

5.3 HAZARD RANKING

After the hazards of concern were identified for Westchester County, the hazards were ranked to describe their probability of occurrence and their impact on population, property (general building stock including critical facilities) and the economy. Each participating city, township, or borough may have differing degrees of risk exposure and vulnerability compared to the County as a whole; therefore each jurisdiction ranked the degree of risk to each hazard as it pertains to their community using the same methodology as applied to the County-wide ranking. This assured consistency in the overall ranking of risk process. The hazard ranking for the County and each participating district can be found in their jurisdictional annex in Volume II of this plan.

5.3.1 Hazard Ranking Methodology

The methodology used to rank the hazards of concern for Westchester County is described below. Estimates of risk for the County were developed using methodologies promoted by FEMA’s hazard mitigation planning guidance and generated by FEMA’s HAZUS-MH risk assessment tool.

Probability of Occurrence

The probability of occurrence is an estimate of how often a hazard event occurs. A review of historic events assists with this determination. Each hazard of concern is rated in accordance with the numerical ratings and definitions in Table 5.3-1.

Table 5.3-1. Probability of Occurrence Ranking Factors

Rating	Probability Category	Definition
1	Rare	Hazard event is not likely to occur within 100 years (>1% chance of occurrence in any given year)
2	Occasional	Hazard event is likely to occur within 100 years (1% chance of occurrence in any given year)
3	Frequent	Hazard event is likely to occur within 25 years (4% chance of occurrence in any given year)

Impact

The impact of each hazard is considered in three categories: impact on population, impact on property (general building stock including critical facilities), and impact on the economy. Based on documented historic losses and a subjective assessment by the Planning Committee, an impact rating of high, medium, or low is assigned with a corresponding numeric value for each hazard of concern. In addition, a weighting factor is assigned to each impact category: three (3) for population, two (2) for property, and one (1) for economy. This gives the impact on population the greatest weight in evaluating the impact of a hazard. Table 5.3-2 presents the numerical rating, weighted factor and description for each impact category.

Table 5.3-2. Numerical Values and Definitions for Impacts on Population, Property and Economy

Category	Weighting Factor	Low Impact* (1)	Medium Impact (2)	High Impact (3)
Population	3	14% or less of your population is exposed to a hazard with potential for measurable life safety	15% to 29% of your population is exposed to a hazard with potential for measurable life safety impact, due to its extent and location	30% or more of your population is exposed to a hazard with potential for measurable life safety impact, due to its extent and location

Category	Weighting Factor	Low Impact* (1)	Medium Impact (2)	High Impact (3)
		impact, due to its extent and location		
Property	2	Property exposure is 14% or less of the total replacement cost for your community	Property exposure is 15% to 29% of the total replacement cost for your community	Property exposure is 30% or more of the total replacement cost for your community
Economy	1	Loss estimate is 9% or less of the total replacement cost for your community	Loss estimate is 10% to 19% of the total replacement cost for your community	Loss estimate is 20% or more of the total replacement cost for your community

Note: A numerical value of zero is assigned if there is no impact.

*For the purposes of this exercise, “impacted” means exposed for population and property and loss for economy.

Risk Ranking Value

The risk ranking for each hazard is then calculated by multiplying the numerical value for probability of occurrence by the sum of the numerical values for impact. The equation is as follows: Weighting Factor (1, 2, or 3) X Impact Value (6 to 18) = Hazard Ranking Value. Based on the total for each hazard, a priority ranking is assigned to each hazard of concern (high, medium, or low).

5.3.2 Hazard Ranking Results

Using the process described above, the risk ranking for the identified hazards of concern was determined for Westchester County. Based on the combined risk values for probability of occurrence and impact to Westchester County, a priority ranking of “high”, “medium” or “low” risk was assigned. The hazard ranking process for the Westchester County planning area is detailed in the subsequent tables that present the step-wise process for the ranking. The county-wide risk ranking includes the entire planning area and may not reflect the highest risk indicated for any of the participating jurisdictions. The resulting ranks of each municipality indicate the differing degrees of risk exposure, and vulnerability. The results support the appropriate selection and prioritization of initiatives to reduce the highest levels of risk for each municipality. Both the County and the participating jurisdictions have applied the same methodology to develop the county-wide risk and local rankings to ensure consistency in the overall ranking of risk.

This risk ranking exercise serves two purposes: 1) to describe the probability of occurrence for each hazard, and 2) to describe the impact each would have on the people, property and economy of Westchester County. Estimates of risk for Westchester County were developed using methodologies promoted by FEMA’s hazard mitigation planning guidance and generated by FEMA’s HAZUS-MH risk assessment tool.

Table 5.3-3 shows the probability ranking assigned for likelihood of occurrence for each hazard.

Table 5.3-3. Probability of Occurrence Ranking for Hazards of Concern for Westchester County

Hazard of Concern	Probability	Numeric Value
Earthquake	Occasional	2
Extreme Temperature	Frequent	3
Flood	Frequent	3
Severe Storm	Frequent	3
Severe Winter Storm	Frequent	3
Wildfire	Frequent	3
CBRN Incident	Frequent	3
Cyber Attack	Frequent	3

Hazard of Concern	Probability	Numeric Value
Critical Infrastructure Failure	Frequent	3
Disease Outbreak	Frequent	3

Table 5.3-4 shows the impact evaluation results for each hazard of concern, including impact on property, structures, and the economy on the County level. It is noted that several hazards that have a high impact on the local jurisdictional level, may have a lower impact when analyzed county-wide. Jurisdictional ranking results are presented in each local annex in Section 9 of this plan. The weighting factor results and a total impact for each hazard also are summarized.

Table 5.3-4. Impact Ranking for Hazards of Concern for Westchester County

Hazard of Concern	Population			Property			Economy			Total Impact Rating (Population + Property + Economy)
	Impact	Numeric Value	Multiplied by Weighing Factor (3)	Impact	Numeric Value	Multiplied by Weighing Factor (2)	Impact	Numeric Value	Multiplied by Weighing Factor (1)	
Earthquake	H	3	3 x 3 = 9	L	1	2 x 1 = 2	L	1	1 x 1 = 1	12
Extreme Temperature	M	2	3 x 2 = 6	L	1	2 x 1 = 2	M	2	1 x 2 = 2	10
Flood	H	3	3 x 3 = 9	L	1	2 x 1 = 2	L	1	1 x 1 = 1	12
Severe Storm	H	3	3 x 3 = 9	H	3	2 x 3 = 6	L	1	1 x 1 = 1	16
Severe Winter Storm	H	3	3 x 3 = 9	H	3	2 x 3 = 6	M	2	1 x 2 = 2	17
Wildfire	M	2	3 x 2 = 6	M	2	2 x 2 = 4	M	2	1 x 2 = 2	12
CBRN Incident	H	3	3 x 3 = 9	M	2	2 x 2 = 4	M	2	1 x 2 = 2	15
Cyber Attack	M	2	3 x 2 = 6	M	2	2 x 2 = 4	M	2	1 x 2 = 2	12
Critical Infrastructure Failure	H	3	3 x 3 = 9	M	2	2 x 2 = 4	M	2	1 x 2 = 2	15
Disease Outbreak	H	3	3 x 3 = 9	L	1	2 x 1 = 2	L	1	1 x 1 = 1	12

Notes:
H = High; L = Low; M = Medium



Table 5.3-5 presents the total ranking value for each hazard.

Table 5.3-5. Total Risk Ranking Value for Hazards of Concern for Westchester County

Hazard of Concern	Probability	Impact	Total = (Probability x Impact)
Earthquake	2	12	24
Extreme Temperature	3	10	30
Flood	3	12	36
Severe Storm	3	16	48
Severe Winter Storm	3	17	51
Wildfire	3	12	36
CBRN Incident	3	15	45
Cyber Attack	3	12	36
Critical Infrastructure Failure	3	15	45
Disease Outbreak	3	12	36

Table 5.3-6 presents the hazard ranking category by jurisdiction assigned for each hazard of concern. The ranking categories are determined by an evaluation of the total risk ranking score into three categories, low, medium, and high whereby a total score of 14 and below is categorized as low, 15 to 30 is medium, and 31 and over is considered a high risk category.

These rankings have been used as one of the bases for identifying the jurisdictional hazard mitigation strategies included in Section 9 of this plan. The summary rankings for the County reflect the results of the vulnerability analysis for each hazard of concern and vary from the specific results of each jurisdiction. For example the coastal storm hazard may be ranked high in one jurisdiction, but due to the exposure and impact county-wide, it is ranked as a medium hazard and is addressed in the county mitigation strategy accordingly.

Table 5.3-6. Summary of Overall Ranking of Natural Hazards by Municipality

Westchester County Municipalities	Hazard Ranking									
	Earthquake	Extreme Temp	Flood	Severe Storm	Severe Winter Storm	Wildfire	CBRN Incident	Cyber Attack	Critical Infrastructure Failure	Disease Outbreak
Ardsey (V)	Medium	Medium	High	High	High	Medium	Medium	Medium	High	High
Bedford (T)	Medium	Medium	High	High	High	High	Medium	Medium	High	High
Briarcliff Manor (V)	Medium	Medium	High	High	High	High	Medium	Medium	High	High
Bronxville (V)	Medium	Medium	High	High	High	Medium	Medium	Medium	High	High
Buchanan (V)	Medium	Medium	High	High	High	High	Medium	Medium	High	High
Cortlandt (T)	Medium	Medium	High	High	High	High	Medium	Medium	High	High
Croton-on-Hudson (V)	Medium	Medium	High	High	High	High	Medium	Medium	High	High

Section 5.3: Risk Assessment – Hazard Ranking

Westchester County Municipalities	Hazard Ranking									
	Earthquake	Extreme Temp	Flood	Severe Storm	Severe Winter Storm	Wildfire	CBRN Incident	Cyber Attack	Critical Infrastructure Failure	Disease Outbreak
Dobbs Ferry (V)	Medium	Medium	High	High	High	Medium	Medium	Medium	High	High
Eastchester (T)	Medium	Medium	High	High	High	Medium	Medium	Medium	High	High
Elmsford (V)	Medium	Medium	High	High	High	Medium	Medium	Medium	High	High
Greenburgh (T)	Medium	Medium	High	High	High	Medium	Medium	Medium	High	High
Harrison (T)	Medium	Medium	High	High	High	Medium	Medium	Medium	High	High
Hastings-on-Hudson (V)	Medium	Medium	High	High	High	Medium	Medium	Medium	High	High
Irvington (V)	Medium	Medium	High	High	High	Medium	Medium	Medium	High	High
Larchmont (V)	Medium	Medium	High	High	High	Medium	Medium	Medium	High	High
Lewisboro (T)	Medium	Medium	High	High	High	High	Medium	Medium	High	High
Mamaroneck (T)	Medium	Medium	High	High	High	Medium	Medium	Medium	High	High
Mamaroneck (V)	Medium	Medium	High	High	High	Medium	Medium	Medium	High	High
Mount Kisco (T)	Medium	Medium	High	High	High	High	Medium	Medium	High	High
Mount Pleasant (T)	Medium	Medium	High	High	High	High	Medium	Medium	High	High
Mount Vernon (C)	Medium	Medium	High	High	High	Medium	Medium	Medium	High	High
New Castle (T)	Medium	Medium	High	High	High	High	Medium	Medium	High	High
New Rochelle (C)	Medium	Medium	High	High	High	Medium	Medium	Medium	High	High
North Castle (T)	Medium	Medium	High	High	High	High	Medium	Medium	High	High
North Salem (T)	Medium	Medium	High	High	High	High	Medium	Medium	High	High
Ossining (T)	Medium	Medium	High	High	High	High	Medium	Medium	High	High
Ossining (V)	Medium	Medium	High	High	High	High	Medium	Medium	High	High
Peekskill (C)	Medium	Medium	High	High	High	High	Medium	Medium	High	High
Pelham (T)	Medium	Medium	High	High	High	Medium	Medium	Medium	High	High
Pelham (V)	Medium	Medium	High	High	High	Medium	Medium	Medium	High	High
Pelham Manor (V)	Medium	Medium	High	High	High	Medium	Medium	Medium	High	High
Pleasantville (V)	Medium	Medium	High	High	High	Medium	Medium	Medium	High	High
Port Chester (V)	Medium	Medium	High	High	High	Medium	Medium	Medium	High	High
Pound Ridge (T)	Medium	Medium	High	High	High	High	Medium	Medium	High	High
Rye (C)	Medium	Medium	High	High	High	Medium	Medium	Medium	High	High
Rye Brook (V)	Medium	Medium	High	High	High	Medium	Medium	Medium	High	High
Scarsdale (T)	Medium	Medium	High	High	High	Medium	Medium	Medium	High	High
Sleepy Hollow (V)	Medium	Medium	High	High	High	Medium	Medium	Medium	High	High
Somers (T)	Medium	Medium	High	High	High	High	Medium	Medium	High	High
Tarrytown (V)	Medium	Medium	High	High	High	Medium	Medium	Medium	High	High

Westchester County Municipalities	Hazard Ranking									
	Earthquake	Extreme Temp	Flood	Severe Storm	Severe Winter Storm	Wildfire	CBRN Incident	Cyber Attack	Critical Infrastructure Failure	Disease Outbreak
Tuckahoe (V)	Medium	Medium	High	High	High	Medium	Medium	Medium	High	High
White Plains (C)	Medium	Medium	High	High	High	Medium	Medium	Medium	High	High
Yonkers (C)	Medium	Medium	High	High	High	Medium	Medium	Medium	High	High
Yorktown (T)	Medium	Medium	High	High	High	High	Medium	Medium	High	High

The hazard rankings indicated in this plan update have been adjusted from the 2010 plan due to the improved vulnerability assessment based on structure-specific data available from the County rather than HAZUS default aggregate data as discussed in Section 5.1 (Methodology). Any changes to the ranking results therefore do not necessarily reflect significant changes in exposure, but a more refined vulnerability analysis methodology. The summary County level values reflect the vulnerability data on the County level and do not represent an average of jurisdiction ranks or the highest rank indicated in Westchester County. These designations are an element of the prioritization criteria as detailed in Section 6 of this plan.

5.4 Hazards Profiles and Vulnerability Assessment

The following sections profile and assess vulnerability for each hazard of concern. For each hazard, the profile includes: the hazard description; its location and extent; previous occurrences and losses; and the probability of future events. The vulnerability assessment for each hazard includes: an overview of vulnerability; the data and methodology used; the impact on life, health and safety; impact on general building stock; impact on critical facilities; impact on the economy; additional data needs and next steps; and the overall vulnerability assessment finding.