SEVERE STORM

HAZARD PROFILE

Description

The severe storm hazard includes hail, hurricane, lightning, thunderstorm, tropical storm, and tornados. A description of each of these is provided below.

Hail: Showery precipitation in the form of irregular pellets or balls of ice more than 5 millimeters in diameter, falling from a cumulonimbus cloud (NWS, 2005).

Hurricane: An intense tropical cyclone with wind speeds reaching a constant speed of 74 miles per hour (mph) or more (FEMA, 2004).

Lightning: An electrical discharge that results from the buildup of positive and negative charges within a thunderstorm.

Thunderstorm: A combination of moisture, rapidly rising warm air and a force capable of lifting air such as a warm and cold front, a sea breeze or a mountain. All thunderstorms contain lightning and can produce hail (NWS, 2005).

Tropical Storm: A tropical cyclone with maximum sustained winds greater than 39 mph and less than 74 mph (FEMA, 2004).

Tornado: A violent windstorm characterized by a twisting, funnel-shaped cloud. It is spawned by a thunderstorm (or sometimes as a result of a hurricane) and produced when cool air overrides a layer of warm air, forcing the warm air to rise rapidly. The damage from a tornado is a result of the high wind velocity and wind-blown debris. Tornado season is generally March through August, although tornados can occur at any time of year (FEMA, 2004).

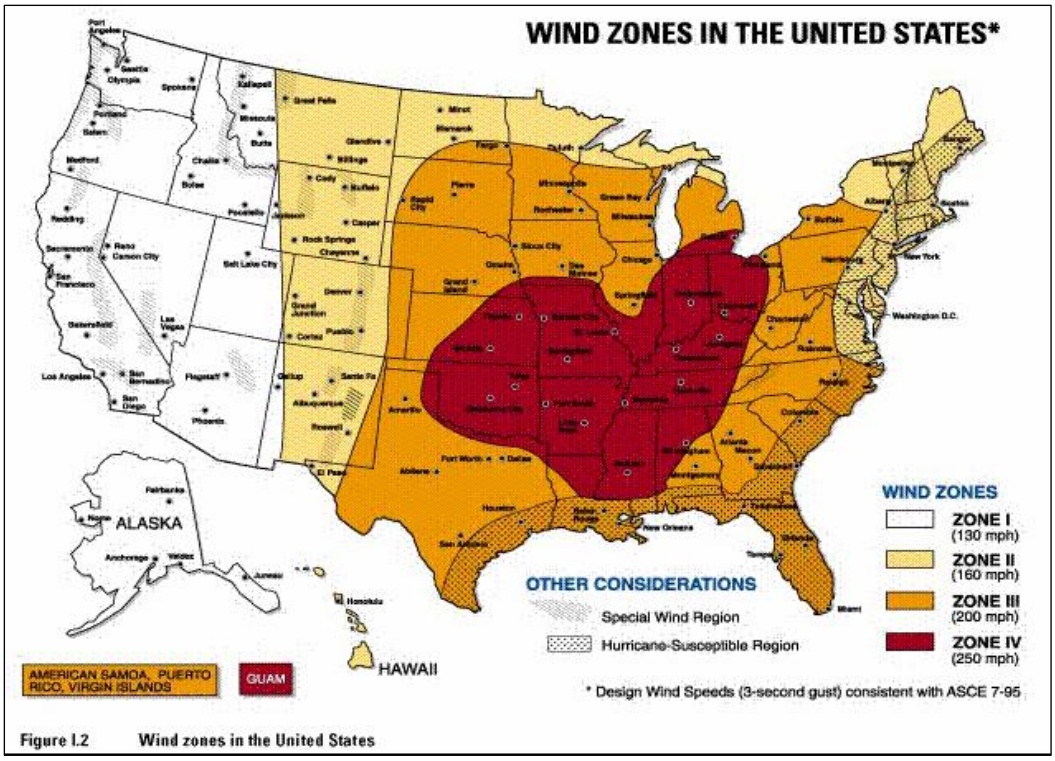
Windstorm: Wind is air moving from high to low pressure. Windstorm events are associated with cyclonic storms, thunderstorms and tornados (FEMA, 1997).

Location and Extent

Severe storms may affect the entire mitigation study area. Figures 5-2 and 5-3 show designated wind zones that impact the U.S. and NY, respectively. WC is located in Wind Zone II with speeds up to 160 miles per hour.

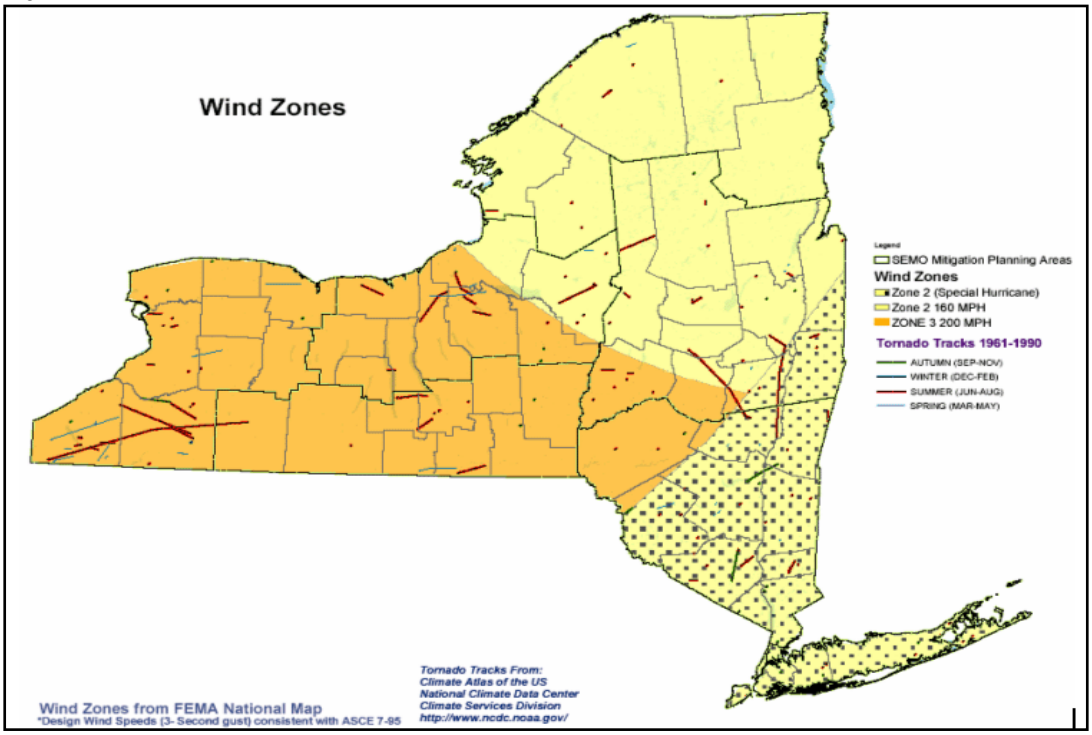
According to NOAA's NCDC, no hurricanes have directly impacted WC or the Village since 1950. However, the County has felt the peripheral landward effects, including high winds, heavy rains, and flooding associated with several hurricanes and tropical storms in recent history. Figure 5-4 illustrates NOAA's historic North Atlantic tropical cyclone tracks through WC from 1851-2002.

Figure 5-2. Wind Zones in the United States



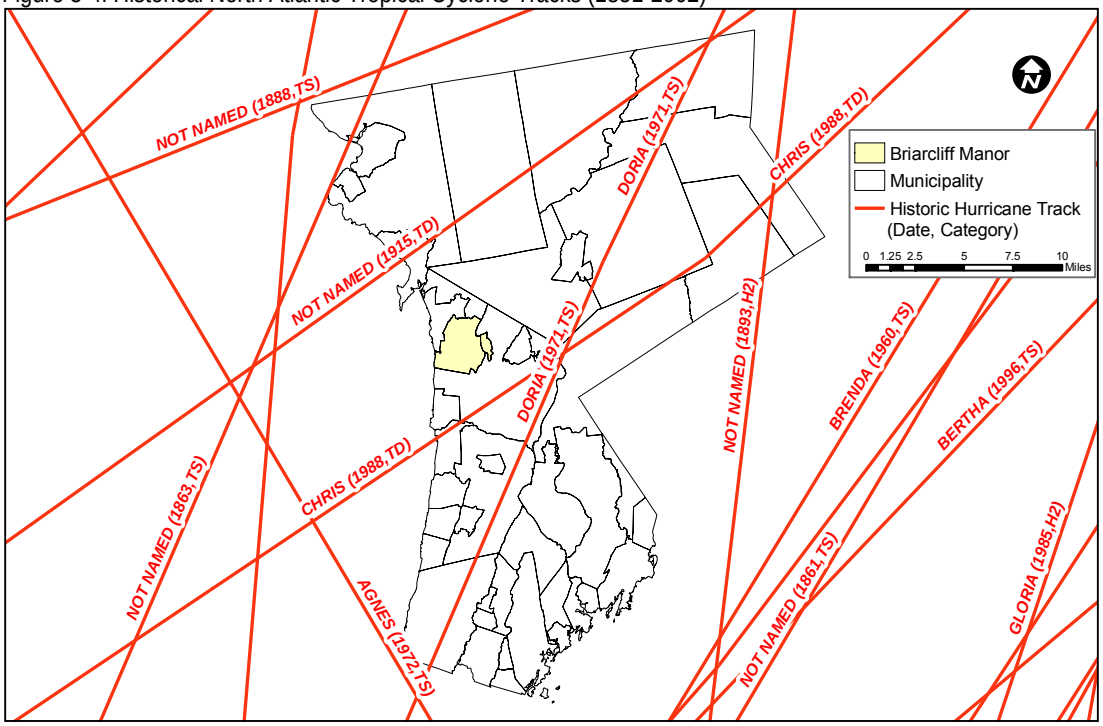
Source: FEMA

Figure 5-3. Wind Zones in New York State



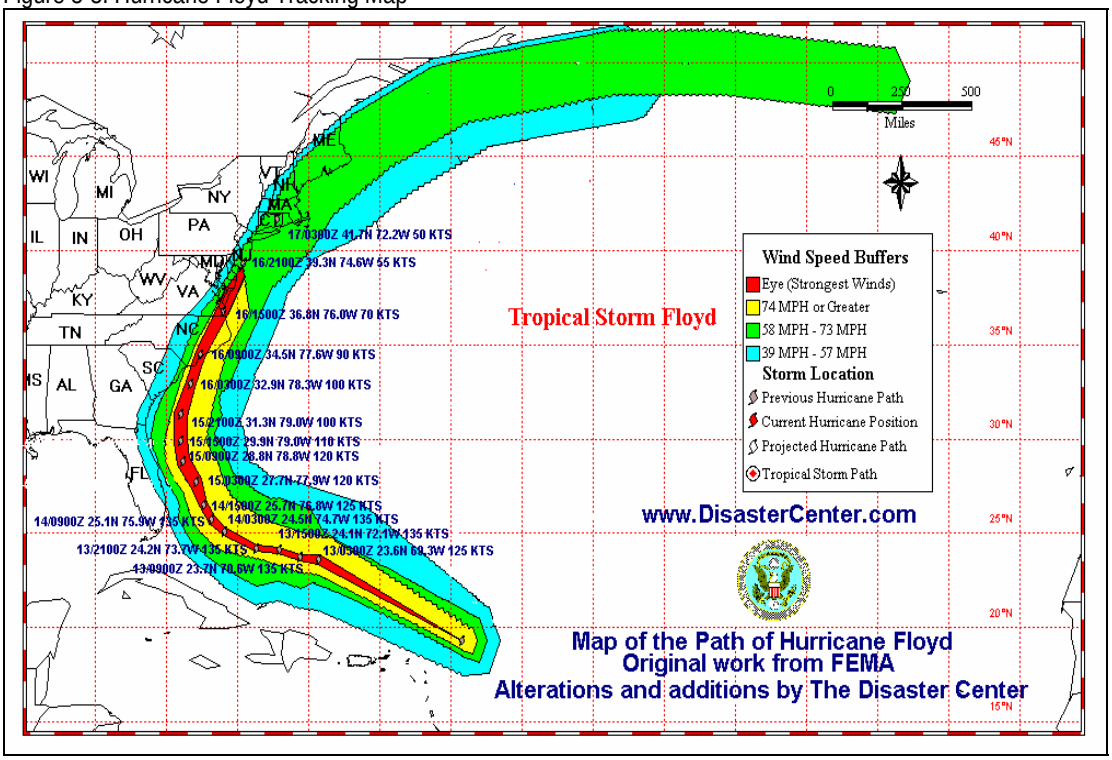
Source: New York State Hazard Mitigation Plan, 2005.

Figure 5-4. Historical North Atlantic Tropical Cyclone Tracks (1851-2002)



Source: NOAA, Tropical Prediction Center/National Hurricane Center, 2003

Figure 5-5. Hurricane Floyd Tracking Map



Source: The Disaster Center (http://www.disastercenter.com/hurrican/FloydTrc.htm)

The extent (that is, magnitude or severity) of a severe storm is largely dependent upon sustained wind speed. The extent of a hurricane is categorized by the Saffir-Simpson scale. The Saffir-Simpson scale categorizes hurricanes (1 to 5) based on their intensity. Table 5-8 presents this scale, which is used to estimate the potential property damage and flooding expected when a hurricane makes land fall (NWS, 2006). The magnitude or severity of a tornado is categorized using the Fujita Scale. The Fujita Scale categorizes tornadoes from F0 to F5 based on wind speed or wind speeds (NOAA, 2007).

Table 5-8. The Saffir-Simpson Scale

Category	Wind Speed (mph)	Storm Surge (above normal sea level)	Expected Damage
1	74-95	4 – 5 feet	Minimal: Damage is done primarily to shrubbery and trees, unanchored mobile homes are damaged, some signs are damaged, and no real damage is done to structures.
2	96-110	6 – 8 feet	Moderate: Some trees are toppled, some roof coverings are damaged, and major damage is done to mobile homes.
3	111-130	9 – 12 feet	Extensive: Large trees are toppled, some structural damage is done to roofs, mobile homes are destroyed, and structural damage is done to small homes and utility buildings.
4	131-155	13 – 18 feet	Extreme: Extensive damage is done to roofs, windows, and doors; roof systems on small buildings completely fail; and some curtain walls fail.
5	> 155	> 18 feet	Catastrophic: Roof damage is considerable and widespread, window and door damage is severe, there are extensive glass failures, and entire buildings could fail.

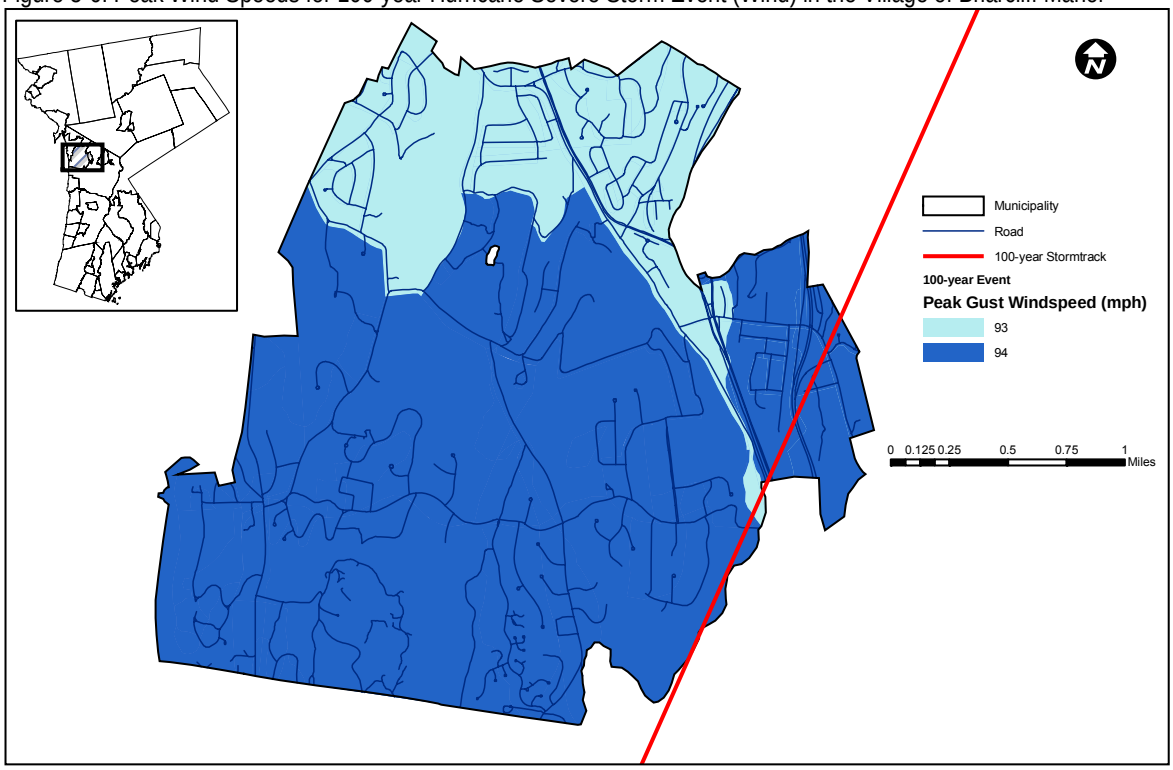
Source: FEMA, 2004. Notes: mph=Miles per hour; >=Greater than.

In evaluating the potential for hazard events of a given magnitude, a mean return period is often used. The mean return period provides an estimate of the magnitude of an event that may occur within any given year based on past recorded events. Figure 5-6 shows the maximum peak wind speeds that can be anticipated in and around the study area associated with the 100-year mean return period (MRP) hurricane event. The estimated hurricane track for the 100-year event is also shown. The figure shows that maximum peak wind speeds for the Village range from 93 to 94 mph for the 100-year MRP event. Figure 5-7 shows the maximum peak wind speeds that can be anticipated in this area associated with the 500-year MRP hurricane event. The hurricane track for the 500-year event is northwest of the Village. The figure shows that maximum peak wind speeds for the Village range from 121 to 124 mph for the 500-year MRP hurricane event.

Mean Return Period
is the average period of time, in years, between occurrences of a particular hazard event (equal to the inverse of the annual frequency of exceedance).

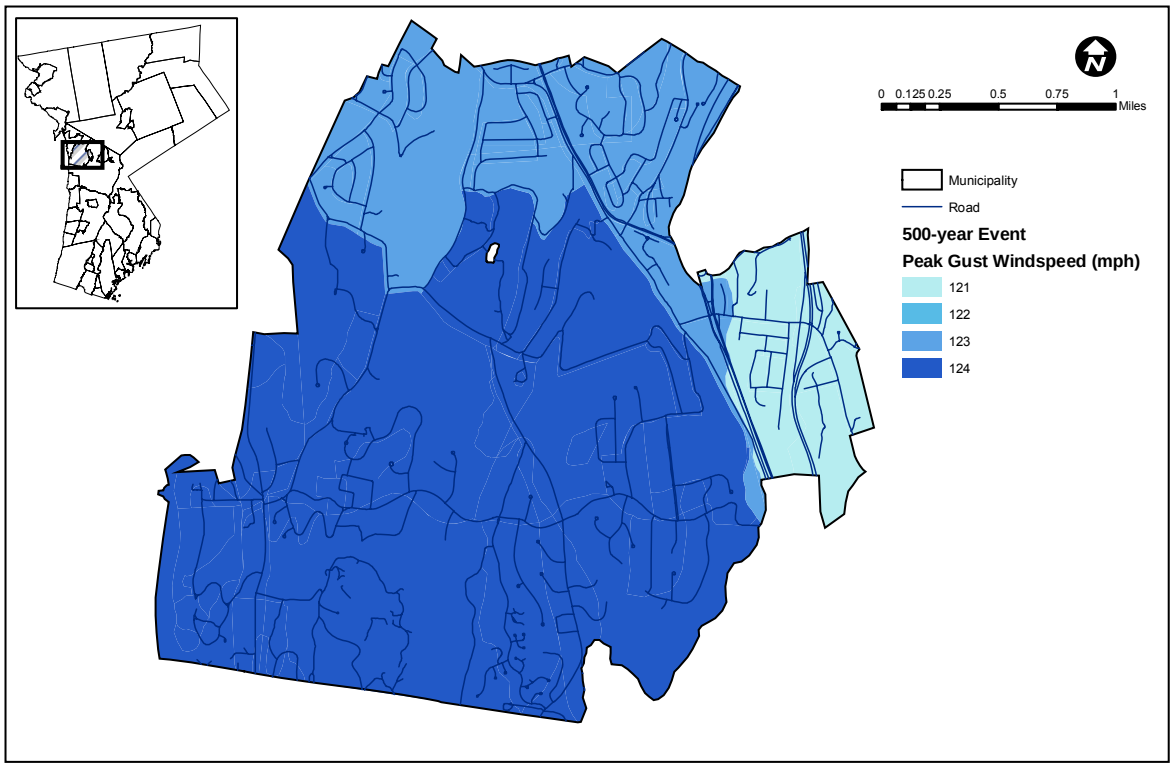
For example, a flood that has a 1-percent chance of being equaled or exceeded in any given year. This flood event is also referred to as the base flood and has a MRP of 100. The term "100-year flood" can be misleading; it is not the flood that will occur once every 100 years. Rather, it is the flood elevation that has a 1- percent chance of being equaled or exceeded each year. Therefore, the 100-year flood could occur more than once in a relatively short period of time.

Figure 5-6. Peak Wind Speeds for 100-year Hurricane Severe Storm Event (Wind) in the Village of Briarcliff Manor



Source: HAZUS-MH

Figure 5-7. Peak Wind Speeds for 500-year Hurricane Severe Storm Event (Wind) in the Village of Briarcliff Manor



Source: HAZUS-MH, 2005. Note: The 500-year MRP event storm track is located approximately 33 miles west of the Village. Peak wind speeds estimated would range from 121 to 124 miles per hour in the Village.

Previous Occurrences and Losses

Severe storms are frequent events for the Village. Data provided by FEMA on Presidential Declared Disasters identifies two Presidential Declarations associated with severe storm events between 1992 and 2005 (Table 5-9).

Table 5-9. Presidential Disaster Declarations for Severe Storm Events

Type of Event	Date	Declaration Number	Cost of Losses (approximate)
Hurricane Floyd (Countywide)*	September 1999	DR 1296 / EM 3149	Briarcliff Manor Union Free School District received $27,000 in disaster payments, and the Village of Briarcliff received a total of $898,000.
Severe Storms – Flooding (Countywide)	April 2005	DR 1589	Westchester County received $76,000 in federal reimbursements for losses.

Source: FEMA website (http://www.fema.gov/library/drcys.shtm). Notes: Losses indicate the value of loss in terms of payments made to recipients; this data is made available through public records and does not reflect all losses incurred.
* Hurricane Floyd was a Tropical Storm when it impacted the Village.

The following sources provided data and statistics of historic losses and impacts as a result of severe storm events within WC and the Village. The sources indicate that main severe storm events throughout WC and the Village include, but are not limited to, those that took place in August 1971, September 1975, July 1997, September 1999, April 2005 and July and September 2006 (see the summary of hazard events table provided in Appendix F). Some of the bullets provide information about the same events, but reflect information available from a range of different sources.

- Tropical Storm Ernesto impacted the WC area on September 2-3, 2006. According to a ConEd Report on Preparation and System Restoration Performance, this storm began over Labor Day and interrupted electrical service in all operating areas, with the greatest impact in WC. A change in the anticipated severity and path of the remnants of this tropical storm resulted in nearly 2.5 inches and up to 35 mpg winds, with gusts of up to 45 mph in some service areas. Massive damage to the WC overhead system occurred from 1,000 fallen trees and limbs, 100 poles knocked down, 70 transformers damaged, and 2,300 primary and secondary wires down. This blocked 240 roadways in WC and 76,000 WC customers lost power as a result of the storm. Briarcliff was one of the hardest hit areas. By September 7, 100 percent of these customers had power restored (ConEd, 2006).

- The Upton NWS Forecast Office indicates that on July 12, 2006, a tornado created significant damage within close proximity to the Village. The NWS confirmed that a tornado produced a damage track approximately 10 miles in length that extended from Grand View-On-Hudson in Rockland County, through central WC of Southeastern NY and then into North Greenwich in extreme southwestern Fairfield County, Connecticut. The maximum intensity of the tornado was rated as F2. Wind damage uprooted large trees and damaged commercial structures. No fatalities occurred and only six minor injuries were recorded.

- According to a July 13, 2006, New York Times newsletter, a reported tornado touched down in central WC on July 12, 2006, heavily damaging commercial buildings on Route 9A, knocking down trees, and physically lifting a state trooper car and twirling it around. It moved over the Village of Sleepy Hollow, the Town of Mount Pleasant (directly south of the Village), and further into the hamlet of Hawthorne. The tornado also snapped electrical wires, caused the evacuation of a preschool, closed roads due to fallen trees, created traffic jams associated with closed roads, and results in power outages to 4,000 residents in Westchester.

- According to a July 13, 2006, Metro newsletter, written by Jim Fitzgerald, the July 12, 2006, tornado created winds of 100 to 125 mph. It was the first tornado to hit WC since 2000 and only the eighth since 1950, according to a list maintained by NOAA. None of the others achieved an F-2 intensity. The July tornado uprooted or snapped thousands of trees, caused roadways and railroad tracks to be blocked, blew out the concrete-block wall of a California Closets warehouse, destroyed a 125-year-old stained-glass window, tossed a truck into a bank of gasoline pumps, and lifted a state trooper's cruiser off the ground, spun it and dropped it. Over the high wooded grounds of the Rockefeller Estate in the Town of Mount Pleasant, the storm reached its top intensity. Two small, old barns on the estate were destroyed (http://ny.metro.us/metro/local/ap/NY_Tornado.html).

- According to Journal News newsletter, high winds on January 18, 2006, in the WC area resulted in many road closings, downed wires, trees and poles. Route 9 and Route 117 were closed in both directions in Mount Pleasant and Chappaqua Road was closed in both directions at Route 9A in the Village. About 5,700 customers in WC lost power following this event (Journal News, 2006).

- On September 1, 1974, a tornado impacted WC, resulting in $250,000 in damage. Specific loss information for the Village was not available.

- According to FEMA, WC has received two Presidential DRs for severe storm events between 1999 and 2005 (Table 5-9). DR 1296 / EM 3149 was issued following September 16-17, 1999, in association with indirect effects of Hurricane Floyd. Hurricane Floyd was classified as a Tropical Storm when it impacted the Village. This flooding/severe storm event resulted in the issuance of approximately $9 million in FEMA disaster relief funds to multiple counties throughout NYS, including WC. As presented in newsletters by Governor Pataki in February and March 2000, the Briarcliff Manor Union Free School District and the Village received approximately $924.968.92 in disaster relief funds, following Floyd. DR 1589 was issued in April 2005, with issuance of $76,136 in federal reimbursements to WC for emergency protective measures taken in response to the storms and flooding; this allowed the repair of damaged infrastructure and provided for debris removal. Information regarding federal funds issued to the Village was not available.

- The NOAA's NCDC storm events database indicates approximately 159 severe storm events impacted WC from 1950 to 2006. The database does not indicate if events specifically impacted the Village. The database estimates total property damages form these severe storm events (including tornado and hurricane events) to be approximately $7 million between 1950 and 2006. On September 1, 1974, a tornado impacted WC, resulting in $250,000 in damage. On September 16-17, 1999, $6.6 million in damages to WC resulted from the indirect impacts of Tropical Storm Floyd. Torrential record rainfall, caused serious widespread urban, small stream, and river flooding was associated with remnants of Tropical Storm Floyd and impacted multiple counties in NYS. Property damage in many counties, including WC, resulted in disaster declarations. Widespread flooding of low-lying and poorly drained areas resulted in the closure of many roads and basement flooding across the entire region. Strong and gusty winds and rain downed trees, tree limbs, and power lines across the area. Significant power outages resulted. Figure 5-5 includes a hurricane tracking map of Floyd.

- According to the Spatial Hazard Events and Losses Database for the United States (SHELDUS) established by the Hazard and Vulnerability Research Institute-University of Southern California (USC), WC experienced multiple severe storm events between 1960 and 2006. The database indicates that severe storm hazard events and losses specifically associated with WC and its municipalities totaled nearly $25 million in property damages and included three fatalities. Main events occurred on August 11, 1971, September 22, 1975, and July 9, 1997. However, these numbers may vary between data sources due to the manner in which location of the hazard events are identified in various forms or throughout multiple counties or regions, including WC (USC, Hazard Research Lab, 2006).

- According to Bob Swanson and Doyle Rice of USA Today, in 1977 lightning struck a key electrical transmission line near Indian Point in WC, plunging NY City into darkness. Looting resulted in $1 billion in losses during the massive 24-hour blackout (USA Today, 2006).

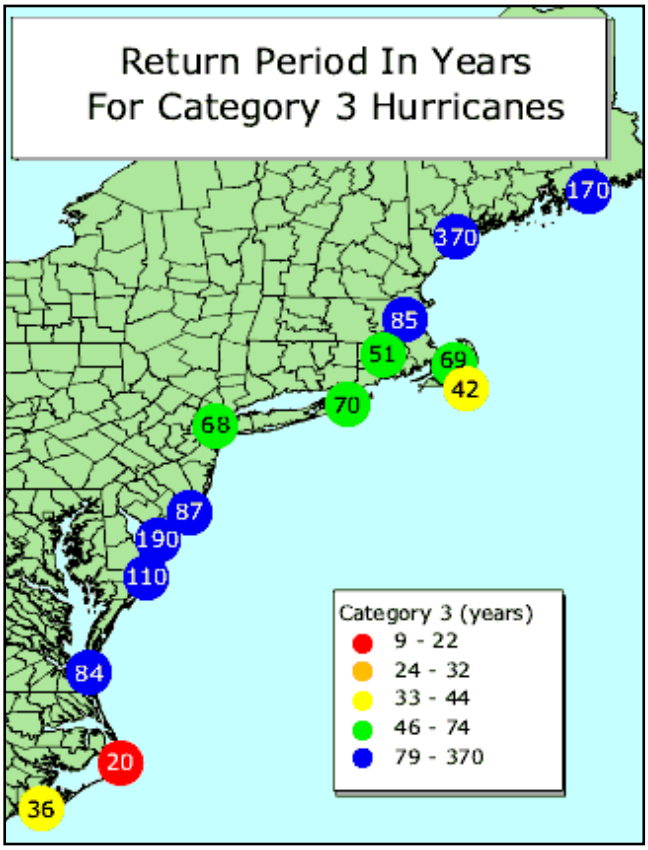
- Windstorms and thunderstorms occur frequently in the Village; however, only a small fraction of these storms are considered severe. NCDC lists 159 thunderstorm, heavy wind, tornado, hail and lightning events for the period between 1950 and 2006 for WC (NCDC, 2006). SHELDUS indicates that severe storm hazard events and losses specifically associated with WC and its municipalities totaled nearly $25 million in property damages and three fatalities between 1960 and 2006 (USC, Hazard Research Lab, 2006).

According to the Village's Fire Chief, during severe storms, the fire department receives approximately 30 calls regarding downed trees and wires. Power outages due to downed trees and limbs are a common occurrence in the Village.

Probability of Future Events

NOAA's National Hurricane Center Risk Analysis Program has calculated hurricane MRPs for the northeastern U.S. for the five hurricane categories (see Figure 5-8 for a Category 3 hurricane). Table 5-10 documents the return period for Categories 1 through 5 that may impact WC.

Figure 5-8. Return Period for Category 3 Hurricanes



Source: NOAA National Hurricane Center (http://www.nhc.noaa.gov/HAW2/english/basics/images/cat3_ne.gif).

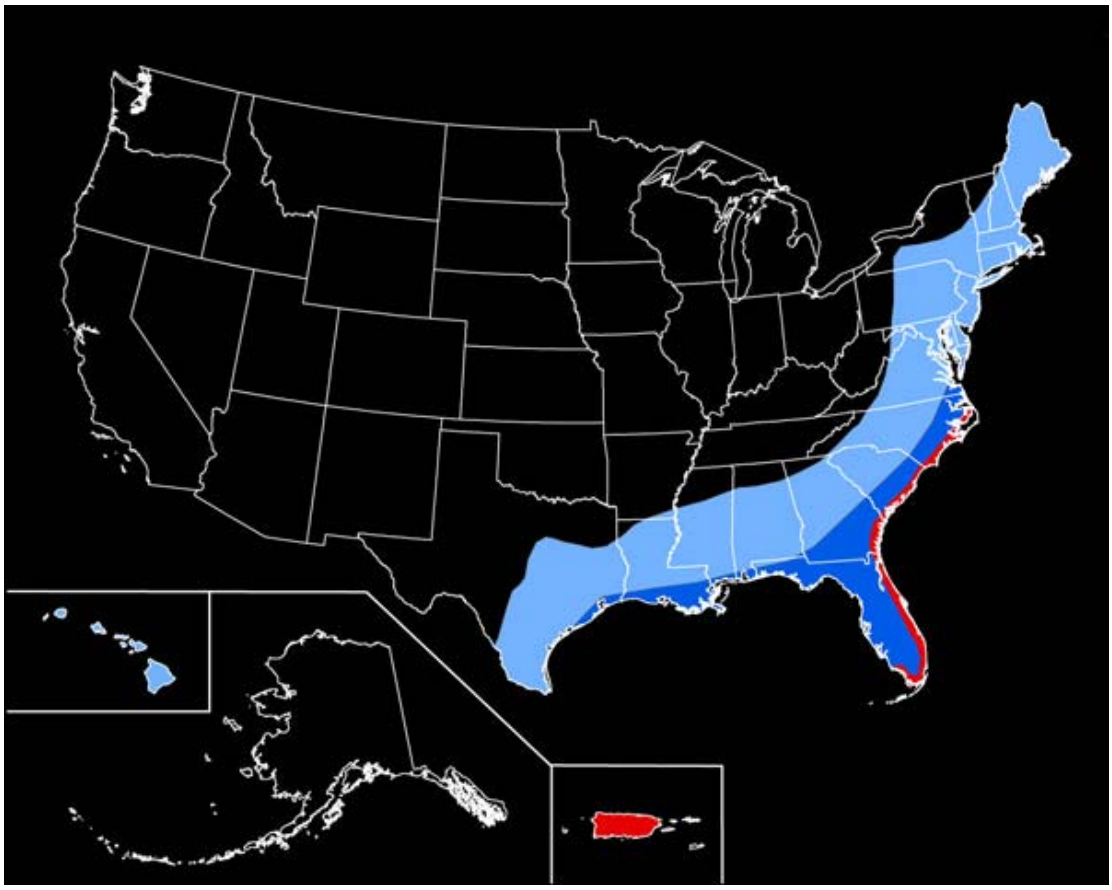
Table 5-10. Return Period in Years for Hurricanes (by Category) for Westchester County

Return Period in Years for Hurricanes		
Category	Wind Speed	Return Period
1	74-95 mph	17 years
2	96-110 mph	39 years
3	111-130 mph	68 years
4	131-155 mph	150 years
5	> 155 mph	370 years

Sources: FEMA, 2004; NOAA National Hurricane Center (http://www.nhc.noaa.gov/HAW2/english/basics/return.shtml)

Figure 5-9 illustrates the number of hurricanes expected to occur during a 100-year period. According to this map, WC can expect 20 to 40 hurricanes during a 100-year return period.

Figure 5-9. Number of Hurricanes for a 100-year Return Period



Source: USGS, 2007 (http://www.usgs.gov/hazards/hurricanes/). Notes: The number of hurricanes expected to occur during a 100-year MRP based on historical data—light blue area, 20 to 40; dark blue area, 40 to 60; red area, more than 60. Map not to scale.

Earlier in this section, the identified hazards of concern for the Village were ranked. The NYS Hazard Mitigation Plan conducts a similar ranking process for hazards that affect the State. The probability of occurrence, or likelihood of the event, is one parameter used for ranking hazards. Based on historical records and input from the Planning Committee, the probability of occurrence for severe storms in the Village is considered frequent (likely to occur more than once every 5 years, as presented in Table 5-4). It is estimated that WC and all of its jurisdictions, including the Village, will continue to experience severe 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. 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 storms include high winds and air speeds that result in power outages, disruptions to transportation corridors and equipment, loss of workplace access, significant property damage, injuries and loss of life, and the need to shelter and care for individuals impacted by the events. A large amount of damage can be inflicted by trees, branches, and other objects that fall onto power lines, buildings, roads, vehicles, and, in some cases, people. The risk assessment for severe storm evaluates available data for a range of storms included in this hazard category. In addition, for windstorm, the wind-related impact of coastal hurricanes is presented.

Due to the Village's inland location, the loss associated with hurricanes is primarily associated with severe thunderstorm or hurricane-related rains (see flooding discussion) and severe winds. Secondary flooding associated with the torrential downpours during hurricanes is also a primary concern in the Village. The Village has experienced flooding in association with several hurricanes and tropical storms in the past. In addition, there is a potential for flooding associated with storm surges along the Hudson River due to a drop in atmospheric pressure and the tidal influences of the river. The flood hazard is discussed later in the Plan.

In the study area, winds associated with a hurricane event are similar to a severe wind storm and therefore, can support analysis of the severe storm event for this study area. The entire inventory of the Village is at risk of being damaged or lost due to impacts of severe wind. Certain areas, infrastructure, and types of building are at greater risk than others due to proximity to falling hazards, their manner of construction.

Potential losses associated with high wind events were calculated for the Village for two probabilistic hurricane events, the 100-year and 500-year MRP hurricane events. The impacts on population, existing

structures and critical facilities are presented below, following a summary of the data and methodology used.

Data and Methodology

After reviewing historic data, the HAZUS-MH methodology and model were used to analyze the hurricane hazard for the Village. Data used to assess this hazard include data available in the HAZUS-MH hurricane model, NOAA NCDC data, professional knowledge, information provided by the Village's Planning Committee, and input from public citizens.

HAZUS-MH contains data on historic hurricane events and wind speeds. It also includes surface roughness and vegetation (tree coverage) maps for the area. Surface roughness and vegetation data support the modeling of wind force across various types of land surfaces. Hurricane and inventory data available in HAZUS-MH were used to evaluate potential losses from the 100- and 500-year MRP hurricane event (severe wind impacts). Locally available inventory data were reviewed to determine their appropriateness for inclusion. Other than data for critical facilities, the default data in HAZUS-MH was the best available for use in this evaluation. The 11 residential and 10 commercial occupancy classes available in HAZUS-MH were condensed into the following occupancy classes (residential, commercial, industrial, agricultural, religious, government, and educational) to facilitate the analysis and the presentation of results. Residential loss estimates address both multi-family and single family dwellings. In addition, impacts to critical facilities were evaluated for the 100-year and 500-year MRP events.

Impact on Life, Health and Safety

The impact of severe storms on life, health and safety is dependent upon the severity of the storm event. Residents may be displaced or require temporary to long-term sheltering. In addition, downed trees, damaged buildings and debris carried by high winds can lead to injury or loss of life. Socially vulnerable populations are most susceptible, based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. According to the 2000 Census, 14.7% of the Village's total population is 65 years of age and above. Few manufactured homes (trailer homes) are located in the area; citizens living in these types of structures are particularly vulnerable to wind events.

For a 100-year MRP event, HAZUS-MH estimates that one household will be displaced and require temporary shelter. A total of about 3,121 tons of debris will be generated, primarily tree debris. For a 500-year MRP event, HAZUS-MH estimates that 116 households will be displaced and 21 households will require short-term sheltering. A total of about 19,609 tons of debris will be generated, primarily brick, wood and tree debris.

Impact on General Building Stock

After considering the population exposed to the severe storm hazard, the value of general building stock exposed to and damaged by 100- and 500-year MRP events was evaluated. Potential damage is the modeled loss that could occur to the exposed inventory, including structural and content value. Table 5-11 presents the total exposure value for general building stock by occupancy class for the Village.

Table 5-11. Building Stock Exposure by Occupancy Class for the Village of Briarcliff Manor

Building Occupancy Class	Number of Buildings	Exposure Value	Percent of Total Exposure Value
Residential	2406	$1,044,542,000	87.4
Commercial	34	$116,225,000	9.7
Industrial	0	$1,0756,000	0.9
Agricultural*	0	$624,000	0.05
Religious	1	$6,226,000	0.5
Government	2	$4,506,000	0.4
Educational**	0	$12,856,000	1.05

Sources: Data presented is HAZUS-MH provided data (2005). Notes: Exposure value includes both structure and building contents. * The Village of Briarcliff Manor does not have any land zoned as agricultural. **HAZUS-MH default data indicates there are no educational buildings present in the Village but assigns an exposure value of greater than $12million to this occupancy class. Currently, there are 5 schools located in the Village.

The entire study area is considered at risk for the hurricane wind hazard. Expected building damage was evaluated by HAZUS across the following damage categories: no damage/very minor damage, minor damage, moderate damage, severe damage, and total destruction. Table 5-12 summarizes the definition of the damage categories.

Table 5-12. Description of Damage Categories

Qualitative Damage Description	Roof Cover Failure	Window Door Failures	Roof Deck	Missile Impacts on Walls	Roof Structure Failure	Wall Structure Failure
No Damage or Very Minor Damage Little or no visible damage from the outside. No broken windows, or failed roof deck. Minimal loss of roof over, with no or very Limited water penetration.	≤2%	No	No	No	No	No
Minor Damage Maximum of one broken window, door or garage door. Moderate roof cover loss that can be covered to prevent additional water entering the building. Marks or dents on walls requiring painting or patching for repair.	>2% and ≤15%	One window, door, or garage door failure	No	<5 impacts	No	No
Moderate Damage Major roof cover damage, moderate window breakage. Minor roof sheathing failure. Some resulting damage to interior of building from water.	>15% and ≤50%	> one and ≤ the larger of 20% & 3	1 to 3 panels	Typically 5 to 10 impacts	No	No
Severe Damage Major window damage or roof sheathing loss. Major roof cover loss. Extensive damage to interior from water.	>50%	> the larger of 20% & 3 and ≤50%	>3 and ≤25%	Typically 10 to 20 impacts	No	No
Destruction Complete roof failure and/or, failure of wall frame. Loss of more than 50% of roof sheathing.	Typically >50%	>50%	>25%	Typically >20 impacts	Yes	Yes

Source: HAZUS-MH Hurricane Technical Manual

The percent probability of experiencing damage of various severities is summarized for the 500-year event in Table 5-13. The hurricane analysis considers damage associated with significant winds. Such wind impacts also could occur as a result of the severe wind storms or tornados and therefore, are considered relevant to the severe storm hazard. Rain often is associated with hurricanes and heavy rains could result in flooding. Flooding is addressed under the flood hazard.

Table 5-13. Estimated Percent Probability of Various Damage Levels for 500-Year Hurricane Severe Storm Event

Category	500-year MRP Hurricane Event	
	Percent Probability of Experiencing Damage*	Severity of Damage Experienced
Residential Exposure (Single and Multi-Family Dwellings)	47%	None
	31%	Minor
	15%	Moderate
	4%	Severe
	3%	Complete Destruction
Commercial Buildings	90.8%	None
	3.9%	Minor
	3.7%	Moderate
	1.6%	Severe
	0%	Complete Destruction
Industrial Buildings	95.9%	None
	1.6%	Minor
	1.7%	Moderate
	0.8%	Severe
	0%	Complete Destruction
Education, Government and Agricultural Facilities	98.6%	None
	0.7%	Minor
	0.5%	Moderate
	0.2%	Severe
	0%	Complete Destruction

Source: HAZUS-MH, 2005. * Average reported across all Census blocks in the study region.

Table 5-14 summarizes the property damage estimated for the 100- and 500-year MRP hurricane event (rounded to the nearest thousand dollars). The data shown indicates total losses associated with wind damage to building structure and content.

Table 5-14. Village of Briarcliff Manor Building Value (Structure and Content) Damaged by the 100-Year and 500-Year MRP Hurricane-Related Winds

Occupancy Category	Building Value Damage (Structure and Content)	
	100-Year	500-Year
Residential	$8,648,000	$116,944,000
Commercial	$221,000	$7,227,000
Industrial	$9,000	$514,000
Agricultural	$2,000	$49,000
Religious	$17,000	$305,000
Government	$10,000	$289,000
Education	$13,000	$654,000

Source: HAZUS-MH, 2005;.

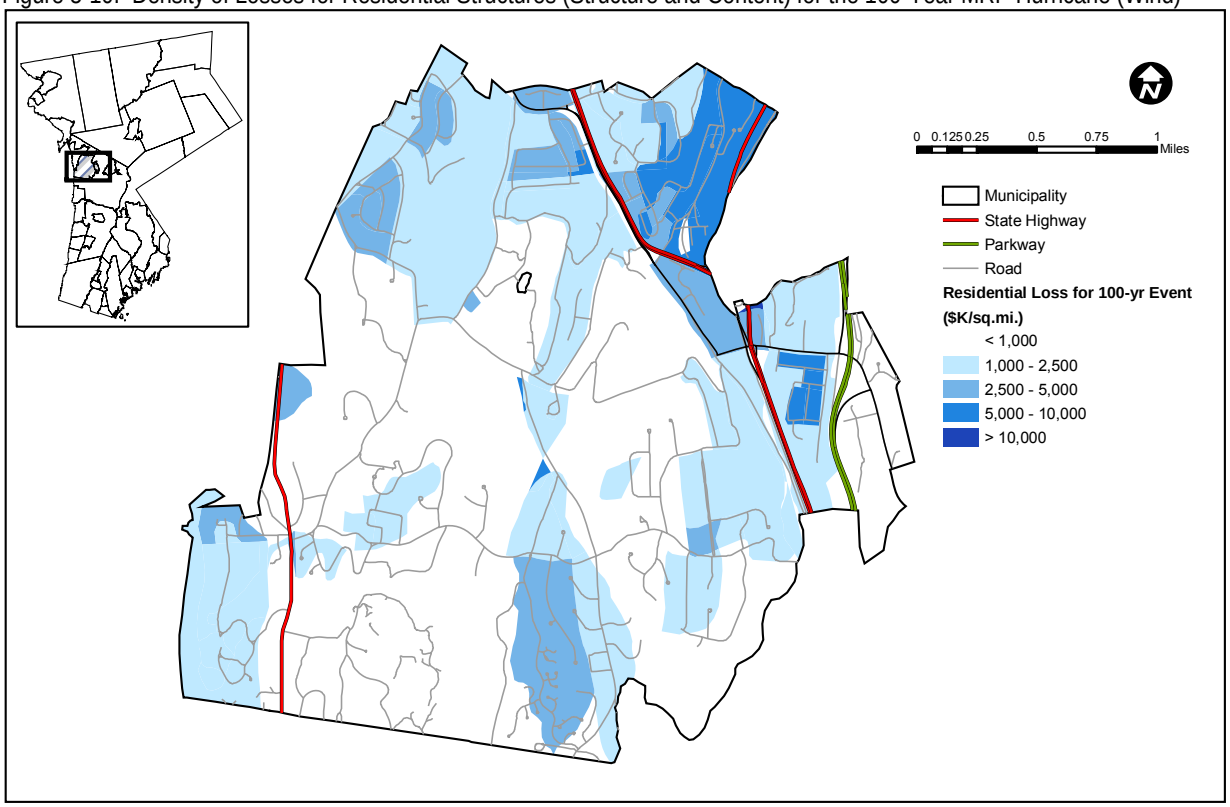
Residential buildings account for most of the damage for this event (greater than 92% of total building loss for the 500-year MRP event) and also comprise the majority of the building inventory. Because of differences in building construction, residential structures are generally more susceptible to wind damage than commercial and industrial structures. The damage counts include buildings damaged at all severity

levels from minor damage to total destruction. Total dollar damage reflects the overall impact to buildings at an aggregate level.

As shown in Table 5-14, the total damage to residential, commercial, industrial, and other buildings is estimated as greater than $8.9 million for building structure and content for a 100-year MRP event, and $129 million for a 500-year MRP event. The majority of losses are to the residential building category.

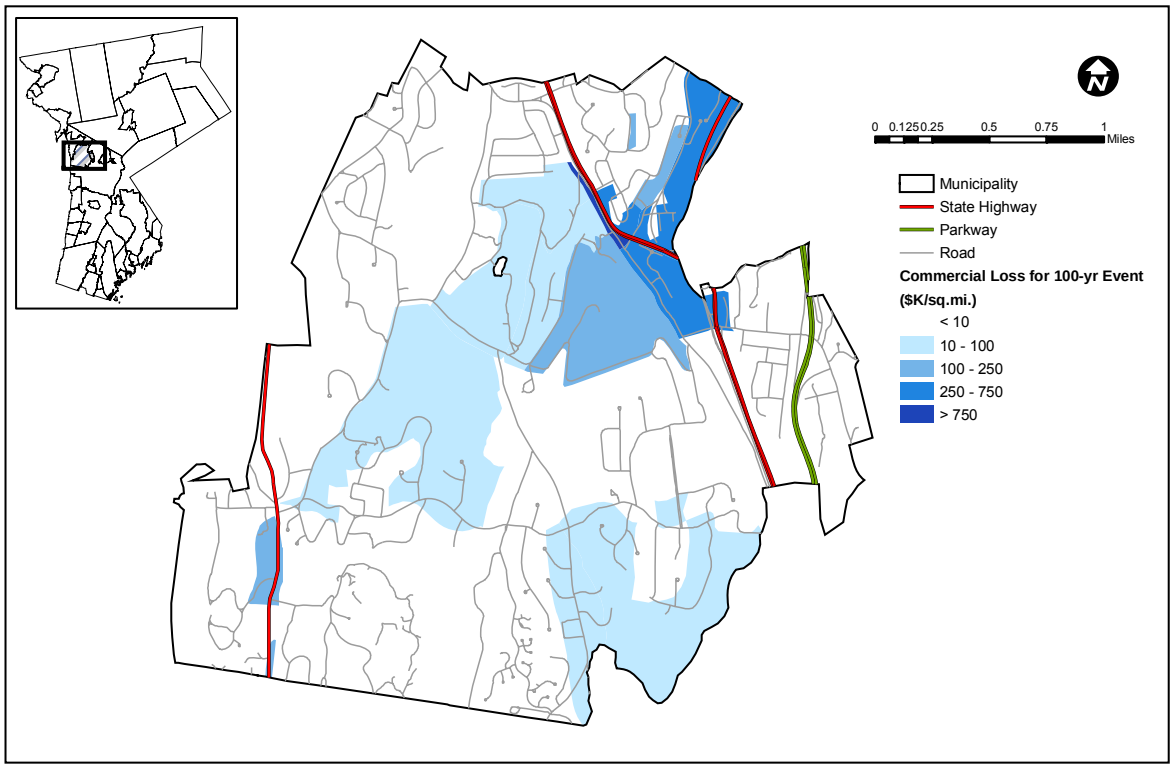
Figures 5-10 through 5-13 show the density of damage estimated for residential and commercial structures for the 100-year and 500-year MRP events. As can be seen from the figures, the density of loss to residential buildings is significant for the hurricane-related wind impact.

Figure 5-10. Density of Losses for Residential Structures (Structure and Content) for the 100-Year MRP Hurricane (Wind)



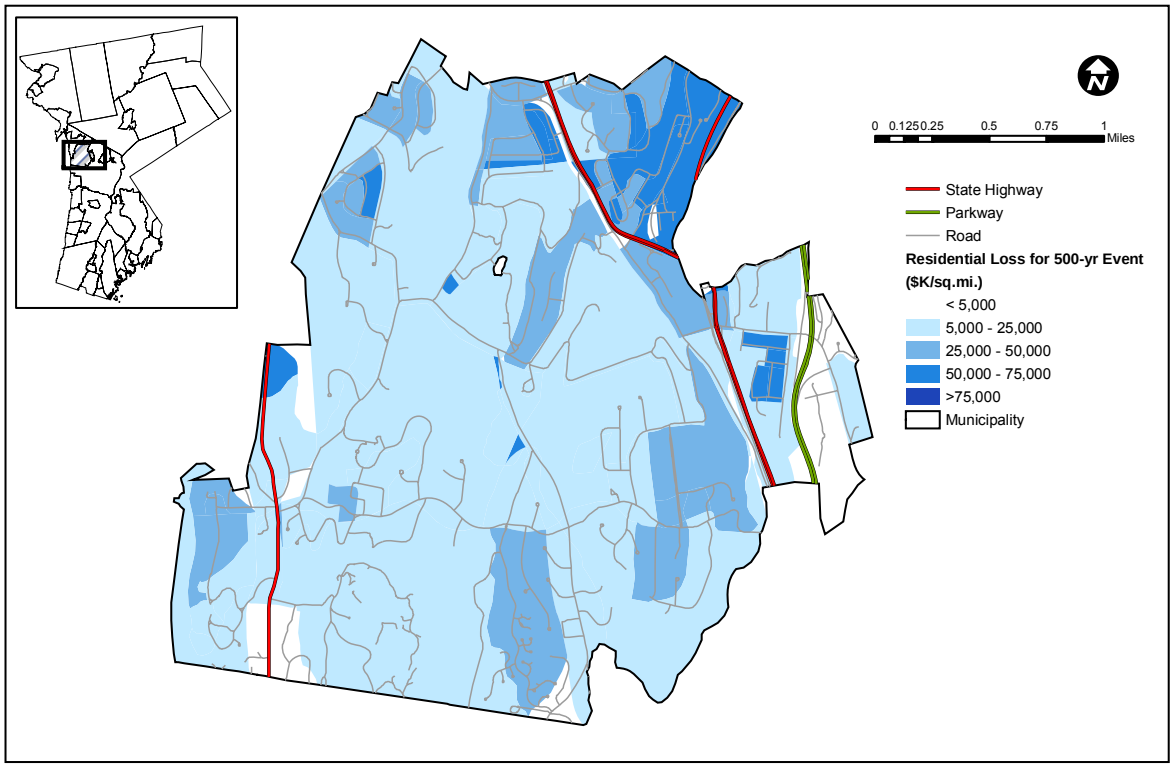
Source: HAZUS-MH, 2005. Note: The municipality boundary is the study area generated in HAZUS-MH based on Census blocks and tracts.

Figure 5-11. Density of Losses for Commercial Structures (Structure and Content) for the 100-Year MRP Hurricane (Wind)



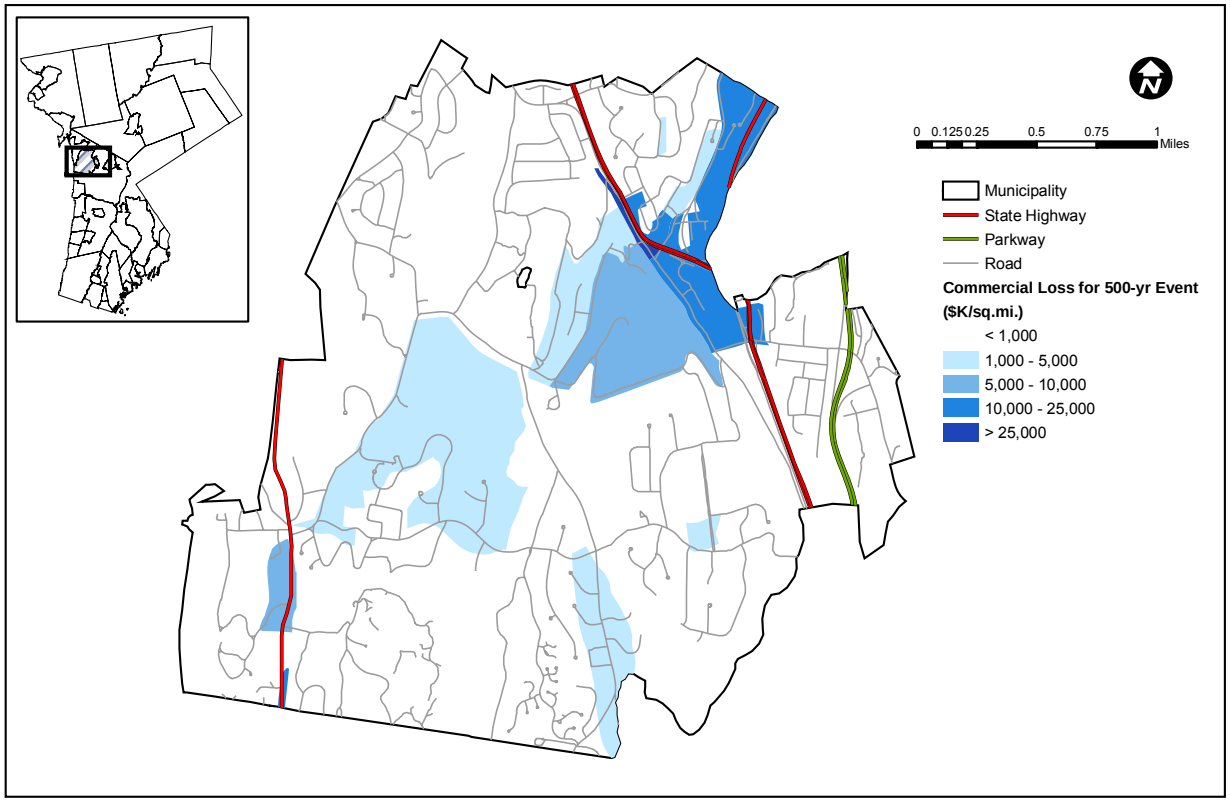
Source: HAZUS-MH, 2005. Note: The municipality boundary is the study area generated in HAZUS-MH based on Census blocks and tracts.

Figure 5-12. Density of Losses for Residential Structures (Structure and Content) for the 500-Year MRP Hurricane (Wind)



Source: HAZUS-MH, 2005. Note: The municipality boundary is the study area generated in HAZUS-MH based on Census blocks and tracts.

Figure 5-13. Density of Losses for Commercial Structures (Structure and Content) for the 500-Year MRP Hurricane (Wind)



Source: HAZUS-MH, 2005. Note: The municipality boundary is the study area generated in HAZUS-MH based on Census blocks and tracts.

Manufactured homes (trailer homes) are particularly vulnerable to severe storms. The 2000 U.S. Census of Population and Housing, accessed on the NYS Data Center website, indicate that there are five manufactured homes in the Village; However, HAZUS-MH indicates there is only one manufactured home located in the Village. HAZUS estimates the value of the home is estimated at $25,000.

Impact on Critical Facilities and Infrastructure

100-Year MRP Event – With regard to critical facilities, HAZUS-MH estimates the Fire Departments, Police Department and EMS facility have a 7 percent chance of suffering minor damage and 1 percent chance of suffering moderate damage. The loss of use of these facilities is estimated to be one day. HAZUS-MH estimates schools have a 5 to 6 percent chance of suffering minor damage and 0 to 1 percent chance of suffering moderate damage. There is no loss of use estimated for these facilities. In addition, HAZUS-MH estimates the Department of Public Works building has a 5 percent chance of suffering minor damage.

500-Year MRP Event – HAZUS-MH estimates the Fire Departments, Police Department and EMS facility have a 25 percent chance of suffering minor damage and 27 percent chance of suffering moderate damage during a 500-year event. The loss of use of these facilities is estimated to be 46 days. HAZUS-MH estimates the five schools present in the Village have a 27 percent chance of suffering minor damage and 20 to 25 percent chance of suffering moderate damage. Loss of use for these facilities is an estimated 24 to 42 days. In addition, HAZUS-MH estimates the Department of Public Works building has a 27 percent chance of suffering minor damage and 25 percent chance of suffering moderate damage.

Transportation lifelines are not considered particularly vulnerable to the severe storm wind hazard or other storms associated with the severe storm hazard. However, utility structures could suffer damage associated with falling tree limbs or other debris. Such impacts can result in the loss of power, which can impact business operations and can impact heating or cooling provision to citizens (including the young and elderly, who are particularly vulnerable to temperature-related health impacts).

Impact on Economy

Sufficient information was not available to perform a detailed assessment of estimated losses to the economy. It is estimated that the impact to the economy, as a result of severe storm event, would be considered "medium" in accordance with the risk ranking shown in Table 5-5.

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 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 storms.

Additional Data and Next Steps

Over time, the Village will obtain additional value data to support the analysis of this hazard. Data that will support the analysis would include additional detail on past hazard events and impacts, additional information on estimated frequency of these events, and future data regarding events and damages as they occur. In addition, information on particular buildings or infrastructure and their value will support updates regarding the particular assets in the Village that are most vulnerable to severe storm (wind-related) events. Additional utility data would support an improved assessment of potential damage for this infrastructure category.

For the severe storm events that cannot currently be modeled in HAZUS-MH (tornado, thunderstorm, windstorm, etc.), additional detailed loss data from past and future events will assist in assessing potential future losses. Based on these values and a sufficient number of data points, future losses could be modeled. Alternately, percent of damage estimates could be made and multiplied by the inventory value to estimate potential losses. 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). Finally, with time, HAZUS-MH will be released with modules that address hurricane wind and associated flooding as one model and will include a tornado module. As this version of HAZUS-MH is released, the Village can run analyses for the tornado hazard and re-run an analysis for an overall picture of the hurricane-associated wind and flood damages.

Overall Vulnerability Assessment

Severe storms are common in the study area, often causing impacts and losses to the Village's structures, facilities, utilities, and population. 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 overall hazard ranking determined by the Planning Committee for this hazard is high (see Table 5-7).