong winds will combine to produce a blinding snow, visibility near zero/whiteouts, and deep snow drifts (NWS 2015).

Location

The climate of New York State is marked by abundant snowfall. Winter weather can reach New York State as early as October and is usually in full force by late November with average winter temperatures between 20 and 40° F. As indicated in the 2014 NYS HMP, communities in New York State receive more snow than most other communities in the nation. Although the entire state is subject to winter storms, the easternmost and west-central portions of the state are more likely to suffer under winter storm occurrences than any other location (NYS DHSES 2014). With the exception of coastal New York State, the state receives an average seasonal amount of 40 inches of snow or more. The average annual snowfall is greater than 70 inches over 60 percent of New York State's area, with Genesee County's average over 84 inches annually. Albany, Syracuse, Buffalo and Rochester are typically in the top ten cities in the nation in annual snowfall (NYS DHSES 2014).

Figure 5.4.9-1, an annual average snowfall map, illustrates the annual average snowfall totals over a 50-year period for New York State. The general indication of the average annual snowfall map shows areas that are subject to a consistent risk for large quantities of snow (NYS DHSES 2014).

Figure 5.4.9-1. Annual Average Snowfall for New York State



Source: NYS DHSES 2014
Note: Genesee County is indicated by a red oval. Some areas of the County had an annual average snow accumulation of 60 to 95 inches; others had annual average snow accumulation of less than 60 inches.

Previous Occurrences and Losses

Many sources provided winter storm information regarding previous occurrences and losses associated with winter storm events throughout Genesee County. With so many sources reviewed for this HMP update, loss and impact information for many events may vary. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP.

Between 1954 and 2017, FEMA included New York State in 25 winter-storm-related major disaster (DR) or emergency (EM) declarations. These events were classified as one or a combination of the following incidents: ice storm, severe storms, flooding, snowstorms, severe winter storm, severe blizzard, blizzard, snow, and winter storm. Generally, these disasters cover a wide region of the state; therefore, they may have impacted many counties. Genesee County was included in 10 of these declarations (refer to Table 5.4.9-2).

Table 5.4.9-2. FEMA Declarations for Severe Winter Storm Events in Genesee County

FEMA Declaration Number	Date(s) of Event	Event Type	Counties Included
DR-494	March 1976	Ice Storm, Severe Storms, and Flooding	Cattaraugus, Chautauqua, Erie, Genesee, Livingston, Monroe, and Wyoming
EM-3027	January 1977	Snowstorms	Cattaraugus, Chautauqua, Erie, Genesee, Jefferson, Lewis, Niagara, Orleans, and Wyoming
DR-527	February 1977	Snowstorms	Cattaraugus, Chautauqua, Erie, Genesee, Jefferson, Lewis, Niagara, Orleans, and Wyoming
DR-898	March 3-4, 1990	Severe Winter Storm	Allegany, Genesee, Jefferson, Lewis, Livingston, Monroe, Ontario, Orleans, St. Lawrence, Steuben, Wayne, Wyoming, and Yates
EM-3107	March 13-17, 1993	Severe Blizzard	All 62 counties in New York State
EM-3136	January 1-15, 1999	Snow	Cattaraugus, Chautauqua, Erie, Genesee, Jefferson, Lewis, Niagara, Orleans, St. Lawrence, and Wyoming,
EM-3170	December 24-29, 2001	Snow	Cattaraugus, Chautauqua, Erie, Genesee, Niagara, and Wyoming
DR-1467	April 3-5, 2003	Ice Storm	Cayuga, Chenango, Genesee, Livingston, Madison, Monroe, Oneida, Onondaga, Ontario, Orleans, Oswego, Otsego, Schenectady, Seneca, Wayne, and Yates
EM-3268	October 12-25, 2006	Lake Effect Snowstorm	Erie, Genesee, Niagara, and Orleans
DR-4204	November 17-26, 2014	Severe Winter Storm, Snowstorm, and Flooding	Cattaraugus, Chautauqua, Erie, Genesee, Jefferson, Lewis, Orleans, St. Lawrence, and Wyoming

Source: FEMA 2017

The Secretary of Agriculture from the U.S. Department of Agriculture (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. Between 2012 and 2016, Genesee County was included in one USDA declaration involving winter weather.

- S3777 (excessive snow, flooding, freeze and high winds) – November 17-24, 2014

USDA crop loss data 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. Table 5.4.9-3 presents the crop losses from winter weather events in Genesee County, as reported by the USDA. This table includes information from 2012 to 2016.

Table 5.4.9-3. USDA Crop Losses from Severe Winter Storms in Genesee County

Year	Crop Type	Cause of Loss	Losses
2013	Soybeans	Other (Snow-Lightning-Etc.)	$2,485.00
2013	Soybeans	Other (Snow-Lightning-Etc.)	$7,203.00
2014	Corn	Other (Snow-Lightning-Etc.)	$66,580.60
2014	Corn	Other (Snow-Lightning-Etc.)	$28,120.00

Source: USDA 2017

For this 2019 HMP update, severe winter storm events were summarized from 2007 to 2017 and are identified in Table 5.4.9-4. For events prior to 2007, refer to the 2008 Genesee County HMP. Please note that not all events that have occurred in Genesee County are included due to the extent of documentation and the fact that 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. For detailed information on damages and impacts to each municipality, refer to Section 9 (jurisdictional annexes).

Table 5.4.9-4. Winter Storm Events Impacting Genesee County between 2007 and 2017

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	County Designated?	Losses / Impacts
February 13, 2007	Heavy Snow	N/A	No	A general snowfall of between one and two feet of snow blanketed the entire region, with slightly higher amounts across the higher elevations of the Finger Lakes Region. There were multiple automobile crashes due to wintery conditions. There were several reports of roofs collapsing as well. Overall, Genesee County had approximately $20,000 in property damage from this event.
March 16, 2007	Heavy Snow	N/A	No	A low pressure over the area brought a blanket of heavy snow across the entire region. Between eight and 10 inches of snow fell across the area, with slightly higher amounts downwind of Lakes Erie and Ontario. The heavy snow fell after significant flooding across the western sections. Overall, Genesee County had approximately $10,000 in property damage from this event.
December 15-17, 2007	Heavy Snow	N/A	No	A system brought heavy snow across the region, closing many schools. Numerous automobile accidents were reported due to snow-covered and slippery roads. Overall, Genesee County had approximately $15,000 in property damage from this event.
March 7-9, 2008	Winter Storm	N/A	No	This was one of the worst storms of the 2007-2008 winter season. Numerous automobile accidents occurred due to slippery conditions and poor visibility in falling and blowing snow. Snowfall totals in Genesee County included 16 inches in Darien (T). The county had approximately $25,000 in property damage from this event.
December 1, 2010	Lake-Effect Snow	N/A	No	This was the second lake-effect event of the winter season and was one of the most intense and disruptive storms in the Buffalo area. Snowfall rates of one to two inches per hour fell over the area. In Genesee County, snowfall totals included 17 inches in Darien (T). The county had approximately $20,000 in property damage from this event.
December 21, 2013	Ice Storm	N/A	No	Genesee County had approximately $50,000 in property damage from this event.
November 17-19, 2014	Severe Winter Storm, Snowstorm, and Flooding	DR-4204	Yes	This event was one of the most significant winter events in Buffalo history. Over 5 feet of snow fell in areas just east of Buffalo. There were 13 fatalities, hundreds of major roof collapses and structural failures, thousands of stranded motorists, and scattered food and gas shortages. The weight of the snow downed trees, causing isolated power outages. The event resulted in a FEMA major disaster declaration in New York State for nine counties, including Genesee County. In Genesee County, snowfall totals included 40 inches in Corfu (V), 36 inches in Darien (T), and 28 inches in Attica (V). The County had approximately $285,000 in property damage from this event.
December 10, 2014	Winter Storm	N/A	No	Snowfall totals in Genesee County included 12 inches in Stafford (T). The county had approximately $25,000 in property damage.
January 8, 2015	Lake-Effect Snow	N/A	No	Snowfall totals in Genesee County included 23 inches in Attica (V) and 8 inches in Corfu (V). The county had approximately $15,000 in property damage from this event.
February 1, 2015	Winter Storm	N/A	No	Snowfall totals in Genesee County included 13 inches in Corfu (V). The county had approximately $20,000 in property damage from this event.
February 15-16, 2016	Winter Storm	N/A	No	A winter storm brought snow to western New York State. Snowfall totals in Genesee County included 12 inches at Stafford (T) and 14 inches in Le Roy (T). The county had approximately $15,000 in property damage from this event.

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	County Designated?	Losses / Impacts
November 20, 2016	Lake-Effect Snow	N/A	No	Widespread light to moderate snow fell across the region from Genesee Valley into Central and Northern New York State. Snowfall totals of 9 inches were reported in Genesee County. The county had approximately $20,000 in property damage from this event.
March 13, 2017	Winter Storm	DR-4322	No	Significant snow fell over the region, closing schools and businesses, and cancelling flights out of Buffalo and Rochester. The state enacted a travel ban on tractor trailers on the major interstates. The National Guard was called on to assist in snow removal in some locations. The event resulted in a FEMA major disaster declaration in New York State for 28 counties; however, Genesee County was not included in the declaration. In Genesee County, 14 inches of snow was reported in Stafford (T) and Corfu (V). The county had approximately $30,000 in property damage from this event.
December 10, 2017	Lake-Effect Snow	N/A	No	Cold air deepened over the eastern Great Lakes with heavy lake snows developing east of Lakes Erie and Ontario. The wind direction was from the west-southwest for most of the event, directing the heaviest snow into the nearby Buffalo Southtowns off Lake Erie, and areas just south and east of Watertown off Lake Ontario. This band of heavy snow then remained nearly stationary through the afternoon and evening of December 10, extending east into northern Wyoming and southern Genesee Counties. During the height of the storm, snowfall rates reached about 3 inches per hour. Heavy accumulation extended farther inland (which was unusual), reaching eastern Genesee and eastern Wyoming Counties with moderate accumulations being reported into western Monroe and northern Livingston Counties. In Genesee County, snowfall totals included 13 inches in Attica (V), and 8 inches in Stafford (T) and Corfu (V). The county had approximately $15,000 in property damage from this event.

Source(s): *NYS DHSES 2014; FEMA 2016; NWS 2016; NOAA-NCEI 2018*

FEMA *Federal Emergency Management Agency*
NOAA-NCEI *National Oceanic Atmospheric Administration – National Centers for Environmental Information*
NWS *National Weather Service*
NYSDHSES *New York State Department of Homeland Security and Emergency Services*
N/A *Not applicable*
T *Town*
V *Village*

Probability of Future Events

Winter storm hazards in New York State are virtually guaranteed yearly since the State is located at relatively high latitudes resulting in winter temperatures that range between 0°F and 32°F for a good deal of the fall through early spring season (late October until mid-April). In addition, the State is exposed to large quantities of moisture from both the Great Lakes and the Atlantic Ocean. While it is almost certain that a number of significant winter storms will occur during the winter and fall season, what is not easily determined is how many such storms will occur during that time frame (NYS DHSES 2014).

According to the 2014 New York State HMP Update, between 1960 and 2012, Genesee County had 183 severe winter storm events, which resulted in eight fatalities, six injuries, over $55 million in property damage, and over $964,000 in crop damage. These statistics show that the county has a 352 percent chance of severe winter storm events occurring with a recurrence interval of 0.28. This information was collected from the Spatial. Hazard Events and Loss Database for the United States (SHELDUS™) (NYS DHSES 2014).

For the 2019 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of winter storm events, of all magnitudes, for Genesee County. Information from NOAA-NCEI storm events database and the NYS 2014 HMP were used to identify the number of winter storm events that occurred between 1960 and 2017. Using these sources ensures the most accurate probability estimates possible. The tables below show these statistics, as well as the annual average number of events and the estimated percent chance of an incident occurring in any given year.

Table 5.4.9-5. Probability of Future Occurrence of Severe Winter Storm Events

Hazard Type	Number of Occurrences Between 1960 and 2017	Annual Number of Events (average)	Recurrence Interval* (in years)	Probability of Event Occurring in Any Given Year	% Chance of Occurring in Any Given Year
Severe Winter Storms	377	6.61	0.15	6.5	100%

Source: *NOAA-NCEI 2018; NYS DHSES 2014*
Note: *Severe winter storm events include blizzard, heavy snow, ice storm, lake-effect snow, winter storm, and winter weather*
**Estimate of the likelihood of an event to occur*

In Section 5.3, the identified hazards of concern for Genesee County were ranked using a variety of parameters. 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 severe winter storms in the county is considered "frequent" (event that will occur in 25 years) (see Section 5.3, Tables 5.3-1 and 5.3-3).

Climate Change Impacts

New York State averages more than 40 inches of snow each year. Snowfall varies regionally, based on topography and the proximity to large lakes and the Atlantic Ocean. Maximum annual snowfall is more than 165 inches in parts of the Adirondacks and Tug Hill Plateau, as well as in the westernmost parts of the state. The warming influence of the Atlantic Ocean keeps snow in the New York City and Long Island areas generally below 36 inches each year.

Climate change is beginning to affect both people and resources in New York State, and these impacts are projected to continue to grow. Impacts related to increasing temperatures and sea level rise are already being felt in the state. 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 the development of adaptation strategies informed by both local experience and scientific knowledge (New York State Energy Research and Development Authority [NYSERDA] 2014).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Genesee County is part of Region 1, which includes western New York and the Great Lakes Plain. Some areas in this region account for the highest agricultural revenue in the state and climate change could affect rainfall and increase the risk of summer drought. High-value crops could also need irrigation and grapes may be affected (NYSERDA 2014).

Temperatures are expected to increase throughout the state, by two to 3.4 ºF by the 2020s, 4.1° F to 6.8° F by the 2050s, and 5.3° F to 10.1° F by the 2080s. The lower ends of these ranges are for lower greenhouse gas emission scenarios and the higher ends for higher emission scenarios. Annual average precipitation is projected to increase by 1 to up to 8 percent by the 2020s, from 3 up to 12 percent by the 2050s, and from 4 up to 15 percent by the 2080s. By the end of the century, the greatest increases in precipitation are projected to be in the northern parts of the state. Although seasonal projections are less certain than annual results, this additional precipitation will most likely occur during the winter months, with the possibility of slightly reduced precipitation projected for the late summer and early fall. Table 5.4.9-6 displays the projected precipitation change for the Western New York Great Lakes ClimAID Region (NYSERDA 2014).

Table 5.4.9-6. Projected Seasonal Precipitation Change in Region 1, 2050s (% change)

Baseline (1971-2000) 34.0 inches	Low Estimate (10th Percentile)	Middle Range (25th to 75th Percentile)	High Estimate (90th Percentile)
2020s	0 percent	+ 2 to + 7 percent	+ 8 percent
2050s	+ 2 percent	+ 4 to + 10 percent	+ 12 percent
2080s	+ 1 percent	+ 4 to + 13 percent	+ 17 percent
2100	+ 3 percent	+ 4 to + 19 percent	+ 24 percent

Source: NYSERDA 2014

It is uncertain how climate change will impact winter storms. Based on historical data, it is expected that the following will occur at least once per 100 years:

- Up to 4 inches of freezing rain in the ice band near central New York State, consisting of between 1 and 2 inches of accumulated ice over a 24-hour period
- Up to 2 feet of accumulated snow in the snow band in northern and western New York State over a 48-hour period (NYSERDA 2011)

New York State is already experiencing the effects of climate change during the winter season. Annual ice cover has decreased 71 percent on the Great Lakes since 1973. This decrease may lead to increased lake-effect snow in the next couple of decades through greater moisture availability. By mid-century, however, lake-effect snow will generally decrease as temperatures below freezing become less frequent (NYSERDA 2014). Winter snow cover is decreasing and spring comes, on average, about a week earlier than it did a few years ago. Night-time temperatures are measurably warmer, even during the colder months (NYSDEC, Date Unknown). Overall winter temperatures in New York State are almost 5 degrees F warmer than in 1970 (NYSDEC, Date Unknown). The state has seen a decrease in the number of cold winter days (below 32°F) and can expect to see a decrease in snow cover, by as much as 25 to 50 percent by end of the next century. The lack of snow cover may jeopardize winter sport businesses offering skiing, snowmobiling, and other types of winter recreation; and natural ecosystems will be affected by the changing snow cover (Cornell University College of Agriculture and Life Sciences 2011).

5.4.9.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For the severe winter storm hazard, all of Genesee County has been identified as the hazard area. Therefore, all assets in the county (population, structures, critical facilities, and lifelines), as described in the County Profile (Section 4), are vulnerable to a winter storm event. The following text evaluates and estimates the potential impact of severe winter storm events on the 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 compared to the 2008 Genesee County Hazard Mitigation Plan
- Further data collections that will assist understanding this hazard over time

Overview of Vulnerability

Severe winter storms are of significant concern to the county because of the frequency and magnitude of these events in the region, the direct and indirect costs associated with these events, delays caused by the storms, and impacts on the people and facilities of the region related to snow and ice removal, health problems, cascade effects such as utility failure (power outages) and traffic accidents, and stress on community resources.

Data and Methodology

Updated population and general building stock data were used to support an evaluation of assets exposed to this hazard and the potential impacts associated with this hazard. Additionally, available economic losses were provided by the Planning Committee to support this vulnerability assessment.

Impact on Life, Health and Safety

According to the NOAA National Severe Storms Laboratory (NSSL), every year, winter weather indirectly and deceptively kills hundreds of people in the United States, primarily from automobile accidents, overexertion, and exposure. Winter storms are often accompanied by strong winds creating blizzard conditions with blinding wind-driven snow, drifting snow, extreme cold temperatures, and dangerous wind chill. They are considered deceptive killers because most deaths, impacts, or losses are indirectly related to the storm. People may die in traffic accidents on icy roads, from heart attacks while shoveling snow, or of hypothermia from prolonged exposure to cold. Heavy accumulations of ice can bring down trees and power lines, disabling electric power and communications for days or weeks. Heavy snow can immobilize a region and paralyze a city, shutting down all air and rail transportation, and disrupting medical and emergency services. The economic impact of winter weather each year is huge, with costs for snow removal, damage repair, and loss of business in the millions (NSSL 2006).

Accumulations of snow can collapse buildings and knock down trees and power lines. In rural areas, homes and farms may be isolated for days, and unprotected livestock may be lost. In the mountains, heavy snow can lead to avalanches.

Heavy accumulations of ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. Communications and power can be disrupted for days while utility companies work to repair the extensive damage. Even small accumulations of ice may cause extreme hazards to motorists and pedestrians. Bridges and overpasses are particularly dangerous because they freeze before other surfaces (NSSL 2006).

For the purposes of this HMP update, the entire population of Genesee County (60,079) is exposed to severe winter storm events (U.S. Census 2010). Snow accumulation and frozen or slippery road surfaces increase the frequency and impact of traffic accidents, which may result in personal injuries. Refer to the County Profile for population statistics for each participating municipality.

The elderly are considered most susceptible to this hazard because of their increased risk of injuries and death from falls, and overexertion or hypothermia from attempts to clear snow and ice. In addition, severe winter storm events can reduce the ability of these populations to access emergency services. Residents with low incomes may not have access to housing or their housing may be less able to withstand cold temperatures (e.g., homes with poor insulation and heating supply).

Impact on General Building Stock

The entire general building stock inventory in Genesee County is exposed and vulnerable to the severe winter storm hazard. In general, structural impacts include damage to roofs and building frames, rather than building content. Table 5.4.9-7 presents the total exposure value for general building stock for each participating municipality (structure only).

Current modeling tools are not available to estimate specific losses for this hazard. As an alternate approach, this HMP Update considers percentage damages that could result from severe winter storm conditions. Table 5.4.9-7 below summarizes percent damages that could result from severe winter storm conditions for the Planning Area's total general building stock. Given professional knowledge and the currently available information, the potential loss for this hazard is many times considered to be overestimated because of varying factors (building structure type, age, load distribution, building codes in place, etc.). Therefore, the following information should be used as estimates only for planning purposes with the knowledge that the associated losses for severe winter storm events vary greatly.

Table 5.4.9-7. General Building Stock Exposure (Structure Only) and Estimated Losses from Severe Winter Storm Events in Genesee County

Municipality	Total RCV (Structure only)	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Alabama (T)	$177,868,000	$1,778,680	$8,893,400	$17,786,800
Alexander (T)	$222,538,000	$2,225,380	$11,126,900	$22,253,800
Alexander (V)	$54,017,000	$540,170	$2,700,850	$5,401,700
Attica (V)	$12,031,000	$120,310	$601,550	$1,203,100
Batavia (C)	$2,234,447,000	$22,344,470	$111,722,350	$223,444,700
Batavia (T)	$844,623,000	$8,446,230	$42,231,150	$84,462,300
Bergen (T)	$223,831,000	$2,238,310	$11,191,550	$22,383,100
Bergen (V)	$136,350,000	$1,363,500	$6,817,500	$13,635,000
Bethany (T)	$168,126,000	$1,681,260	$8,406,300	$16,812,600
Byron (T)	$209,780,000	$2,097,800	$10,489,000	$20,978,000
Corfu (V)	$92,250,000	$922,500	$4,612,500	$9,225,000
Darien (T)	$320,981,000	$3,209,810	$16,049,050	$32,098,100
Elba (T)	$165,232,000	$1,652,320	$8,261,600	$16,523,200
Elba (V)	$68,206,000	$682,060	$3,410,300	$6,820,600
Le Roy (T)	$322,222,000	$3,222,220	$16,111,100	$32,222,200
Le Roy (V)	$563,883,000	$5,638,830	$28,194,150	$56,388,300
Oakfield (T)	$145,747,000	$1,457,470	$7,287,350	$14,574,700
Oakfield (V)	$158,486,000	$1,584,860	$7,924,300	$15,848,600
Pavilion (T)	$236,747,000	$2,367,470	$11,837,350	$23,674,700
Pembroke (T)	$323,821,000	$3,238,210	$16,191,050	$32,382,100
Stafford (T)	$320,339,000	$3,203,390	$16,016,950	$32,033,900
County Total	**$7,001,525,000**	**$70,015,250**	**$350,076,250**	**$700,152,500**

Source: HAZUS-MH v4.0

Notes: *RCV = Replacement Cost Value*
T = Town
V = Village

A specific area that is vulnerable to the severe winter storm hazard is the floodplain. Severe winter storms can cause flooding through blockage of streams or through snow melt. At risk residential infrastructure are presented in the section for the flood hazard (Section 5.4.6). Generally, losses resulting from flooding associated with severe winter storms should be less than that associated with a 100-year flood. In addition, coastal areas are at high risk during winter storm events that involve high winds. Please refer to the severe storm profile for losses resulting from wind (Section 5.4.8).

Impact on Critical Facilities

Full functionality of critical facilities such as police, fire, and medical facilities is essential for response during and after a severe winter storm event. These critical facility structures are largely constructed of concrete and masonry; therefore, they should only suffer minimal structural damage from severe winter storm events. Because power interruption can occur, backup power is recommended. Infrastructure at risk for this hazard includes roadways that could be damaged from the application of salt and intermittent freezing and warming conditions that can damage roads over time. Severe snowfall requires clearing of roadways and alerting of citizens to dangerous conditions; following the winter season, resources for road maintenance and repair are required.

Impact on Economy

The cost of snow and ice removal, road repair due to the freeze/thaw process can drain local financial resources. The economy is also impacted by loss of commuters traveling into or out of the area for work or school. The loss of power and closure of roads prevents the commuter population from traveling to work within and outside of the county.

Future Growth and Development

As discussed in Sections 4 and 9 (Volume II), areas targeted for future growth and development have been identified across the county. Any areas of growth could be potentially impacted by the severe winter storm hazard because the entire planning area is exposed and vulnerable. Areas targeted for potential future growth and development in the next 5 years have been identified across the county at the municipal level. Refer to the jurisdictional annexes in Volume II of this HMP.

Current New York State land use and building codes incorporate standards that address and mitigate snow accumulation. Some local municipalities in the state have implemented the following measures to eliminate loss of life and property and infrastructure damages during winter storm events:

- Remove snow from roadways
- Remove dead trees and trim trees/brush from roadways to lessen falling limbs and trees
- Ensure proper road signs are visible and installed properly
- Bury electrical and telephone utility lines to minimize downed lines
- Remove debris and obstructions in waterways and develop routine inspections and maintenance plans to reduce potential flooding
- Replace substandard roofs of critical facilities to reduce exposure to airborne germs resulting from leakage
- Purchase and install backup generators in evacuation facilities and critical facilities offering essential services to residents

- Install cell towers in areas where limited telecommunication is available to increase emergency response and cell phone coverage (NYS DHSES 2014).

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 winter storms. While predicting winter storm events under a changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society, and the environment (U.S. Environmental Protection Agency [EPA] 2013).

The 2011 "Responding to Climate Change in New York State" report was prepared by the New York State Energy Research and Development Authority to study the potential impacts of global climate change on New York State. According to the synthesis report, it is uncertain how climate change will influence extreme winter storm events. Winter temperatures are projected to continue to increase. In general, warmer winters may lead to a decrease in snow cover and an earlier arrival in spring; all of which have numerous cascading effects on the environment and the state's economy. Annual average precipitation is also projected to increase. The increase in precipitation is likely to occur during the winter months as rain, with the possibility of slightly reduced precipitation projected for the late summer and early fall. Increased rain on snowpack may lead to increased flooding and related impacts on water quality, infrastructure, and agriculture in the state. Overall, it is anticipated that winter storms will continue to pass through New York State (NYSERDA 2011). Future enhancements in climate modeling will provide an improved understanding of how the climate will change and impact the northeast portions of the country.

Change of Vulnerability

There was no quantitative vulnerability assessment conducted for the 2008 version of the HMP. For this update, the county's building inventory is being used to estimate potential loss resulting from severe winter storm events. Overall, the county's vulnerability has not changed, and the entire county will continue to be exposed and vulnerable to severe winter storm events.

Additional Data and Next Steps

The assessment above identifies vulnerable populations and economic losses associated with this hazard of concern. Historic data on structural losses to general building stock are not adequate to predict specific losses to this inventory; therefore, the percent of damage assumption methodology was applied. This methodology is based on FEMA's How to Series (FEMA 386-2), "Understanding Your Risks, Identifying and Estimating Losses" (FEMA 2001) and FEMA's "Using HAZUS-MH for Risk Assessment (FEMA 433)" (FEMA 2004). The collection of additional and actual valuation data for general building stock and critical infrastructure losses would further support future estimates of potential exposure and damage for the general building stock inventory. Mitigation strategies addressing early warning, dissemination of hazard information, provisions for snow removal, and backup power are included in Volume II, Section 9 of this plan.