Risk Assessment

Requirement §201.6(c)(2):

The risk assessment shall provide the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

Methodology

As defined by the Federal Emergency Management Agency (FEMA), risk is a combination of hazard, vulnerability, and exposure. "It is the impact that a hazard would have on people, services, facilities, and structures in a community and refers to the likelihood of a hazard event resulting in an adverse condition that causes injury or damage."

The risk assessment process identifies and profiles relevant hazards and assesses the exposure of lives, property, and infrastructure to these hazards. The process allows for a better understanding of a jurisdiction's potential risk to natural hazards and provides a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events.

This risk assessment followed the methodology described in the FEMA publication *Understanding Your Risks—Identifying Hazards and Estimating Losses* (2002), which breaks the assessment down to a four-step process:

- 1) Identify Hazards
- 2) Profile Hazard Events
- 3) Inventory Assets
- 4) Estimate Losses

Data collected through this process has been incorporated into the following sections of this chapter:

- Section 5.1: Identifying Hazards identifies the hazards that threaten the planning area.
- Section 5.2: Profiling Hazards discusses the threat to the planning area and describes previous occurrences of hazard events and the likelihood of future occurrences.
- Section 5.3: Assessing Vulnerability assesses the Town / Village's total exposure to natural hazards, considering assets at risk, critical facilities, and future development trends.

5.1 Identifying Hazards

Requirement §201.6(c)(2)(i):

The risk assessment shall include a description of the type of all natural hazards that can affect the jurisdiction.

The HMPC, through its consultant, conducted a hazard identification study to determine the hazards that threaten the planning area.

Tools

To address the requirements of DMA 2000 and understand potential vulnerability and losses associated with the hazards of concern, the Town / Village used standardized tools, combined with local, state and federal data and expertise to conduct the risk assessment. Using existing natural hazards data and input gained through planning meetings, the HMPC agreed upon a list of natural hazards that could affect the Town/Village of Harrison.

Multi-Hazard (HAZUS)

FEMA has developed a standardized model for estimating losses caused by earthquakes, known as Hazards U.S. or HAZUS. HAZUS was developed in response to the need for more effective national, state, and community level planning and the need to identify areas that face the highest risk and potential for loss. HAZUS was expanded into a multi-hazard methodology, HAZUS-MH with new models for estimating potential losses from wind (hurricanes) and flood (riverine and coastal) hazards. HAZUS-MH is a Geographic Information System (GIS)-based software tool that applies engineering and scientific risk calculations that have been developed by hazard and information technology experts to provide defensible damage and loss estimates. These methodologies are accepted by FEMA and provide a consistent framework for assessing risk across a variety of hazards. The GIS framework also supports the evaluation of hazards and assessment of inventory and loss estimates for these hazards.

HAZUS-MH uses GIS technology to produce detailed maps and analytical reports that estimate a community's direct physical damage to building stock, critical facilities, transportation systems and utility systems. To generate this information, HAZUS-MH uses default HAZUS-MH provided data for inventory, vulnerability, and hazards; this default data can be supplemented with local data to provide a more refined analysis. Damage reports can include induced damage (inundation, fire, threats posed by hazardous materials and debris) and direct economic and social losses (casualties, shelter requirements, and economic impact) depending on the hazard and available local data. HAZUS-MH's open data structure can be used to manage community GIS data in a central location. The use of this software also promotes consistency of data output now and in the future and standardization of data collection and storage. The guidance *Using HAZUS-MH for Risk Assessment: How-to Guide* (FEMA 433) was used to support the application of HAZUS-MH for this risk assessment and plan. More information on HAZUS-MH is available at <u>http://www.fema.gov/hazus</u>.

HAZUS - MH was used to assess potential exposure and losses associated with hazards of concern for the Town / Village.

HAZUS-MH was applied using HAZUS-MH software and associated tools to estimate losses associated with the flood and hurricane hazards. HAZUS-MH support was used to evaluate other hazards, where possible. For most of the hazards evaluated in this risk assessment, historic data is not sufficient to model future losses at this time. However, HAZUS-MH can map hazard areas and calculate exposures if geographic information on the locations of the hazards and inventory data is available. For some of the other hazards of concern, areas and inventory susceptible to specific hazards were mapped and exposure was evaluated to help guide mitigation efforts discussed in Chapter 6. For other hazards, a qualitative analysis was conducted using the best available data, professional judgment and knowledge of the community over time. This approach was applied to all hazards of concern to the Town / Village.

In addition, this approach was applied to the non-hurricane components of the severe storm hazard. For this risk assessment, the loss estimates, exposure assessments, and hazard-specific vulnerability evaluations rely on the best available data and methodologies. Uncertainties are inherent in any loss estimation methodology and arise in part from incomplete scientific knowledge concerning natural hazards and their affects on the built environment.

Where HAZUS-MH data conflicts with locally obtained information, the local information shall be verified and utilized in the plan where appropriate. Where such data discrepancies exist, a notation shall be made referencing such discrepancy.

Identification of Hazards of Concern

In order to initially identify what hazards may exist in the study area, the Westchester County CEMP (version November 2005) and the 2008 New York State Hazard Mitigation Plan were consulted. The Westchester County CEMP utilized the Hazards New York (HAZNY) software provided by NYSEMO to score and classify the potential hazards to which Westchester County as a whole is exposed (450 square mile area and a population of approximately 900,000). The hazards ultimately identified by the Town Village of Harrison correspond to some extent with those identified by the Westchester County CEMP although in some cases with differing classifications. These differing classifications exist due to the differing levels of response and recovery between these two levels of government. The 2008 New York State Hazard Mitigation Plan, while viewing hazards from a statewide perspective, provided information on specific hazards which were determined to be of concern in the study area.

The Town / Village of Harrison HMPC considered the full range of hazards that could impact the area and then identified and ranked those hazards presenting the greatest concern. The basis for the

determination involved the utilization of Worksheet #1 in the FEMA publication *Understanding Your Risks—Identifying Hazards and Estimating Losses* (2002). This Worksheet, coupled with additional research of local, state and federal databases on frequency, magnitude and potential for occurrence by the consultant resulted in identifying the hazards most likely to impact the community and thus requiring further analysis. In some cases, the FEMA Region II Hazard Mitigation Toolkit, available on the internet was consulted for direction and formatting.

Because of similar characteristics and reporting criteria, certain hazards were combined following consultation with the NYSEMO representative.

The Hazard Identification was completed over the course of three (3) meetings with the HMPC. The first step was to provide the HMPC with a listing of the potential hazards (Worksheet 1) along with instructions on how to proceed. The first meeting Hazard Identification meeting was held on June 18, 2008 and included discussion on each of the Hazards indicated on Worksheet # 1. The discussion include personal knowledge of the HMPC including the consultant staff. A preliminary list of potential hazards was developed, and the consultant was to provide a database search on the potential hazards identified and make a report to the HMPC at the July 9, 2008 meeting. Table 5.1 below lists all the Hazards of Concern and whether or not a significant threat exists to the Town/Village of Harrison.

Table 5.1 Hazards of Concern

Hazard of Concern	Potential for Hazard to occur in	If Yes, does Hazard pose a	Reason for Determination	Source of Information
	Study Area?	Significant Threat	~	
Avalanche	No	No	Study area does not	Input from HMPC
			have topography for	and Study area
			such an event	DPW
Coastal Erosion	No	No	Study area has no	Municipal Map
			coast line	
Coastal Storm	Yes	Yes	Study area lines	FEMA Disaster
			within 1 mile of	Records, NYSEMO
			Long Island Sound	HMP
Dam Failure	Yes	Yes	5 dams located in	NYSDEC, DPW
			study area	data base
Drought	Yes	Yes	Identified in	NOAA, NCDC,
C C			NYSEMO HMP,	NYCDEP data base
			Identified by HMPC	NYSEMO HMP
Earthquakes	Yes	Yes	Identified in	USGS Earthquakes
1			NYSEMO HMP,	Hazard Program,
			identified by HMPC	Lamont Cooperative
			5	Seismographic
				Network, NYSEMO
				HMP
Expansive Soils	No	No	No history of such	USGA Landslide
			an event, soil in area	Hazards Program
			not conducive to	
			such an event, not	
			identified in	
			NYSEMO HMP	

Hazard of Concern	Potential for Hazard to occur in	If Yes, does Hazard pose a	Reason for Determination	Source of Information
Extreme Heat	Yes	Yes	Identified by HMPC	Input from HMPC
Flood	Yes	Yes	Presidential Disaster	NOAA NCDC
11000	105	105	Declarations	FEMA Disaster
			identified in	Records, NYSEMO
			NYSEMO HMP.	HMP.
			identified by HMPC	· · · · · · ,
Hailstorm	Yes	Yes	See Severe Storm	See Severe Storm
Hurricane	Yes	Yes	See Severe Strom	See Severe Storm
Land Subsidence	No	No	No local history	No local records of
				such an event
Landslide	No	No	No local history	No such records of
				such an event
Severe Storms	Yes	Yes	Presidential	Local records,
(windstorm,			Declarations,	NOAA, NCDC,
hurricane,			identified in	FEMA Disaster
hailstorm, tornado)			NYSEMO HMP,	Records, NYSEMO
			identified by HMPC	HMP,
Severe Winter	Yes	Yes	Presidential	NOAA, NCDC,
Storms (blizzard,			Declarations,	Local records, input
ice storm)			identified in	from HMPC
			NYSEMO HMP	
Tornado	Yes	Yes	See Severe Storm	See Severe Storm
Tsunami	No	No	No local records, not	No records of such
			identified in	an event in study
			NYSEMO HMP	area
Volcano	No	No	No volcanos located	NYSEMO HMP
			in study area	
Wildfires	No	No	Identified as minor	Input from HMPC
			hazard by HMPC	
Windstorm	Yes	Yes	See Severe Storm	See Severe Strom

The consultant reported the results of their review of all potential hazards at the July 9, 2008 HMPC meeting and a draft final list of potential hazards was developed. The HMPC was to review the draft final list of potential hazard, provide any comments or questions to the consultant with a final determination of potential hazards to be made at the next HMPC meeting. At the October 22, 2008, a review was made of the draft potential hazards and was determined as final with no adjustments.

Hazard Ranking

Each hazard was ranked to indicate the probability of occurrence and their impacts on both population and property. This section outlines factors that influenced the ranking including probability of occurrence and impacts

Probability of Occurrence

Probability of occurrence is an estimate of how often a hazard event occurs. The consultant reviewed historical records from Federal agencies such as FEMA, NOAA and USGS, the New

York State (NYSEMO Hazard Mitigation Plan), New York City Department of Environmental Protection and local records on file in the Town / Village's Department of Public Works developed as a result of significant disaster related events. Designations utilized in this plan are consistent with those used in the New York State Hazard Mitigation Plan. Hazards were then ranked based on definition criteria, historical database information and the institutional memory of the HMPC.

Table 5.1.1 Probability of Occurrence Ranking Factors

Rating	Probability	Definition	
1	Rare	Hazard event is likely to	
		occur less than once every 30 years	
2	Occasional	Hazard event is likely to occur less	
		than once every 5 years, but more	
		than once every 30 years	
3	Frequent	Frequent Hazard event is likely to occur more	
		than once every 5 years	

Utilizing these criteria, the HMPC developed the following listing of hazards, in the order of potential frequency for occurrence and grouped based on similar damage characteristics:

- Flood
- Severe Storm (Windstorm, Hurricane, Coastal Storm, Hailstorm, Tornado)
- Severe Winter Storm (Ice Storm, Blizzard)
- Extreme Heat
- Drought
- Earthquake
- Dam Failure

5.2 Profiling Hazards

Requirement §201.6(c)(2)(i):

The risk assessment shall include a description of the location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

For each hazard, a generic description of the hazard and associated problems is provided along with details specific to the Town / Village of Harrison. Information on past occurrences and the extent or location of the hazard within or near the Town / Village and impacts, where known, are also discussed. To assess the history of natural hazard events in Harrison, the HMPC evaluated the hazards history for the Town / Village. Existing data and statistics are maintained in the Department of Public Works as well as FEMA and other Federal Agency databases.

The HMPC and other local resources, such as newspaper articles, were used to refine the data to more accurately indicate how hazards affected the Town / Village in the past. In general, information provided by planning team members is integrated into this section with information from other data sources.

FEMA Profiling Requirements

The FEMA requirements call for a full profiling of all natural hazards that impact the jurisdiction. Specifically, the Risk Assessment regulation (201.6. (c)(2)(i)) requires that "the plan include a description of all natural hazards that affect the jurisdiction."

There are FEMA requirements for plans to specifically address the following in their risk assessment: Location, Extent, Previous Occurrences, and Probability of Future Events. The FEMA "How to Guide: Understanding Your Risks" (FEMA 386-2) was consulted throughout the development of the risk assessment phase of the plan. In addition, the FEMA Region II "Tool Kit", which provided numerous tables and formats to assist in meeting requirements for plan approval was consulted. The FEMA requirements relating to the hazard profile/ description section of a plan are provided in the following paragraphs as an indication of the actions taken.

The description of each hazard **shall** include the following information:

- The **location** or geographical areas in the community that would be affected.
- The hazard **extent** (i.e., magnitude or severity) of potential hazard events. For those hazards not geographically determined, plans **shall** indicate their applicable intensity. For example, in areas where tornadoes occur, plans *should* indicate the recorded intensities of previous events.
- The **probability**, likelihood, or frequency that the hazard event would occur in an area.

The plan **shall** also provide a discussion of **past occurrences** of hazard events in or near the community. This discussion *should* include:

- Information on the damages that occurred (e.g., costs of recovery, property damage, and lives lost) to the extent practicable.
- Level of severity (i.e., flood depth or extent, wind speeds, earthquake intensity, etc.).
- Duration of event.
- Date of occurrence.
- Sources of information used or consulted for assembling a history of past occurrences.

When appropriate, the hazard analysis *should* also identify on a map the areas affected by each identified hazard. Additionally, a composite map (i.e., a map showing combined information from different thematic map layers) *should* be provided for hazards with a recognizable geographic boundary (i.e., hazards that are known to occur in particular areas of the jurisdiction, such as floods, coastal storms, wildfires, and landslides).

The characterization of hazards *should* describe the conditions, such as topography, soil characteristics, meteorological conditions, etc., in the area that may exacerbate or mitigate the

potential effects of hazards. The hazard analysis *should* be detailed enough to allow identification of the areas of the jurisdiction that are most severely affected by each hazard.

The plan *should* describe the analysis or sources used to determine the probability, likelihood, or frequency of occurrence as well as the severity or magnitude of future hazard events. The plan *should* note any data limitations and create mitigation strategy actions for obtaining the limited data to improve future risk analysis efforts.

As mentioned above, planning jurisdictions are strongly encouraged to utilize the "How to Guides" and the Region II "Tool Kit" as they prepare their mitigation plan. In addition, the plan will have a greater likelihood of receiving FEMA approval if a specific effort is made to review the plan approval criteria in detail using the Local <u>Hazard Mitigation Plan Review Crosswalk</u> Form, and assuring that each element of the requirement is fully addressed in the plan.

5.3: Assessing Vulnerability

To understand risk, a community must evaluate what assets are exposed to hazard events. The inventory of assets considers the population, structures, and lifelines that could be impacted by hazard events. This section of the risk assessment will be broken down into the following subsections for each hazard:

- Overview of vulnerability
- Data and methodology used in the evaluation
- Impact on life, safety and health
- Identifying structures including general building stock, critical facilities and critical infrastructure
- Economic impact
- Addressing Repetitive Loss Properties (NFIP data for floods, other hazards as available)
- Estimating Potential Losses
- Analyzing Development Trends (new buildings, critical facilities and Infrastructure)
- Additional Data and Next Steps
- Overall vulnerability conclusion
- Multi-jurisdictional Risk Assessment

Information available locally as well as that available from the County of Westchester Planning Department and in the HAZUS MH database will be utilized to quantify the people, places, and things that could be injured, damaged, or destroyed during the occurrence of a hazard. Once the overall asset inventory was established, the portion of the inventory that is at risk of being impacted by the various hazards will be identified. This "at-risk" segment can be identified by overlaying the hazard area (for example, flood zone) with the asset data to estimate the assets at risk. For example, areas of residential development may be compared with flood zones to determine the locations and number of structures at risk of damage or destruction from flooding. Because HAZUS-MH was used to support this mitigation plan, HAZUS-MH provided data was used as a starting point for inventory data. HAZUS-MH includes a range of asset data based on national and regional data sets, such as the U.S. Census for population data. Potential sources of information including their own institutional memory was discussed with the HMPC at the

October 22, 2008 meeting. At this point the consultant began the process of gathering the needed information. The consultant then reviewed this data with the planning committee and selected data for inclusion, focusing on critical and essential facilities first. These facilities include police and fire stations, schools, hospitals, and other buildings that are critical to community functions and recovery after a hazard event. A range of other data also were reviewed; for example, local parcel data was reviewed for building value data but this data set did not provide all of the attributes needed for HAZUS-MH. Local building and facility data were used to supplement the HAZUS-MH-provided data for individual, site-specific critical facility categories.