

## **5.1 METHODOLOGY AND TOOLS**

This section describes the methodology and tools used to support the risk assessment process.

### **METHODOLOGY**

The risk assessment process used for this Plan is consistent with the process and steps presented in FEMA 386-2, State and Local Mitigation Planning How-to-Guide, Understanding Your Risks – Identifying Hazards and Estimating Losses (FEMA, 2001). This process identifies and profiles the hazards of concern and assesses the vulnerability of assets (population, structures, critical facilities and the economy) at risk in the community. A risk assessment provides a foundation for the community’s decision makers to evaluate mitigation measures that can help reduce the impacts of a hazard when one occurs (Section 6 of this plan).

Step 1: The first step of the risk assessment process is to identify the hazards of concern. FEMA’s current regulations only require an evaluation of natural hazards. Natural hazards are natural events that threaten lives, property, and many other assets. Often, natural hazards can be predicted, where they tend to occur repeatedly in the same geographical locations because they are related to weather patterns or physical characteristics of an area.

Step 2: The next step of the risk assessment is to prepare a profile for each hazard of concern. These profiles assist communities in evaluating and comparing the hazards that can impact their area. Each type of hazard has unique characteristics that vary from event to event. That is, the impacts associated with a specific hazard can vary depending on the magnitude and location of each event (a hazard event is a specific, uninterrupted occurrence of a particular type of hazard). Further, the probability of occurrence of a hazard in a given location impacts the priority assigned to that hazard. Finally, each hazard will impact different communities in different ways, based on geography, local development, population distribution, age of buildings, and mitigation measures already implemented.

Steps 3 and 4: To understand risk, a community must evaluate what assets it possesses and which assets are exposed or vulnerable to the identified hazards of concern. Hazard profile information combined with data regarding population, demographics, general building stock, and critical facilities at risk, located in Section 4, prepares the community to develop risk scenarios and estimate potential damages and losses for each hazard.

### **TOOLS**

To address the requirements of DMA 2000 and better understand potential vulnerability and losses associated with hazards of concern, Fulton County used standardized tools, combined with local, state, and federal data and expertise to conduct the risk assessment. Our standardized tools used to support the risk assessment are described below.

#### **Hazards U.S. – Multi-Hazard (HAZUS-MH)**

In 1997, FEMA 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 architecture 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 <http://www.fema.gov/plan/prevent/hazus/index.shtm>.

Probabilistic analyses were performed to develop estimates of long-term average losses (annualized losses) as well as an expected/estimated distribution of losses (mean return period losses) for the earthquake, flood and wind hazards. The probabilistic hazard generates estimates of damage and loss for specified return periods (e.g., 100- and 500-year). For annualized losses, HAZUS-MH MR4 calculates the maximum potential annual dollar loss resulting from various return periods averaged on a "per year" basis. It is the summation of all HAZUS-supplied return periods (e.g., 10, 50, 100, 200, 500) multiplied by the return period probability (as a weighted calculation). In summary, the estimated cost of a hazard each year is calculated.

Custom methodologies in HAZUS-MH MR4 were used to assess potential exposure and losses associated with hazards of concern for Fulton County:

- **Inventory:** The default demographic data in HAZUS-MH MR4, based on the 2000 U.S. Census, was used for analysis. The valuation of general building stock and the loss estimates determined in Fulton County were based on the default general building stock database provided in HAZUS-MH MR4. The general building stock valuations provided in HAZUS-MH MR4 are Replacement Cost Value from RSMMeans as of 2006. The critical facility inventory (essential facilities, utilities, high-potential loss facilities and user-defined facilities) was updated for all three hazard models (flood, wind and earthquake). This comprehensive inventory was developed by gathering input from numerous sources including HAZUS-MH MR4, Fulton County and input from the Planning Committee.
- **Flood:** There are no FEMA Quality 3 (Q3) or DFIRMs available for Fulton County. The HAZUS-MH MR4 riverine model was used to generate the 100- and 500-year mean return period (MRP) flood boundaries and depth grids using a USGS 1 ArcSecond Digital Elevation Model. For the purposes of this plan, the HAZUS-MH generated flood depth grid used to estimate losses to the general building stock and critical facility inventory for the specified return periods (annualized losses and the 100- and 500-year MRPs) (see Figure 5.1-1).
- **Wind/Severe Storm:** A modified Level 1 HAZUS-MH probabilistic analysis was performed to analyze the wind hazard losses for the Planning Area. The probabilistic hurricane hazard activates a database of thousands of potential storms that have tracks and intensities reflecting the full spectrum of Atlantic hurricanes observed since 1886 and identifies those with tracks associated with the Planning Area. Annualized losses and the 100- and 500-year MRPs were examined for the wind/severe storm hazard. Default demographic and general building stock data in HAZUS-MH

MR4 were used for the analysis. However, as described above, updated critical facility inventories were used.

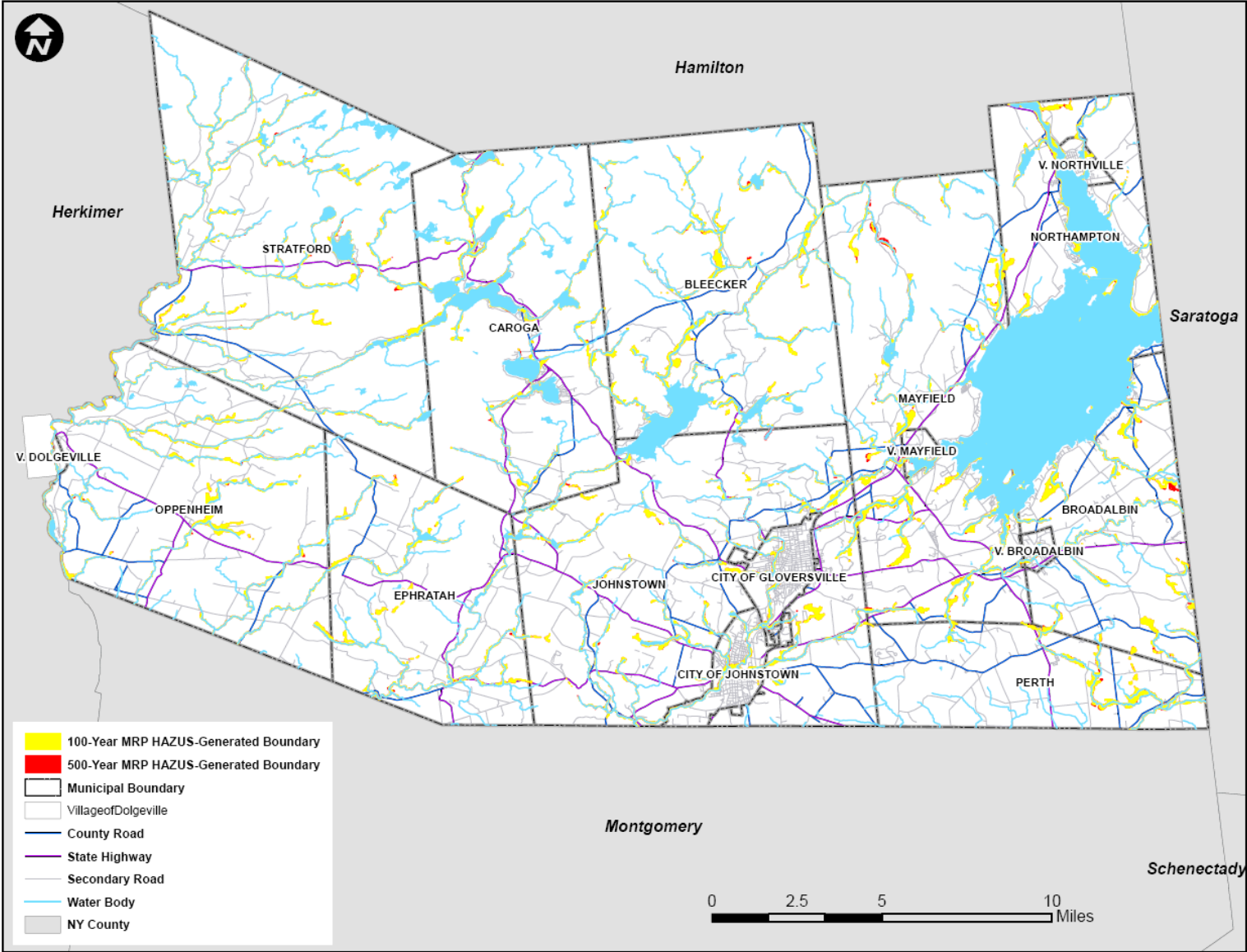
- **Earthquake:** A Level 2 HAZUS-MH MR4 analysis using a probabilistic scenario was performed to analyze the earthquake hazard losses for Fulton County (annualized losses and 100-, 500- and 2,500-year mean return period [MRP] losses). A Level 1 analysis is a basic estimate of earthquake losses based on national databases and using the default data in the model. Default demographic and general building stock data in HAZUS-MH MR4 were used for the earthquake analysis. However, as described above, updated critical facility inventories were used. Additionally, a local soil map provided by NYSEMO was entered into HAZUS-MH MR4 to replace default soil conditions. HAZUS-MH MR4 uses the seismic soil type classes recommended by the National Earthquake Hazard Reduction Program (NEHRP). The NEHRP soils classification system ranges from A to E, where A represents hard rock that reduces ground motions from an earthquake and E represents soft soils that amplify and magnify ground shaking and increase building damage and losses (NYSEMO, 2004; NYCEM, 2003). When a Level 1 HAZUS-MH MR4 earthquake analysis is conducted, the NEHRP soil classification type “D” is used as the soil type across the entire study region. For this HMP, a local soil map with Fulton County’s NEHRP soil types (B, C, D and E) provided by NYSEMO was entered into HAZUS-MH MR4 and used for all analyses.
- **Other Hazards:** HAZUS-MH MR4 support was used to evaluate other hazards, as feasible. For many of the hazards evaluated in this risk assessment, historic data are not adequate 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 are 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 Section 6 and Volume II, Section 9. For other hazards, a qualitative analysis was conducted using the best available data and professional judgment.

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. Uncertainties also result from the following:

- 1) Approximations and simplifications necessary to conduct such a study
- 2) Incomplete or dated inventory, demographic, or economic parameter data
- 3) The unique nature, geographic extent, and severity of each hazard
- 4) Mitigation measures already employed by Fulton County and the amount of advance notice residents have to prepare for a specific hazard event

These factors can result in a range of uncertainty in loss estimates, possibly by a factor of two or more. Therefore, potential exposure and loss estimates are approximate. These results do not predict precise results and should be used to understand relative risk. Over the long term, Fulton County will collect additional data to assist in developing refined estimates of vulnerabilities to natural hazards.

Figure 5.1-1. HAZUS-MH MR4 Generated Flood Boundaries for Fulton County



Source: HAZUS-MH MR4

