5.4.3 EXTREME TEMPERATURE

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

HAZARD PROFILE

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

Description

Extreme temperature both heat and cold events, can have a significant impact to human health, commercial/agricultural businesses and infrastructure. What constitutes "extreme cold" or "extreme heat" can vary across different areas of the country, based on climate and topography.

Extreme Cold: Extreme cold events are when temperatures drop well below normal in an area. According to National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS), the term "extreme cold" constitutes different conditions in different parts of the country, ranging from near freezing (32°F) in the South to temperatures well below zero in the North. Prolonged exposure to cold temperatures, whether indoors or outside, can lead to serious or life-threatening health problems (Centers of Disease Control and Prevention [CDC], 2005).

Extreme Heat: Extreme heat is when temperatures hover 10 degrees or more above the average high temperature for the region and last for several weeks (FEMA, 2006; CDC, 2009). A heat wave is a period of abnormally and uncomfortably hot and unusually humid weather that lasts two or more days (NWS Glossary, 2009). A heat wave is applied to both routine weather variations and to extraordinary spells of heat, which may only occur once every century. Similar to extreme cold, prolonged exposure to extreme heat can lead to serious or life-threatening health problems (Centers of Disease Control and Prevention [CDC], 2005).

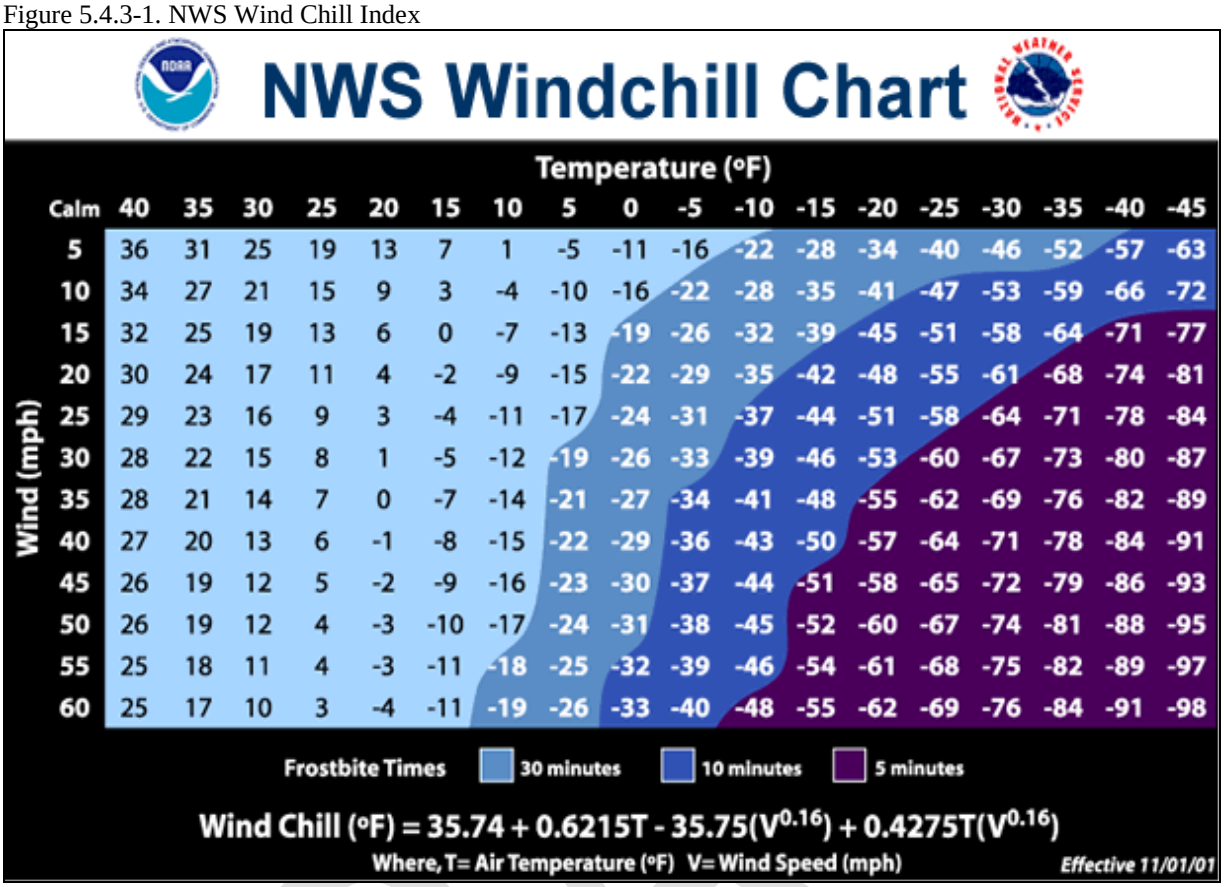
Extent

Extreme Cold Temperatures

The extent (severity or magnitude) of extreme cold temperatures are generally measured through the Wind Chill Temperature (WCT) Index. Wind Chill Temperature is the temperature people feel when outside. It is based on the rate of heat loss from exposed skin by the effects of wind and cold. As the wind increases, the body is cooled at a faster rate causing the skin's temperature to drop (NWS, 2009).

Figure 5.4.3-1 shows the WCT Index. The Index depicts the difference between actual air temperature and perceived temperature, and amount of time until frostbite occurs (NWS, 2009).

Figure 5.4.3-1. NWS Wind Chill Index



Source: NWS, 2008

Extreme Heat Temperatures

The extent of extreme heat temperatures are generally measured through the Heat Index, identified in Table 5.4.3-1. Created by the NWS, the Heat Index is a chart which accurately measures apparent temperature of the air as it increases with the relative humidity. It is important to note that the Heat Index values are devised for shady, light wind conditions. Exposure to full sunshine can increase the Heat Index by up to 15 degrees (NYSDPC, 2008; NCDC, 2000).

Table 5.4.3-1. Heat Index Chart

Relative Humidity (%) \ Temperature (°F)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Source: NCDC, 2000; NYSDPC, 2008

Table 5.4.3-2 describes the adverse effects that prolonged exposure to heat and humidity can have 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/or heat exhaustion possible with prolonged exposure and/or physical activity.
Extreme Caution	90 °F – 105 °F	Sunstroke, muscle cramps, and/or heat exhaustions possible with prolonged exposure and/or physical activity.
Caution	80 °F – 90 °F	Fatigue possible with prolonged exposure and/or physical activity.

Source: NYSDEC, 2008

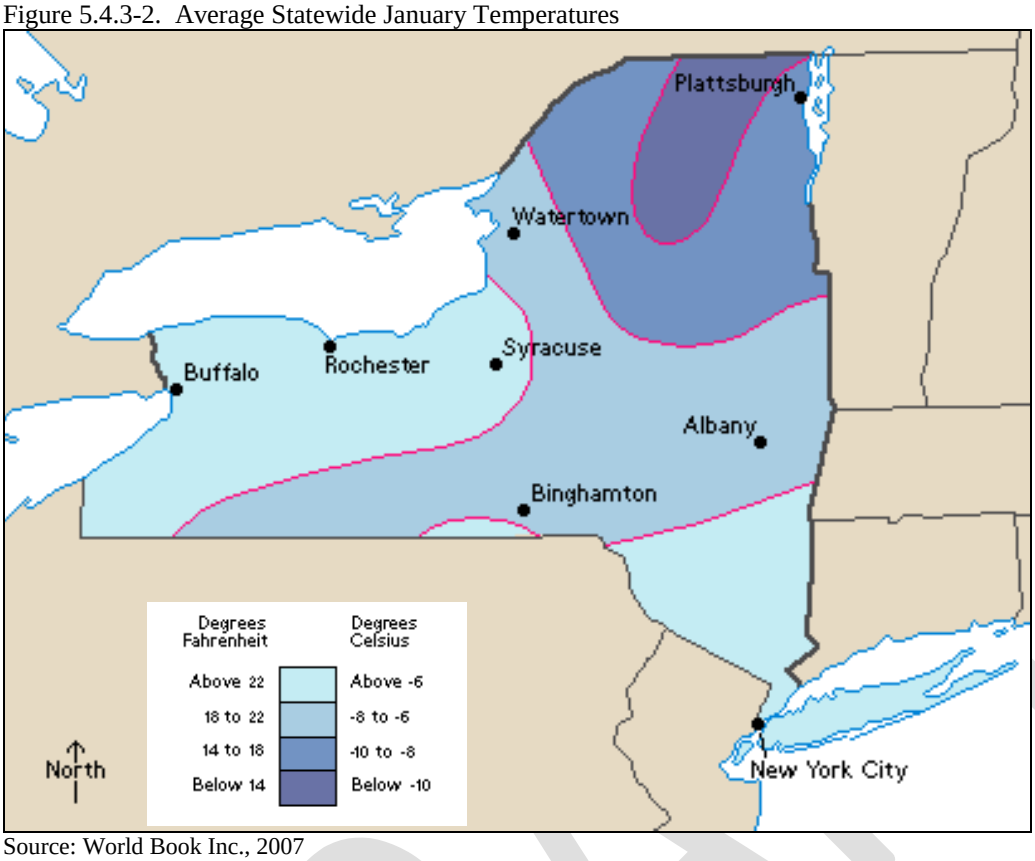
Location

As discussed within the Drought Profile of this document, New York State is divided into 10 climate divisions; the Town of Blooming Grove Planning Area is located within the Hudson Valley Climate Division. Please refer to Section 5.4.1 (Drought) for detailed information regarding the climate divisions of New York State.

Extreme Cold Temperatures

According to the New York State Climate Office, extreme cold events in New York State occur regularly, and are most common between October and March. **Error! Reference source not found.** identifies the average January temperatures of the State, with the northeast sections experiencing the coldest conditions and the west and southeast experiencing the mildest winters.

Figure 5.4.3-2. Average Statewide January Temperatures



Source: World Book Inc., 2007

Through the tempering influence of the Atlantic Ocean, winter temperatures are moderated considerably throughout the lower Hudson Valley Climate Division. In the region, the coldest temperature in most winters will range between 0° and -10°. The average length of the freeze-free season varies from 150 to 180 days in duration (NYSC, Date Unknown).

As provided by The Weather Channel, average high and low temperatures during the winter months around the Town of Blooming Grove Planning Area are identified in Table 5.4.3-3.

Table 5.4.3-3. Average High and Low Temperature Range for Winter Months in the Town of Blooming Grove Planning Area

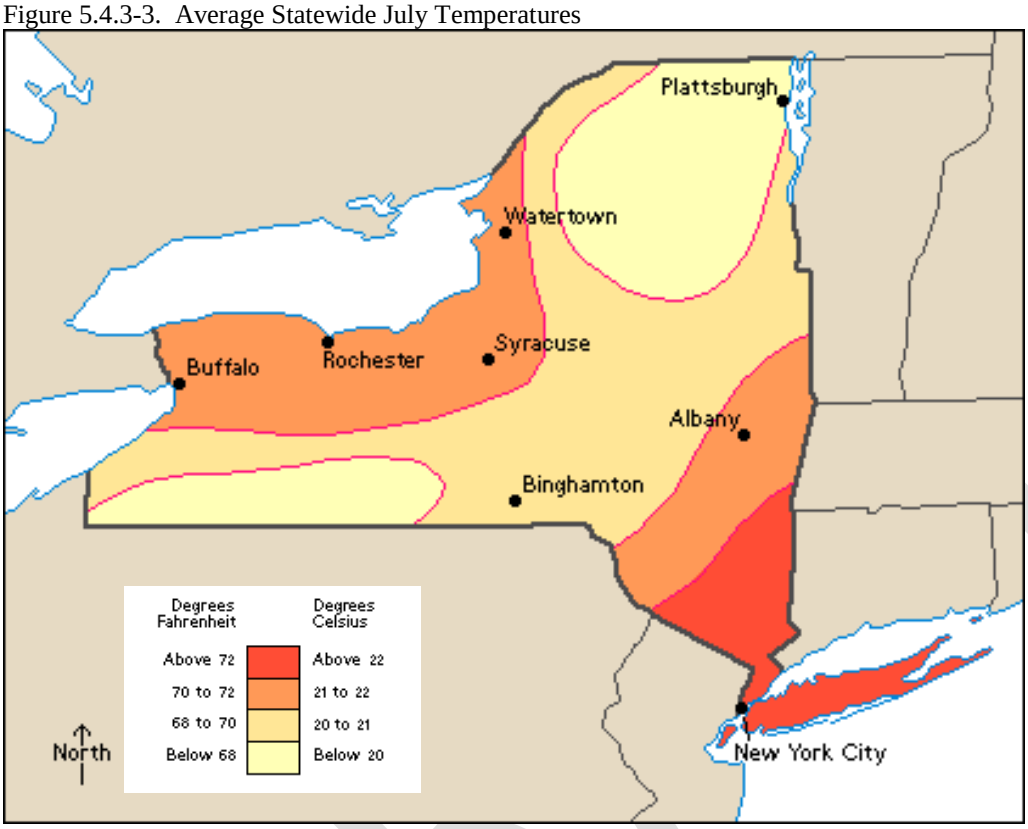
Month	Average High	Average Low	Record Low Event(s)
January	34ºF	15ºF	-27ºF in 1994
February	38ºF	17ºF	-18ºF in 1996
March	46ºF	26ºF	-13ºF in 2003
November	51ºF	31ºF	4ºF in 1995
December	39ºF	21ºF	-14ºF in 1989

Source: The Weather Channel, 2012

Extreme Heat Temperatures

Extreme heat temperatures of varying degrees are existent throughout the State for most of the summer season, except for areas with high altitudes. **Error! Reference source not found.** identifies the average July temperatures of the State, with the southeast and northwest sections experiencing the hottest conditions.

Figure 5.4.3-3. Average Statewide July Temperatures



Source: World Book Inc., 2008

As provided by The Weather Channel, average high and low temperatures during the summer months around the Town of Blooming Grove Planning Area are identified in Table 5.4.3-4.

Table 5.4.3-4. Average High and Low Temperature Range for Summer Months in the Town of Blooming Grove Planning Area

Month	Average High	Average Low	Record High Event(s)
May	69ºF	46ºF	94ºF in 1987
June	78ºF	56ºF	94ºF in 1999
July	83ºF	60ºF	100ºF in 1995
August	81ºF	59ºF	99ºF in 2001
September	74ºF	50ºF	96ºF in 1983

Source: The Weather Channel, 2012

Previous Occurrences and Losses

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

The Midwest Regional Climate Center (MRCC) operates an online annual temperature extremes database of the Continental U.S., otherwise known as "MRCC Cooperative Observer Station Annual Temperature Record Data Set". The data set contains the annual maximum and minimum temperature records for stations in the U.S. Each station has a cooperative observer system i.d. number (coop number), and those examined for this HMP had a running length of more than five years. In New York State, there are 269 stations that were observed; however, there are no stations located in Town of Blooming Grove Planning Area. Not every city, town and/or village in New York State contains a station (MRCC, 2012).

Between 1954 and 2012, New York State was not included in any major disaster declarations or emergency declarations due to extreme temperatures. Information regarding specific details of temperature extremes in Town of Blooming Grove is scarce; therefore, previous occurrences and losses associated with extreme temperature events are limited. Table 5.4.3-5 summarizes the extreme temperature events in Orange County.

Table 5.4.3-5. Extreme Temperature Events between 1950 and 2012

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
April 20-22, 1963	Heat	NA	NA	Unseasonable heat resulted in over $35 K in property damage.	SHELDUS
June 13-16, 1988	Heat	NA	NA	No reference and/or no damage reported.	SHELDUS
August 1, 1998	Heat	NA	NA	No reference and/or no damage reported.	SHELDUS
February 1-2, 1993	Extreme Cold	NA	NA	A strong pressure gradient moved across the area on February 1st, producing northerly winds of 15 to 30 mph. The strong winds, coupled with temperatures between -5 °F and 10 °F, resulted in wind chill readings of -30 to -40 °F in many areas.	Orange County HMP
July 4-6, 1999	Extreme Heat	NA	NA	On Sunday July 4th, temperatures soared into the mid and upper 90s. The combination of high temperatures and moderate humidity caused most heat indices to range from 100 to 105 degrees. On Monday July 5th, many new maximum temperature records were set. Heat indices peaked from 110°F to 115°F. Widespread blackouts occurred across the New York City Metro area, including Westchester County's sound shore from Pelham Manor to Port Chester. This heat wave was directly responsible for killing 33 people in the New York City Metro area.	Orange County HMP
January 17-18, 2000	Extreme Cold	NA	NA	Strong and gusty northwest winds combined with well below normal temperatures and produced extremely low wind chill values mainly on January 17th and January 18th. On January 17th, wind speeds from 15 to 20 mph combined with temperatures between 5 °F and 10 °F, produced wind chill values from -20 to -30 °F across the Lower Hudson Valley. On January 18th, wind chills across the Lower Hudson Valley were -30 to -35°F. Three people died in New York City from exposure.	Orange County HMP, NCDC
January 21, 2000	Extreme Cold	NA	NA	Northwest winds averaged 25 to 35 mph with gusts from 38 mph at Orange County Airport in Montgomery. As temperatures fell to around 10°F, wind chill values plummeted from -20 to -30°F along the coast and to -25 to -35°F inland.	Orange County HMP
January 27, 2000	Extreme Cold/Wind Chill	NA	NA	Strong and gusty northwest winds combined with well below normal temperatures and produced extremely low wind chill values across the Lower Hudson Valley.	NOAA-NCDC

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
August 8-10, 2001	Extreme Heat	NA	NA	Heat indices peaked across the entire region on August 9th between 105 and 110°F. As temperatures rose higher each day, demand for electricity increased. Scattered power outages first occurred in urban areas on August 7th, then spread across the suburbs on the 8th and became more widespread on August 9th and 10th. Excessive heat caused a portion of Sunrise Highway at Exit 40 to buckle, causing road closures. Four deaths in New York City were attributed to the heat.	Orange County HMP
January 15-16, 2004	Extreme Cold	NA	NA	On January 16th, low temperatures reached -3°F at Orange County Airport in Montgomery. Peak wind gusts were between 30 and 40 mph. In Orange County, loss of heat in the County Mental Health Building caused significant damage when pipes froze.	Orange County HMP
August 1-3, 2006	Extreme Heat	NA	NA	High temperatures ranged mainly from the upper 90s to around 100°F. With surface dew point temperatures in the mid-70s, heat indices ranged from 105 to 115°F. Excessive heat resulted in 42 deaths and scattered power outages in southeast New York State.	Orange County HMP, SHELDUS
July 22-23, 2011	Heat	NA	NA	Excessive heat resulted in one fatality.	SHELDUS

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

NOAA-NCDC National Oceanic Atmospheric Administration – National Climate Data Center
NWS National Weather Service
NYS New York State
SHELDUS Spatial Hazard Events and Losses Database for the United States

Agriculture-related disasters are quite common. The Secretary of Agriculture is authorized to designate counties as disaster areas to make emergency loans (EM) to producers suffering losses in those counties and in counties that are contiguous to a designated county. Table 5.4.3-6 presents USDA declared drought, excessive heat, frosts and freeze events impacting Orange County.

Table 5.4.3-6. USDA Declared Disasters

Incidence Period	Event Type	USDA Designation Number	County Designated?*	Losses / Impacts	Source(s)
March 1, 2012 and continuing	Frosts & Freeze	S3249	Yes	Physical and production losses attributed to frost and freezing temperatures	USDA
March 26 to April 8, 2012	Frosts & Freeze	S3251	Yes	Physical and production losses attributed to frost and freezing temperatures	USDA
June 2, 2012 and continuing	Drought and Excessive Heat	S3427	Yes	Production losses were attributed to drought and excessive heat	USDA
June 28 to November 8, 2012	Drought and Excessive Heat	S3487	Yes	Production losses were attributed to drought and excessive heat	USDA

Source: USDA, 2012
*Disaster event occurred within the county.
M Presidential Major Disaster Declaration
N Administrative Physical Loss Notification
S Secretarial National Disaster Determination
USDA United States Department of Agriculture

Probability of Future Events

Several extreme temperature events occur each year throughout Town of Blooming Grove. It is estimated that the town 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.

Based on historical records and input from the Planning Committee, the probability of occurrence for extreme temperatures in the Town of Blooming Grove Planning Area is considered "XX" (hazard event that is likely to occur within XX years) (see Section 5.3, Tables 5.3-4 and 5.3-6).

Climate Change Impacts

Please refer to the Drought Profile for information regarding Climate Change and its effects on extreme temperatures.

VULNERABILITY ASSESSMENT

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For the extreme temperature events, the entire Planning Area has been identified as the hazard area. Therefore, all assets in the Planning Area (population, structures, critical facilities and lifelines), as described in the Regional Profile (Section 4), are vulnerable. The following text evaluates and estimates the potential impact of extreme temperatures on the Town of Blooming Grove Planning Area 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
- 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 (e.g., through pipe bursts associated with freezing, power failure) and the economy.

Data and Methodology

Data used to assess the extreme temperature natural hazard include U.S. Census 2010, USDA, Town of Blooming Grove and Planning Committee sources. At the time of this HMP, historic impacts to population, general building stock and the economy were not available and potential future losses could not be quantified. Available information and a preliminary assessment are provided below.

Impact on Life, Health and Safety

For the purposes of this HMP, the entire population in the Planning Area is exposed and vulnerable to extreme temperature events. Extreme temperature events have potential health impacts including injury and death.

According to the Centers for Disease Control and Prevention (CDC), populations most at risk to extreme cold and heat events include the following: 1.) the elderly, who are less able to withstand temperatures extremes due to their age, health conditions and limited mobility to access shelters; 2.) infants and children up to four years of age; 3.) individuals who are physically ill (e.g., heart disease or high blood pressure), 4.) low-income persons that cannot afford proper heating and cooling; and 5.) the general public who may overexert during work or exercise during extreme heat events or experience hypothermia during extreme cold events (CDC, 2009). Drought conditions, often associated with extreme high temperature events, impact the infirm, young, and elderly as well. Drought is also considered a significant concern to the Planning Area and is included as a separate hazard in Section 5.4.1.

The high cost of fuel to heat residential homes can create a financial strain on populations with low or fixed incomes (a portion of which includes the elderly population). In addition, low income residents 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). Refer to Section 4, Regional Profile, for figures that

show the distribution of persons over the age of 65 and low income populations in the Town of Blooming Grove Planning Area. Table 5.4.1-7 summarizes the population over the age of 65 and individuals living below the Census poverty threshold.

Meteorologists can accurately forecast extreme heat event development 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 (EPA, 2006).

Impact on General Building Stock

All of the building stock in the Planning Area is exposed to the extreme temperature hazard. Table 4-3 summarizes the general building stock in the Planning Area. Based on available data, it appears that there are almost just as many extreme heat events as extreme cold events. Extreme cold temperature events can damage buildings through freezing/bursting pipes and freeze/thaw cycles. Additionally, antiquated or poorly constructed homes and facilities may have inadequate capabilities to withstand extreme temperatures. Due to a lack of data regarding past losses specific to the Planning Area, it is not possible at this time to estimate potential future losses to extreme temperature events.

Impact on Critical Facilities

All critical facilities in the Planning Area are exposed to the extreme temperature hazard. Impacts to critical facilities are the same as described for general building stock (above). Additionally, it is essential that critical facilities remain operational during natural hazard events. Extreme heat events can sometimes cause short periods of electric utility failure, commonly referred to as "brown-outs", due to increased usage from air conditioners, appliances, etc. Similarly, heavy snowfall and ice storms, associated with extreme cold temperature events, can cause power interruption as well. As mentioned in the Severe Winter Storm section, 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/loss of inventory. Business-owners may be faced with increased financial burdens due to unexpected repairs caused to the building (e.g., pipes bursting), higher than normal utility bills or business interruption due to power failure (i.e., loss of electricity, telecommunications).

The agricultural industry is most at risk in terms of economic impact and damage due to extreme temperature events. Extreme heat events can result in drought and dry conditions and directly impact livestock and crop production. Due to the significant agricultural activities in the area, drought is considered a significant concern and is included as a separate hazard (Section 5.4.1). Extreme low temperatures and unseasonable frost events during the growing season and harvest months can cause significant losses in crops, depending on the duration of the frost event. Due to a lack of data regarding past losses specific to the Town of Blooming Grove or its municipalities, it is not possible at this time to estimate potential future losses to extreme temperature events.

Future Growth and Development

As discussed in Section 4, areas targeted for future growth and development have been identified across the Planning Area. Future development of recreational and agricultural areas including golf courses, farms, or nurseries may be impacted (reduced) by this hazard due to unfavorable conditions.

Additional Data and Next Steps

Extreme temperature loss data appears to be somewhat limited for the Town of Blooming Grove Planning Area and the surrounding area. Over time, the Planning Area can track data on extreme temperature events, obtain additional jurisdiction-specific information on past and future events, particularly in terms of any injuries, deaths, shelter needs/cooling-heater centers, pipe freeze, agricultural losses and other impacts. This will help to identify any concerns or trends for which mitigation measures should be developed or refined. Mitigation actions for the Planning Area are identified in Section 6 of this plan and in the Appendix for the participating jurisdictions. Periodic review and update of the plan will address tracking the progress on these initiatives and inclusion of additional actions. Section 7, Plan Maintenance contains the procedures for the update of the plan.