



5.3 HAZARD RANKING

As discussed in Section 5.2, Identification of Hazards of Concern, a comprehensive range of natural hazards that pose a significant risk to Erie County was selected and considered during the development of this plan. However, each community in Erie County has differing levels of exposure and vulnerability to each of these hazards. It is important for each community participating in this plan to recognize those hazards that pose the greatest risk to their community and direct their attention and resources accordingly to most effectively and efficiently manage risk and reduce losses. The hazard ranking for the county and each participating jurisdiction can be found in their jurisdictional annexes in Volume II, Section 9 of this plan.

To this end, a hazard risk ranking process was conducted for Erie County and its municipalities using the method described below. This method includes four risk assessment categories—probability of occurrence, impact (population, property, and economy), adaptive capacity, and changing future conditions (i.e., climate change). Each was assigned a weighting factor to calculate an overall ranking value for each hazard of concern. Depending on the calculation, each hazard was assigned a high, medium, or low ranking. Details regarding each of these categories are described in the sections below.

5.3.1 Hazard Ranking Methodology

The methodology used to rank the hazards of concern for Erie County is described below. Estimates of risk for the county were developed using methodologies promoted by the Federal Emergency Management Agency’s (FEMA) hazard mitigation planning guidance, generated by FEMA’s HAZUS-MH risk assessment tool and input from Erie County and participating jurisdictions. The ranking includes a factor to evaluate capacity of the participating jurisdiction to address each hazard through plans, policies, and mitigation strategies. For example, a community participating in the Community Rating System (CRS) Program has a high capacity to address and mitigate flooding issues, which will be reflected in the ranking benchmark. In addition, a factor addressing the degree of climate change impact is included in the methodology to adjust rankings for hazards expected to be significantly impacted by climate change. Table 5.3-1 shows the values for the four risk assessment categories assigned to Erie County’s hazards. Details for each category are further described below.

Table 5.3-1. Summary of Hazard Ranking Approach

Category		Level / Category	Degree of Risk / Benchmark Value	Numeric Value	Weighted Value
Probability of Occurrence		Unlikely	A hazard event is not likely to occur or is unlikely to occur with less than a 1 percent annual chance probability.	0	30%
		Rare	Between 1 and 10 percent annual probability of a hazard event occurring.	1	
		Occasional	Between 10 and 100 percent annual probability of a hazard event occurring.	2	
		Frequent	100 percent annual probability; a hazard event may occur multiple times per year.	3	
Impact (Sum of all 3)	Population (Numeric Value x 3)	Low	14 percent or less of population is exposed to a hazard with potential for measurable life-safety impact due to its extent and location.	1	30%
		Medium	15 to 29 percent of population is exposed to a hazard with potential for measurable life-safety impact due to its extent and location.	2	
		High	30 percent or more of population is exposed to a hazard with potential for measurable life-safety impact, due to its extent and location.	3	
	Property (Numeric Value x 2)	Low	Property exposure is 14 percent or less of the total number of structures for your community.	1	
		Medium	Property exposure is 15 to 29 percent of the total number of structures for the community.	2	



Category		Level / Category	Degree of Risk / Benchmark Value	Numeric Value	Weighted Value
Economy (Numeric Value x 1)	High	High	Property exposure is 30 percent or more of the total number of structures for the community.	3	
	Low	Low	Loss estimate is 9 percent or less of the total replacement cost for the community.	1	
	Medium	Medium	Loss estimate is 10 to 19 percent of the total replacement cost for the community.	2	
	High	High	Loss estimate is 20 percent or more of the total replacement cost for the community.	3	
Adaptive Capacity	Low	Low	Weak/outdated/inconsistent plans, policies, codes/ordinances in place; no redundancies; limited to no deployable resources; limited capabilities to respond; long recovery.	3	30%
	Medium	Medium	Plans, policies, codes/ordinances in place and meet minimum requirements; mitigation strategies identified but not implemented on a widespread scale; county/jurisdiction can recover but needs outside resources; moderate county/jurisdiction capabilities.	2	
	High	High	Plans, policies, codes/ordinances in place and exceed minimum requirements; mitigation/protective measures in place; county/jurisdiction has ability to recover quickly because resources are readily available, and capabilities are high.	1	
Climate Change	Low	Low	No local data are available; modeling projects are uncertain on whether there is increased future risk; confidence level is low (inconclusive evidence).	1	10%
	Medium	Medium	Studies and modeling projections indicate a potential for exacerbated conditions due to climate change; confidence level is medium to high (suggestive to moderate evidence).	2	
	High	High	Studies and modeling projections indicate exacerbated conditions/increased future risk due to climate change; very high confidence level (strong evidence, well documented, and acceptable methods).	3	

Probability of Occurrence

The probability of occurrence is the likelihood of a hazard event occurring in any given year. A review of historic events assists with this determination. Each hazard of concern is rated in accordance with the numerical ratings and definitions described in Table 5.3-2. The probability of occurrence is given a weighted value of 30 percent.

Table 5.3-2. Probability of Occurrence Ranking Factors

Numeric Value	Probability Category	Definition
0	Unlikely	A hazard event is not likely to occur or is unlikely to occur with less than a 1 percent annual chance probability.
1	Rare	Between 1 and 10 percent annual probability of a hazard event occurring.
2	Occasional	Between 10 and 100 percent annual probability of a hazard event occurring.
3	Frequent	100 percent annual probability; a hazard event may occur multiple times per year.

Hazard Impacts

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 individual assessments by each participating municipality, 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: 3 for population, 2 for property, and 1 for economy. This gives the impact on population the greatest weight in evaluating the impact of a hazard. The total of each category is assigned a



weighted value of 30 percent. Table 5.3-3 presents the numerical rating, weighted factor, and description for each impact category.

Table 5.3-3. Numerical Values and Definitions for Impacts on Population, Property, and Economy

Category	Weighted Value	Low Impact* (1)	Medium Impact (2)	High Impact (3)
Population	3	14% or less of population is exposed to a hazard with potential for measurable life-safety impact, due to its extent and location.	15% to 29% of population is exposed to a hazard with potential for measurable life-safety impact, due to its extent and location.	30% or more of population is exposed to a hazard with potential for measurable life-safety impact, due to its extent and location.
Property	2	Property exposure is 14% or less of the total number of structures for community.	Property exposure is 15% to 29% of the total number of structures for community.	Property exposure is 30% or more of the total number of structures for community.
Economy	1	Loss estimate is 9% or less of the total replacement cost for community.	Loss estimate is 10% to 19% of the total replacement cost for community.	Loss estimate is 20% or more of the total replacement cost for 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.

Additional Impacts

Along with impacts on population, property, and economy, the overall risk ranking considers two additional impacts that affect the county's vulnerability: Capability and Climate Change. Table 5.3-4 presents the numerical rating and description for each category.

Adaptive Capacity

Capability refers to a jurisdiction's ability to protect the community from or withstand a hazard event. Mitigation measures are already in place, including codes and ordinances, plans, and procedures to withstand hazards due to design or location, deployable resources, or plans and procedures in place to respond to an event. The capability category has a weighted factor of 30 percent.

Climate Change or Changing Future Conditions

Climate change refers to the impact that climate change projections have on increasing or decreasing the severity and frequency of a hazard. The Climate Change category has a weighted factor of 10 percent.

Table 5.3-4. Numerical Values and Definitions for Changing Future Conditions and Adaptive Capacity

Category	Low Impact	Medium Impact	High Impact
Capability	Weak/outdated/inconsistent plans, policies, codes/ordinances in place; no redundancies; limited to no deployable resources; limited capabilities to respond; long recovery.	Plans, policies, codes/ordinances in place and meet minimum requirements; mitigation strategies identified but not implemented on a widespread scale; county/jurisdiction can recover but needs outside resources; moderate county/jurisdiction capabilities.	Plans, policies, codes/ordinances in place and exceed minimum requirements; mitigation/protective measures in place; county/jurisdiction has ability to recover quickly because resources are readily available and capabilities are high.
Climate Change	No local data are available; modeling projects are uncertain on whether there is increased future risk; confidence level is low (inconclusive evidence).	Studies and modeling projections indicate a potential for exacerbated conditions due to climate change; confidence level is medium to high (suggestive to moderate evidence).	Studies and modeling projections indicate exacerbated conditions and increased future risk due to climate change; very high confidence level (strong evidence, well documented and acceptable methods).



Note: "Low impact" for adaptive capacity means the jurisdiction does not have the capability to effectively respond, which increases vulnerability; whereas high impact for adaptive capacity means the jurisdiction does have the capability to effectively respond, which decreases vulnerability.

Risk Ranking Value

Each impact was then weighted and the risk ranking for each hazard is then calculated using the following formula:

Example Risk Ranking Equation

$$\text{Risk Ranking} = [(\text{Impact on Population} \times 3) + (\text{Impact on Property} \times 2) + (\text{Impact on Economy} \times 1) \times 0.3] + [\text{Capability} \times 0.3] + [\text{Climate Impact} \times 0.1] + [\text{Probability of Occurrence} \times 0.3]$$

Based on the total for each hazard, a priority ranking is assigned to each hazard of concern (high, medium, or low). The rankings were categorized as follows: Low = values less than 3.9; Medium = values between 3.9 and 4.9; High = values greater than 4.9.

5.3.2 Hazard Ranking Results

Using the process described above, the risk ranking for the identified hazards of concern was determined for Erie County. The hazard ranking for Erie County is detailed in the subsequent tables that present the step-wise process for the ranking. The countywide 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 countywide risk and local rankings to ensure consistency in the overall ranking of risk; jurisdictions had the ability to alter rankings based on local knowledge and experience in handling each hazard.

This hazard ranking exercise serves four purposes: (1) to describe the probability of occurrence for each hazard; (2) to describe the impact each would have on the people, property, and economy; (3) to evaluate the capabilities a community has with regards to natural hazards; and (4) to consider changing future conditions (i.e., climate change) in Erie County. Estimates of risk for Erie County were developed using methodologies promoted by FEMA’s hazard mitigation planning guidance, generated by FEMA’s HAZUS-MH risk assessment tool and input from the county and participating municipalities.

Table 5.3-5 shows the probability ranking assigned for the likelihood of occurrence for each hazard.

Table 5.3-5. Probability of Occurrence Ranking for Hazards of Concern for Erie County

Hazard of Concern	Probability	Numeric Value
Coastal Erosion	Unlikely	0
Cyber Attack	Frequent	3
Earthquake	Rare	1
Expansive Soils	Rare	1
Extreme Temperature	Rare	1
Flood	Frequent	3
Hazardous Materials	Frequent	3
Landslide	Unlikely	0



Hazard of Concern	Probability	Numeric Value
Pandemic	Unlikely	0
Severe Storm	Frequent	3
Severe Winter Storm	Frequent	3
Utility Interruption	Frequent	3
Wildfire	Occasional	2

Table 5.3-6 shows the impact evaluation results for each hazard of concern, including impact on property, structures, and the economy on the county level. The weighting factor results and a total impact for each hazard also are summarized. It is noted that several hazards that have a high impact on the local jurisdictional level can have a lower impact when analyzed countywide.

Table 5.3-6. Impact Ranking for Hazards of Concern for Erie 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)	
Coastal Erosion	Low	1	3	Low	1	2	Low	1	1	6
Cyber Attack	Low	1	3	Low	1	2	High	1	3	8
Earthquake	High	3	9	High	3	6	Low	1	1	16
Extreme Temperature	High	3	9	Low	1	2	Low	1	1	12
Expansive Soils	Low	1	3	Low	1	2	Medium	2	2	7
Flood	Low	1	3	Low	1	2	Low	1	1	6
Hazardous Materials	Low	1	3	Low	1	2	Medium	2	1	6
Landslide	Low	1	3	Low	1	2	Low	1	1	6
Pandemic	High	3	9	Low	1	2	High	3	3	14
Severe Storm	High	3	9	Low	1	2	Low	1	1	12
Severe Winter Storm	High	3	9	Low	1	2	Low	1	1	12
Utility Interruption	Medium	2	6	Medium	2	4	Medium	2	2	12
Wildfire	Medium	2	6	Medium	3	6	Medium	2	2	14

Table 5.3-7 shows the additional impact rankings for the hazards of concern. This includes the overall capabilities of the county and municipalities and the consideration of changing future conditions, such as climate change.

Table 5.3-7. Additional Impact Ranking for Hazards of Concern for Erie County

Hazard of Concern	Capabilities	Numeric Value	Climate Change	Numeric Value
Coastal Erosion	High	1	Medium	2
Cyber Attack	Medium	2	Low	1
Earthquake	High	1	Low	1
Extreme Temperature	High	1	High	3
Expansive Soils	High	1	Low	1
Flood	Medium	2	High	3
Hazardous Materials	High	1	Low	1



Hazard of Concern	Capabilities	Numeric Value	Climate Change	Numeric Value
Landslide	High	1	Low	1
Pandemic	High	1	Medium	2
Severe Storm	High	1	Medium	2
Severe Winter Storm	High	1	Medium	2
Utility Interruption	High	1	Medium	2
Wildfire	High	1	High	3

Table 5.3-8 presents the total calculations for each hazard ranking value for the hazards of concern. The rankings were categorized and assigned a color as follows: Low = values less than or equal to 3.8 (green); Medium = values between 3.9 and 4.9 (yellow); High = values greater than or equal to 5.0 (red).

Table 5.3-8. Total Hazard Ranking Values for the Hazards of Concern for Erie County

Hazard of Concern	Probability x 30%	Total Impact x 30%	Adaptive Capacity x 30%	Changing Future Conditions x 10%	Total Risk Ranking Value
Coastal Erosion	0	3	2	1	Low
Cyber Attack	0.9	3	2	3	Medium
Earthquake	0.3	9	6	1	High
Expansive Soils	0.3	3	2	2	Low
Extreme Temperature	0.3	9	2	1	Medium
Flood	0.9	3	2	1	Low
Hazardous Materials	0.9	3	2	2	Low
Landslide	0	3	2	1	Low
Pandemic	0	9	2	3	Medium
Severe Storm	0.9	9	2	1	High
Severe Winter Storm	0.9	9	2	1	High
Utility Interruption	0.9	6	4	2	High
Wildfire	0.6	6	4	2	Medium

Notes: Low = Values less than 3.9; Medium = Values between 3.9 and 4.9; High = Values greater than 4.9

Table 5.3-9 presents the jurisdictional hazard ranking for each hazard. An evaluation of the total risk ranking score determined ranking categories that were grouped into three categories: low, medium, and high. It also includes input by the municipalities.

These rankings have been used as one of the bases for identifying the jurisdictional hazard mitigation strategies included in this plan in Section 9, Jurisdictional Annexes. 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 severe storm hazard may be ranked low in one jurisdiction, but due to the exposure and impact countywide, it is ranked as a high hazard and is addressed in the county mitigation strategy accordingly. Jurisdictional ranking results are presented in each local annex in this plan in Section 9, Jurisdictional Annexes.



Table 5.3-9. Summary of Overall Ranking of Hazards by Jurisdiction

Erie County Municipalities	Coastal Erosion	Cyber	Earthquake	Expansive Soils	Extreme Temperature	Flood	Hazardous Material	Landslide	Pandemic	Severe Storm	Severe Winter Storm	Utility Interruption	Wildfire
Erie County	Low	Medium	High	Low	Medium	Low	Low	Low	Medium	High	High	High	Medium
Erie County Water Authority	Low	Medium	High	Low	Medium	Low	Low	Low	Medium	High	High	High	Medium
Akron (V)	Low	Medium	Low	Low	Medium	Low	Low	Low	High	High	High	High	Low
Alden (T)	Low	Medium	Low	Low	Medium	Medium	Low	Low	Medium	Medium	High	Medium	Low
Alden (V)	Low	Medium	Low	Low	Medium	Low	Medium	Low	Low	Medium	High	High	Low
Amherst (T)	Low	Medium	Medium	Medium	Medium	Low	Low	Low	Medium	Medium	Medium	Medium	Low
Angola (V)	Low	Medium	Medium	Low	Medium	Low	Low	Low	High	High	High	High	Medium
Aurora (T)	Low	Medium	Low	Low	Medium	High	Low	Medium	Medium	Medium	Medium	High	Low
Blasdell (V)	Low	Medium	Low	Low	Medium	Low	Low	Low	Medium	Medium	Medium	Low	Low
Boston (T)	Low	Medium	Low	Low	Medium	Low	Low	Low	Medium	High	High	High	High
Brant (T)	Low	Medium	High	Low	Medium	Low	Low	Low	Medium	High	High	High	High
Buffalo (C)	Low	Medium	High	Low	Medium	Low	Low	Low	High	High	High	High	Low
Cheektowaga (T)	Low	Medium	Medium	Low	Medium	Low	Low	Low	High	High	High	High	Low
Clarence (T)	N/A	Medium	Medium	Medium	Medium	Low	Low	Low	High	High	High	High	Low
Colden (T)	Low	Medium	Low	Low	Medium	Low	Low	Medium	Medium	High	High	High	Medium
Collins (T)	Low	Medium	High	Low	Medium	Low	Low	Medium	Medium	High	High	High	High
Concord (T)	Low	Medium	High	Low	Medium	Low	Low	Medium	High	High	High	High	High
Depew (V)	Low	Medium	Medium	Low	Medium	High	Medium	Low	Medium	Medium	Medium	Medium	Low
East Aurora (V)	Low	Medium	Low	Low	Medium	Low	Low	Low	Medium	High	High	High	High
Eden (T)	Low	Medium	Medium	Medium	Medium	Low	Low	Low	High	High	High	Medium	Medium
Elma (T)	Low	Medium	High	Medium	Medium	Low	Low	Low	Medium	High	Medium	Medium	High
Evans (T)	High	Medium	Medium	Medium	Medium	High	Low	Low	High	High	High	High	Medium
Farnham (V)	Low	Medium	High	Low	Medium	Low	Low	Low	Medium	High	High	High	High
Gowanda (V)	Low	Medium	High	Low	Medium	Low	Low	Low	Medium	High	High	High	High
Grand Island (T)	Medium	Medium	Low	High	Medium	Low	Low	Low	High	Low	Medium	High	High
Hamburg (T)	Low	Medium	High	High	Medium	Low	Low	Low	High	High	High	High	High
Hamburg (V)	Low	Medium	High	Low	Medium	Low	Low	Low	High	High	High	High	Low
Holland (T)	Low	Medium	Low	Low	Medium	Medium	Low	Medium	Medium	High	High	High	Low
Kenmore (V)	Low	Medium	High	Low	Medium	Low	Low	Low	High	High	High	High	Low



Erie County Municipalities	Coastal Erosion	Cyber	Earthquake	Expansive Soils	Extreme Temperature	Flood	Hazardous Material	Landslide	Pandemic	Severe Storm	Severe Winter Storm	Utility Interruption	Wildfire
Lackawanna (C)	Low	Medium	High	Low	Medium	Low	Low	Low	Medium	High	High	High	Low
Lancaster (T)	Low	Medium	Medium	Medium	Medium	High	Medium	Low	Medium	High	High	High	Medium
Lancaster (V)	Low	Medium	High	Medium	Medium	High	High	Low	Medium	High	High	Medium	Low
Marilla (T)	Low	Low	Medium	Low	Medium	Low	Low	Low	Medium	Medium	Medium	High	Low
Newstead (T)	Low	Medium	Medium	Low	Medium	Medium	Low	Low	High	High	High	High	Medium
North Collins (T)	Low	Medium	Low	Low	Medium	Low	Low	Low	Medium	High	High	High	High
North Collins (V)	Low	Medium	High	Low	Medium	Low	Low	Low	Medium	High	High	High	High
Orchard Park (T)	Low	Medium	Low	Low	Medium	Low	Medium	Low	Medium	High	High	High	Medium
Orchard Park (V)	Low	Medium	Low	Low	Medium	Low	Low	Low	Medium	High	High	High	Low
Sardinia (T)	Low	Medium	High	Low	Medium	Medium	High	Low	High	High	High	High	High
Sloan (V)	Low	Medium	High	Low	Medium	Low	Low	Low	High	High	High	High	Low
Springville (V)	Low	Medium	High	Low	Medium	Low	Low	Low	Medium	High	High	High	High
Tonawanda (C)	Low	Medium	Medium	Low	Medium	Low	High	Low	High	High	High	High	Low
Tonawanda (T)	Low	Medium	High	Low	Medium	Low	High	Low	High	High	High	High	Low
Wales (T)	Low	Low	Low	Low	Medium	Low	Medium	Low	Medium	Medium	Medium	Medium	Low
West Seneca (T)	Low	Medium	High	Medium	Medium	High	Medium	Low	High	High	High	High	Medium
Williamsville (V)	Low	Medium	Low	Low	Medium	Low	Low	Low	Medium	High	High	High	Low