

SEVERE WINTER STORM

HAZARD PROFILE

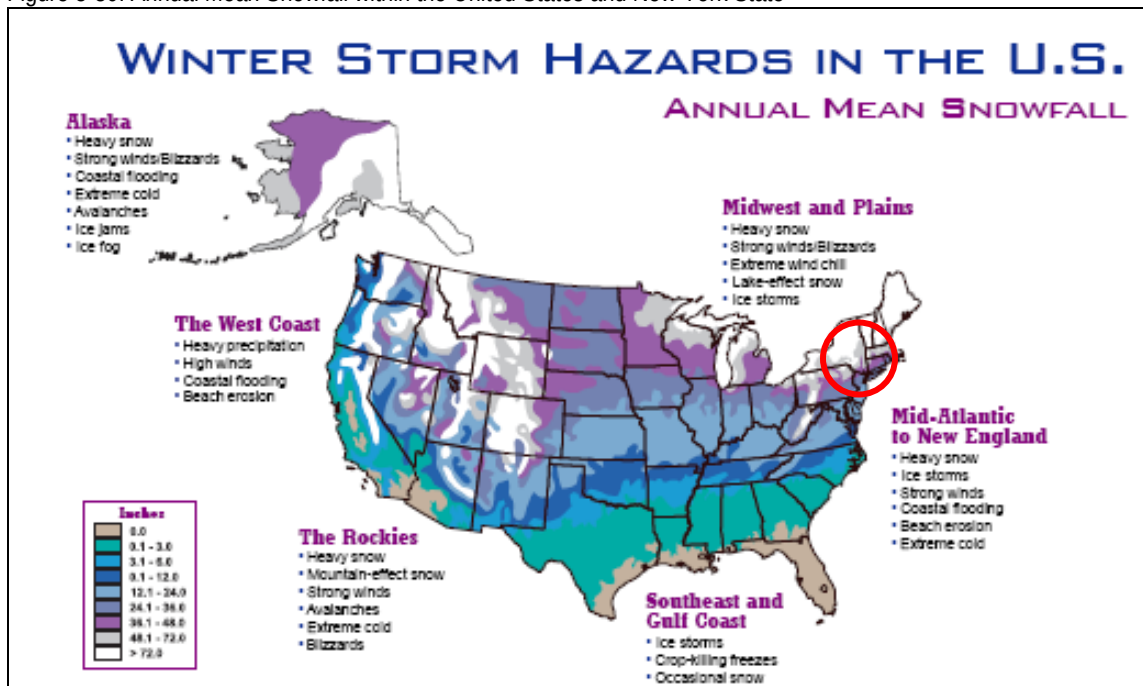
Description

Winter storms deposit precipitation, such as snow, sleet or freezing rain and can have a significant impact on transportation systems and public safety. Nor'easters are common winter storms for the eastern portion of NYS and can produce gale force winds and deposit over nine (9) inches of snow. According to the NYS Plan, winter storms are frequent events for the State and occur from late October until mid-April.

Location and Extent

All of WC, including the Village, is susceptible to winter storms. Figure 5-30 indicates the mean annual snowfall for the U.S., including NYS. The mean annual snowfall for WC, which includes the Village, is 24.1 to 36.0 inches.

Figure 5-30. Annual Mean Snowfall within the United States and New York State



Source: "Winter Storms – The Deceptive Killers" - U.S. Department of Commerce, NOAA, NWS. December, 2001. <http://www.nws.noaa.gov/om/winterstorm/winterstorms.pdf>. Note: The red circle within NYS indicates the approximate location of the Village of Briarcliff Manor. Annual mean snow fall within Briarcliff Manor ranges between 36.1 to 48 inches.

The magnitude or severity of a severe winter storm depends on several factors including temperature, wind speed, type of precipitation, rate of deposition, and time of day and/or year the storm occurs. The most severe categories of winter storms include the following:

Heavy Snow: This includes significant accumulations of snow in a short period of time. Heavy snow generally means snow accumulating four or more inches in less than 12 hours. Snow squalls or brief intense snow showers accompanied by gusting winds can deposit significant amounts of snow (NOAA, 2001).

Blizzard: Blizzards are characterized by low temperatures, wind gusts of 35 mph or more and falling and/or blowing snow that reduces visibility to 0.25 miles or less for an extended period of time (three or more hours) (NWS, 2005).

Sleet or Freezing Rain Storm: Sleet is rain that freezes into pellets before reaching the ground. Freezing rain is rain that falls onto a surface with a temperature that is below the freezing point; the rain then can freeze on the surface. Both types of precipitation, even in small accumulations, can cause significant hazards to a community (NOAA, 2001).

Ice storm: During an ice storm, freezing rain produces significant and damaging accumulations of ice (0.25 inches or greater). When rain falls and freezes immediately on impact; communications and power can be disrupted for days; even small accumulations of ice may cause extreme hazards to motorists and pedestrians (NOAA, 2005).

The extent of a severe winter storm can be classified by meteorological measurements, such as those above, and by evaluating its societal impacts. The Northeast Snowfall Impact Scale (NESIS) categorizes snowstorms in this manner. Unlike the Fujita and Saffir-Simpson Scales that characterize tornados and hurricanes, respectively, there is no widely used scale to classify snowstorms. NESIS was developed by Paul Kocin of The Weather Channel and Louis Uccellini of the NWS to characterize and rank high-impact, Northeast snowstorms. The five categories of NESIS are notable, significant, major, crippling, and extreme (rated 1 through 5). This scale was developed because Northeast snowstorms can impact the rest of the country in terms of both transportation and economic disruptions (NCEM, 2006).

As noted above, severe winter storms can cause numerous impacts to the social, political, economic and public safety infrastructure. These events also cause lost productivity and work time, school cancellations, transportation delays, increased road maintenance, and higher demands on community services. Snow and ice-covered surfaces result in significant damage to trees, building and infrastructure inventory, such as power lines, bridges, and substations. The freeze/thaw cycle, salts, sand, and heavy use of plows and trucks that often accompanies winter storms result in the formation of potholes, damaged roads and bridges, and increased maintenance costs to a community.

Previous Occurrences and Losses

Table 5-21 summarizes Presidential Disaster Declarations for severe winter storm events for NYS and WC, which includes the study area.

Table 5-21. Presidential Disaster Declarations for Severe Winter Storm Events for State and County

Type of Event	Date	Declaration Number	Cost of Losses (approximate)
Winter Storm (Southeast NYS)	December 1992	DR 974	Counties within the Southeastern section of NYS, including Westchester County, had total eligible damages of approximately \$31 million. Losses to Briarcliff Manor were not documented.
Blizzard (Statewide)	March 1993	EM 3107	Total eligible damages were estimated at \$8.5 million. Losses to WC or Briarcliff Manor were not documented.
Blizzard (Statewide)	January 1996	DR 1083	\$4.2 million in federal and state funds were provided to 150 municipalities in seven counties of NYS as part of the ongoing recovery from the Blizzard of '96. The Village received \$20,757 in disaster funding.
Snowstorm (Countywide)	February 2003	EM 3184	N/A

Source: FEMA website (<http://www.fema.gov/library/drcys.shtm>) Notes: Recorded losses indicate the dollar value funding made available to the local entities as a result of the disaster declaration; it does not reflect all categories of loss incurred.

The following bullets provide data and statistics regarding historic losses and impacts as a result of severe winter storm events within WC and the Village. These winter storm events include, but are not limited to, those that took place in December 1992, March 1993, January 1996, February 2003, and February 2006:

- Heavy snowfall and strong winds hit the NYS region on February 12, 2006. In WC, many vehicles spun out of control in near whiteout conditions. On Route 9A in the Village, cars skidded and struck guardrails. Along the Sprain Brook Parkway, near Interstate 287, disabled cars required tow trucks. Limited visibility forced motorists to slow their vehicles 30 mph. The weather service warned that wind gusts between 40 and 50 mph could down trees and power lines; temperatures were expected to fall as low as 23 degrees (The Journal News, 2006).
- The February 2006 snowstorm (see above) inundated the Northeast, closing regional airports, canceling hundreds of flights and paralyzing normal traffic for city residents who took to the snow-caked streets in snowshoes and skis. The winter storm's high winds, icy snow, thunder and lightning hit much of the mid-Atlantic and New England region. A fairly large area was impacted, with snow accumulations of more than 20 inches in New Jersey, New York and Connecticut. About 16 to 24 inches were expected throughout the NYS region, according to weather forecasters. The NWS described the weather conditions as "a major snowstorm" with winds up to 50 mph. ConEd assigned 250 crews to WC, which is typically hard hit during blizzards and was hit hard during this storm, to repair downed power lines (The New York Times, 2006).
- According to NOAA's NCDC storm events database, a February 2003 snowstorm (EM 3184) impacted multiple counties throughout NYS, resulting in \$20 million in damages. Snowfall in WC ranged from 14.5 inches at Croton-on-Hudson to 26.0 inches at Thornwood. Information regarding specific impacts and losses for the Village are not available in the information cited.
- According to FEMA, NYS and WC, which includes the Village, has received two DRs and two EMs for snow events between 1992 and 2003 (FEMA, 2006). Table 5-21 identifies winter storms that resulted in Presidential Disaster or Emergency Declarations. DR 974 was a southeast NYS declaration, which includes WC. This event occurred in December 1992, and according to the September 2004 NYSEMO Comprehensive Emergency Management Plan – NYS Multi-jurisdictional HMP, it resulted in total eligible damages of approximately \$31 million. Specific losses

for WC or the Village were not documented. EM 3107 was declared as a result of a state-wide blizzard in March 1993. According to NYSEMO, the 1993 blizzard resulted in total eligible damages of approximately \$8.5 million. Specific losses for WC or the Village are not documented. DR 1083 was issued following a state-wide blizzard that in January 1996, which resulted in \$4.2 million in federal and state disaster funds being issued to 150 municipalities in seven counties of NYS (part of the ongoing recovery from the Blizzard of '96). The Village received \$20,757 in disaster funding. EM 3184 was issued as a result of a county-wide snowstorm that occurred in February 2003. Information regarding disaster funding was not made available in the sources reviewed.

Probability of Future Events

Earlier in this section, the identified hazards of concern for the Village were ranked. The NYS Plan includes a similar ranking process for hazards that affect the State. The probability of occurrence, or likelihood of the event, is one parameter used in this ranking process. Based on historical records and input from the Planning Committee, the probability of occurrence for severe winter storms in the Village is considered frequent (likely to occur more than once every 5 years). This ranking aligns with the NYS Plan ranking, which indicates that NYS will receive at least one significant winter storm each year and can expect a snow storm of emergency or disaster declaration proportions every 3 to 5 years. It is estimated that WC and all its jurisdictions, including the Village, will continue to experience severe winter storms annually that may induce secondary hazards such as utility failure and transportation accidents.

VULNERABILITY ASSESSMENT

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For severe storms, the entire Village has been identified as the hazard area. Therefore, all assets in the Village (population, structures, critical facilities and lifelines), as described in the Village Profile section, are vulnerable to a severe winter storm. The following text evaluates and estimates the potential impact of severe storms on the Village including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact, including: (1) impact on life, safety and health of Village residents, (2) general building stock, (3) critical facilities and infrastructure, and (4) economy
- Impact on new buildings, critical facilities and infrastructure
- Further data collections that will assist understanding of this hazard over time
- Overall vulnerability conclusion

Overview of Vulnerability

Severe winter storms are of significant concern to the Village 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/traffic accidents, and stress on community resources.

Data and Methodology

National weather databases and local resources were used to collect and analyze severe winter storm impacts on the Village. Default HAZUS-MH data was used to support an evaluation of assets exposed to this hazard and the potential impacts associated with this hazard.

Impact on Life, Health and Safety

Vulnerable populations, including the elderly and low income populations, are considered most susceptible to the severe winter storm hazard. The high cost of fuel to heat residential homes can create a financial strain on populations with low or fixed incomes. In addition, low income residents may not have access to housing or their housing may be less able to withstand cold temperatures (for example, trailer homes and homes with poor insulation and heating supply). The Village includes a minimal number of manufactured homes. The elderly population has an increased risk of injuries and death due to falls and from overexertion and/or hypothermia from attempts to clear snow. In addition, severe winter storm events can reduce the ability of these populations to access emergency services. Table 5-22 summarizes the population over the age of 65 and living in households with an income below \$20,000 per year.

Table 5-22. Vulnerable Population Exposed to Severe Winter Storm Events in the Village of Briarcliff Manor

Population Category	Number of Persons Exposed
Elderly (Over 65 years of age)	432
Low Income (Persons living in households with annual incomes less than \$20,000)	251

Source: HAZUS-MH, 2005.

Snow accumulation and frozen/slippy road surfaces also increases in the frequency and impact of traffic accidents for the general population, resulting in personal injuries.

Impact on General Building Stock

The entire inventory in the Village is vulnerable to a severe winter storm. However, historic data and current modeling tools are not available to estimate specific losses for this hazard. As an alternate approach, this plan considers percentage damages that could result from severe winter storm conditions. Table 5-23 identifies the exposed buildings and value in the Village and losses that would result from 1, 5, and 10 percent damage to this inventory as a result of a severe winter storm. Given professional knowledge and information available, these are considered conservative estimates of potential losses for this hazard.

Table 5-23. Inventory of General Building Stock Exposure for the Village of Briarcliff Manor

Building Occupancy Class	Number of Buildings	Total Value	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Residential	2406	\$1,044,542,000	\$10,445,420	\$52,227,100	\$104,454,200
Commercial	34	\$116,225,000	\$1,162,250	\$5,811,250	\$11,622,500
Industrial	0	\$10,756,000	\$107,560	\$537,800	\$1,075,600
Agricultural	0	\$624,000	\$6,240	\$31,200	\$62,400
Religious	1	\$6,226,000	\$62,260	\$311,300	\$622,600
Government	2	\$4,506,000	\$45,060	\$225,300	\$450,600
Educational*	0	\$12,856,000	\$128,560	\$642,800	\$1,285,600
Total	2,443	\$1,195,735,000	\$11,957,350	\$59,786,750	\$119,573,500

Source: HAZUS-MH, 2005. The HAZUS-MH provided data indicates that there are no educational buildings present in the Village but assigns an exposure value of greater than \$12 million to this occupancy class. Local data provided in Section 4 includes information for local school inventory in the area. The building values shown include building structure and content; therefore, this presents a conservative estimate of loss because for the severe storm hazard, damage will generally impact structures such as the roof and building frame (rather than building content).

A specific area that is vulnerable to the severe winter storm hazard is the flood plain. Severe winter storms can cause flooding through blockage of streams or through snow melt. At risk residential infrastructure are presented in the presentation for the flood hazard. Generally, losses resulting from flooding associated with severe winter storms should be less than that associated with a 100-year or 500-year flood.

Impact on Critical Facilities and Infrastructure

HAZUS-MH estimates the replacement value for each police, fire and EMS facility as \$1,652,000. These 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 for critical facilities and infrastructure. Infrastructure at risk for this hazard includes roadways that could be damaged due to the application of salt and intermittent freezing and warming conditions that can damage roads over time. Severe snowfall requires infrastructure to clear roadways, alert citizens to dangerous conditions, and following the winter requires resources for road maintenance and repair.

Impact on Economy

The cost of snow and ice removal and repair of roads from the freeze/thaw process can drain local financial resources. However, because severe winter storms are a regular occurrence in this area, WC is well-prepared for snow and ice removal each season (WC DPW, 2006). Another impact on the economy includes impacts on commuting into, or out of, the area for work or school. The loss of power and closure of roads and/or mass transportation prevents the large NYC commuter population from traveling to work. Specific information on the number of in- and out-commuters is available in the WC Databook and indicates that in 2000, the total workers in WC was about 400,000 and that 33 percent of these workers commuted from other areas (NY City, Bronx, CT, and others). Similarly WC included over 450,000 working residents, with 37 percent working out of the County, primarily community to NY City (75 percent of out community) and surrounding areas (WC Databook, 2005).

Impact on New Buildings, Critical Facilities and Infrastructure

As identified in Section 4, “Village Profile – Future Development”, at this time the Village anticipates residential and limited business development within the Scarborough Road Corridor, which will require improvements to roads, utilities and stormwater management systems in the area. Any structures, facilities and infrastructure built in this area may be assumed to be vulnerable to impacts from severe winter storms. Overhead utilities are particularly susceptible to ice storms.

Additional Data and Next Steps

Although event data is available mainly for WC, location-specific data regarding damage has not been tracked and correlation to specific infrastructure and inventory areas is not possible because winter storms can impact any portion of the study area. Based on currently available data, modeling of future losses would only be possible for total losses and would have a large margin of uncertainty given the currently available data. However, the exposure assessment discussed above identifies vulnerable populations and infrastructure of particular concern for this hazard. Conservative estimates of potential losses based on “percent of damage” assumptions also are provided in the tables in this section as a guide for planning mitigation options.

As additional/actual valuation data for critical infrastructure and area of impact is obtained, the data in HAZUS-MH can be modified. This would support estimates of potential exposure and damage for critical facilities. Additional data could include the collection of cost data from federal and state agencies on the valuation of roadways, bridges and other critical infrastructure. Standard valuation data is available from a variety of public and private sources. For example, if the average cost of a roadway mile, railway segments, and categories of schools, nursing homes, or potable water treatment piping were identified, the assets value could be calculated based on this information. Resources for obtaining this information include but are not limited to the Federal Highway Administration, RS Means, DOT, GSA, and NYSDEC. Also, the study area representatives will track more specific event and loss data to support the identification of particular assets of concern.

Because historic data on losses will not be adequate to predict specific losses to inventory, the percent of damage assumption methodology employed for general buildings and mobile homes in this section can be applied to infrastructure and critical facilities, when valuation data is available. 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).

Overall Vulnerability Assessment

Severe winter storms are common in the study area, often causing significant impacts and losses to the Village and the town’s roads, structures, facilities, utilities, and population. The overall hazard ranking determined for this HMP for the severe winter storm hazard is high, with a frequent occurrence (likely to occur more than once every five years). Because the area is frequently exposed to this event, it is well prepared to respond. The Village, WC, and ARC have outreach materials and/or resources and information sharing tools in place to warn residents of this hazard event and address its impacts. Existing and future mitigation efforts should continue to be developed and employed that will enable the study area to be prepared for these events when they occur. The cascade effects of severe winter storms include utility losses and transportation accidents and flooding. Losses associated with the flood hazard are discussed earlier in this section. Particular areas of vulnerability include low-income and elderly populations, mobile homes, and infrastructure such as roadways and utilities that can be damaged by such storms and the low-lying areas that can be impacted by flooding related to rapid snow melt.