4.11 SEVERE WINTER WEATHER

SECTION 4.11 SEVERE WINTER WEATHER

4.11-1 HAZARD OVERVIEW

For this plan update Severe Winter Weather includes winter storms, blizzards, and ice storms. Nor'easters are also a common type of storm that may occur during winter months within the State of New Jersey; however, given the frequency of these types of storms in the State and their severe potential impact, Nor'easters are considered as a separate hazard and are further discussed in q 4.9: Hurricanes, Nor'easters, and Tropical Storms. Extreme cold temperatures and wind chills are also associated with winter storms; however, these events are further discussed in this plan in Section 4.6: Extreme Temperatures. Refer to tab 5: Capability Assessment for ongoing capabilities and Section 6.0: Mitigation Strategy for planned activities in the mitigation strategy to address severe winter weather.

Every county in New Jersey identifies severe winter weather as a hazard of concern in their HMPs; and each county has been part of a declared disaster. In current county HMPs, 13 counties identify ice storms as a separate hazard, though only Union County and Warren County ranked it as a high hazard of concern. Collectively, New Jersey has been a part of eight Disaster Declarations and two Emergency Management Declarations from severe winter weather since 1977. In New Jersey severe winter weather has resulted in 11 reported fatalities since 2010.

Hazard Definitions

Winter Storm/Winter Weather

FEMA's National Risk Index for Natural Hazards (NRI) categorizes winter weather events as a winter storm in which the main type of precipitation is snow, sleet, or freezing rain. The quantity of precipitation to be considered heavy snowfall varies by elevation across the country. Heavy snowfall in non-mountainous areas is four inches or more in a 12-hour period, or six inches or more in a 24-hour period. In mountainous areas, heavy snowfall is considered 12 inches or more in a 12-hour period or 18 inches or more in a 24-hour period.

Some winter storms are large enough to immobilize an entire region while others may only affect a single area. Winter storms may be 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.

Blizzards

A blizzard is a winter snowstorm with sustained or frequent wind gusts of 35 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. 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 when temperatures are 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.

Ice Storms

An ice storm describes those events when damaging accumulations of ice are expected during freezing rain situations. Significant ice accumulations are typically accumulations of ¼" or greater (NWS, 2013). Heavy accumulations of ice can bring down trees, power lines and 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, 2008).

Secondary Hazards

In addition to the damage and disruption that may occur from snow and ice, severe winter weather events bring threats of wind chill, frostbite and hypothermia, flooding, and wind damage. Power outages/failure is a secondary hazard of significant concern as can lead to significant consequences, including service disruption, disruption to infrastructure operations, and loss of heat or cooling that can cause further disturbance or injury. Carbon monoxide poisoning is known to increase during winter

months as home heating systems run for extended periods of time. Also, while not a secondary hazard, the overlap between winter storms and the COVID-19 pandemic created challenges related to sheltering across the state.

4.11-2 LOCATION, EXTENT, AND MAGNITUDE

Location

The entire state has the potential for winter storms, blizzards, and ice storms. Generally, snow may fall from mid-October to the end of April in the northern counties and from mid-November to mid-April in the southern counties (ONJSC, 2013), but the total volume of snow over a season will vary year to year as shown in Figures 4.11-1 and 4.11-2.

Winter Storms

Normally experiencing lower temperatures on most winter days, the northern region of the state has a greater chance of all types of winter storms occurring. Elevation can play a role in lowering the temperature to cause ice and snow to form on hilltops while valley locations remain above freezing, receiving only rain or freezing rain. Often a difference of only 100 to 200 feet can make a difference between liquid rain, adhering ice, and snow. For example, Essex County's Orange Mountains, with an elevation of only 200 feet above the valley, have had ice while valley residents have experienced only rain.

Heavy Snow and Blizzards

Although the entire state may be considered at risk for snow and blizzards, higher snow accumulations are prevalent in northern New Jersey, primarily in the northwestern corner. The lower snow accumulations appear to be prevalent along the eastern coastal areas of the State buffered by the ocean. The trajectory of the storm center—whether it passes close to the New Jersey coast or at a distance—largely determines both the intensity and the duration of the snowfall over the State. Winter storms tend to have the heaviest snowfall within a 150-mile-wide swath to the northwest of what are generally southwest to northeast moving storms.

Ice Storms

All regions of New Jersey are subject to ice storms. The distribution of ice storms often coincides with general distribution of snow within several zones in the State. A cold rain may be falling over the southern portion of the State, freezing rain over the central region, and snow over the northern counties as a coastal storm moves northeastward offshore. A locality's distance to the passing storm center is often the crucial factor in determining the temperature and type of precipitation during a winter storm. While higher elevations may experience more snowfall, ice storms may occur in valleys and not on hilltops if cold air gets trapped in the valleys of regions with greater variation in topography.

Extent and Magnitude

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 NWS uses winter weather watches, warnings, and advisories to notify people of potentially hazardous conditions. 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 watch is issued to provide 12 to 48-hour notice of the possibility of severe winter weather. A watch is upgraded to a winter storm warning when hazardous winter weather, in the form of heavy snow, heavy freezing rain or heavy sleet, is imminent or occurring. They are usually issued 12 to 24 hours before the event is expected to begin. Winter weather advisories inform people that winter weather conditions are expected to cause significant inconveniences that may be hazardous. The NWS may also issue a blizzard warning when snow and strong winds combine and produce a blinding snow, deep drifts, and wind chill (NWS, 2013).

NOAA's National Centers for Environmental Information (NCEI) created a Regional Snowfall Index (RSI) to categorize significant snowstorms. Table 4.11-1 presents the five RSI ranking categories. These designations have been created for snowstorms in the northeast region. NOAA is not currently using the RSI to identify severe winter weather events in its Storm Events Database, but the NCEI has analyzed and assigned RSI values to over 500 storms since 1900 (NOAA-NCEI, 2011). The RSI is different than

other magnitude indices for natural hazards in that it is based on the spatial extent of the storm, the amount of snowfall, and the impacts on population and property. It allows a retrospective look at the magnitude of historical events. It is currently unclear if NOAA intends to use this scale in the future to predict magnitude during forecasting.

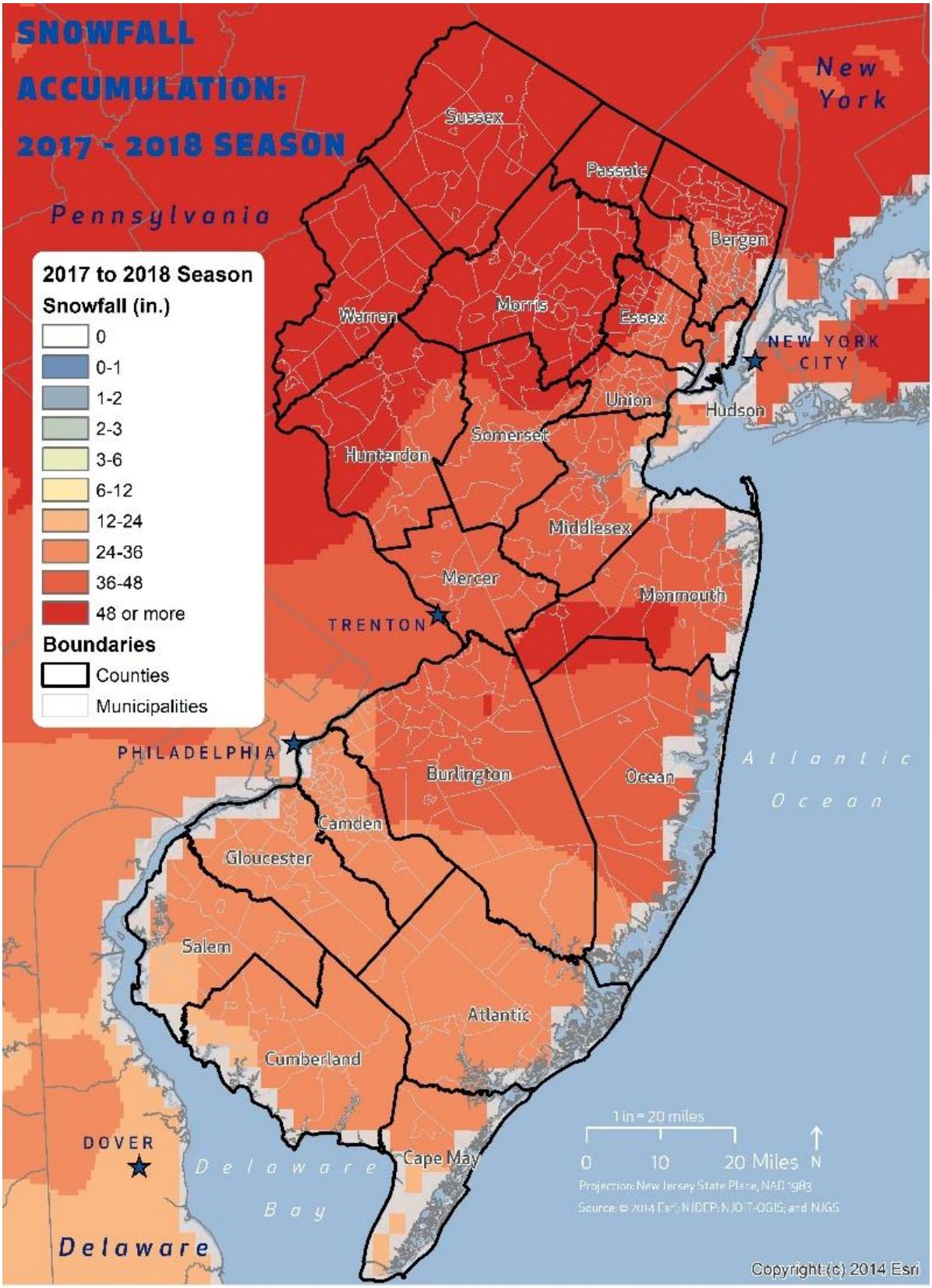
Table 4.11-1 RSI Ranking Categories

Category	Description	RSI Value
1	Notable	1-3
2	Significant	3-6
3	Major	6-10
4	Crippling	10-18
5	Extreme	19+

Source: NOAA-NCEI, 2011

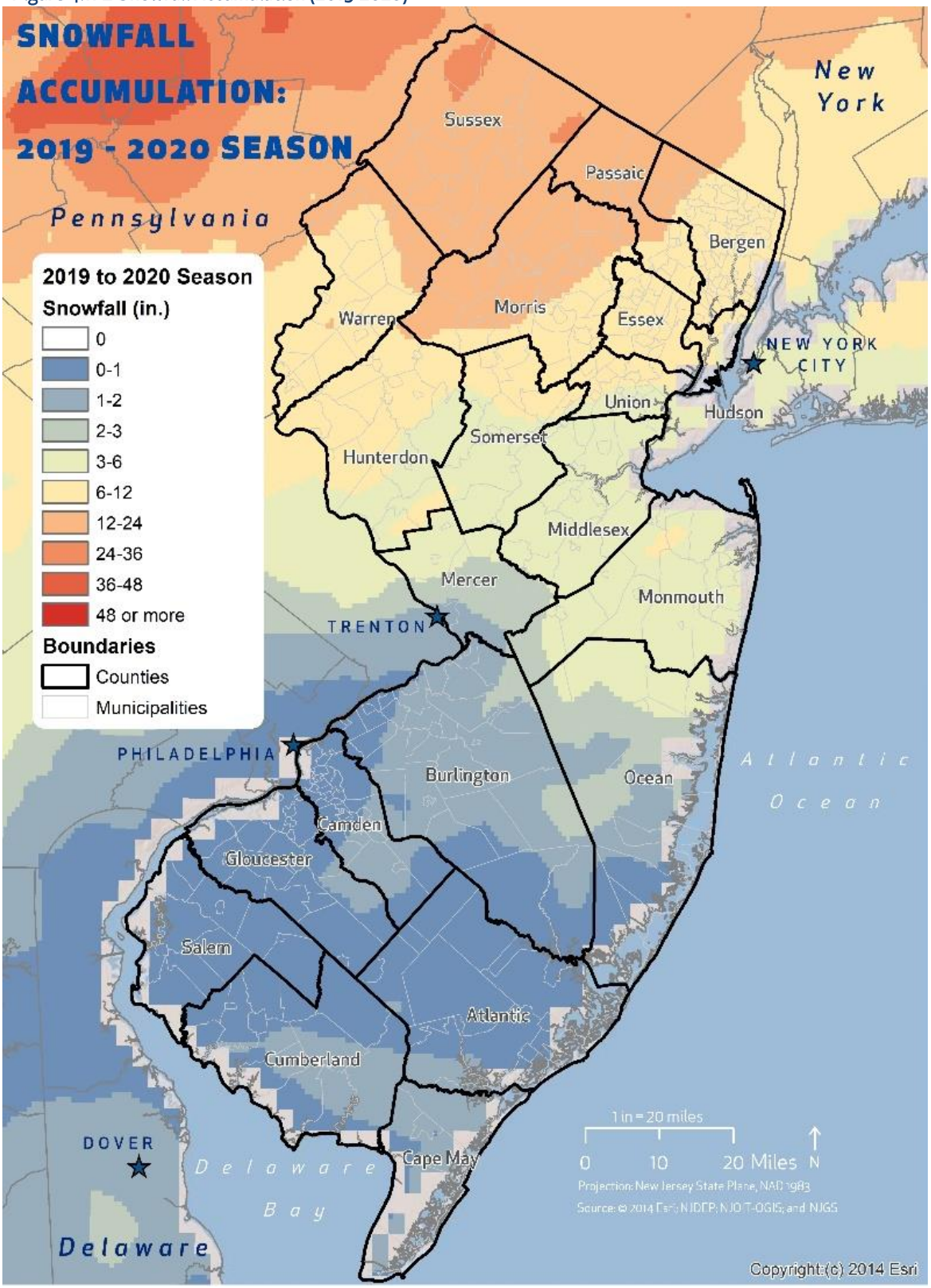
The State of New Jersey can experience a variety of seasonal weather. This variation can be seen across the state and from year to year. Figures 4.11-1 and 4.11-2 represent this variety. These maps represent data provided through NOAA's National Gridded Snowfall Analysis. Figure 4.11-1 shows snowfall accumulation in the winter season of 2017 to 2018, when the entire state experienced over a foot of snow; most of the state experienced over two, three, or four feet of snow depending on the region. In contrast, Figure 4.11-2 shows snowfall accumulation in the winter season of 2019 to 2020. Only a small section in northern New Jersey experienced over one foot of snowfall accumulation, with majority of the state experiencing 3 inches or less from 2019 to 2020. These seasonal snowfall accumulations are close in time but show how the state can experience varying winter weather.

Figure 4.11-1 Snowfall Accumulation (2017-2018 Season)



Source: NOAA, 2023

Figure 4.11-2 Snowfall Accumulation (2019-2020)



Source: NOAA, 2023

4.11-3 PREVIOUS OCCURRENCES AND LOSSES

FEMA Disaster Declarations

Between 1977 and 2021, FEMA declared that the State of New Jersey experienced eight winter storm-related disasters (DR) and two emergencies (EM) classified as one or a combination of the following disaster types: ice conditions, blizzard, snowstorm, or 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 as determined by FEMA.

Historical Events Summary

Many sources provided historical information regarding previous occurrences and losses associated with winter storm events throughout the State of New Jersey. With so many sources reviewed, 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 information available during research for this Plan Update. Table 4.11-2 outlines the history of winter storms in New Jersey from 2010 to the present. Storms included in this table fit at least one of three criteria, those with a FEMA disaster declaration, those with reported fatalities, or those with an RSI of 4 or greater.

Winter Storms

The National Hazard Risk tool uses SHELDUS data to calculate the number of previous events that occurred. In the state of New Jersey, Sussex County has experienced the highest number of winter weather events throughout the historical record at 90, while Cape May County has experienced the fewest at 17. The Average number of winter weather events across the state is 59.

Heavy Snow and Blizzards

NOAA manages the online Storm Events Database which provides information including a narrative summary of each historical event in the state beginning in January 1950. Since records began, NOAA has documented 123 days with heavy snow or blizzards within the state. Prior to 2010, significant snowfalls occurred in the region in 1933, 1947, 1958, 1961, 1978, 1996, 2001, and 2003.

Ice Storms

The National Hazard Risk tool uses SHELDUS data to calculate the number of previous events that occurred. Cape May has recorded the fewest ice storms, with only eight events, while Warren County has 117 events that have been identified through historical records. The average number of ice storms per county in this database across New Jersey is 56.

Table 4.11-2 show the significant historical severe winter weather events since 2010. It includes the dates of the event, the RSI category to describe the magnitude of the event, the FEMA Disaster Declaration number (if applicable), and the counties impacted by the event. It also includes the direct fatalities reported as a result of the event and a brief summary of the event's impacts.

Table 4.11-2 Significant Historical Severe Winter Weather Events Since 2010

Date	RSI Category	FEMA Declaration	Counties Impacted	Fatalities Reported	Brief Summary of Impacts
February 4-8, 2010	3	DR-1889-NJ	Statewide (FEMA emergency declared in Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, and Salem)		A major winter storm dropped 20 to 30 inches of snow across the southern third of New Jersey, 10 to 20 inches across the central third of New Jersey, and less than 10 inches of snow in the northern third of New Jersey from the afternoon of February 5 into the afternoon of February 6, 2010. Blizzard conditions occurred in the southeastern part of the State during the early morning of February 6th, as winds gusted up to 50 mph. The 18.2 inches of snow that fell at the Atlantic City International Airport (Atlantic County) was the 3rd-highest single snowfall event on record. Cape May County was particularly hard hit by this storm with more than 70,000 homes and businesses losing power.
February 10, 2010	3	DR-1889-NJ	Statewide (FEMA emergency declared in Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, and Salem Counties)	2	For the second time within one week a major winter storm affected New Jersey. Blizzard conditions occurred at times across the extreme southern part of the state during the afternoon and early evening of February 10th. Snowfall averaged seven to 15 inches across northwest New Jersey, 12 to 20 inches across central New Jersey, and six to 12 inches across the southern third of New Jersey. Ice accretions were less than one tenth of an inch. Two storm-related deaths occurred in Burlington and Middlesex Counties.
February 25-27, 2010	4		Northwest		A heavy, wet snow fell across much of the region during this storm; however, the snow that fell was a bit lighter and drier throughout northern New Jersey where more blowing and drifting occurred. The combination of gusty winds and accumulating snow resulted in scattered power outages and downed trees. Slippery conditions led to traffic accidents and speed restrictions on the region's roadways and interstates. Numerous flights were cancelled at county and international airports.
December 26-27, 2010	4	DR-1954-NJ	Statewide (FEMA emergency declared in Atlantic, Bergen, Burlington, Cape May, Cumberland, Essex, Hudson, Mercer, Middlesex, Monmouth, Morris, Ocean, Passaic, Somerset, and Union Counties)		A major and for parts of eastern New Jersey record breaking winter storm and blizzard affected the state. Snowfall averaged around two feet for the shore counties as well as Middlesex and Morris Counties in New Jersey with drifts often at least twice that high. Snowfall across southwest New Jersey averaged around one foot and in northwest New Jersey around six inches. As the afternoon progressed, winds also increased, and blizzard conditions occurred across eastern New Jersey from Atlantic County northward.
February 8. 2013	3		North, Central	1	Precipitation started to spread across the area during the morning hours on Friday February 8th. Areas across northern New Jersey started as all snow and remained snow through the entire event. Some areas started as a mix of snow and freezing rain before changing over to all rain during the daytime hours. A changeover to all snow occurred during the evening. Snowfall ranged from 14 inches to 3 inches or less in Southern Jersey. High wind speeds were recorded throughout the state. A fatality was reported as a result of unsafe driving conditions.
January 23, 2016	5		Statewide	8	Snow began falling in the south during early evening of the 22nd, moving steadily northward. The intensity of the storm grew overnight, with heavy snow and howling winds by the morning of the 23rd. Early snow turned over to a mix of snow, sleet, and rain before turning back to snow, producing records in many parts of the state.

Date	RSI Category	FEMA Declaration	Counties Impacted	Fatalities Reported	Brief Summary of Impacts
March 14, 2017	4		Northeast		Rapidly deepening low pressure tracked up the eastern seaboard on Tuesday, March 14,2017 bringing blizzard conditions to Western Passaic county. Heavy snow and sleet along with strong winds occurred across the rest of Northeast New Jersey. The storm cancelled numerous flights at Newark airport with some mass transit services suspended. Large trees fell onto homes in Bergen county and approximately 4,500 power outages resulted from the strong winds and heavy snow.
January 31-February 2, 2021	3	DR-4597-NJ	Statewide (FEMA emergency declared in Cape May, Morris, Ocean, Sussex, and Warren Counties)		The low pressure brought a major winter storm to northeast New Jersey, with the most significant impacts occurring on Monday, February 1, 2021. 3 to 6 inches of snow had already accumulated by the start of the morning commute. Near blizzard conditions then occurred through the rest of the morning into the early afternoon with snowfall rates of 1 to 3 inches per hour. Strong winds combined with these heavy snow rates to produce visibilities one quarter mile or less at times. Snowfall totals ranged 15 to 20 inches of snow with some locations receiving around two feet. Winds gusted 40 to 55 mph at times on Monday, February 1, 2021, which caused power outages. Travel was also severely impacted as many flights were cancelled and travel by train was suspended. COVID testing and vaccination sites were closed.

Source: NOAA-NCEI, 2023

Power Outages

Power failure is defined as any interruption or loss of electrical service caused by disruption of power transmission caused by accident, sabotage, natural hazards, or equipment failure (also referred to as a loss of power or power outage). Power failures in New Jersey are usually localized and are usually the result of a natural hazard event. Power disruption can lead to significant consequences, including service disruption, disruption to infrastructure operations, and loss of heat or cooling that can cause further disturbance or injury.

Extreme winter weather can cause power outages primarily due to high velocity winds. High winds can directly damage power equipment by toppling utility poles along with causing downing of tree limbs which can damage exposed power lines. Additionally accumulating snow and ice from a winter storm can weigh down tree branches and cause them to fall onto power lines. Table 4.11-3 details past occurrences of power outages due to severe winter weather in the State within the past 10 years as recorded by the New Jersey Board of Public Utilities.

Table 4.11-3 Power Outages in New Jersey due to Severe Winter Weather since 2010

Date	Event	Population Impacted
10/29/2011	Snowstorm	670,000 electrical customers out at peak
3/2/2018	Winter Storm	230,000 electrical customers out at peak
3/7/2018	Winter Storm	342,000 electrical customers out at peak
3/21/2018	Winter Storm	87,000 electrical customers out at peak

Source: NJBPU, 2023

4.11-4 PROBABILITY OF FUTURE OCCURRENCES

Severe winter weather is a common occurrence in New Jersey. It is highly likely that New Jersey will see winter weather events in the future. Historically, most of the state receives at least one measurable snow event during the winter months. The months of January, February, March, April, October, November, and December are typically when a vast majority of New Jersey has been observed to receive measurable snow. Generally, counties in the northern region experience more snow events than those in the southern region.

Table 4.11-4 depicts the expected number of ice storm and winter weather events per year as calculated by FEMA's National Risk Index. This annualized frequency represents the average number of recorded hazard events per year over the period of record (67.1 years for ice storms and 16.9 years for winter storms). This table does not account for possible changes in future occurrences due to climate change.

Table 4.11-4 Number of Events Expected Each Year

County	# of Ice Storm events expected per year	# of Winter Weather events expected per year
Atlantic	0.25	2.86
Bergen	0.95	3.97
Burlington	0.85	3.38
Camden	0.84	3.60
Cape May	0.26	2.43
Cumberland	0.50	2.87
Essex	0.74	4.03
Gloucester	0.92	3.70
Hudson	0.88	3.38
Hunterdon	1.46	4.52
Mercer	1.09	3.84
Middlesex	1.06	4.12
Monmouth	0.75	3.25
Morris	0.87	5.21
Ocean	0.42	3.23
Passaic	0.88	4.74
Salem	1.15	3.77
Somerset	0.95	4.52
Sussex	0.98	5.57
Union	0.74	3.76
Warren	1.74	5.14

Source: NRI, FEMA

Potential Effects of Climate Change

Since 1895, New Jersey's annual temperature has increased by 3.5° F, a trend projected to continue with average annual temperatures in New Jersey expected to increase by 4.1° F to 5.7° F by 2050 (NJDEP, 2020). The general warming trend in the state is expected to be felt more during the winter months, and result in fewer sub-freezing days, and less snow accumulation (NJDEP, 2020). However, climate change research also indicates global patterns of increasing surface temperatures, reductions in Arctic Sea ice, and a greater prevalence of high-pressure blocking patterns over the North Atlantic create conditions that are conducive to the formation of slow-moving winter storm development. This suggests that while snowfall may decrease in the upcoming decades, along with a decline in the number of snowstorms, snow will still remain a part of the weather scene in New Jersey for years to come.

4.11-5 VULNERABILITY ASSESSMENT

Vulnerable Jurisdictions

A review of the historic record indicates that all counties have experienced severe winter weather events. Further, all counties identified severe winter weather or winter storms as a hazard of concern in their hazard mitigation plans, as summarized in the table below. In addition to the rankings created by the counties, the table below includes the Hazard Risk Rating data from the

National Risk Index. These ratings are relative to other jurisdictions and based on a risk equation consisting of a natural hazard risk component multiplied by a Community Risk Factor (CRF). Expected Annual Loss is the natural hazards risk component, measuring the expected loss of building value, population, and/or agricultural value each year due to natural hazards. The CRF is determined by combining the community's social vulnerability and community resilience. Social vulnerability measures the susceptibility of social groups to the adverse impacts of natural hazards while community resilience uses demographic characteristics to measure a community's ability to prepare for, adapt to, withstand, and recover from the effects of natural hazards.

Table 4.11-5 Severe Winter Weather Risk Rankings

County	Winter Weather		Ice Storms	
	NRI Hazard Risk Rating	Ranking of Hazard by County HMP	NRI Hazard Risk Rating	Ranking of Hazard by County HMP
Atlantic	Relatively Moderate	Medium	Relatively Low	Not Profiled
Bergen	Relatively High	Profiled, Not Ranked	Relatively High	Profiled, Not Ranked
Burlington	Relatively High	High	Relatively High	High
Camden	Relatively High	Low	Relatively High	Not Profiled
Cape May	Relatively Moderate	Low	Relatively Low	Not Profiled
Cumberland	Relatively Moderate	High	Relatively Moderate	Not Profiled
Essex	Relatively High	Low	Relatively Moderate	Low
Gloucester	Relatively Moderate	Medium	Relatively Moderate	Medium
Hudson	Relatively High	Low	Relatively Moderate	Low
Hunterdon	Relatively Moderate	Low	Relatively Low	Low
Mercer	Relatively High	Low	Relatively Moderate	Low
Middlesex	Relatively High	Medium	Relatively High	Medium
Monmouth	Relatively High	Medium	Very High	Not Profiled
Morris	Relatively Low	Low	Relatively Moderate	Low
Ocean	Relatively High	High	Very High	Not Profiled
Passaic	Very High	Low	Relatively Moderate	Low
Salem	Relatively Moderate	High	Relatively Low	Not Profiled
Somerset	Relatively Moderate	Medium	Relatively Moderate	Medium
Sussex	Relatively Low	Medium	Relatively Low	Not Profiled
Union	Relatively Moderate	High	Relatively Moderate	High
Warren	Relatively High	High	Relatively Moderate	High

Source: FEMA NRI (accessed June 2023), County Hazard Mitigation Plans (accessed June 2023)

Built Environment

Damage to buildings, vehicles, and infrastructure, from heavy snowfall, ice, and high wind speeds make up the majority of losses associated with winter storms. However, businesses are facing more interruption losses as a result of winter storm events. (Munich Re, 2023). The entire general building stock inventory in the State may be exposed to the severe winter weather hazard; that said, not all buildings across the state can handle the load of heavy snow. Older homes may be more vulnerable to heavy snow that may result in roof collapse. Building structure type, age, and load distribution may vary and influence structural vulnerability. 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 can vary greatly.

In addition to building damage, 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.

Potential Losses from Buildings

Table 4.11-6 shows estimated potential annual losses (EAL) for severe winter weather (winter weather and ice storms) by county in the state of New Jersey. Total Building EAL was derived from FEMA's NRI (pulled on 7/3/2023) while EAL for state owned assets was calculated by multiplying Replacement Cost Value data for state owned facilities per county derived from LBAM data and Expected Annual Loss Rate for Buildings by county provided by the NRI.

Table 4.11-6 Estimated Potential Annual Losses for Winter Weather and Ice Storms

County	Winter Weather		Ice Storms	
	Total Buildings	State-Owned Assets	Total Buildings	State-Owned Assets
Atlantic	$76,744.28	$524.05	$6,685.23	$45.65
Bergen	$471,477.38	$423.26	$74,914.48	$67.25
Burlington	$105,949.23	$680.87	$43,283.50	$278.16
Camden	$107,021.45	$527.41	$48,369.96	$238.37
Cape May	$75,674.83	$227.77	$74,750.15	$224.99
Cumberland	$136,976.50	$2,941.43	$127,115.81	$2,729.69
Essex	$27,163.50	$173.31	$123,400.36	$787.32
Gloucester	$218,081.00	$384.75	$29,349.51	$51.78
Hudson	$13,945.31	$46.78	$78,490.04	$263.28
Hunterdon	$107,817.30	$703.82	$26,219.29	$171.16
Mercer	$52,550.66	$1,742.31	$41,916.97	$1,389.75
Middlesex	$64,965.43	$213.69	$84,082.87	$276.57
Monmouth	$41,954.65	$119.98	$41,833.31	$119.63
Morris	$47,334.25	$147.72	$45,222.25	$141.13
Ocean	$82,501.02	$236.60	$16,247.49	$46.60
Passaic	$207,802.37	$616.35	$26,884.62	$79.74
Salem	$72,920.16	$360.38	$8,087.16	$39.97
Somerset	$137,335.73	$353.18	$38,929.68	$100.11
Sussex	$48,262.69	$131.50	$15,443.04	$42.08
Union	$18,328.89	$32.50	$89,296.84	$158.35
Warren	$117,090.61	$325.34	$20,909.35	$58.10

Source: NRI, FEMA; NJOMB, 2023

Lifeline Impacts

FEMA created eight Community Lifelines to contextualize information from incidents, communicate impacts in plain language, and promote a more unified effort across a community that focuses on stabilizes these lifelines during response. More information on these lifelines can be found in Section 4.1: Risk Assessment Overview. Table 4.11-7 showcases the most likely lifelines to be impacted by severe winter weather, including a short description of anticipated impacts.

Table 4.11-7 Lifelines Most Likely Impacted by Severe Winter Weather

Lifeline Categories	Notable Impacts
Safety and Security	Community safety may be threatened due to potential direct harm from storm impacts and compounding effects on administration of services. Transportation infrastructure issues may directly impact the abilities of law enforcement, fire service, search and rescue, and other government services.

Lifeline Categories	Notable Impacts
Food, Hydration, Shelter	Winter storms can cause damage to shelter structures and water utility infrastructure, while the food supply chain may be disrupted due to impacts on transportation infrastructure. The ability of shelter to provide an adequately safe temperature can be impacted by potential effects of winter storms on energy systems.
Health and Medical	Potential Impacts to the Health and Medical lifeline can be a result of damage to medical structures and transportation infrastructure. Medical facilities can be impacted due to power disruptions or damage to structures from winter storms and patient movement and medical supply chains can be impacted by damage to transportation infrastructure and dangerous conditions on roadways.
Energy	Severe winter weather has the potential to cause direct damage to infrastructure and its ability to provide power to the grid. Additionally, this could result in potential increases in fuel usage for those who lost access to electrical heating.
Communications	Accumulation of ice has the potential of causing collapse of trees, utility poles, and communication towers. Ice can disrupt communications and power for days.
Transportation	Anticipated impacts for the Transportation lifeline consist of direct damage to infrastructure and dangerous road conditions such as ice and decreased visibility. Bridges and overpasses are particularly dangerous because they freeze before other surfaces (NSSL, 2006). Damage to the Transportation lifeline has cascading effects among other lifelines which depend on movement of people or goods.
Hazardous Materials	Hazardous Materials facilities could be impacted by power disruptions due to effects to energy infrastructure. Transport of hazardous materials can be impacted by transportation infrastructure issues and dangerous road conditions including the potential for spills or releases.
Water Systems	Severe winter weather has the potential to threaten the Water Systems lifeline. Cold temperatures associated with winter storms and ice storms could cause water infrastructure such as pipes to burst. Water expands when it freezes, bursting pipes that aren't adequately protected. Then when the temperature rises, those broken pipes start leaking. This affects water pressure impacting delivery of water to homes, businesses, and other community lifelines.

Population and Economy

Economic Impacts

Of the billion-dollar disasters that have affected New Jersey since 1980, winter storms account for $5-10 billion, or 8.8% of total costs (NOAA, 2023). The cost of snow and ice removal and repair of roads from the freezing and thawing process can drain local financial resources. The potential secondary impacts from winter storms also impact the local economy including loss of utilities, interruption of transportation corridors, and loss of business function. For instance, there are over 700,000 acres of farmland in New Jersey (FEMA, 2020) that represent $1.26 billion of agricultural value potentially exposed to winter weather (NRI, FEMA)

One of the worst winter storms to impact New Jersey was the March 1993 "Storm of the Century." While New Jersey was not as hard hit as other parts of the country, it still saw a foot or more of snow is most areas. Central New Jersey reported 2.5 inches of sleet on top of 12 inches of snow – creating somewhat of an "ice-cream sandwich" effect. The storm closed nearly all interstate highways, and many homes and businesses lost electricity. Every major airport on the East Coast, including Newark Airport, were closed – unprecedented at the time, representing the most weather-related flight cancellations in U.S. history up to that point (NOAA, 2023).

Population Impacts and Changes in Development

According to the NOAA National Severe Storms Laboratory (NSSL), every year winter weather contributes to hundreds of fatalities in the United States, primarily from automobile accidents, over-exertion, and exposure. Injuries and fatalities may occur because of traffic accidents on icy roads, falls from ice and snow, heart attacks while shoveling snow, or of hypothermia from prolonged exposure to cold. NJ Department of Health collects emergency room visit data across the state. Between 2016 and 2021, when the dataset is available, New Jerseyans averaged 357 visits to the emergency rooms after a fall due to ice and/or snow. The low during this time period of 82 visits in 2020 when individuals were commuting less during the winter

months. The high of 613 visits to the emergency room came in 2018 when there were no individual significant winter storms. The total accumulation of snowfall that year was high, indicating many smaller events that resulted in a more falls/visits to the hospital (NJDOH, 2023).

As New Jersey's population continues to grow, so will the number of individuals potentially impacted by severe winter weather. However, recent changes in land use, development, and infrastructure in New Jersey have no measurable impact to the location or magnitude New Jersey faces from winter storms, blizzards, or ice storms.

Socially Vulnerable and Underserved Communities

People who need frequent medical care are considered most vulnerable to severe winter weather events, because these events may prevent these individuals from accessing care. Older adults and children are also considered vulnerable to severe winter weather because of their increased risk of injury and death from falls, overexertion, and/or hypothermia. Severe winter weather events can also reduce the ability of individuals to access emergency services. In addition, 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).

Additionally, those in New Jersey experiencing homelessness are particularly vulnerable to the impacts of severe winter weather. The 2022 Point In Time Count documented 8,752 persons within 6,631 households that were experiencing homelessness in New Jersey at the time of the survey, January 25th, 2022 (US HUD, 2022). This was a decline from 2020, where 9,662 individuals were sheltered and nearly a 50 percent decline from 2007. Approximately 11 percent of the population surveyed in 2022 was unsheltered (US HUD, 2020). New Jersey has a Code Blue program that activates a network of organizations, led by County Offices of Emergency Management to provide temporary shelter to unsheltered populations experiencing homelessness during severe winter weather events.

Ecosystems and Natural Assets

Air Quality

There are no identified impacts to air quality associated with severe winter weather.

Beaches and Dunes

Winter storms along the coast may result in coastal erosion, the impacts of which is summarized in Section 4.2: Coastal Erosion.

Water Resources

Aquifers, streams, rivers, and lakes depend on winter precipitation to replenish volumes and ensure water quality. Snowpack allows for a slower discharge through the watershed, which can improve recharge for surficial and subsurface water resources. It is projected that streams will reach maximum spring flow one to two weeks earlier than in the past due to the seasonal shift in when snowmelt occurs across the region (NJDEP, 2020). For information about Ice Jams, see Section 4.7: Flood.

Freshwater and Coastal Wetlands

Wetlands can be sensitive to excessive water and may be damaged from prolonged or heavy snowpack. There is no indication that wetlands should be managed differently in New Jersey to minimize the risk of severe winter weather.

Forests and Vegetated Lands

Forests and vegetated lands allow snowfall to melt into the ground, recharge subsurface water levels, and reduce the potential for flooding to result from heavy snowfalls. The environmental impacts of a severe winter weather event are associated with the heavy snow and/or ice accumulations that can bring down vegetation and tree limbs. The 2020 Scientific Report on Climate Change identified the relationship between changes in the frequency of winter snowfall and forests to be an identified data gap for the state.