4.4 Assessing Vulnerability: Estimating Potential Losses

This section presents exposure, damage, and loss estimates, for each of the 12 hazards evaluated. The findings support local and regional planners' understanding of the potential impacts associated with each hazard and provide a foundation for the mitigation strategy presented in Section 5. Where quantifiable loss estimates are feasible, these results are presented. Where quantifiable loss estimates are not feasible using existing data, comparative evaluations of the risks posed by each hazard are presented and demonstrate the types of impacts that can occur, current knowledge of the study area relative to each hazard, and a qualitative vulnerability assessment of each hazard. For these hazards, future efforts will include the development of additional data so that quantitative loss estimates may be feasible in the future; to comply with DMA 2000, a data collection plan addressing current data needs is included in the mitigation strategy section of this plan (Section 5).

For this portion of the risk assessment, available data, methodologies, and assumptions were used to select and apply a risk assessment methodology for each hazard. Table 4-4-1 shows the risk assessment methodology selected for each hazard.

Table 4-4-1. Summary of Risk Assessment Methodology Selection

Hazard	Comments	Output
HAZUS-MH Methodology		
Flood	HAZUS-MH-provided data were used and supplemented with local data for critical facilities. The HAZUS-MH models were used to obtain exposure and loss estimates.	HAZUS-MH Exposure and Loss Estimate Maps, Tables and Text
Hurricane (Part of Severe Storm)		
HAZUS-MH Supported Methodology		
Severe Winter Storm (Non-Hurricane Portion)	Sufficient historic data were not available to forecast the probability of future hazard events. However, available historic and professional expertise regarding areas at risk for each hazard was compiled from a variety of sources. Professional judgment and available data were then used to evaluate past and potential events, and assess risks in a qualitative manner. HAZUS-MH was used to support inventory evaluations and graphical presentations of areas at risk.	HAZUS-MH Supported Exposure Estimates and Input to Data Needs Portion of Mitigation Strategy (Section 5)
Ice Jam		
Severe Winter Storm (Including Ice Storm)		
Extreme Temperature		
Ice Storm		
Infestation		
Wildfire		
Drought		
Dan Failure		
Water Supply Contamination		

The two methodologies used to assess potential exposure and losses associated with priority hazards of greatest concern to Delaware County and the 28 participating jurisdictions are summarized below:

- **HAZUS-MH** is a parametric model in that distinct hazard and inventory parameters (for example, wind speed and building types) are considered quantitatively to determine the potential impact (damages and losses) on humans, buildings, roads, and other assets. The HAZUS-MH risk assessment methodology was applied using HAZUS-MH software to estimate losses

associated with the flood and hurricane (part of severe storm) hazards. HAZUS-MH loss estimate data include the three areas summarized below:

1. The replacement values for general building stock; this includes the cost of full repair or replacement to the building stock based on damage associated with a hazard event. For buildings, replacement value addresses the aggregate loss and replacement value for structural replacement, non-structural replacement, and content replacement.

2. Impact to critical facilities and lifelines, where feasible. For this assessment, the percent of buildings damage or the range of damage (from none to severe) is evaluated using HAZUS-MH. This also can be used to estimate the annual loss, where value data for critical facilities is available. However, for critical facilities, the functionality of facilities after a hazard event is generally the primary focus for these classes of buildings.

3. Population at risk or impacted. Using the inventory data in HAZUS-MH, population related data are analyzed to assess the potential population that could be impacted by the hazard.

- **HAZUS-MH support** can support the evaluation of other hazards, for which built-in models do not yet exist in HAZUS-MH. For example, HAZUS-MH can map hazard areas and calculate exposures if geographic information on the locations of the hazards are available. For most of the hazards evaluated in this risk assessment, historic data are not adequate to model future losses. However, for some hazards, areas of concern could be identified. For other hazards, such as the winter storm hazard, the entire study area is at risk, or exposed, to the hazard. For these hazards, available data, professional knowledge, and evaluation of local data are used to evaluate the qualitative risk, exposure and loss associated with each hazard. This evaluation provides a sound basis for, mitigation strategies developed in Section 5. This approach was applied to nine hazards of concern, including the following:

  1) Ice Jam
  2) Severe winter storm (including ice storm)
  3) Extreme temperature
  4) Ice storm
  5) Infestation
  6) Wildfire
  7) Drought
  8) Dam Failure
  9) Water Supply Contamination

For the HAZUS-MH supported analysis, data from HAZUS-MH augmented with local data were used to assess vulnerabilities of inventory and populations at risk based on the designated hazard areas identified in Section 4.2 of this plan for each hazard. The percent of inventory vulnerable to each hazard was evaluated based on historic information and best professional judgment using the best readily-available data. With time, additional data collection and research will support further refinement of the exposure and loss estimate results.

When feasible, matrices of inventory by building type and critical facilities grouped by municipality were developed to identify the exposure values in each hazard area. In some cases, based on the nature of the hazard, percentage values are presented as at risk. In these cases, assumptions are made about percentages of property or population that could be impacted to assess exposure to assess the range of impacts that could occur.

All of the exposure assessments and loss estimations are based on the best readily available data. Where information limitations exist and prevent completion of this section to fulfill DMA 2000 requirements, the following are described under Data Needs:

(1) An explanation of why the assessment could not be completed
(2) A summary of additional data needs for further analysis
(3) Measures that will be undertaken to gather data to complete the analysis over time

Additional data that would be useful to estimate losses or exposure for the hazards of concern are also summarized in Table 4-4-62 at the end of this section. This data supplementation effort is included as a mitigation action in the mitigation strategy portion of this plan. The planning group adopted this methodology based on FEMA's How To Guide, which states "in cases where loss estimation tables are not currently available, base your assumptions on your past experience with those hazards in your planning area." Also, DMA states that the best available data is acceptable and that plans to update and improve currently available data over time should be addressed. Therefore, when the extent of damage cannot be estimated quantitatively, the vulnerable asset data values and qualitative assessment of risk suffice for this mitigation plan. Future updates to this plan will improve and refine the analyses presented in this plan.

As discussed in Section 4.2, hazards are presented by category in the following order:

Natural Hazards

1) Flood
2) Severe storm (wind, including hurricane and tornado)
3) Ice jam
4) Severe winter storm (snow)
5) Extreme temperature
6) Ice storm
7) Infestation
8) Wildfire
9) Agricultural Epidemic
10) Drought

Technological Hazards

1) Dam failure

Human-Caused Hazards

1) Water supply contamination

Major data sources used to derive the inventory exposure and loss estimates presented in this section are included in Appendix C and listed in the references section of this document.

4.4.1 Natural Hazards

Natural hazards assessed n this section include: flood, severe storm (wind, including hurricane and tornado), ice jam, severe winter storm (including snow), extreme temperatures, ice storm, infestation (agricultural and disease-carrying insects), wildfire, agricultural epidemic, and drought.

4.4.4.1 Flood

Flood is a significant concern for the study area. The flood hazard exposure and loss estimate analysis is presented below.

Data Collected and Used

Input data collected and reviewed for the flood hazard includes local damage data from historic flood events and FEMA Q3 flood zone data, which delineate the 100- and 500-year flood plain boundaries. Population data were taken from HAZUS-MH and are based on the most recent census conducted in 2000 (FEMA 2005). General building stock data was used as provided in HAZUS-MH, supplemented by local data regarding critical facilities and lifelines.

The modeling approach used Q3 flood zone flood polygon data and U.S. Geologic Survey (USGS) Digital Elevation Model (DEM) data to estimate the base elevation. Given the size of the area of interest, a third-party tool, the HAZUS-MH flood wizard (a macro) was used to support analysis of the entire study area and results for participating jurisdictions.

A *flood polygon* is a GIS vector file outlining the area exposed to the flood hazard. HAZUS-MH generates this polygon at the end of the flood computations in order to analyze the at-risk inventory.

A *GIS shape file* is a type of GIS vector file that was developed by ESRI for its ArcView software. This type of file contains a table and a graphic. The records in the table are linked to corresponding objects in the graphic.

The HAZUS-MH methodology was customized to analyze the flood hazard for Delaware County. Losses were estimated for a 100- and a 500-year mean return period (MRP) flood event. The 11 residential and 10 commercial occupancy classes available in HAZUS-MH were condensed into three primary occupancy classes (residential, commercial, and industrial) and other classes (agricultural, government, education, and religious) to facilitate the analysis and the presentation of results. Residential losses were estimated for both multi-family and single family dwellings. Because the plan is a multi-jurisdictional plan, HAZUS-MH also was used to analyze losses for each of the 19 towns that comprise the study area. Analysis at the village level was not conducted; however, the town results include the 11 villages that fall within each town. In addition, impacts to critical facilities were evaluated for the 100-year and 500-year MRP flood events.

Exposure and Loss Estimation

Table 4-4-2 shows the population estimated to be at risk for the 100- and 500-year MRP flood events. The 100-year flood has a 1 percent chance of occurring in any one year. The 500-year flood event has a 0.2 percent chance of occurring in any one year.

Table 4-4-2. Estimated General Population at Risk from Riverine Flood in Delaware County

Town (Villages Within Town)	100-year Flood	500-year Flood
	Population Within Flood Zone	Population Within Flood Zone
Andes	80	80
Bovina	30	30
Colchester	220	250
Davenport	180	180
Delhi (Village of Delhi)	310	350
Deposit (Village of Deposit)	610	690
Franklin (Village of Franklin)	130	130
Hamden	90	90

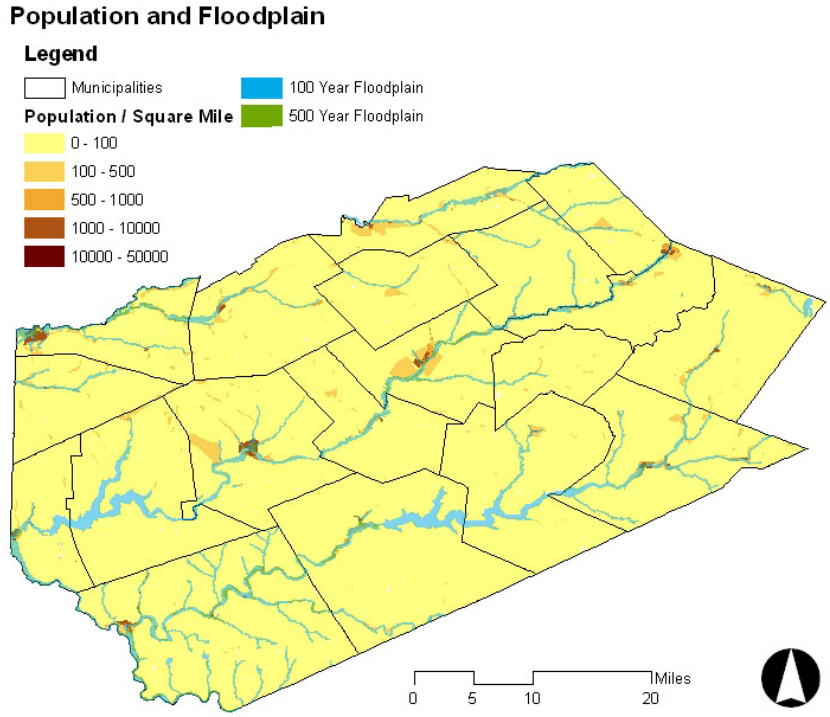
Town (Villages Within Town)	100-year Flood	500-year Flood
	Population Within Flood Zone	Population Within Flood Zone
Hancock (Village of Hancock)	650	770
Harpersfield	70	70
Kortright	160	160
Masonville	80	80
Meredith	20	20
Middletown (Villages of Margaretville and Fleischman's)	500	510
Roxbury	140	140
Sidney (Village of Sidney)	1,150	1,400
Stamford (Villages of Hobart and Stamford)	150	150
Tompkins	2	2
Walton (Village of Walton)	940	1,150
Total	5,500	6,230

Notes: The population represents the population that lives in the flood plain area. Villages are included with the towns above (as indicated in column 1).

Based on the flood zone evaluation, about 11 percent and 13 percent of the population of the entire study area, respectively, is living in areas that are at direct risk for the 100-year and 500-year flood events (48,055 total persons in the study area). Villages that lie along or near major waterways include the Villages of Deposit, Hancock, Sydney, Stamford, and Hobart. For this project, the potential population impacted is used as a guide to consider the potential maximum number of persons that may be displaced or require shelter during a flood. The total number of injuries and casualties resulting from flooding is generally limited based on advance weather forecasting, blockades and warnings. Therefore, injuries and deaths generally are not anticipated should this hazard occur. Ongoing mitigation efforts should help to avoid the most likely cause of injury, which would be from those trying to cross flooded roadways or channels during a flood.

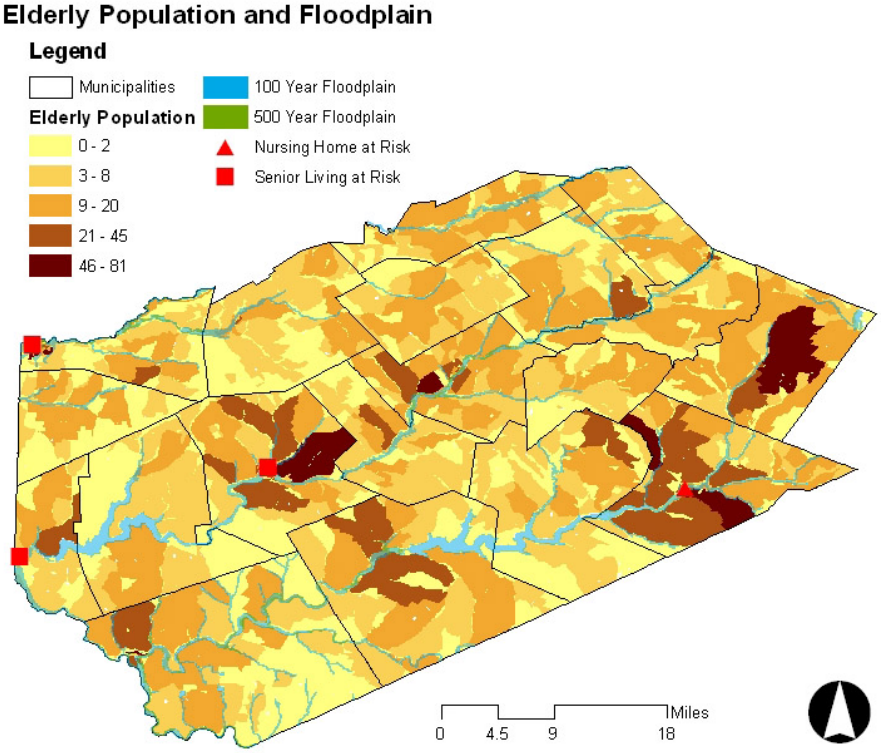
Figure 4-4-1 shows the extent of the 500-year flood zone in relation to population density to illustrate areas of the study area where a higher density of population is exposed to the flood hazard. Figures 4-4-2 and 4-4-3 show the population densities for elderly and low-income populations in relation to the 500-year flood zone, respectively.

Figure 4-4-1. Distribution of Population Density Relative to 500-Year Flood Zone for Delaware County



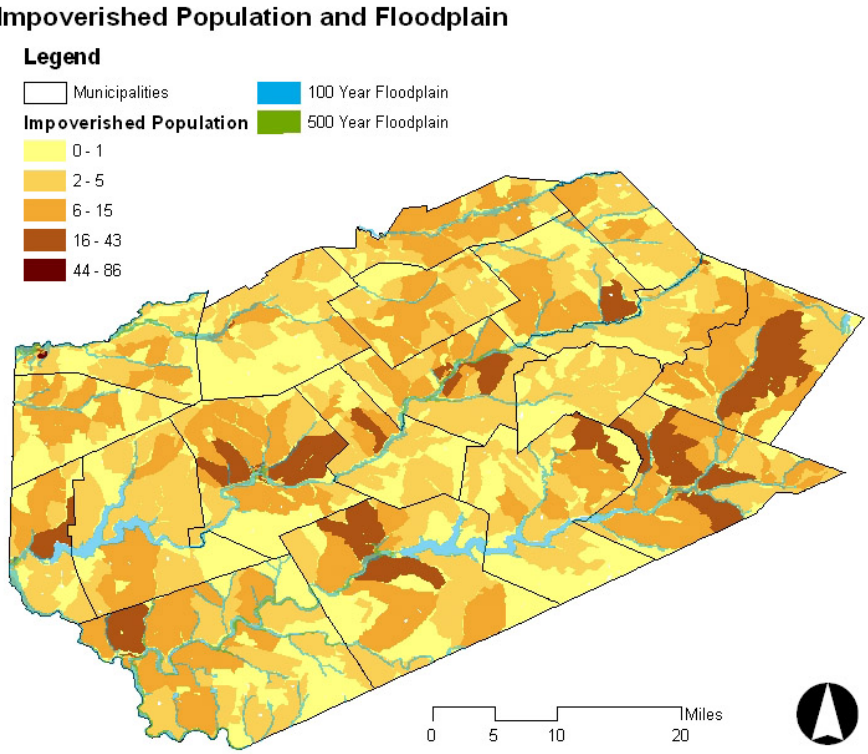
Source: HAZUS-MH (FEMA 2005)

Figure 4-4-2. Distribution of Elderly Population Density in Relation to 500-Year Flood Extent for Delaware County



Source: HAZUS-MH (FEMA 2005)

Figure 4-4-3. Distribution of Low-Income Population Density to 500-Year Flood Extent for Delaware County



Source: HAZUS-MH (FEMA 2005)

General Building Stock Exposure and Loss

The total value of general building stock considered to be "at risk" is summarized in Table 4-4-3 for both the 100-year and 500-year MRP flood events. The damage value includes an aggregate value for buildings damaged at all severity levels, from slight damage to total destruction; the total dollar damage estimates the impact to individual buildings at an aggregate level.

Table 4-4-3. Estimated General Building Stock Exposure and Loss for 100-Year Flood for Delaware County

General Building Category	Exposure				Loss			
	Building Count	Dollar Value			Building Count	Dollar Value		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential Exposure (Single and Multi-Family Dwellings)	1,982	$302.4M	$151.5M	$453.9M	1,982	$26.8M	$14.3M	$41.1M
Commercial Exposure At-Risk	26	$48.4M	$51.2M	$99.6M	26	$5.4M	$7.4M	$12.8M
Industrial Exposure At-Risk	4	$9.7M	$13.9M	$23.5M	4	$0.8M	$1.4M	$2.2M
Agricultural Exposure At-Risk	0	$1.3M	$1.2M	$2.5M	0	$0.2M	$0.2M	$0.4M
Religious Exposure At Risk	2	$6.0M	$6.0M	$12.0M	2	$1.0M	1.2M	$2.2M
Government Exposure At Risk	3	$2M	$2.1M	$4.1M	3	$0.3M	$0.4M	$0.7M
Educational Exposure At Risk	1	$3.5M	$3.5M	$7M	1	$0.5M	$0.6M	$4.1M
TOTAL AT-RISK	2,018	$373.3M	$229.3M	$602.6M	2,018	$35.0M	$25.5M	$60.5M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent.

Table 4-4-4 estimates exposure and loss associated with a 500-year flood event.

Table 4-4-4. Estimated General Building Stock Exposure and Loss for 500-Year Flood for Delaware County Study Area

Category	Exposure				Losses			
	Building Count	Dollar Value			Building Count	Dollar Value		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	2,216	$339.7M	$170.2M	$509.9M	2,216	$34.8M	$18.5M	$53.3M
Commercial	31	$57.8M	$61.2M	$119M	31	$8.7M	$11.8M	$20.5M
Industrial	4	$10.8M	$15.4M	$26.2M	4	$1.4M	$2.6M	$4.1M
Agricultural	0	$1.5M	$1.5M	$3.0M	0	$0.2M	$0.3M	$0.5M
Religious	2	$6.8M	$6.8M	$13.6M	2	$1.4M	$1.7M	$3.2M
Government	3	$2.3M	$2.4M	$4.7M	3	$0.5M	$0.8M	$1.3M
Educational	1	$3.7M	$3.7M	$7.4M	1	$0.6M	$0.7M	$1.3M
TOTAL AT-RISK	2,257	$422.6M	$261.2M	$683.8M	2,257	$47.7M	$36.4M	$84.1M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count from because all of the buildings exposed are assumed to be damaged to some extent.

For the study area as a whole, 2,018 and 2,257 of the total number of 21,928 buildings in the study area are located in either the 100- or 500-year flood plain. Structural losses associated with the 100- and 500-year flood are estimated at $35M and $47.7M for the 100- and 500-year flood events. This represents a damage percent of 1 and 1.5 percent of the total building structure value for the 100- and 500-year flood events. The overall risk to the study area appears relatively low. However, some towns in the area including: Hancock, Deposit, and others appear to have a relatively higher risk (as discussed in jurisdiction-specific results, below).

DMA requires that where feasible, the different impacts of a hazard to participating entities be identified for multi-jurisdiction plans. Tables 4-4-5 through 4-4-42 present the exposure and loss estimates for the 100-year and 500-year flood events for the participating jurisdictions as follows: (1) Andes, (2) Bovina, (3) Colchester, (4) Davenport, (5) Delhi, (6) Deposit, (7) Franklin, (8) Hamden, (9) Hancock, (10) Harpersfield, (11) Kortwright, (12) Masonville, (13) Meredith, (14) Middleton, (15) Roxbury, (16) Sidney, (17) Stamford, (19) Tompkins, and (20) Walton. A discussion of the impacts to each town or village follows the tables, which are presented on one page for each of the entities discussed above.

Andes: The flood wizard results for Andes are presented below.

Table 4-4-5. Estimated Exposure and Loss for 100-Year Flood for Andes

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	37	$6.8M	$3.4M	$10.2M	37	$0.1M	$0.0M	$0.1M
Commercial	2	$1.3M	$1.3M	$2.6M	2	$0.0M	$0.0M	$0.0M
Industrial	1	$0.1M	$0.1M	$0.2M	1	$0.0M	$0.0M	$0.0M
Agricultural	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Religious	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Government	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Educational	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	43	$8.2M	$4.4M	$13.0M	43	$0.1M	$0.0M	$0.1M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent.

Table 4-4-6. Estimated Exposure and Loss for 500-Year Flood for Andes

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	37	$6.8M	$3.4M	$10.2M	37	$0.1M	$0.0M	$0.1M
Commercial	2	$1.3M	$1.3M	$2.6M	2	$0.0M	$0.0M	$0.0M
Industrial	1	$0.1M	$0.1M	$0.2M	1	$0.0M	$0.0M	$0.0M
Agricultural	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Religious	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Government	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Educational	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	43	$8.2M	$4.4M	$13.0M	43	$0.1M	$0.0M	$0.1M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count from because all of the buildings exposed are assumed to be damaged to some extent.

As shown above, a total of 43 buildings in Andes are exposed to the 100-year or 500-year flood. The total building count in Andes is 1,079 (as indicated in Table 4-3-2 in Section 4.3). The total losses associated with a 100- or 500-year flood are estimated at $0.1M. This represents less than 0.1 percent of the total building structural value (excluding content) of $149.3M. Therefore, the overall risk of flood to the Town of Andes is considered relatively low. Although a major river runs through the Town of Andes, it appears that no critical facilities are located in the flood zone and that construction generally is located to minimize the potential damage associated with flood events. Eighty of the town's 1,356 citizens live in

the flood zone area.

Bovina: The flood wizard results for Bovina are presented below.

Table 4-4-7. Estimated Exposure and Loss for 100-Year Flood for Bovina

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	16	$2.0M	$1.0M	$3.0M	16	$0.1M	$0.1M	$0.2M
Commercial	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Industrial	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Agricultural	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Religious	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Government	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Educational	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	17	$2.0M	$1.0M	$3.0M	17	$0.1M	$0.1M	$0.2M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent.

Table 4-4-8. Estimated Exposure and Loss for 500-Year Flood for Bovina

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	16	$2.0M	$1.0M	$3.0M	16	$0.1M	$0.1M	$0.2M
Commercial	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Industrial	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Agricultural	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Religious	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Government	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Educational	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	17	$2.0M	$1.0M	$3.0M	17	$0.1M	$0.1M	$0.2M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent.

As shown above, a total of 17 buildings in Bovina are exposed to the 100-year or 500-year flood. The total building count in Andes is 433 (as indicated in Table 4-3-2 in Section 4.3). The total building structure losses associated with a 100- or 500-year flood are estimated at $0.1M. This represents less than 0.2 percent of the total building structural value (excluding content) of $61.0M. Therefore, the overall risk of flood to Bovina is considered relatively low. Although waterways run through Bovina, it appears that no critical facilities are located in the flood zone and that construction generally is located to minimize the potential damage associated with flood events. Eighty of the town's 664 citizens live in the flood zone area.

Colchester: The flood wizard results for Colchester are presented below.

Table 4-4-9. Estimated Exposure and Loss for 100-Year Flood for Colchester

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	104	$12.7M	$6.3M	$19.0M	104	$1.6M	$1.0M	$2.5M
Commercial	1	$0.2M	$0.2M	$0.4M	1	$0.0M	$0.0M	$0.1M
Industrial	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Agricultural	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Religious	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Government	1	$0.1M	$0.1M	$0.3M	1	$0.0M	$0.0M	$0.0M
Educational	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	106	$13.0M	$6.6M	$19.7M	106	$1.6M	$1.0M	$2.6M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count from because all of the buildings exposed are assumed to be damaged to some extent.

Table 4-4-10. Estimated Exposure and Loss for 500-Year Flood for Colchester

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	115	$13.9M	$7.0M	$20.9M	115	$2.3M	$1.2M	$3.4M
Commercial	1	$0.3M	$0.3M	$0.5M	1	$0.0M	$0.0M	$0.1M
Industrial	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Agricultural	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Religious	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Government	1	$0.2M	$0.2M	$0.4M	1	$0.0M	$0.0M	$0.0M
Educational	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	117	$14.4M	$7.5M	$21.8M	117	$2.3M	$1.2M	$3.4M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count from because all of the buildings exposed are assumed to be damaged to some extent.

As shown above, a total of 106 and 117 buildings in Colchester are exposed to the 100-year or 500-year flood, respectively. The total building count in Colchester is 1,300 (as indicated in Table 4-3-2 in Section 4.3). The total structural losses associated with a 100- or 500-year flood are estimated at $1.6M and $2.3M, respectively for the 100- and 500-year flood events. This represents about 1.0 to 1.3 percent of the total building structural value (excluding content) of $168.7M. Therefore, the overall risk of flood to Colchester is considered relatively low to moderate. Although a river runs through Colchester, it appears that only one critical facility is located in the flood zone (discussed later under critical facilities) and that construction generally is located to reduce the potential damage associated with flood events. Two hundred and 250 of the town's 2,042 citizens live in the 100- and 500-year flood zone areas, respectively.

Davenport: The flood wizard results for Davenport are presented below.

Table 4-4-11. Estimated Exposure and Loss for 100-Year Flood for Davenport

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	65	$7.6M	$3.8M	$11.4M	65	$1.2M	$0.6M	$1.8M
Commercial	1	$1.2M	$1.2M	$2.4M	1	$0.3M	$0.4M	$0.6M
Industrial	1	$0.4M	$0.5M	$0.8M	1	$0.1M	$0.1M	$0.2M
Agricultural	1	$0.3M	$0.3M	$0.5M	1	$0.1M	$0.1M	$0.1M
Religious	1	$0.4M	$0.4M	$0.8M	1	$0.1M	$0.2M	$0.3M
Government	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Educational	1	$0.5M	$0.5M	$0.9M	1	$0.1M	$0.1M	$0.2M
TOTAL AT-RISK	71	$10.4M	$6.7M	$16.8M	71	$1.9M	$1.5M	$3.2M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count from Table 4-4-11 because all of the buildings exposed are assumed to be damaged to some extent.

Table 4-4-12. Estimated Exposure and Loss for 500-Year Flood for Davenport

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	65	$7.6M	$3.8M	$11.4M	65	$1.2M	$0.6M	$1.8M
Commercial	1	$1.2M	$1.2M	$2.4M	1	$0.3M	$0.4M	$0.6M
Industrial	1	$0.4M	$0.5M	$0.8M	1	$0.1M	$0.1M	$0.2M
Agricultural	1	$0.3M	$0.3M	$0.5M	1	$0.1M	$0.1M	$0.1M
Religious	1	$0.4M	$0.4M	$0.8M	1	$0.1M	$0.2M	$0.3M
Government	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Educational	1	$0.5M	$0.5M	$0.9M	1	$0.1M	$0.1M	$0.2M
TOTAL AT-RISK	71	$10.4M	$6.7M	$16.8M	71	$1.9M	$1.5M	$3.2M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent.

As shown above, a total of 71 buildings in Davenport are exposed to the 100-year or 500-year flood. The total building count in Davenport is 1,135 (as indicated in Table 4-3-2 in Section 4.3). The total structural losses associated with a 100- or 500-year flood are estimated at $1.9M, for the 100- and 500-year flood events. This represents about 1.5 percent of the total building structural value (excluding content) of $128.4M. Therefore, the overall risk of flood to Davenport is considered low to moderate. Although waterways run through Davenport, it appears that no critical facilities are located in the flood zone (discussed later under critical facilities) and that construction generally is located to minimize the potential damage associated with flood events. Two hundred and 250 of the town's 2,042 citizens live in the 100- and 500-year flood zone areas, respectively.

Delhi: The flood wizard results for Delhi are presented below.

Table 4-4-13. Estimated Exposure and Loss for 100-Year Flood for Delhi

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	113	$16.8M	$8.4M	$25.2M	113	$1.5M	$0.8M	$2.2M
Commercial	1	$1.1M	$1.1M	$2.3M	1	$0.2M	$0.2M	$0.3M
Industrial	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Agricultural	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Religious	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Government	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Educational	1	$0.0M	$0.0M	$0.1M	1	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	115	$17.9M	$9.5M	$27.6M	115	$1.7M	$1.0M	$2.5M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent.

Table 4-4-14. Estimated Exposure and Loss for 500-Year Flood for Delhi

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	128	$19.0M	$9.5M	$28.5M	128	$1.9M	$1.0M	$3.0M
Commercial	1	$1.3M	$1.3M	$2.7M	1	$0.2M	$0.2M	$0.4M
Industrial	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Agricultural	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Religious	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Government	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Educational	1	$0.0M	$0.0M	$0.1M	1	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	130	$20.3M	$10.8M	$31.2M	130	$2.1M	$1.2M	$3.4M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count from Table 4-4-14 because all of the buildings exposed are assumed to be damaged to some extent.

As shown above, a total of 155 and 130 buildings in Delhi are exposed to the 100-year and 500-year flood, respectively. The total building count in Delhi is 1,373 (as indicated in Table 4-3-2 in Section 4.3). The total structural losses associated with a 100- or 500-year flood are estimated at $1.7M and $2.1M for the 100- and 500-year flood events, respectively. This represents about 0.5 to 0.6 percent of the total building structural value (excluding content) of $312.3M. Therefore, the overall risk of flood to Delhi is considered low. Although waterways run through Delhi, it appears that no critical facilities are located in the flood zone (discussed later under critical facilities) and that construction generally is located to minimize the potential damage associated with flood events. Two hundred and 310 and 350 of the town's 4,629 citizens live in the 100- and 500-year flood zone areas, respectively.

Deposit: The flood wizard results for Deposit are discussed below.

Table 4-4-15. Estimated Exposure and Loss for 100-Year Flood for Deposit

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	213	$29.2M	$14.7M	$43.9M	213	$1.1M	$0.6M	$1.7M
Commercial	1	$1.5M	$1.5M	$2.9M	1	$0.0M	$0.0M	$0.1M
Industrial	1	$0.2M	$0.2M	$0.4M	1	$0.0M	$0.0M	$0.0M
Agricultural	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Religious	1	$0.3M	$0.3M	$0.7M	1	$0.0M	$0.0M	$0.0M
Government	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Educational	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	217	$31.2M	$16.7M	$47.9M	217	$1.1M	$0.6M	$1.8M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent.

Table 4-4-16. Estimated Exposure and Loss for 500-Year Flood for Deposit

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	246	$33.9M	$17.0M	$50.9M	246	$2.6M	$1.3M	$3.9M
Commercial	1	$1.5M	$1.5M	$3.0M	1	$0.1M	$0.1M	$0.2M
Industrial	1	$0.2M	$0.2M	$0.4M	1	$0.0M	$0.0M	$0.1M
Agricultural	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Religious	1	$0.4M	$0.4M	$0.8M	1	$0.0M	$0.0M	$0.0M
Government	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Educational	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	250	$36.0M	$19.1M	$55.1M	250	$2.7M	$1.4M	$4.2M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count from because all of the buildings exposed are assumed to be damaged to some extent.

As shown above, a total of 217 and 250 buildings in Deposit are exposed to the 100-year and 500-year flood, respectively. The total building count in Deposit is 749 (as indicated in Table 4-3-2 in Section 4.3). The total structural losses associated with a 100- or 500-year flood are estimated at $1.1M and $2.7M for the 100- and 500-year flood events, respectively. This represents about 1.1 to 2.8 percent of the total building structural value (excluding content) of $96M. Therefore, the overall risk of flood to Deposit is considered low to moderate. Waterways run through Deposit, and critical facilities are located in the flood zone (discussed later under critical facilities). The Planning Committee also identified areas of Deposit as a concern for the flood hazard. Two hundred and 610 and 690 of the town's 1,687 citizens live in the 100- and 500-year flood zone areas, respectively.

Franklin: The flood wizard results for Franklin are discussed below.

Table 4-4-17. Estimated Exposure and Loss for 100-Year Flood for Franklin

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	45	$6.4M	$3.2M	$9.5M	45	$0.8M	$0.4M	$1.3M
Commercial	1	$0.2M	$0.2M	$0.4M	1	$0.0M	$0.0M	$0.1M
Industrial	1	$0.0M	$0.0M	$0.1M	1	$0.0M	$0.0M	$0.0M
Agricultural	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Religious	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Government	1	$0.2M	$0.2M	$0.4M	1	$0.0M	$0.0M	$0.1M
Educational	1	$1.4M	$1.4M	$2.7M	1	$0.2M	$0.3M	$0.5M
TOTAL AT-RISK	49	$8.2M	$5.0M	$13.1M	49	$1.0M	$0.7M	$2.0M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent.

Table 4-4-16. Estimated Exposure and Loss for 500-Year Flood for Franklin

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	45	$6.4M	$3.2M	$9.5M	45	$0.8M	$0.4M	$1.3M
Commercial	1	$0.2M	$0.2M	$0.4M	1	$0.0M	$0.0M	$0.1M
Industrial	1	$0.0M	$0.0M	$0.1M	1	$0.0M	$0.0M	$0.0M
Agricultural	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Religious	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Government	1	$0.2M	$0.2M	$0.4M	1	$0.0M	$0.0M	$0.1M
Educational	1	$1.4M	$1.4M	$2.7M	1	$0.2M	$0.3M	$0.5M
TOTAL AT-RISK	49	$8.2M	$5.0M	$13.1M	49	$1.0M	$0.7M	$2.0M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. Te damaged building count equals the exposed building count because the buildings exposed are assumed to be damaged to some extent.

As shown above, a total of 49 buildings in Franklin are exposed to the 100-year or 500-year flood. The total building count in Franklin is 1,094 (as indicated in Table 4-3-2 in Section 4.3). The total building structure losses associated with a 100- or 500-year flood are estimated at $1.0M. This represents less than 0.7 percent of the total building structural value (excluding content) of $145.4M. Therefore, the overall risk of flood to Franklin is considered relatively low. Although waterways run through Franklin, it appears that no critical facilities are located in the flood zone and that construction generally is located to minimize the potential damage associated with flood events. One hundred and thirty of the town's 2,621 citizens live in the flood zone area.

Hamden: The flood wizard results for Hamden are discussed below.

Table 4-4-19. Estimated Exposure and Loss for 100-Year Flood for Hamden

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	35	$4.6M	$2.3M	$6.9M	35	$0.4M	$0.2M	$0.6M
Commercial	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Industrial	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Agricultural	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Religious	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Government	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Educational	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	36	$4.6M	$2.3M	$6.9M	36	$0.4M	$0.2M	$0.6M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count from Table 4-4-19 because all of the buildings exposed are assumed to be damaged to some extent.

Table 4-4-20. Estimated Exposure and Loss for 500-Year Flood for Hamden

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	35	$4.6M	$2.3M	$6.9M	35	$0.4M	$0.2M	$0.6M
Commercial	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Industrial	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Agricultural	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Religious	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Government	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Educational	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	36	$4.6M	$2.3M	$6.9M	36	$0.4M	$0.2M	$0.6M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent.

As shown above, a total of 36 buildings in Hamden are exposed to the 100-year or 500-year flood. The total building count in Hamden is 703 (as indicated in Table 4-3-2 in Section 4.3). The total building structure losses associated with a 100- or 500-year flood are estimated at $0.4M. This represents less than 0.5 percent of the total building structural value (excluding content) of $85.8M. Therefore, the overall risk of flood to Hamden is considered relatively low. Although waterways run through Hamden, it appears that no critical facilities are located in the flood zone and that construction generally is located to minimize the potential damage associated with flood events. Ninety of the town's 1,280 citizens live in the flood zone area.

Hancock: The flood wizard results for Hancock are discussed below.

Table 4-4-21. Estimated Exposure and Loss for 100-Year Flood for Hancock

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	293	$37.2M	$18.6M	$55.8M	293	$5.8M	$3.0M	$8.8M
Commercial	1	$3.2M	$4.0M	$7.2M	1	$0.4M	$0.6M	$1.0M
Industrial	1	$0.5M	$0.7M	$1.2M	1	$0.1M	$0.2M	$0.3M
Agricultural	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Religious	1	$0.0M	$0.0M	$0.1M	1	$0.0M	$0.0M	$0.0M
Government	1	$0.6M	$0.6M	$1.2M	1	$0.2M	$0.2M	$0.4M
Educational	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	297	$41.1M	$23.9M	$65.5M	297	$6.5M	$4.0M	$10.5M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent.

Table 4-4-22. Estimated Exposure and Loss for 500-Year Flood for Hancock

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	339	$43.4M	$21.7M	$65.1M	339	$7.2M	$3.8M	$11.0M
Commercial	2	$5.0M	$6.2M	$11.2M	2	$1.2M	$1.7M	$2.9M
Industrial	1	$0.5M	$0.8M	$1.3M	1	$0.2M	$0.3M	$0.4M
Agricultural	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Religious	1	$0.0M	$0.0M	$0.2M	1	$0.0M	$0.0M	$0.0M
Government	1	$0.6M	$0.6M	$1.2M	1	$0.3M	$0.3M	$0.6M
Educational	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	344	$49.5M	$29.3M	$79.0M	344	$8.9M	$6.1M	$14.9M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent.

As shown above, a total of 297 and 344 buildings in Hancock are exposed to the 100-year or 500-year flood respectively. The total building count in Hancock is 1,922 (as indicated in Table 4-3-2 in Section 4.3). The total building structure losses associated with a 100- or 500-year flood are estimated at $6.5M and $8.9M, respectively for the 100- and 500-year flood events. This represents about 2.5 and 3.5 percent of the total building structural value (excluding content) of $257.8M. Therefore, the overall risk of flood to Hancock is considered to be of moderate risk. Although waterways run through Hancock, it appears that only one critical facility is located in the flood zone (discussed later under critical facilities) and that construction generally is located to minimize the potential damage associated with flood events. Six hundred and fifty and 770 of the town's 3,449 citizens live in the 100- and 500-year flood zone area, respectively.

Harpersfield: The flood wizard results for Harpersfield are discussed below.

Table 4-4-23. Estimated Exposure and Loss for 100-Year Flood for Harpersfield

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	28	$3.9M	$2.0M	$5.9M	28	$0.2M	$0.1M	$0.3M
Commercial	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Industrial	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Agricultural	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Religious	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Government	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Educational	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	28	$3.9M	$2.0M	$5.9M	28	$0.2M	$0.1M	$0.3M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent.

Table 4-4-24. Estimated Exposure and Loss for 500-Year Flood for Harpersfield

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	28	$3.9M	$2.0M	$5.9M	28	$0.2M	$0.1M	$0.3M
Commercial	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Industrial	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Agricultural	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Religious	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Government	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Educational	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	28	$3.9M	$2.0M	$5.9M	28	$0.2M	$0.1M	$0.3M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent.

As shown above, a total of 28 buildings in Harpersfield are exposed to the 100-year or 500-year flood. The total building count in Harpersfield is 668 (as indicated in Table 4-3-2 in Section 4.3). The total building structure losses associated with a 100- or 500-year flood are estimated at $0.2M. This represents about 0.2 percent of the total building structural value (excluding content) of $99.1M. Therefore, the overall risk of flood to Harpersfield is considered relatively low. Although waterways run through Harpersfield, it appears that no critical facilities are located in the flood zone and that construction generally is located to minimize the potential damage associated with flood events. Seventy of the town's 1,603 citizens live in the flood zone area.

Kortright: The flood wizard results for Kortright are discussed below.

Table 4-4-25. Estimated Exposure and Loss for 100-Year Flood for Kortright

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	69	$8.2M	$4.1M	$12.3M	69	$1.2M	$0.6M	$1.9M
Commercial	1	$0.1M	$0.1M	$0.2M	1	$0.0M	$0.0M	$0.0M
Industrial	1	$0.0M	$0.1M	$0.1M	1	$0.0M	$0.0M	$0.0M
Agricultural	1	$0.1M	$0.1M	$0.1M	1	$0.0M	$0.0M	$0.0M
Religious	1	$0.1M	$0.1M	$0.2M	1	$0.0M	$0.0M	$0.0M
Government	1	$0.0M	$0.0M	$0.1M	1	$0.0M	$0.0M	$0.0M
Educational	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	74	$8.5M	$4.5M	$13.0M	74	$1.2M	$0.6M	$1.9M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent.

Table 4-4-26. Estimated Exposure and Loss for 500-Year Flood for Kortright

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	69	$8.2M	$4.1M	$12.3M	69	$1.2M	$0.6M	$1.9M
Commercial	1	$0.1M	$0.1M	$0.2M	1	$0.0M	$0.0M	$0.0M
Industrial	1	$0.0M	$0.1M	$0.1M	1	$0.0M	$0.0M	$0.0M
Agricultural	1	$0.1M	$0.1M	$0.1M	1	$0.0M	$0.0M	$0.0M
Religious	1	$0.1M	$0.1M	$0.2M	1	$0.0M	$0.0M	$0.0M
Government	1	$0.0M	$0.0M	$0.1M	1	$0.0M	$0.0M	$0.0M
Educational	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	74	$8.5M	$4.5M	$13.0M	74	$1.2M	$0.6M	$1.9M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent.

As shown above, a total of 74 buildings in Kortright are exposed to the 100-year or 500-year flood. The total building count in Kortright is 780 (as indicated in Table 4-3-2 in Section 4.3). The total building structure losses associated with a 100- or 500-year flood are estimated at $1.2M. This represents about 1.2 percent of the total building structural value (excluding content) of $102.9M. Therefore, the overall risk of flood to Kortright is considered relatively low. Although waterways run through Kortright, it appears that no critical facilities are located in the flood zone and that construction generally is located to minimize the potential damage associated with flood events. One hundred and sixty of the town's 1,633 citizens live in the flood zone area.

Masonville: The flood wizard results for Masonville are discussed below.

Table 4-4-27. Estimated Exposure and Loss for 100-Year Flood for Masonville

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	30	$3.6M	$1.8M	$5.5M	30	$0.4M	$0.2M	$0.7M
Commercial	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Industrial	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Agricultural	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Religious	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Government	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Educational	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	35	$3.6M	$1.8M	$5.5M	35	$0.4M	$0.2M	$0.7M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent.

Table 4-4-28. Estimated Exposure and Loss for 500-Year Flood for Masonville

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	30	$3.6M	$1.8M	$5.5M	30	$0.4M	$0.2M	$0.7M
Commercial	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Industrial	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Agricultural	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Religious	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Government	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Educational	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	35	$3.6M	$1.8M	$5.5M	35	$0.4M	$0.2M	$0.7M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent.

As shown above, a total of 35 buildings in Masonville are exposed to the 100-year or 500-year flood. The total building count in Masonville is 601 (as indicated in Table 4-3-2 in Section 4.3). The total building structure losses associated with a 100- or 500-year flood are estimated at $0.4M. This represents about 0.5 percent of the total building structural value (excluding content) of $76.9M. Therefore, the overall risk of flood to Masonville is considered relatively low. Although waterways run through Masonville, it appears that no critical facilities are located in the flood zone and that construction generally is located to minimize the potential damage associated with flood events. Eighty of the town's 1,405 citizens live in the flood zone area.

Meredith: The flood wizard results for Meredith are discussed below.

Table 4-4-29. Estimated Exposure and Loss for 100-Year Flood for Meredith

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	9	$1.2M	$0.6M	$1.8M	9	$0.0M	$0.0M	$0.0M
Commercial	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Industrial	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Agricultural	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Religious	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Government	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Educational	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	9	$1.2M	$0.6M	$1.8M	9	$0.0M	$0.0M	$0.0M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent.

Table 4-4-30. Estimated Exposure and Loss for 500-Year Flood for Meredith

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	9	$1.2M	$0.6M	$1.8M	9	$0.0M	$0.0M	$0.0M
Commercial	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Industrial	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Agricultural	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Religious	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Government	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Educational	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	9	$1.2M	$0.6M	$1.8M	9	$0.0M	$0.0M	$0.0M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent.

As shown above, a total of 9 buildings in Meredith are exposed to the 100-year or 500-year flood. The total building count in Meredith is 685 (as indicated in Table 4-3-2 in Section 4.3). The total building structure losses associated with a 100- or 500-year flood are estimated at $0.0M. This represents about 0.0 percent of the total building structural value (excluding content) of $82.9M. Therefore, the overall risk of flood to Meredith is considered relatively low. Although waterways run through Meredith, it appears that no critical facilities are located in the flood zone and that construction generally is located to minimize the potential damage associated with flood events. Twenty of the town's 1,588 citizens live in the flood zone area.

Middleton: The flood wizard results for Middleton are discussed below.

Table 4-4-31. Estimated Exposure and Loss for 100-Year Flood for Middleton

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	225	$38.8M	$19.4M	$58.2M	225	$4.8M	$2.7M	$7.5M
Commercial	1	$6.3M	$7.3M	$13.7M	1	$1.3M	$1.8M	$3.1M
Industrial	1	$0.6M	$0.9M	$1.5M	1	$0.1M	$0.3M	$0.4M
Agricultural	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Religious	1	$0.4M	$0.4M	$0.7M	1	$0.1M	$0.1M	$0.2M
Government	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Educational	1	$0.1M	$0.1M	$0.1M	1	$0.0M	$0.0M	$0.1M
TOTAL AT-RISK	231	$46.2M	$28.1M	$74.2M	231	$6.3M	$4.9M	$11.3M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent.

Table 4-4-32. Estimated Exposure and Loss for 500-Year Flood for Middleton

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	228	$39.5M	$19.8M	$59.3M	228	$5.8M	$3.3M	$9.1M
Commercial	1	$6.4M	$7.4M	$13.8M	1	$1.3M	$1.9M	$3.2M
Industrial	1	$0.6M	$0.9M	$1.5M	1	$0.1M	$0.3M	$0.4M
Agricultural	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Religious	1	$0.4M	$0.4M	$0.7M	1	$0.1M	$0.1M	$0.2M
Government	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Educational	1	$0.1M	$0.1M	$0.1M	1	$0.0M	$0.0M	$0.1M
TOTAL AT-RISK	234	$47.0M	$28.2M	$75.4M	234	$7.3M	$5.6M	$13.0M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent.

As shown above, a total of 231 and 234 buildings in Middleton are exposed to the 100-year or 500-year flood respectively. The total building count in Middleton is 2,262 (as indicated in Table 4-3-2 in Section 4.3). The total building structure losses associated with a 100- or 500-year flood are estimated at $6.3M and $7.3M, respectively for the 100- and 500-year flood events. This represents about 1.7 and 2.0 percent of the total building structural value (excluding content) of $365.2M. Therefore, the overall risk of flood to Middleton is considered to be of moderate risk. Although waterways run through Middleton, it appears that only two critical facilities are located in the flood zone (discussed later under critical facilities) and that construction generally is located to minimize the potential damage associated with flood events. Five hundred and 510 of the town's 4,051 citizens live in the 100- and 500-year flood zone area, respectively.

Roxbury: The flood wizard results for Roxbury are discussed below.

Table 4-4-33. Estimated Exposure and Loss for 100-Year Flood for Roxbury

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	55	$7.8M	$3.9M	$11.8M	55	$0.2M	$0.1M	$0.4M
Commercial	1	$0.1M	$0.1M	$0.2M	1	$0.0M	$0.0M	$0.0M
Industrial	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Agricultural	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Religious	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Government	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Educational	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	60	$7.9M	$4.0M	$12.0M	60	$0.2M	$0.1M	$0.4M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent.

Table 4-4-34. Estimated Exposure and Loss for 500-Year Flood for Roxbury

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	55	$7.8M	$3.9M	$11.8M	55	$0.2M	$0.1M	$0.4M
Commercial	1	$0.1M	$0.1M	$0.2M	1	$0.0M	$0.0M	$0.0M
Industrial	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Agricultural	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Religious	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Government	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Educational	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	60	$7.9M	$4.0M	$12.0M	60	$0.2M	$0.1M	$0.4M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent.

As shown above, a total of 60 buildings in Roxbury are exposed to the 100-year or 500-year flood. The total building count in Roxbury is 1,547 (as indicated in Table 4-3-2 in Section 4.3). The total building structure losses associated with a 100- or 500-year flood are estimated at $0.2M. This represents about 0.08 percent of the total building structural value (excluding content) of $229.3M. Therefore, the overall risk of flood to Roxbury is considered relatively low. Although waterways run through Roxbury, it appears that no critical facilities are located in the flood zone and that construction generally is located to minimize the potential damage associated with flood events. One hundred and forty of the town's 2,509 citizens live in the flood zone area.

Sidney: The flood wizard results for Sidney are discussed below.

Table 4-4-35. Estimated Exposure and Loss for 100-Year Flood for Sidney

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	309	$54.9M	$27.5M	$82.4M	309	$0.9M	$0.5M	$1.4M
Commercial	10	$13.6M	$14.0M	$27.6M	10	$0.3M	$0.5M	$0.8M
Industrial	3	$5.9M	$8.7M	$14.6M	3	$0.4M	$0.8M	$1.2M
Agricultural	11	$0.0M	$0.0M	$0.0M	11	$0.0M	$0.0M	$0.0M
Religious	1	$1.8M	$1.8M	$3.6M	1	$0.0M	$0.0M	$0.0M
Government	1	$0.2M	$0.3M	$0.5M	1	$0.0M	$0.0M	$0.0M
Educational	1	$0.9M	$0.9M	$1.9M	1	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	336	$77.3M	$53.2M	$130.6M	336	$1.6M	$1.8M	$3.4M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count from Table 4-4-35

Table 4-4-36. Estimated Exposure and Loss for 500-Year Flood for Sidney

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	385	$67.3M	$33.7M	$101.1M	385	$1.0M	$0.6M	$1.6M
Commercial	12	$17.5M	$18.0M	$35.4M	12	$0.8M	$1.1M	$1.9M
Industrial	3	$6.8M	$10.0M	$16.8M	3	$0.4M	$0.8M	$1.2M
Agricultural	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Religious	1	$2.3M	$2.3M	$4.6M	1	$0.0M	$0.1M	$0.1M
Government	1	$0.3M	$0.5M	$0.8M	1	$0.0M	$0.0M	$0.0M
Educational	1	$1.0M	$1.0M	$2.0M	1	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	404	$95.2M	$65.5M	$160.7M	404	$2.2M	$2.6M	$4.8M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent.

As shown above, a total of 336 and 404 buildings in Sidney are exposed to the 100-year or 500-year flood respectively. The total building count in Sidney is 2,054 (as indicated in Table 4-3-2 in Section 4.3). The total building structure losses associated with a 100- or 500-year flood are estimated at $1.6M and $2.2M, respectively for the 100- and 500-year flood events. This represents about 0.4 and 0.6 percent of the total building structural value (excluding content) of $367.6M. Therefore, the overall risk of flood to Sidney is considered relatively low. Although waterways run through Sidney, it appears that only two critical facilities are located in the flood zone (discussed later under critical facilities) and that construction generally is located to minimize the potential damage associated with flood events. One thousand and one hundred fifty and 1,400 of the town's 6,109 citizens live in the 100- and 500-year flood zone area, respectively.

Stamford: The flood wizard results for Stamford are discussed below.

Table 4-4-37. Estimated Exposure and Loss for 100-Year Flood for Stamford

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	49	$7.4M	$3.7M	$11.1M	49	$0.5M	$0.3M	$0.8M
Commercial	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Industrial	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Agricultural	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Religious	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Government	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Educational	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	49	$7.4M	$3.7M	$11.1M	49	$0.5M	$0.3M	$0.8M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count from because all of the buildings exposed are assumed to be damaged to some extent.

Table 4-4-38. Estimated Exposure and Loss for 500-Year Flood for Stamford

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	49	$7.4M	$3.7M	$11.1M	49	$0.5M	$0.3M	$0.8M
Commercial	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Industrial	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Agricultural	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Religious	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Government	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Educational	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	49	$7.4M	$3.7M	$11.1M	49	$0.5M	$0.3M	$0.8M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent.

As shown above, a total of 49 buildings in Stamford are exposed to the 100-year or 500-year flood. The total building count in Stamford is 826 (as indicated in Table 4-3-2 in Section 4.3). The total building structure losses associated with a 100- or 500-year flood are estimated at $0.5M. This represents about 0.4 percent of the total building structural value (excluding content) of $120.5M. Therefore, the overall risk of flood to Stamford is considered relatively low. Although waterways run through Stamford, it appears that only one critical facility is located in the flood zone (discussed later under critical facilities) and that construction generally is located to minimize the potential damage associated with flood events. One hundred and fifty of the town's 1,943 citizens live in the flood zone area.

Tompkins: The flood wizard results for Tompkins are discussed below.

Table 4-4-39. Estimated Exposure and Loss for 100-Year Flood for Tompkins

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	2	$0.3M	$0.2M	$0.5M	2	$0.0M	$0.0M	$0.0M
Commercial	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Industrial	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Agricultural	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Religious	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Government	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Educational	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	4	$0.3M	$0.2M	$0.5M	4	$0.0M	$0.0M	$0.0M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent.

Table 4-4-40. Estimated Exposure and Loss for 500-Year Flood for Tompkins

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	2	$0.3M	$0.2M	$0.5M	2	$0.0M	$0.0M	$0.0M
Commercial	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Industrial	1	$0.0M	$0.0M	$0.0M	1	$0.0M	$0.0M	$0.0M
Agricultural	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Religious	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Government	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
Educational	0	$0.0M	$0.0M	$0.0M	0	$0.0M	$0.0M	$0.0M
TOTAL AT-RISK	4	$0.3M	$0.2M	$0.5M	4	$0.0M	$0.0M	$0.0M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent.

As shown above, a total of 4 buildings in Tompkins are exposed to the 100-year or 500-year flood. The total building count in Tompkins is 616 (as indicated in Table 4-3-2 in Section 4.3). The total building structure losses associated with a 100- or 500-year flood are estimated at $0.0M. This represents about 0.0 percent of the total building structural value (excluding content) of $71.2M. Therefore, the overall risk of flood to Tompkins is considered relatively low. Although waterways run through Tompkins, it appears that no critical facilities are located in the flood zone and that construction generally is located to minimize the potential damage associated with flood events. Two of the town's 1,105 citizens live in the flood zone area.

Walton: The flood wizard results for Walton are discussed below.

Table 4-4-41. Estimated Exposure and Loss for 100-Year Flood for Walton

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	287	$52.9M	$26.5M	$79.4M	287	$2.6M	$1.4M	$4.0M
Commercial	12	$19.3M	$19.9M	$39.2M	12	$2.4M	$3.2M	$5.6M
Industrial	1	$1.9M	$2.6M	$4.5M	1	$0.2M	$0.4M	$0.6M
Agricultural	1	$0.8M	$0.8M	$1.7M	1	$0.1M	$0.1M	$0.2M
Religious	1	$2.8M	$2.8M	$5.7M	1	$0.4M	$0.5M	$0.9M
Government	1	$0.9M	$0.9M	$1.8M	1	$0.1M	$0.2M	$0.3M
Educational	1	$0.5M	$0.5M	$1.0M	1	$0.0M	$0.1M	$0.1M
TOTAL AT-RISK	304	$79.1M	$54.0M	$133.3M	304	$5.8M	$5.9M	$11.7M

Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent

Table 4-4-42. Estimated Exposure and Loss for 500-Year Flood for Walton

Category	Exposure				Loss			
	Building Count	Dollar Value Exposure			Building Count	Dollar Value Loss		
		Building Structure	Building Content	Total Value		Building Structure	Building Content	Total Value
Residential (Single and Multi-Family Dwellings)	342	$63.5M	$31.8M	$95.3M	342	$4.5M	$2.5M	$7.0M
Commercial	15	$23.4M	$24.0M	$47.4M	15	$4.2M	$5.5M	$9.8M
Industrial	1	$2.0M	$2.8M	$4.8M	1	$0.3M	$0.6M	$0.9M
Agricultural	1	$1.1M	$1.1M	$2.3M	1	$0.1M	$0.1M	$0.2M
Religious	1	$3.2M	$3.2M	$6.4M	1	$0.6M	$0.8M	$1.4M
Government	1	$0.9M	$0.9M	$1.8M	1	$0.2M	$0.3M	$0.5M
Educational	1	$0.7M	$0.7M	$1.4M	1	$0.0M	$0.0M	$0.1M
TOTAL AT-RISK	362	$94.8M	$65.5M	$159.4M	362	$9.9M	$9.8M	$19.9M

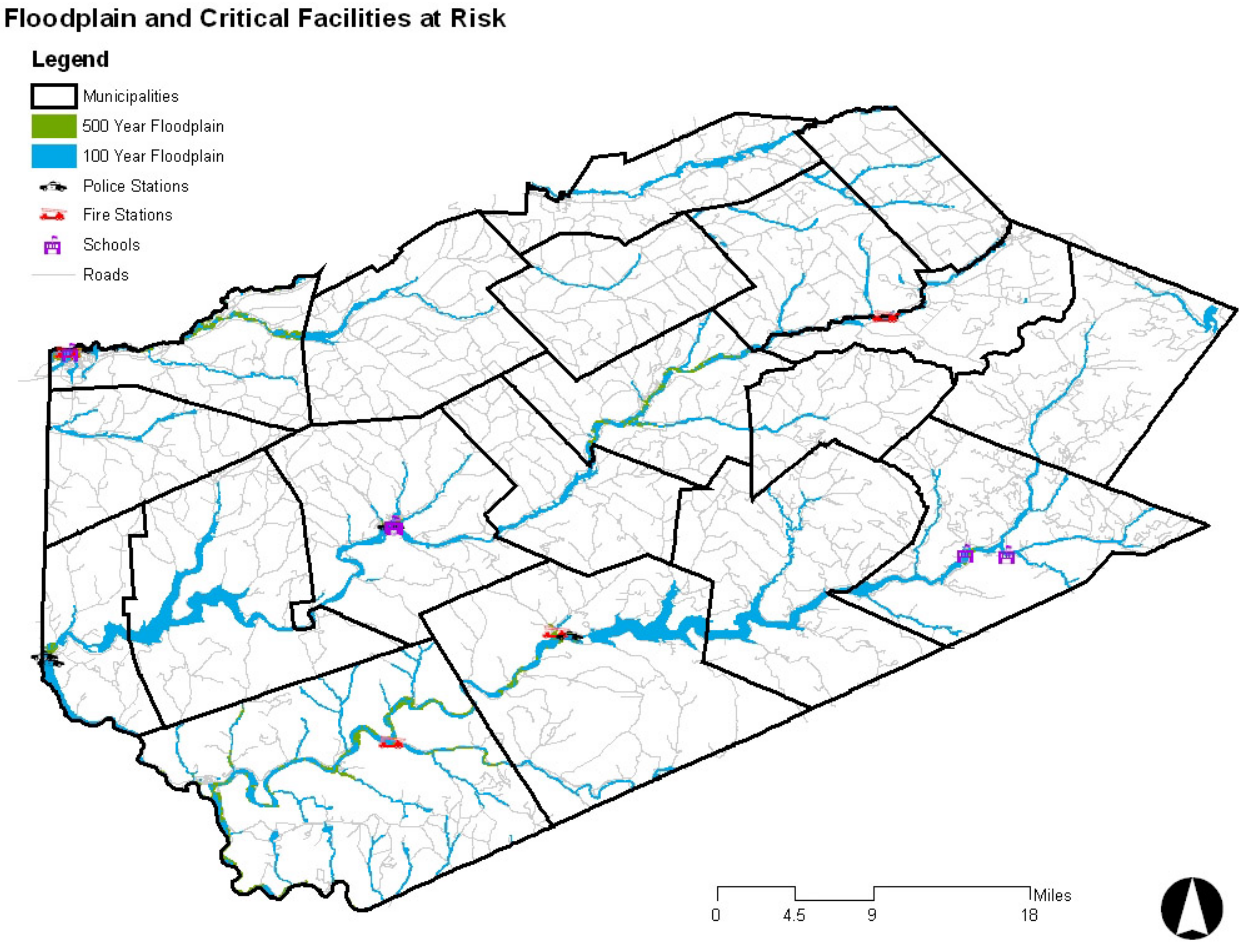
Notes: M - Million. Dollars rounded to the nearest million (M). Total value includes building structure and content exposure. The damaged building count equals the exposed building count because all of the buildings exposed are assumed to be damaged to some extent

As shown above, a total of 304 and 362 buildings in Walton are exposed to the 100-year or 500-year flood respectively. The total building count in Walton is 2,101 (as indicated in Table 4-3-2 in Section 4.3). The total building structure losses associated with a 100- or 500-year flood are estimated at $5.8M and $9.9M, respectively for the 100- and 500-year flood events. This represents about 1.8 and 3.0 percent of the total building structural value (excluding content) of $324.1M. Therefore, the overall risk of flood to Walton is considered to be of moderate risk. Although waterways run through Walton, it appears that only one critical facility is located in the flood zone (discussed later under critical facilities) and that construction generally is located to minimize the potential damage associated with flood events. Nine hundred and forty and 1,150 of the town's 5,607 citizens live in the 100- and 500-year flood zone area, respectively.

Critical Infrastructure Exposure and Loss

In addition to considering general building stock at risk, the risk of flood to critical facilities was evaluated. Critical facilities for this plan include police, fire, EMS, schools, and hospitals. Major employers are evaluated above (as either commercial or industrial categories). Figure 4-4-4 shows critical facilities (police stations, fire stations, and schools) at risk of flood based on location within the 100- and 500-year flood plains.

Figure 4-4-4. Critical Facilities at Risk of Flood for Delaware County Study Area



The review of critical facilities indicate that a number of critical facilities lie within the floodplain. Table 4-4-43 shows the impact to police, fire, EMS and schools in the Delaware County Multi-Jurisdictional area. Only impacted critical facilities are shown on the table; for example, although hospitals and medical facilities are located in the County (see Section 4.3), no hospital or medical facilities are estimated to be impacted by the 100- or 500-year flood or included on Table 4-4-43.

Table 4-4-43. Estimated Flood Damage to Critical Facilities for Delaware County Study Area

Critical Facility (Location or Classification)	100-Year Event			500-Year Event		
	Dollar Value			Dollar Value		
	Building Structure Damage %	Building Content Damage %	Days to 100% Functionality	Building Structure Damage %	Building Content Damage %	Days to 100% Functionality
New York State (NYS) Trooper (Sidney)	73	100	900	86	100	900
Police Department (Sidney)	NA	NA	NA	54	100	900
Village Police Department (Deposit)	16	75	630	16	75	630
Village Police Department (Walton)	63	100	900	61	100	900
DEP (TBD)	63	100	900	61	100	900
Future NYS Trooper (TBD)	16	75	630	12	55	630
Volunteer Fire Department (VFD) (Sidney)	18	83	630	23	98	630
VFD (South Kortright)	88	100	900	88	100	900
VFD (East Branch)	46	100	900	69	100	900
VFD (Downsville)	NA	NA	NA	23	98	630
Joshua House Inc. (School, Sidney)	16	77	720	16	77	720
Central School (Walton/Townsend)	47	100	900	47	100	900
Massis Bruce E (School, Delhi)	67	100	900	75	100	900
Office of Mental Retardation (School, Andes)	33	100	900	54	100	900
Central School (Margaretville)	10	69	630	15	75	720
Delaware Opportunities (School, Walton)	10	68	630	11	70	630

Notes: The value of damage to critical facilities can be calculated for structure using the building structure values included in Section 4.3. The content value can be calculated using the ration of structure value to content value included in HAZUS-MH for each building class or based on actual content estimated at the local level as such data is obtained. Days to 100% functionality indicates the number of days estimated by HAZUS-MH for the building to return to full functionality after the flood event.

These results indicate that 16 critical facilities could experience damage in the event of a 100- or 500-year event. These facilities are located in Delhi, Deposit, Downsville, East Branch, Middleton, Sidney, South Kortright and Walton. Functionality of critical facilities may be impacted for nearly 3 years before full functionality is returned. In cases where short-term functionality is impacted by a hazard, other municipal facilities of neighboring municipalities may need to support response functions during a disaster event. Mitigation planning should consider means to reduce impact to critical facilities and ensure sufficient emergency and school services remain when a significant event occurs.

Because much of the Delaware County region relies heavily on agriculture, as well as the fact that the relatively severe topography in the County has forced agriculture into the level and flood-prone valley regions, the agricultural exposure and risk also was evaluated. Figure 4.4-5 shows agricultural areas in the study area, overlain with the 100- and 500-year flood plain.

Figure 4-4-5. Agricultural Lands and Flood Plains in Delaware County Study Area

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Table 4-4-44 indicates the area of land at risk within the 100-year flood plain. Because the 100-year and 500-year flood zones are similar in areas where crop land and agriculture are located, the exposure for the 500-year MRP flood event for agriculture is similar to the 100-year MRP flood event exposure.

Table 4-4-44. Estimated Flood Exposure for Farmland in Delaware County Study Area

	Total In Town			Total in 100-Year Flood Zone			Total in 500-Year Flood Zone		
NAME	Pasture/ Hay	Row Crops	Total Farmland	Pasture/ Hay	Row Crops	Total Farmland	Pasture /Hay	Row Crops	Total Farmland
Andes	6,054	1,657	7,710	98	23	121	98	23	121
Bovina	4,115	752	4,867	49	4	54	49	4	54
Colchester	2,620	736	3,356	367	58	425	425	59	484
Davenport	5,191	282	5,473	613	130	744	613	130	744
Delhi	7,030	1,068	8,097	738	98	836	793	103	896
Deposit	2,971	526	3,496	279	119	398	285	121	406
Franklin	12,183	1,196	13,379	416	45	461	416	45	461
Hamden	6,819	1,431	8,250	426	63	489	426	63	489
Hancock	3,045	518	3,563	631	96	728	689	106	795
Harpersfield	6,088	938	7,026	349	46	395	349	46	395
Kortright	9,665	361	10,026	583	46	629	583	46	629
Masonville	5,182	1,149	6,331	208	40	249	208	40	249
Meredith	10,015	243	10,258	63	-	63	63	-	63
Middletown	4,389	1,879	6,268	290	246	536	290	247	536
Roxbury	4,876	1,866	6,742	130	45	175	130	45	175
Sidney	6,543	1,223	7,765	575	171	746	635	188	823
Stamford	5,785	1,089	6,874	421	84	505	421	84	505
Tompkins	3,971	1,185	5,157	114	49	163	114	49	163
Walton	9,721	1,300	11,021	554	88	642	554	88	642
County	**116,261**	**19,399**	**135,660**	**6,905**	**1,452**	**8,357**	**7,141**	**1,487**	**8,629**

As shown above, a total of 135,660 acres of farmland are located in the County. Of this, a total of 8,357 and 8,629 are located in the 100- and 500-year flood zones, respectively. Some towns appear to have a significant percent of farmland in the flood zone. For example, the town of Hancock has 20% of its total farmland in the 100-year flood zone and 22% of its total farmland is in the 500-year flood zone. For the town of Davenport 46% of its total row crops are in the 100- and 500-year flood zone. And for the town of Deposit about 23% of its row crops are in the 100- and 500-year flood zone. For the flood estimate, exposure of major agricultural buildings and facilities also was evaluated. No such buildings were estimated to be exposed or suffer losses in the flood plain area (see also Table 4-4-2).

Table 4-4-45 identifies wastewater treatment plants that are located within the 100- and 500-year flood delineations.

Table 4-4-45. Flood Exposure for Wastewater Treatment Facilities in Delaware County Study Area

Facility Name	Location (Town or Village)	Within 100-Year Flood Plain	Within 500-Year Flood Plain
Aerospace Operations	Sidney (V)	Yes	Yes
Stamford (V) Sewage Treatment Plant	Stamford (V)	Yes	Yes
NYC DEP Margaretville (V) STP	Margaretville (V)	Yes	Yes
Hobart (V) STP	Stamford (T)	Yes	Yes

Facility Name	Location (Town or Village)	Within 100-Year Flood Plain	Within 500-Year Flood Plain
Sidney (V) Water Pollution Control Plant	Sidney (V)	Yes	Yes
Hancock (V) STP	Hancock (V)	Yes	Yes
Johnston & Rhodes Stonemill	Hancock (T)	Yes	Yes
Becton Dickinson	Hancock (T)	Yes	Yes
Catskill Mountain Kampground	Colchester (T)	Yes	Yes
Downsville Restaurant	Colchester (T)	No	Yes
Beaver-Del Campsites	Hancock (T)	Yes	Yes
Penn Quality Meats Cooperative, Inc.	Stamford (T)	Yes	Yes
Palace Hotel, Inc.	Middletown (T)	Yes	Yes
Norbord Industries, Inc.	Deposit (T)	Yes	Yes
Maintenance Patrol – Deposit	Deposit (T)	Yes	Yes

Based on a review of available data for general building stock, critical/essential facilities, agriculture, and other factors, it appears that a significant portion of current development is located in flood-prone areas. Therefore exposure in some jurisdictions is significant and mitigation measures are identified in Section 5.

Additional Data Needs and Next Steps

Over time, the jurisdictions comprising Delaware County will continue to work together to learn more about the flood hazard, maintain or improve participation in FEMA's NFIP, and support further mitigation efforts, as discussed in Section 5 to reduce the losses when future flood events occur. Refinement of floodplain maps and improvement of local inventory data will support refined analyses using the flood model over time. Future evaluations may apply the HAZUS-MH model to study particular reaches of concern in greater detail. Also, the model may be used to estimate the impact of particular mitigation activities that could be implemented to reduce flood risk. Also, as new or refined flood maps are created and development and mitigation efforts occur, future evaluations will consider any changes to the flood loss estimates presented in this plan.

Overall Vulnerability Assessment

The flood hazard is evaluated as a significant threat, which can be managed and planned for through the mitigation strategy and specific activities outlined in Section 5.

4.4.1.2 Severe Storm (Including Hurricane)

Severe storms, including windstorms, thunderstorms, hailstorms, hurricanes, and tornadoes, can 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 section.

Data Collected and Used

Data used to assess this hazard include data available for storms, including hurricanes, in HAZUS-MH, NOAA NCDC data, professional knowledge and other information provided by participating municipalities, planning committee members, and FEMA.

HAZUS-MH contains data on historic hurricane events. 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 are sufficient to evaluate potential loss from the hurricane hazard (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.

According to NOAA's NCDC database, no hurricane or tropical storm events have been recorded in Delaware County since 1950. However, high winds and flooding associated with hurricanes and tropical storms that directly impact other areas also have peripheral landward impacts for Delaware County. Full-force hurricanes are not likely to occur in Delaware County based on its distance from the Atlantic Ocean and its latitude. However, Delaware County is capable of experiencing hurricane-force winds and flooding associated with such events. For example, the County has felt the peripheral landward effects, including high winds, heavy rains, and flooding associated with several hurricanes and tropical storms. Most recently, Delaware County experienced high winds associated with Hurricane Jeanne in September of 2004. Additionally, Delaware County experienced flooding in association with Hurricane's Bob (1991), Floyd (1999), Isabel (2003), Frances, and Ivan (2004) (NCDC, 2004). Also, according to NOAA's National Hurricane Center, Delaware County experienced flooding from Hurricane Gracie (1959) and Hurricane David (1979) and a Tropical Depression (1939) (National Atlas, 2005). Winds associated with Hurricane David averaged approximately 45 miles per hour in the Delaware County area.

The entire inventory is considered 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 and structural considerations that impact vulnerability to wind damage. The exposure and loss estimation for hurricane (below) focus on wind related damages for the hurricane event. Flooding associated with hurricanes is currently considered with the flood hazard in Section 4.1.1.

Exposure and Loss Estimation

Due to Delaware County's inland location, the loss associated with hurricane is primarily associated with hurricane-related rains (see flooding discussion). Secondary flooding associated with the torrential downpours during hurricanes is also a primary concern in Delaware County and the County has

experienced flooding in association with several hurricanes and tropical storms in the past. The flood hazard is described previously in this section.

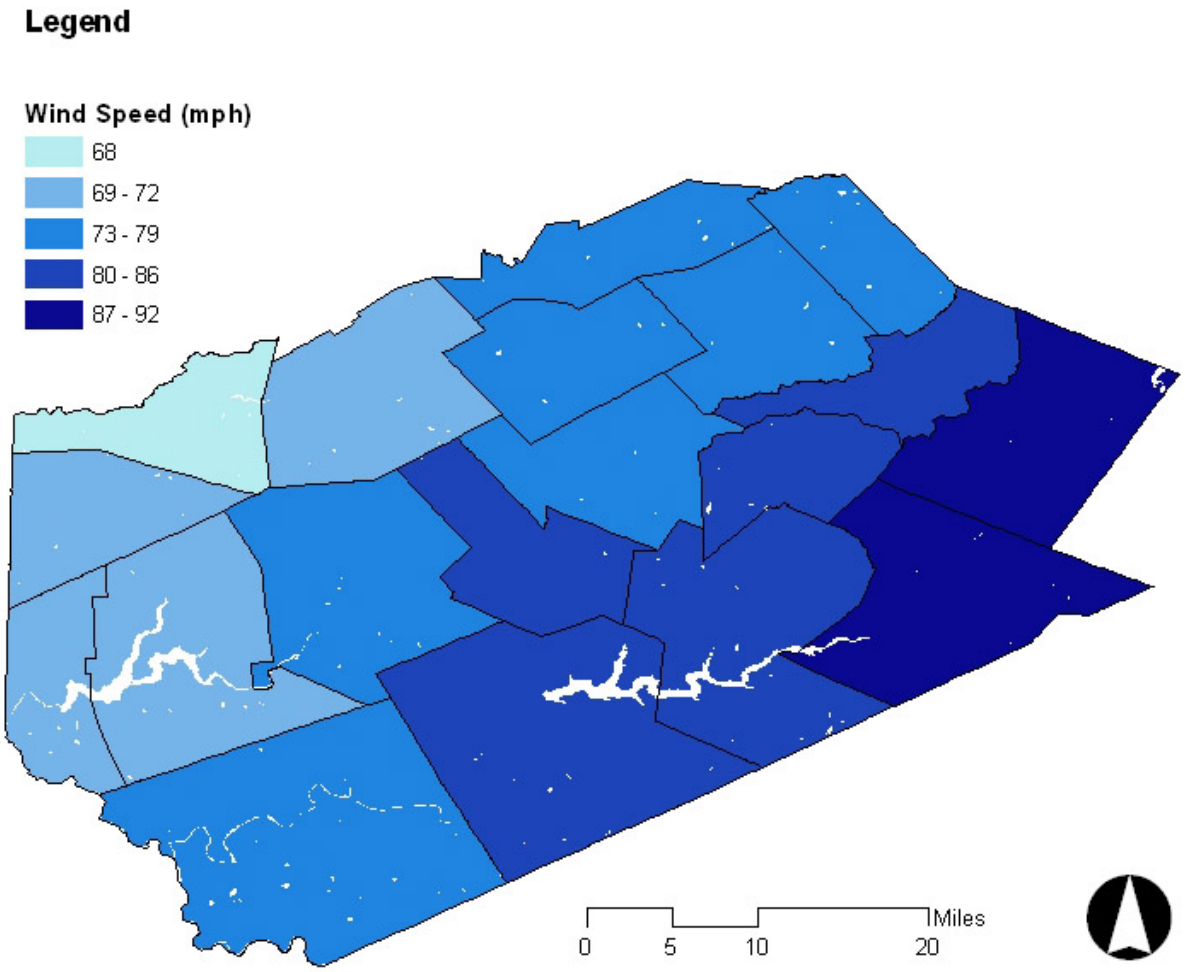
Wind associated with the hurricane event is more similar to a severe wind storm and therefore, can support analysis of the severe storm event for this area. The damage from hurricane-related winds is considered representative of a severe windstorm due to downed trees and damaged buildings.

Besides hurricane, other wind and storm related events included with the severe storm hazard include: windstorms, thunderstorms, hail, lightning events, and tornados. Windstorms and thunderstorms occur relatively frequently in Delaware County; however, only a small fraction of all storms are considered severe. NCDC lists 169 thunderstorm, heavy wind, hail and lightning events for the period between 1950 and 2005. One such event was a thunderstorm wind event with winds reaching 80 to 90 knots between the Town of Walton and Delhi in July 2003. Property damage was approximately $500,000 in Delaware County and surrounding areas as a result of the event (NCDC, 2005). According to the Binghamton NWS, tornado events average approximately 0.35 events annually and hail events average approximately 0.65 events annually in the area. Twenty-two hail events are reported in the NCDC database between 1950 and June 2005; a total damage listing of $125,000 and no injuries are noted for these tornadoes in and around the study area. Ten lightning events are listed in the NCDC database between 1950 and June 2005; total damages of $293,000 in property damage and 2 injuries are noted for these events in Delaware County and the surrounding area.

NCDC also lists eight tornado events during the period of 1950 and 2005. One tornado event consisted of an F3 tornado in May 1998; property damage for this event was estimated at approximately $1.0 million for the Towns of Deposit, Tompkins, Colchester, and Downsville (NCDC, 2005). Based on historical information found on the NOAA websites 150 severe storm event days including heavy winds have occurred from 1950 through 2005, including eight tornados (2 category FO, 4 category F1, 1 category F2, and 1 category F3, occurred from 1986 through 2004). Total damages recorded for the 8 tornado events in the NCDC database total $2.21 million in property damage and 1 injury in and around the study area.

After reviewing historic data, the HAZUS-MH methodology and model were used to analyze the hurricane hazard for Delaware County. Figure 4-4-6 shows the maximum peak wind speeds that can be anticipated in this area associated with the 500-year MRP hurricane event. The figures show that maximum peak wind speeds for the County range from 68 to 92 miles per hour (mph) for the 500-year MRP hurricane event.

Figure 4-4-6. Peak Wind Speeds for 500-year Hurricane Severe Storm Event (Wind) in Delaware County



Wind losses were calculated at the County level for two probabilistic hurricane events, the 100- and 500-year MRP hurricane events. These losses are presented below.

100-Year Event – The entire geographic area of 1,456 acres is considered at risk for the hurricane wind hazard. For this hazard event, estimated damages are not significant. Expected building damage was evaluated across the following damage categories: no damage, minor damage, moderate damage, severe damage, and total destruction. No buildings were estimated to suffer moderate, severe or total destruction damage. Ten residential buildings were estimated to have minor damage. Of these, the majority are constructed of wood and masonry.

All agriculture, commercial, education, government, industrial, religious and residential buildings are estimated to suffer no damage in association with the 100-year hurricane wind event. In addition, fire stations, hospitals, police stations and schools are estimated to suffer very limited damage, if any,

resulting in the loss of use of these facilities for a period of less than one day. HAZUS-MH estimates that no people will require temporary shelter. A total of about 1 million tons of debris will be generated, including primarily tree debris. Property damage values are estimated to total $885,000 for building structure and content across all building categories (residential, commercial, industrial and other).

500-Year Event – Tables 4-4-46 summarizes the property damage that is estimated for the 500-year MRP hurricane event. The data shown indicates losses associated with wind damage to structures. Residential buildings account for most of the damage for this event and also comprise the majority of the building inventory (87% of total building value). 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 slight damage to total destruction. Total dollar damage reflects the overall impact to buildings at an aggregate level.

Table 4-4-46. Estimated Damage to General Building Stock from 500-Year MRP Hurricane Severe Storm Event in Delaware County Study Area

500-year MRP Hurricane Event								
Residential Damages			Commercial Damages			Industrial Damages		
Structure	Content	Total	Structure	Content	Total	Structure	Content	Total
$8.9M	$1.5M	$10.4M	$0.1m	$0	$0.1M	$0M	$0M	$0M

Notes: M indicates million.

As shown in Table 4-4-46, the total damage to residential, commercial, industrial, and other buildings is estimated as $9 million for building structure, $1.5 million for building content, and $10.5 million total damage with the majority of losses resulting to the residential building category.

The percent probability of experiencing damage of various severities is summarized for the 500-year event in Table 4-4-47. The hurricane analysis considers damage associated with significant winds. Such wind impacts also could occur as a result of the severe wind storms or tornadoes 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 4-4-47. 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)	98 %	None
	2 %	Minor
	0 %	Moderate of Severe
Commercial Buildings	99 %	None
	1 %	Minor
	0 %	Moderate to Severe
Industrial Buildings	99 %	None
	1 %	Minor
	0 %	Moderate to Severe
Education, Government and Agricultural Facilities	99 %	None
	1 %	Minor
	0 %	Moderate to Severe

Of the buildings that suffer minor damage, 318 are wood, 51 are masonry, 2 are concrete, 2 are manufactured homes, and 1 is steel. Of 17 buildings that suffer moderate damage, 12 are wood and 5 are masonry. Similar to the 100-Year event all critical facilities (fire stations, hospitals, police stations and schools) are expected to lose less than one day of expected use.

No households are expected to be displaced or require temporary shelter. An estimated 4.6 million tons of debris will be generated, consisting primarily of tree debris.

Manufactured homes are particularly vulnerable to severe storms. Figure 4-4-7 and Table 4-4-48 show the distribution of these types of homes in the Delaware County Multi-Jurisdictional Study Area. Based on available information, 4,599 such homes are located in the area, comprising 22 percent of the total residential units (approximately 21,000).

Table 4-4-48. Manufactured Homes in Delaware County Study Area

Jurisdiction	Total Number in Town	Number in Villages (Subset of Town Total)
Andes	145	0
Bovina	56	0
Colchester	363	0
Davenport	439	0
Delhi	199	26 (Delhi Village)
Deposit	184	52 (Deposit Village)
Franklin	206	5 (Franklin Village)
Hamden	160	0
Hancock	501	52 (Hancock Village)
Harpersfield	157	9 (Stamford Village, Harpersfield portion)
Kortright	222	0
Masonville	154	0
Meredith	141	0
Middletown	343	8 (Fleishman's Village), 7 (Margaretville)
Roxbury	249	0
Sidney	295	32
Stamford	142	15 (Hobart), 28 (Stamford portion)
Tompkins	210	0
Walton	433	27 (Walton Village)
Delaware County	**4,599**	*

*Included with total for town

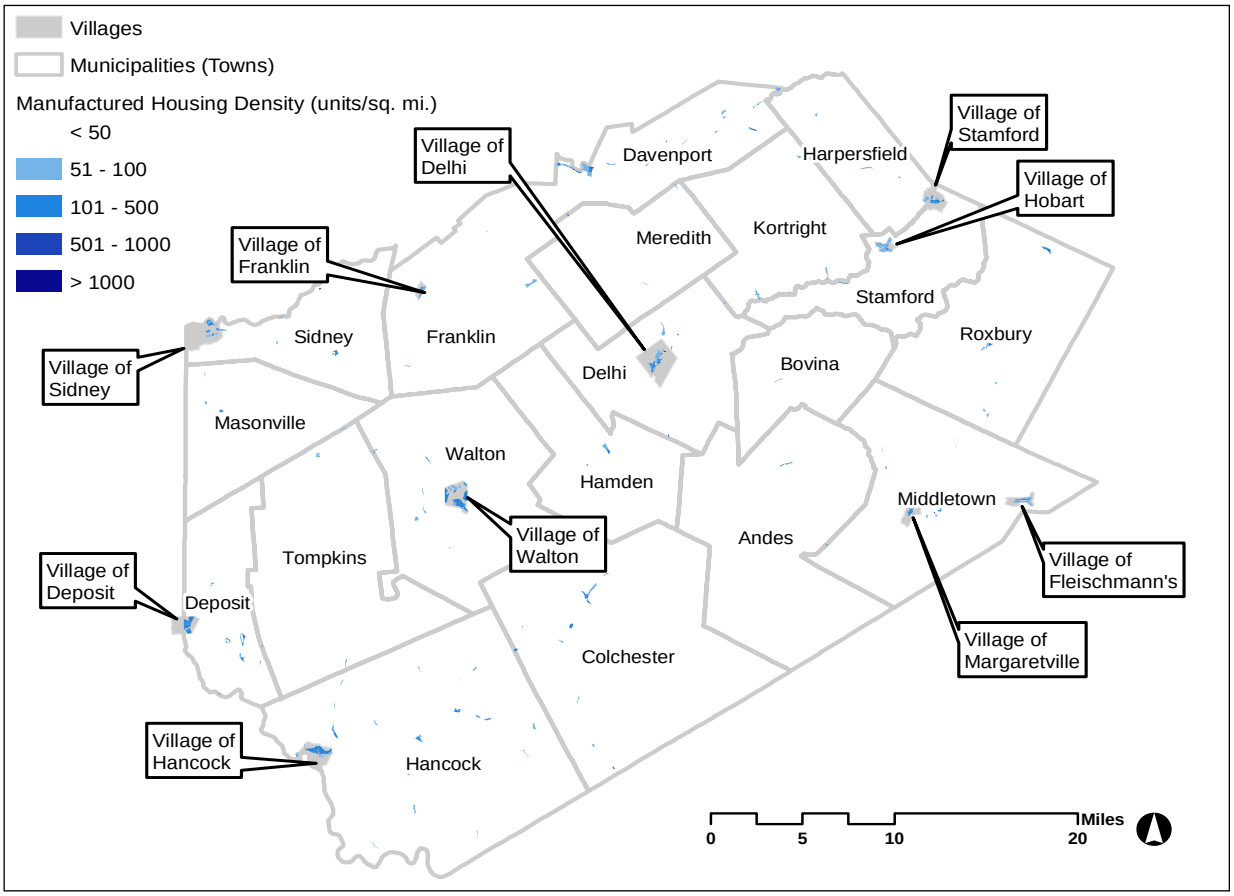
Transportation lifelines are not considered particularly vulnerable to the severe storm wind hazard. However, utility structures could suffer damage associated with falling tree limbs or other debris. Such impacts can result in the loss of power, which can impact business operations and can impact heating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

Additional Data and Next Steps

Based on initial analyses, hurricane-related wind impacts are not considered to present a significant risk. Other hazard events in the severe storm (wind-related) category can not currently be modeled in HAZUS-MH (tornado, thunderstorm, windstorm, etc.). For these hazards, additional detailed loss data associated with past and future events will assist in modeling potential future losses in a quantitative manner. Based on these values and a 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).

Figure 4-4-7. Manufactured Homes in Delaware County



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 study area 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 Delaware and the municipalities' roads, structures, facilities, utilities, and population. The impact of individual events is generally not significant; however, the range of events included in the severe storm hazard means that events can be expected regularly. 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.

4.4.1.3 Ice Jam

The ice jam hazard is considered a concern to Delaware County given its northern location. The cold winter weather causes ice to accumulate and then thaw during warm periods (and during the spring). Ice jams are separated from other winter weather events because the Planning Committee recognizes that in Delaware County, the ice jam event can occur on its own without other natural hazards. Warming temperatures combined with heavy rains can increase the risk and impacts associated with the ice jam hazard. Potential impacts can include disruption to waterway commerce and flooding in area neighborhoods.

Data Collected and Used

Data used for this section includes NOAA NCDC data, Northeast States Energy Consortium, U.S. Army Corps of Engineers (USACE) Cold Region Research and Engineering Lab (CCREL), Planning Committee and local input.

Exposure and Loss Estimation

According to the USACE, Cold Region Research and Engineering Lab (CRREL), Delaware County has experienced approximately 77 historic ice jam events between 1930 and 2001. In addition, 14 ice jams have also been recorded within the Schoharie Creek, which partially extends through the northeastern section of Delaware County.

In Delaware County, ice jams typically have formed along the following rivers and tributaries within Delaware County: the Little Delaware River, the West and East Branch of the Delaware River, Oquaga Creek, Oulelet Creek, Trout Creek, Susquehanna River, Schoharie Creek, Platte Kill, Mill Brook, Terry Clove Kill, Coles Clove Kill, Beaver Kill and Tremper Kill (USACE-CRREL, 2005).

Ice jams occur relatively frequently in Delaware County; however, only a small fraction of ice jams are considered severe. USACE CRREL data indicate that ice jams in the area generally average between zero to four events annually. However, historical ice jams have ranged between five and eight events in some years (1945, 1946, and 1950). All documented events have occurred between January and April, in association with snow melts. Based on the USACE CRREL database, it appears that ice jam incidences have declined within the recent years; however, there is always the potential for such events to occur during the winter months.

Documented ice jam events within Delaware County have occurred in the following locations:

1. Fishs Eddy along the East Branch, Delaware River
2. Hale Eddy along the West Branch, Delaware River
3. Rock Royal along Trout Creek
4. East Sidney along Ouleout Creek
5. Unadilla along Susquehanna River
6. Delhi along the Little Delaware River
7. Dunraven along Platte Kill
8. Arena along Mill Brook
9. Pepacton along Terry Clove Kill
10. Shavertown along Tremper Kill
11. Pepacton along Coles Clove Kill

12. Cooks Falls along Beaver Kill
13. Deposit along Oquaga Creek
14. Stilesville along the West Branch, Delaware River
15. Cannonsville along Trout Creek
16. Harvard along the East Branch, Delaware River
17. Andes along Tremper Kill
18. Walton along the West Branch, Delaware River

Areas where ice jams have occurred are shown in Figure 4-8.

Figure 4-4-8. Ice Jam Events in Delaware County Area

Source: USACE-CCREL, 2005

Color Code for Events

- 1 Ice Jam
- 2 - 5 Ice Jams
- 5 - 10 Ice Jams
- > 10 Ice Jams

Loss data associated with ice jam events is limited. However, where flooding occurs in association with ice jams, impacts and losses can be expected to be similar to other flooding. The ice itself can cause additional impacts, such as damage to dams, boats, and other structures on the waterway; this can increase the losses associated with the ice jam event. These damages can range from thousands to millions of dollars in damages.

Additional Data and Next Steps

Although data is available on the number of ice jam events that can occur annually, limited data is currently available from national or local sources. Therefore, additional research on historic damages is warranted. In addition, Delaware County will establish a tracking system to record future ice jam events and damages. This data can then be used to identify specific vulnerabilities and identify mitigation measures.

Overall Vulnerability Assessment

With respect to the probability of future ice jam hazard events, the HAZNY Report for the study area resulted in a frequency description term of a "regular event" for ice jams. The ground rules for the program quantify this descriptor as an event that occurs between once a year and once every 7 years (inclusive). It is estimated that Delaware County will continue to experience ice jams annually that may induce secondary hazards such as flooding, utility failure and transportation accidents.

4.4.1.4 Severe Winter Storm (snow)

Severe winter storms and ice storms are of significant concern to Delaware County and the participating jurisdictions due to the frequency and magnitude of these events in the region, the direct and indirect costs, delays, and impacts on the people and facilities of the region related to snow and ice removal, health problems, cascade effects such as utility failure, and stress on community resources.

Data Collected and Used

National weather databases, Delaware County, and jurisdictional data were collected, analyzed, and sorted. Severe winter storm events were categorized and grouped by type of event: heavy snow and ice storm. Based on Planning Committee input, heavy snow is considered as a separate hazard from the ice storm hazard for this plan. Data on property damage and loss, and injuries and deaths, was collected for Delaware County from NOAA's NCDC website. This data was used to support an evaluation of exposures to this hazard.

Exposure and Loss Estimation

Severe winter storm is considered a significant hazard to the study area based on the experience and judgment of the planning group and information available from a range of sources.

Heavy snowfall, coupled with low temperatures, can result in increases in traffic accidents, disruptions in transportation, commerce, government, and education, utility outages due to falling trees, branches, and other objects, personal injuries associated with slippery surfaces and freezing temperatures, and numerous other problems. Specific damages associated with severe snowstorms in the study area include the following primary concerns:

- Injuries, including potential fatalities, associated with accidents, low temperatures, power loss, and falling objects caused by frozen and slippery surfaces
- Increases in the frequency and impact of traffic accidents, which result in personal injuries, taxing of public safety
- Ice-related damage to trees, building and infrastructure inventory, and utilities (power lines, bridges, substations, etc.)
- Ice jams that cause traffic problems on waterways and flooding (see Ice Jam Hazard)
- Roads damaged through freeze and thaw processes
- Stress on the local shelters and emergency response infrastructure
- Lost productivity that occurs when people cannot go to work, school, or stores due to inclement conditions
- Loss of utilities such as private well use

Some minimum damage is anticipated annually, with extensive damage occurring periodically. The climate of Delaware County is such that no municipalities are immune to the potential damaging effects of severe winter storms. Binghamton NWS data indicate that Delaware County is generally one of the counties in NYS hardest hit by winter storm (snow) events. Annual snowfall of over 150 inches has been recorded in recent history (1996) and individual snow events of up to 33.2 inches (Walton Township) have been documented (December 25, 2002). Overall several major snow events can be anticipated each year in Delaware County and the participating municipalities.

NCDC severe storm (snow) data for Delaware County is summarized in Table 4-4-49.

Table 4-4-49. Severe Winter Storm (Snow) Events Impacting Delaware County (1950 to June 2005)

Extreme Temp. Events	Year	Recorded Damages (Property)	Comments
1	1993	$5.0M	A major snow event impact Delaware and surrounding counties, resulting in heavy snow and gusty winds that downed tree limbs and power lines, leaving over 25,000 customers without power in eastern NY.
7	1994	$3.5M	Seven events in 1994 were recorded as impacting the County and surrounding areas, resulting in a total property damage of over $3M. Some snow events were combined with freezing rain, exacerbating transportation hazards and property damages.
14	1995	$1.8M	Snow events, combined with sleet, freezing rain and one incidence of snow squalls were recoded in 1995. These events results in significant property damages.
6	1996	$0.2	A number of snow events were recorded, with non-significant property damages.
38	1997 – 2002	$0M	No property damage was recorded in association with these snow and winter storm (including snow) over a five-year period. It is feasible that unrecorded impacts occurred.
4	2003	$9.4M	Two heavy snow events in January and February incurred $6M and $2.7M in property damage, respectively in Delaware and surrounding counties.
3	2004	$0.8M	No property damage was recorded for two winter storms and two heavy snow events between January 8 and March 21, 1999.
4	2005	$1.1M	Reflects the average loss per year for a large-scale area, including the Town of Clay, based on the reported damages listed in the table.
71	13 Years	$22.3M or $1.7M/yr.	Total property damages association with snow and winter storm (including snow) events recorded in NCDC database.

Notes: Recorded losses indicate the values shown on the web site for Delaware and other surrounding counties impacted. Source: NOAA NCDC Storm Event Database (NOAA NCDC, 2005).

Populations considered to be most vulnerable to severe winter storm were evaluated 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. Table 4-4-50, based on HAZUS-MH data, summarizes the populations of the municipalities over the age of 65 and living in households with an income below the poverty line (household income of $20,000 per year or less), as defined by the U.S. Census Bureau. These types of populations are generally more susceptible to the impacts of hazard events based on their age, mobility, income, and ability to respond (see alternate shelter, etc).

Table 4-4-50. Vulnerable Populations in Study Area Exposed to Severe Winter Storm (Snow) in Delaware County

Town (Villages within Town Border)	Population (2000)	Pop. Over 65 / % of Total	Population in Households Income <$20k/yr. / % of Total
Andes	1356	293 / 22	148 / 11
Bovina	664	145 / 22	41 / 6
Colchester	2042	468 / 23	235 / 12
Davenport	2774	387 / 14	258 / 9
Delhi (Village of Delhi)	4629	825 / 18	359 / 8
Deposit (Village of Deposit)	1687	293 / 17	232 / 14
Franklin (Village of Franklin)	2621	431 / 16	197 / 8
Hamden	1280	231 / 18	108 / 8
Hancock (Village of Hancock)	3449	652 / 19	408 / 12
Harpersfield	1603	400 / 25	147 / 9
Kortright	1633	252 / 15	146 / 9
Masonville	1405	191 / 14	122 / 9
Meredith	1588	212 / 13	139 / 9

Town (Villages within Town Border)	Population (2000)	Pop. Over 65 / % of Total	Population in Households Income <$20k/yr. / % of Total
Middletown (Villages of Margaretville and Fleischman's)	4051	973 / 24	480 / 12
Roxbury	2509	492 / 20	275 / 11
Sidney (Village of Sidney)	6109	1157 / 19	713 / 12
Stamford (Villages of Hobart and Stamford)	1943	335 / 17	205 / 11
Tompkins	1105	186 / 17	104 / 9
Walton (Village of Walton)	5607	1005 / 18	743 / 13
Study Area	48,055	8928 / 19	5,060 / 11

As discussed in Section 4.3, a number of senior housing establishments are located in Delaware County, including senior housing, adult homes, residential care centers, and nursing homes. The concentration of low income and elderly populations generally are located near population centers such as villages. A through understanding of the location and needs of these populations is warranted in planning for emergency support that may be required during a major snow storm event.

The entire inventory in the Delaware County Multi-Jurisdictional Study Area is vulnerable to a severe winter storm (snow). Table 4-4-51 identifies the building count and valuation of this inventory as well as the losses that would result from 1%, 5%, and 10% damage to this inventory as a result of a severe winter storm (snow).

Table 4-4-51. Inventory of Building Structural Exposure to Severe Winter Storm (Snow) for Delaware County Study Area

Building Occupancy Class	Number of Buildings	Total Value	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Residential	21,761	$2.9 billion	$29 million	$145.0 million	$290.0 million
Commercial	127	$0.3 billion	$3.0 million	$15.0 million	$30.0 million
Industrial	16	$0.1 billion	$1.0 million	$ 5.0 million	$10.0 million
Total	21,928	$3.3 billion	$33 million	$165 million	$330.0 million

Note: The building values shown do not include building contents; for the severe winter storm (snow) hazard, damage will generally impact structures such as the roof (roof collapse).

Historic data indicates losses of approximately $0.5 million dollars per year ($23.3 million between 1950 and June 2005) and as high as $6 million have occurred in Delaware and surrounding counties in the past; $6 million is significantly less than the 1 percent damage loss estimated above for property damage. Therefore, the loss estimates of 1, 5 and 10 percent can be considered conservative estimates of anticipated future damage. An assessment on damage to critical infrastructure cannot be made due to the lack of readily available data on past impacts. However, historical data such as the damage and repair to roadways and power outages to critical facilities have been documented in the past.

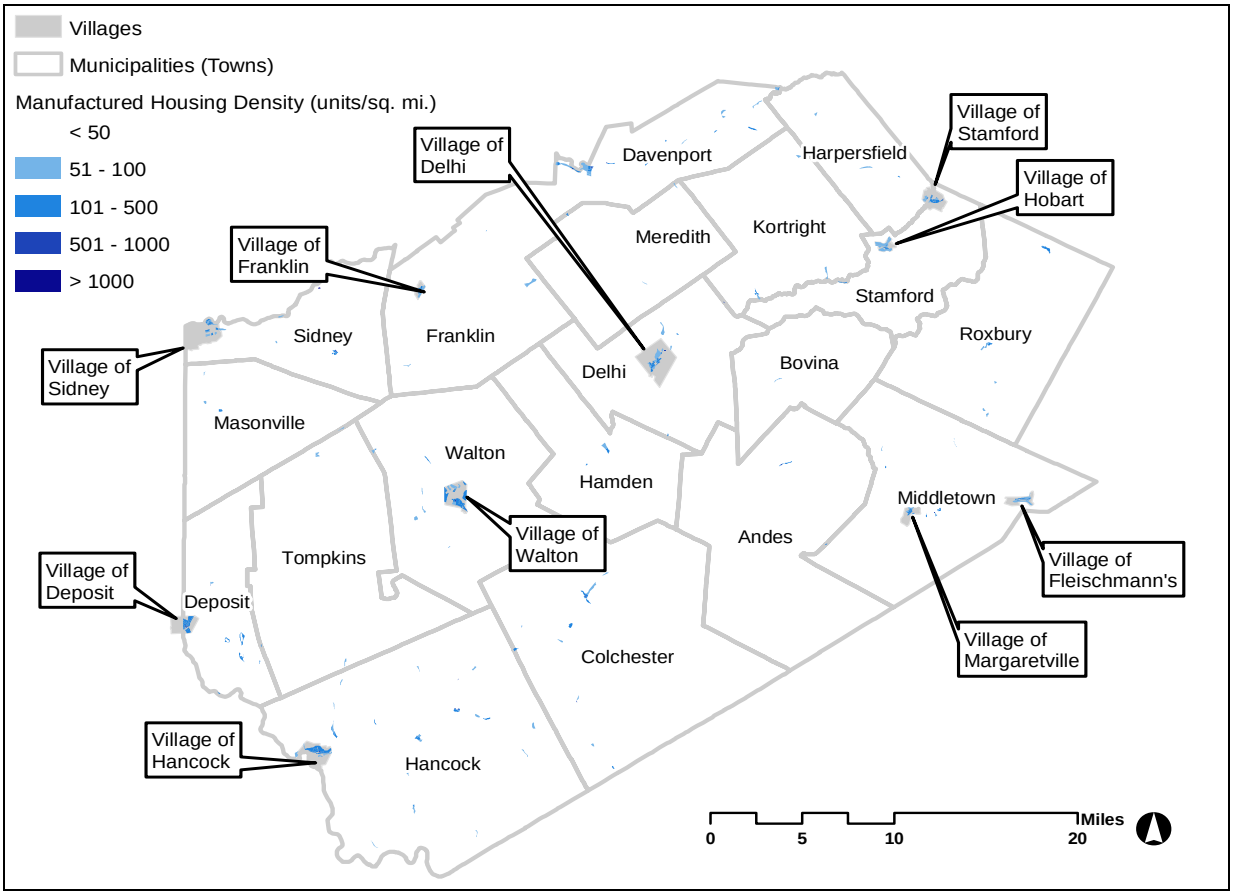
Manufactured homes are particularly vulnerable to severe winter storms. Figure 4-4-9 shows the distribution of these types of homes in the Tompkins County multi-jurisdictional study area and Table 4-4-52 summarizes this data and estimates the loss estimate if 5% and 10% damage accrues to these homes.

Table 4-4-52. Manufactured Homes Exposed in Delaware County Study Area

Town	Total Residential Structures	Total # Manufactured Homes	% of Total Residential Structures	Total Value Manufactured Homes	5% Damage Loss Estimate	10% Damage Loss Estimate
Study Area	21,761	4,599	21%	$232.3M	$11.6M	$23.2M

Note: The building values shown do not include building contents. Average value Manufactured Home estimated to be $50,509. Generally, for the winter storm hazard, the structural components of buildings are anticipated to be most impacted. Source: HAZUS-MH (FEMA 2004).

Figure 4-4-9. Manufactured Homes in Delaware County



In regards to critical facilities, valuation data is available for police stations and hospitals. Because these structures are largely constructed of concrete and masonry, it is anticipated that they should suffer only minimal structural damage from snow storms. Wastewater treatment plants should not be unduly impacted by snow events, but also can suffer temporary power losses (similar to other facilities). Because power interruption can occur, backup power is recommended if a complete avoidance of power interruption is required for a particular critical or infrastructure facility.

Another area that is vulnerable for a severe winter storm is the 100-year flood plain. At risk residential infrastructure are summarized in Section 4.4.1.1. Generally, losses resulting from flooding associated with severe winter storms should be less than the total loss associated with a flood. However, some flooding could be associated with ice jams (discussed in Section 4.4.1.3) that could cause flooding. Infrastructure at risk would include roadways that could be damaged due to the application of salt and intermittent freezing and warming conditions which can damage roads over time.

Additional Data and Next Steps

Although event data is available for a period of over 10 years (1993 to June 2005), location-specific data for these specific events has not been tracked and correlation to specific infrastructure and inventory areas is not possible because winter storms can impact any portion of the study area. Based on currently available data, modeling of future losses would only be possible for total losses and would have a large margin of uncertainty given the currently available data. However, the exposure assessment discussed above identifies vulnerable populations and infrastructure of particular concern for this hazard. Conservative estimates of potential losses based on percent of damage assumptions were possible and are provided in the tables in this section.

Because historic data on losses were not specific, a percent of damage method was used to assess ranges of potential damage and their impact to general building stock. 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). Such methodology could also be applied to critical facilities and infrastructure as additional data on facilities and structures of concern are identified. In addition, detailed recording of property and infrastructure damage would support future modeling of potential losses.

Overall Vulnerability Assessment

Severe winter storm (snow) events are common in the study area, often causing relatively significant impacts and losses to Delaware County and the municipalities' roads, structures, facilities, utilities, and population in the county and in surrounding counties. Existing and future mitigation efforts will continue to be developed and employed that will enable the study area to be prepared for these events when they occur. The secondary affects of severe winter storms including utility losses and transportation accidents are included and the losses associated with these hazards are discussed separately. Particular areas of vulnerability include low-income and elderly populations, trailer homes, and infrastructure such as roadways and utilities that can be damaged by such storms.

4.4.1.5 Extreme Temperature

Extreme temperatures generally occur for a short-term period but can cause a range of impacts, particularly health impacts on vulnerable populations that may not have access to adequate cooling or heating. In addition, extreme weather conditions can cause impacts to agriculture (crops and animals) that can impact the economy. Finally, extreme cold or heat can impact infrastructure (for example, through pipe bursts associated with freezing). In the Delaware County area, extreme cold events are more common than extreme heat events, though both can occur.

Data Collected and Used

Data used to assess the extreme temperature hazard include data available from NOAA NCDC, professional knowledge, data provided by the town of Clay, and available data from FEMA.

Exposure and Loss Estimation

Records indicate that from 1995 through June 2005, 15 extreme weather events were recorded for Delaware County and surrounding areas. Of these, 13 events involved extreme cold or extreme wind-chill events. One involved excessive heat. One involved a record temperature event (heat) in January 2005, but not an "extreme temperature" event. These events and associated damages, injuries and deaths are summarized in Table 4-4-53.

Table 4-4-53. Extreme Temperature Events in Delaware County and Surrounding Area (1995 to June 2005)

Extreme Temp. Events	Year	Recorded Damages (Property)	Comments
1	1995	$0	A record heat event occurred area-wide in January 1995. This was not actually an "extreme temperature" event but a record high temperature for the winter season. The maximum temperature reached was 67 degrees Fahrenheit on January 15.
4	1996	$0	Four extreme cold events were record ranging from January to October 1996. No health, property, or crop damages were reported in the NCDC database in association with these events.
1	1997	$0	One extreme wind chill event was recorded, with no property, crop, or health impacts.
1	2000	$0	One extreme cold event was recorded in September 2000, with no associated damages.
1	2001	$0	One excessive heat event was noted for August, with days of high heat and temperatures at around 100 degrees Fahrenheit. No damages or health impacts were reported.
1	2002	$63,000	One extreme cold event was record with property damages of $63,000; a cold front in May; associated snow and caused tree limbs and wires to come down. Stamford and Delaware County were hardest hit by power outages (property damage).
0	2003	$0	No extreme events noted.
2	2004	$400,000	The NCDC NOAA database lists two extreme cold/wind chill events with high winds including winds up to 25 miles per hour. These occurred wind chill temperatures reached 20 to 40 below 0 Fahrenheit. Scattered pipe freezing was noted at residences and businesses in the counties impacted.
4	2005	$0	Four extreme cold/wind chill events were recorded with no property or health impacts recorded. These events occurred in January 2005.
8	9 yrs.	$44,444/yr.	Reflects the average loss per year for a large-scale area, including Delaware County, based on the reported damages listed in the NOAA NCDC database.

Notes: Recorded losses indicate the values shown on the web site for Delaware and other surrounding counties impacted. Source: NOAA NCDC Storm Event Database (NOAA NCDC, 2005).

The table above illustrates that extreme cold events are more common than extreme heat events in the period for which data are available.

The entire area of the Delaware County is exposed to this hazard. Populations at particular risk to extreme cold and heat events can include the elderly, who are less able to withstand temperature extremes, and low-income persons, which can not afford proper heating or cooling. Table 4-4-54 summarizes the population over the age of 65 and living in households with an income below $20,000 per year. Figures showing the distribution of these populations have been included with the winter storm (snow) event hazard.

Table 4-4-54. Total and Vulnerable Populations Exposed to Extreme Temperature Events in Delaware County

Town (Villages within Town Border)	Population (2000)	Pop. Over 65 / % of Total	Population in Households Income <$20k/yr. / % of Total
Andes	1,356	293 / 22	148 / 11
Bovina	664	145 / 22	41 / 6
Colchester	2,042	468 / 23	235 / 12
Davenport	2,774	387 / 14	258 / 9
Delhi (Village of Delhi)	4,629	825 / 18	359 / 8
Deposit (Village of Deposit)	1,687	293 / 17	232 / 14
Franklin (Village of Franklin)	2,621	431 / 16	197 / 8
Hamden	1,280	231 / 18	108 / 8
Hancock (Village of Hancock)	3,449	652 / 19	408 / 12
Harpersfield	1,603	400 / 25	147 / 9
Kortright	1,633	252 / 15	146 / 9
Masonville	1,405	191 / 14	122 / 9
Meredith	1,588	212 / 13	139 / 9
Middletown (Villages of Margaretville and Fleischman's)	4,051	973 / 24	480 / 12
Roxbury	2,509	492 / 20	275 / 11
Sidney (Village of Sidney)	6,109	1,157 / 19	713 / 12
Stamford (Villages of Hobart and Stamford)	1,943	335 / 17	205 / 11
Tompkins	1,105	186 / 17	104 / 9
Walton (Village of Walton)	5,607	1,005 / 18	743 / 13
Study Area	48,055	8,928 / 19	5,060 / 11

All of the building stock in Delaware County is exposed to the extreme temperature hazard. Based on available data it appears that extreme cold and extreme cold/wind chill events are more common than extreme heat events. Extreme cold events can damage buildings through freezing/bursting pipes and freeze/thaw cycles. Approximately $400,000 of damage from extreme cold/wind chill events is recorded for Delaware County and surrounding areas between 1996 and 2005. Due to a lack of data regarding past losses and the limited period for which data are available (1996 through 2005), it not possible to model or estimate potential future losses related to extreme low temperatures in a quantitative manner at this time. However, as shown in Table 4-4-53, the average property damage for the period associated with extreme temperatures was $44,000/year for Delaware County and surrounding areas.

Farmland and agricultural activity in Delaware County could be impacted by Extreme Temperatures. Table 4-4-44 under the flood hazard shows the total farmland, pasture land and crop land for each town and for the county as a whole. In total, 116,261 acres of pastureland, 19,399 acres of row crop land and

136,660 total acres of agricultural land (farmland and row crops) are exposed to extreme heat impacts. While, extreme heat events can result in drought and dry conditions that are conducive to fires if they occur over a prolonged period of time. However, such conditions are not anticipated to occur frequently in Delaware County, on its northern location and the available data for the area. However, due to the significant agricultural activities in the area, drought is considered a significant concern and is included as a separate hazard (See Section 4.4.10).

Due to a lack of data regarding past losses specific to Delaware County or its municipalities and the limited period for which data are available (1996 through 2005), it not possible to model or estimate potential future losses related to extreme high temperature events in a quantitative manner at this time. Given that no injuries or deaths have been reported in association with these events and limited property damage has been reported, it appears that current mitigation measures are adequate for this hazard. Existing citizen education and shelter provision for potentially impacted populations will remain relevant.

Additional Data and Next Steps

Extreme temperature data appears to be somewhat limited for Delaware County and surrounding area. Although daily high and low temperatures are tracked by NOAA and other agencies, it appears that events qualifying as extreme are relatively rare in the area and when they do occur they do not extend for periods of time that would cause droughts or other major impacts. The drought hazard is considered separately in Section 4.4.10 based on the importance of agriculture in the County.

Delaware County will track data on future extreme temperature events and obtain any additional County- and jurisdiction-specific information on past and future events, particularly in terms of any injuries, deaths, shelter needs, pipe freeze or other building damage. This will help to identify any concerns or trends for which mitigation measures should be developed or refined. In time, quantitative modeling of estimated extreme heat/cold events may be feasible as data is gathered and improved.

Overall Vulnerability Assessment

Overall, this hazard is considered to have potential impacts including injury, death and property damage. Such events appear to be relatively rare (extreme high temperature) to relatively frequent (extreme cold /wind chill events). Extreme temperature events are considered to occur regularly. The overall ranking for this hazard, tied to the vulnerability of the County and its jurisdictions to this hazard and past and expected damage/loss is moderate.

4.4.1.6 Severe Winter Storm (ice)

Severe winter storm (ice) of significant concern to Delaware County and the participating municipalities due to the frequency and magnitude of these events in the region, the direct and indirect costs, delays, and impacts on the people and facilities of the region related to snow and ice removal, health problems, cascade effects such as utility failure, flooding from ice jams, and stress on community resources.

Data Collected and Used

National weather databases (NOAA NCDC, Binghamton NWS), Delaware County, and jurisdictional data were collected, analyzed, and sorted. Severe winter storm (ice) events were considered as an independent hazard based on the significance of this hazard in Delaware County through potential impacts, regular occurrence, and cascade impacts (utility failures, transportation accidents and property damage). Available data was used to support an evaluation of exposures to this hazard.

Exposure and Loss Estimation

Snowfall and ice, coupled with low temperatures, often result in increases in traffic accidents, disruptions in transportation, commerce, government, and education, utility outages due to falling trees, branches, and other objects, personal injuries associated with slippery surfaces and freezing temperatures, and numerous other problems. Specific damages associated with severe ice storms in the study area include the following primary concerns:

- Injuries, including fatalities, associated with accidents, low temperatures, power loss, and falling objects caused by frozen and slippery surfaces
- Increases in the frequency and impact of traffic accidents, which result in personal injuries, taxing of public safety
- Ice-related damage to trees, building and infrastructure inventory, and utilities (power lines, bridges, substations, etc.)
- Ice jams that cause traffic problems on waterways and flooding
- Roads damaged through freeze and thaw processes
- Stress on the local shelters and emergency response infrastructure
- Lost productivity that occurs when people cannot go to work, school, or stores due to inclement conditions
- Well freezing that can prevent citizens from accessing their water supply

Some minimum damage is anticipated annually, with extensive damage every 10 years (HAZNY ranking descriptor of “infrequent” event). Table 4-4-55 shows severe winter storm (ice) events recorded in the NCDC database for the years 1950 to 2005.

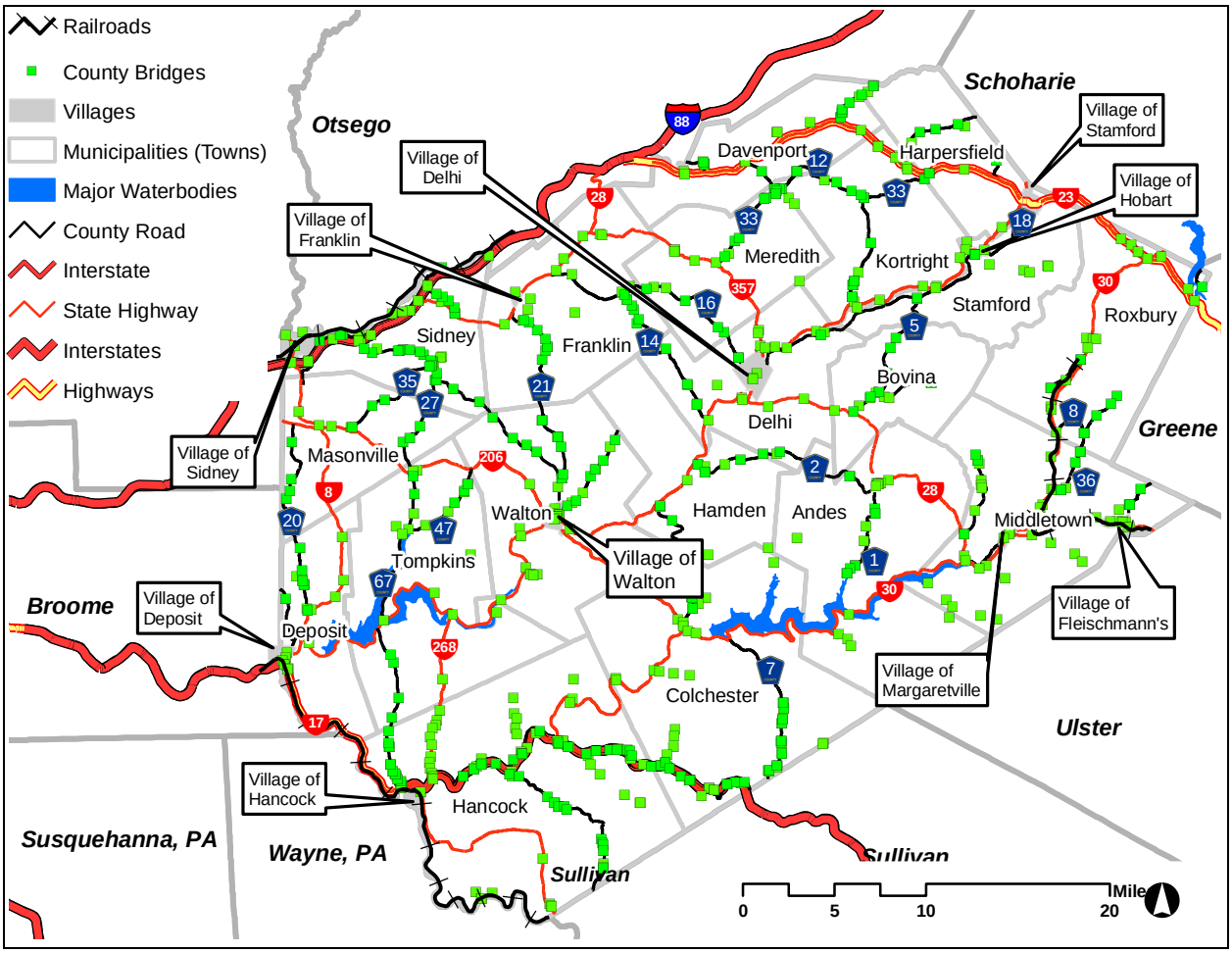
Table 4-4-55. Severe Winter Storm (Ice) Events Impacting Delaware County (1950 to June 2005)

. Events	Year	Recorded Damages (Property)	Comments
0	1993	$0M	No ice events documented.
6	1994	$2M	Six events in 1994 were recorded as snow/sleet, freezing rain, or snow/freezing rain in 1994, with associated property damages of approximately $2M.
6	1995	$0.8M	Six events in 1995 were recorded as snow/freezing rain or snow/sleet/freezing rain.
0	1996 - 1997	$0M	No incidents were recorded.
1	1998	$0M	No property damage was recorded in association with one ice storm noted in January 1998. It is feasible that unrecorded impacts occurred.
1	1999	$0M	No property damage was recorded in association with one ice storm noted in January 1999. It is feasible that unrecorded impacts occurred.
1	2000	$0M	No property damage was recorded in association with one ice storm noted in February 2000. It is feasible that unrecorded impacts occurred.
2	2001	$0M	No property damage was recorded in association with these events. It is feasible that unrecorded impacts occurred.
2	2002	$0.1	Two events each with minor property damage were recorded in 2002 (one in February and one in March).
2	2003	$1.1	Two ice storms with property damage were reported in 2003. The storm in January incurred $1.1 million in damages; around 15,000 customers lost power and ice caused trees and wires to come down; ice remained a problem for 3 days.
0	2004-2005	$0M	No major ice or freezing rain/sleet events noted.
18	13 Years	$4.0M or $0.3M/yr.	Total property damages associated with the above events.

Notes: Recorded losses indicate the values shown on the web site for Delaware and other surrounding counties impacted. Source: NOAA NCDC Storm Event Database (NOAA NCDC, 2005).

The climate of Delaware County is such that no areas are immune to the potential damaging effects of severe winter storms and ice storms. While data are available for evaluation of ice storm events since 1993, assessment of risks associated with ice storms requires correlation with inventory data to determine facilities and resources at particular risk of damage from ice storms, including most above-ground infrastructure, such as overhead electric and telephone lines, electrical substations, and bridges, which freeze more quickly than other areas in freezing temperatures. Figure 4-4-10 shows roadways susceptible to the severe storm (ice) hazard.

Figure 4-4-10. Roadways Susceptible to Severe Storm (Ice) Hazard in Delaware County



Source: HAZUS-MH (FEMA 2005) and Local Data

Information on ice-related traffic concerns and incidents will be included in the revised plan, as it is received from Delaware County or other representatives supporting plan development.

Historic information is sufficient from the NCDC to perform rather crude estimates of the frequency of ice storms in Delaware County. Because data on ice storm events is only readily available from NCDC for the years since 1993, only a relative few ice storms of note have occurred during said period, and reported damages range from $0 to more than $1 million and deaths and injuries vary as well, the statistical power of a test to predict storm occurrence and associated losses would be low. In addition, data acquired to this point is insufficient to predict specific structure or areas of vulnerability at the jurisdiction or County level. Based on available data, it is reasonable to assume that several ice storm events of varying severity will occur "infrequently" in Delaware County (defined in HAZNY as occurring once every 8 to 50 years.

The entire area of Delaware County is vulnerable to this hazard. The range of monetary costs associated with ice storm events since 1993 ranges from a low of $0 to a high of $1.1 million for one event. No injuries or fatalities attributable to ice storm events have been reported during this period. However, it is reasonable to assume that the frequencies and hazards of ice storms are sufficient to suggest that injuries and, in some instances, deaths, can occur in association with downed power lines, power outages, and traffic incidents related to ice on roads.

All populations are exposed to the ice storm hazard. Populations considered to be most vulnerable to such events are those that live in poverty or quality as elderly. This vulnerability is determined 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. Table 4-4-56, based on HAZUS-MH data, summarizes the total population exposed to this hazard as well as those over the age of 65 and living in households with an annual income below the poverty line (household income of $20,000 per year), as defined by the U.S. Census Bureau.

Table 4-4-56. Populations Exposed to Severe Winter Storm (Ice) in Delaware County Study Area

Town (Villages within Town Border)	Population (2000)	Pop. Over 65 / % of Total	Population in Households Income <$20k/yr. / % of Total
Andes	1,356	293 / 22	148 / 11
Bovina	664	145 / 22	41 / 6
Colchester	2,042	468 / 23	235 / 12
Davenport	2,774	387 / 14	258 / 9
Delhi (Village of Delhi)	4,629	825 / 18	359 / 8
Deposit (Village of Deposit)	1,687	293 / 17	232 / 14
Franklin (Village of Franklin)	2,621	431 / 16	197 / 8
Hamden	1,280	231 / 18	108 / 8
Hancock (Village of Hancock)	3,449	652 / 19	408 / 12
Harpersfield	1,603	400 / 25	147 / 9
Kortright	1,633	252 / 15	146 / 9
Masonville	1,405	191 / 14	122 / 9
Meredith	1,588	212 / 13	139 / 9
Middletown (Villages of Margaretville and Fleischman's)	4,051	973 / 24	480 / 12
Roxbury	2,509	492 / 20	275 / 11
Sidney (Village of Sidney)	6,109	1,157 / 19	713 / 12
Stamford (Villages of Hobart and Stamford)	1,943	335 / 17	205 / 11
Tompkins	1,105	186 / 17	104 / 9
Walton (Village of Walton)	5,607	1,005 / 18	743 / 13
Study Area	48,055	8,928 / 19	5,060 / 11

The entire inventory in the Delaware County Multi-Jurisdictional Study Area is vulnerable to a severe winter storm (snow). Table 4-4-57 identifies the building count and valuation of this inventory as well as the losses that would result from 1%, 5%, and 10% damage to this inventory as a result of a severe winter storm (snow).

Table 4-4-57. Inventory of General Building Structural Exposure for Delaware County Multi-Jurisdictional Study Area

Building Occupancy Class	Number of Buildings	Total Value	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Residential	21,761	$2.9 billion	$29 million	$145.0 million	$290.0 million
Commercial	127	$0.3 billion	$3.0 million	$15.0 million	$30.0 million
Industrial	16	$0.1 billion	$1.0 million	$ 5.0 million	$10.0 million
Total	21,928	$3.3 billion	$33 million	$165 million	$330.0 million

Note: The building values shown do not include building contents; for the severe winter storm (snow) hazard, damage will generally impact structures such as the roof (roof collapse).

Historic data indicates losses of approximately $0.5 million dollars per year ($23.3 million between 1950 and June 2005) and as high as $6 million have occurred in Delaware and surrounding counties in the past; $6 million is significantly less than the 1 percent damage loss estimated above for property damage. Therefore, the loss estimates of 1, 5 and 10 percent can be considered conservative estimates of anticipated future damage. An assessment on damage to critical infrastructure cannot be made due to the lack of readily available data on past impacts. However, historical data such as the damage and repair to roadways and power outages to critical facilities have been documented in the past.

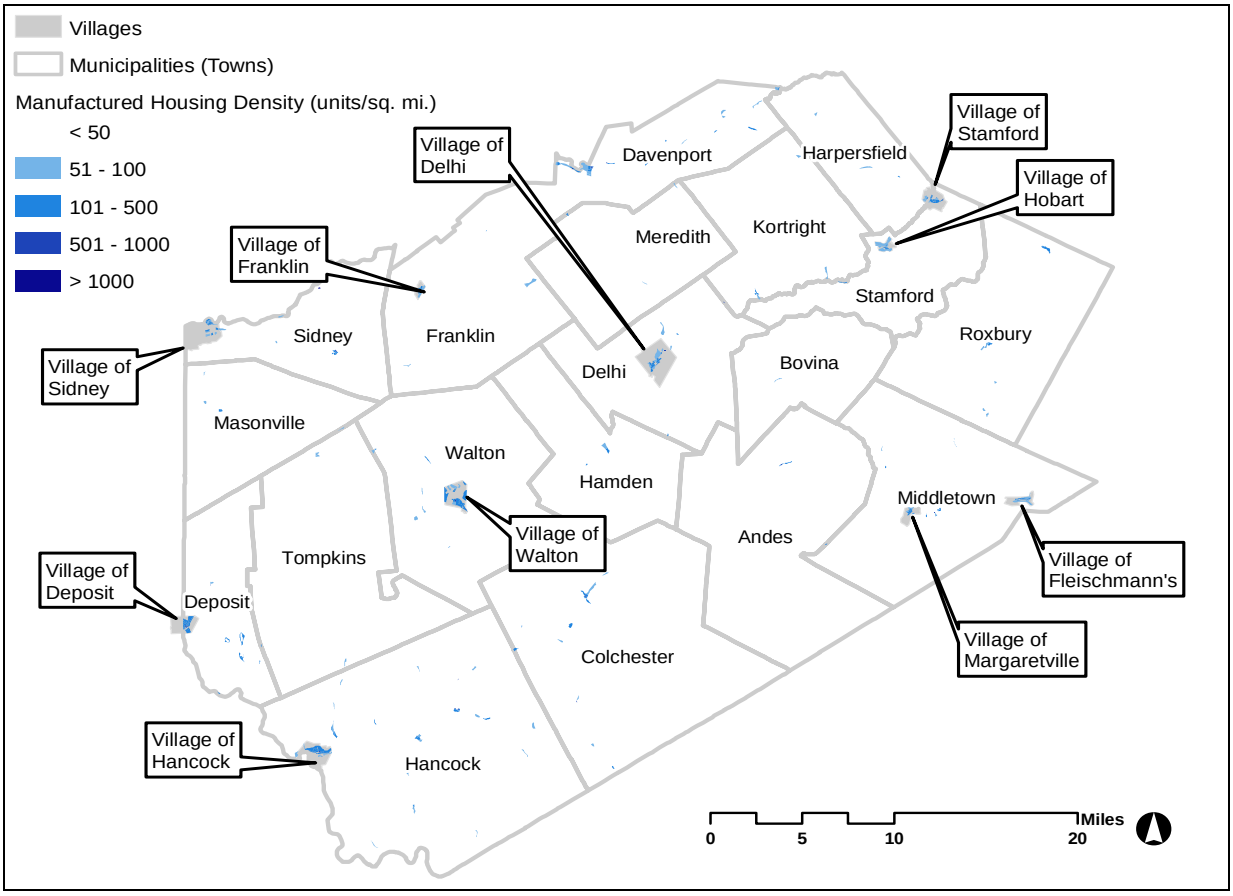
Manufactured homes are particularly vulnerable to severe winter storms. Figure 4-4-11 shows the distribution of these types of homes in the Tompkins County multi-jurisdictional study area and Table 4-4-58 summarizes this data and estimates the loss estimate if 5% and 10% damage accrues to these homes.

Table 4-4-58. Manufactured Homes Exposed in Delaware County Study Area

Town	Total Residential Structures	Total # Manufactured Homes	% of Total Residential Structures	Total Value Manufactured Homes	5% Damage Loss Estimate	10% Damage Loss Estimate
Study Area	21,761	4,599	21%	$232.3M	$11.6M	$23.2M

Note: The building values shown do not include building contents. Average value Manufactured Home estimated to be $50,509. Generally, for the winter storm hazard, the structural components of buildings are anticipated to be most impacted. Source: HAZUS-MH (FEMA 2004).

Figure 4-4-11. Manufactured Homes in Delaware County



In regards to critical facilities, valuation data is available for police stations and hospitals. Because these structures are largely constructed of concrete and masonry, it is anticipated that they should suffer only minimal structural damage from snow storms. Wastewater treatment plants should not be unduly impacted by ice events, but also can suffer temporary power losses (similar to other facilities). Because power interruption can occur, backup power is recommended if a complete avoidance of power interruption is required for a particular critical or infrastructure facility.

Another area that is vulnerable for a severe winter storm is the 100-year flood plain. At risk residential infrastructure are summarized in Section 4.4.1.1. Generally, losses resulting from flooding associated with severe winter storms should be less than the total loss associated with a flood. However, some flooding could be associated with ice jams (discussed in Section 4.4.1.3) that could cause flooding. Infrastructure at risk would include roadways that could be damaged due to the application of salt and intermittent freezing and warming conditions which can damage roads over time.

Additional Data and Next Steps

Although event data is available for a period of over 10 years (1993 to June 2005), location-specific data for these specific events has not been tracked and correlation to specific infrastructure and inventory areas

is not possible because winter storms can impact any portion of the study area. Based on currently available data, modeling of future losses would only be possible for total losses and would have a large margin of uncertainty given the currently available data. However, the exposure assessment discussed above identifies vulnerable populations and infrastructure of particular concern for this hazard. Conservative estimates of potential losses based on percent of damage assumptions were possible and are provided in the tables in this section.

Because historic data on losses were not specific, a percent of damage method was used to assess ranges of potential damage and their impact to general building stock. 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). Such methodology could also be applied to critical facilities and infrastructure as additional data on facilities and structures of concern are identified. In addition, detailed recording of property and infrastructure damage would support future modeling of potential losses.

Overall Vulnerability Assessment

Severe winter storm (ice) events occur infrequently in the study area (HAZNY assessment, between once every 8 years to once every 50 years). Such events can cause impacts and losses to municipal roads, structures, facilities, utilities, and the population. Existing and future mitigation efforts should continue to be developed and refined to enable the study area to be prepared for these events when they occur. The secondary affects of severe winter storms (ice) including utility losses and transportation accidents can cause significant business interruption, property damage, private well freezing (water supply issues) and health impacts. Particular areas of vulnerability include low-income and elderly populations, trailer homes, and infrastructure such as roadways and utilities that can be damaged by such storms. The overall ranking of this hazard assigned by the planning group based on available data and professional judgment is moderate.

4.4.1.7 Infestation (Agricultural and Disease-Carrying Insects)

This section presents available data and potential loss information for the infestation hazard. NYS has been impacted by various infestations, including but not limited to, high populations of mosquitoes (increasing the risk of West Nile Virus (WNV) and other diseases that can be transmitted to animals and humans); deer ticks (presenting the risk of Lyme disease for animals and humans); Asian Longhorned Beetles (ALB) (a non-native insect threat to forest ecosystems); Khapra Beetles (a foreign insect considered to be most destructive to grain products and seeds); and Hemlock Woolly Adelgid (a fluid-feeding insect that destroys Hemlock Trees in eastern North America). Mosquitoes and deer ticks are the primary infestation concerns within the state and Delaware County based on their potential impacts to animal populations and human populations and documented prevalence. The Delaware County HAZNY analysis further identified the infestation hazard based on agricultural losses experienced due to infestations of army worms and moths.

Data Collected and Used

Hazard data was obtained from the planning group, HAZNY effort, and New York State Department of Health (NYSDOH), U.S. Geological Survey, FEMA, Federal Centers for Disease Control (CDC) web sites, and the County Health Department. Given the prevalence of WNV in New York, the NYSDOH has developed WNV Response Plans that are available at its web site. These sites indicate that the WVW is present in the area of the Delaware County.

Data regarding identified cases of WNV in NYS are posted on its website and summarized below. With respect to the probability of future infestation hazard events, the HAZNY report categorizes the potential frequency as a "regular event." The ground rules for the program quantify this descriptor as an event that occurs between once a year and once every 7 years.

Exposure and Loss Estimation

Available information on areas at risk and past occurrences of WNV in Delaware County are presented below. Table 4-4-59 presents documentation from state web sites for the years 2004 for Onondaga County in relation to the west Nile Virus.

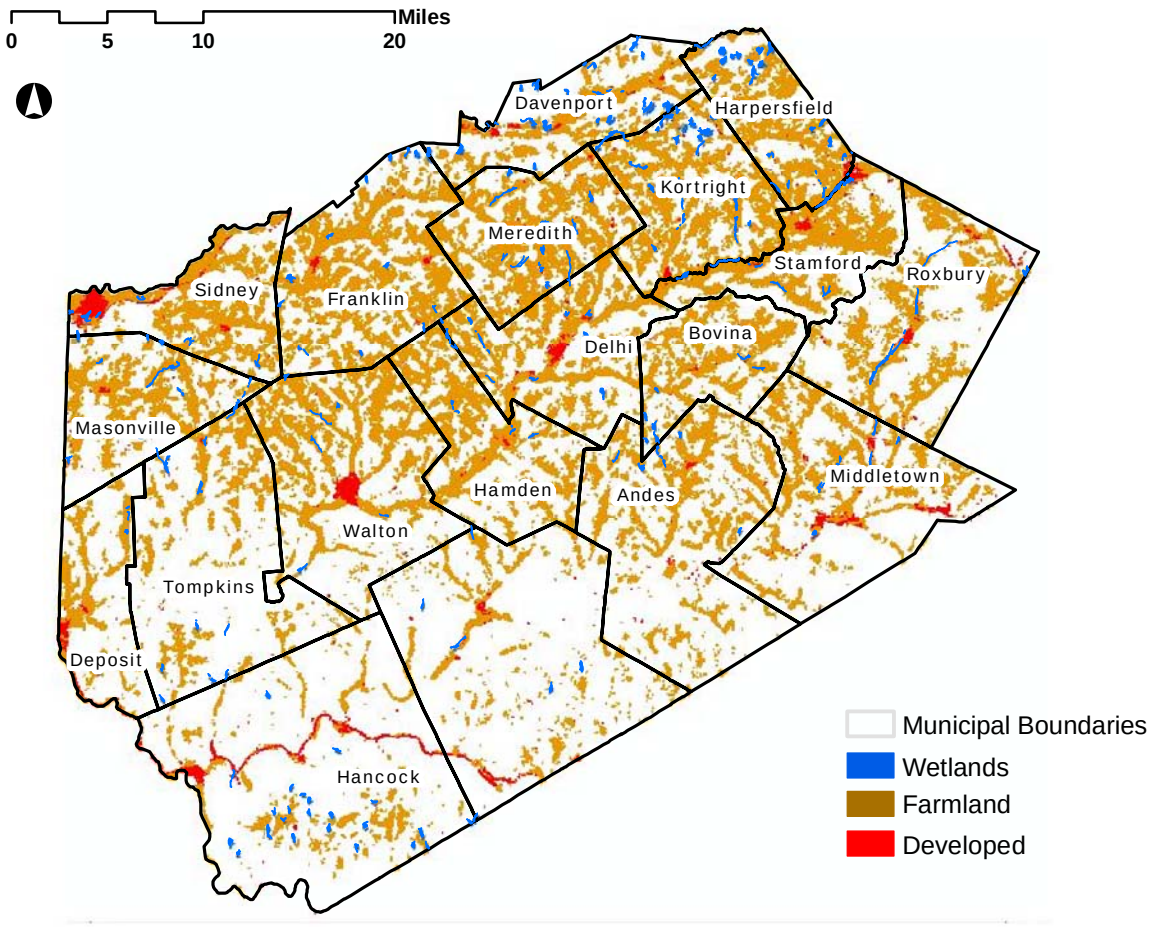
Table 4-4-59. WNV Documentation for NYS and Delaware County (2000 to 2005)

Year	WNV Positive Results for New York (State/ Delaware County)				
	Birds	Horses	Mosquito Pools	Humans	Others
2000	1263 / 4	28 / 0	400 / 0	14 (Not listed) / 0	5 / 0
2001	732 / 0	22 / 0	316 / 0	15(2) / 0	0 / 0
2002	1,410 / 9	36 / 0	445 / 0	83(5) / 0	2 / 0
2003	1,367 / 8	32 / 0	471 / 0	71(1) / 0	3 / 0
2004	207 / 0	5 / 0	238 / 0	10 / 0	1 / 0
2005	14 / 0	0 / 0	0 / 0	0 / 0	0 / 0

Notes: Data obtained from http://www.health.state.ny.us/nysdoh/westnile/ on the NYDOH web site. Data available for the years 2000 through 2005. Data indicate the presence of the virus in specimens analyzed; they do not necessarily indicate ill or symptomatic specifies. Numbers in parentheses for humans indicate deaths.

Evidence of the risk associated by this hazard is indicated by an Emergency Declaration for WNV issued by FEMA (EM-3155) in October 2000. This amendment to an earlier declaration for selected counties declared all NYS counties eligible for Public Assistance, Category B(Emergency Protective Measures) based on WNV impacts in 2000. Areas at risk include those areas including, and around swamps and ponds, as shown in Figure 4-4-12.

Figure 4-4-12: Mosquito Hazard Areas in Delaware County Study Area



Specific areas of concern are located in areas where wetlands and urbanized areas are contiguous. Such areas include portions of the Villages and Hamlets of Margaretville, Roxbury, Stamford, Sidney, Trout Creek, Bovina, and Davenport Center [Delaware County to provide additional areas where mosquitoes are considered a problem]. In addition, Tetra Tech has requested information from Delaware County and its municipalities regarding specific concerns and past losses. This data will be included in future iterations of the plan.

Persons at risk could include those with lower resistance to diseases, particularly the elderly and children. If the Delaware County personnel concur with this approach, Tetra Tech will present data on the elderly population and children as the population at risk. If better data on specific populations at risk area available, Tetra Tech will based its vulnerability analysis on the best available data. Tetra Tech can prepare data on the population of children and elderly using the data contained in HAZUS-MH (2000 Census data).

Additional Data and Next Steps

See text above for requested information. In addition, Delaware County will work with County, State, and Federal health officials to track statistics on future occurrences of disease and implement best and appropriate mitigation measures to address the potential for future infestations and impacts.

Overall Vulnerability Assessment

The preliminary ranking for this hazard is assessed as moderate**.** The overall vulnerability assessment will be presented after the risk assessment for this hazard is complete.

4.4.1.8 Wildfire

Urban fire is a concern wherever concentrations of population and buildings are present. The effects of urban fire can be significant, but are generally localized to one or two city blocks. Given the rural nature of Delaware County and established fire protection for urban areas, the planning group determined to focus on the wildfire hazard for this mitigation planning effort.

Wildfire hazards can impact a greater area. In Delaware County and its municipalities, seasonal rainfall is generally adequate to prevent wildfire and areas of development in the County generally are not located in wildfire hazard areas or in proximity to them. However, increasing and planned development may increase the wildfire hazard in particular municipalities within the study area.

Data Collected and Used

Data available regarding the fire hazard included input from town and county officials, the American Red Cross (ARC), NOAA's NCDC databases, the National Interagency Coordination Center (Intelligence-Predictive Services Section, and the HAZNY documentation for this area.

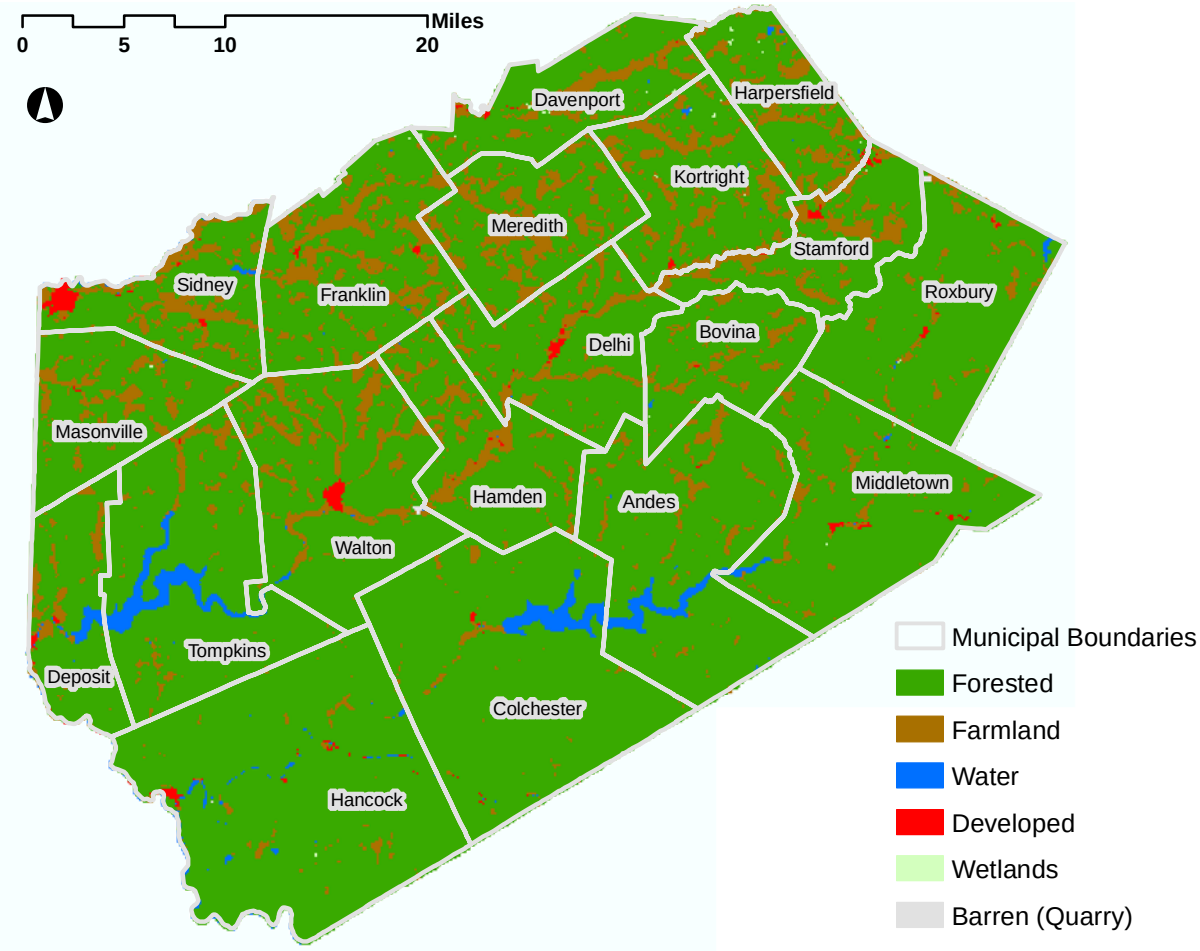
Exposure and Loss Estimation

NOAA's NCDC maintains records of wildland and forest fire events for the period since 1950. According to the NCDC website, no significant wildfires were reported for Delaware County from 1950 through June 2005.

The climate of Delaware County is not conducive to large-scale drought and dry climate vegetation that are primary causes of the massive and highly destructive wildfires that occur periodically in the Western United States. If a wildland fire would occur, a potential concern in some areas of Delaware County and its municipalities would be the availability of fire suppression equipment and infrastructure (e.g., fire hydrants and water sources) to rural populations.

Figure 4-4-13 shows forested land that would provide the fuel for a wildland fire should one begin in a forested area. The area indicated as farmland could result crop fires under extremely dry conditions.

Figure 4-4-13. Land Cover Related to Wildfire Hazard for Delaware County



For the revised plan, Tetra Tech will include areas of development/farmland and forest interface that could be subject to a wildfire risk. Tetra Tech requests input from community planners on such concerns or information regarding new development that may be located in forested areas or in areas where fire suppression equipment is not yet present; this indicates areas where mitigation effort for wildfire, as well as future urban fire concerns, may be warranted.

Additional Data and Next Steps

Data regarding the construction characteristics of structures in the study area, such as primary building materials used (e.g., wood vs. brick, fire detection equipment, age, etc.), proximity to forested areas, and availability of fire suppression infrastructure should be identified for further evaluation. Due to insufficient data, a full loss estimate was not completed for the fire hazard. Based on all of the readily available information, all structures in Delaware County are at some risk of being destroyed or seriously damaged by a fire.

For the revised plan, Tetra Tech also will consider potential wildfire concerns to critical facilities based on type of construction, location and the ability of populations to mobilize to escape a fire.

The FEMA fuel model maps do not provide sufficient information to refine the exposure assessment conducted above or to locate the urban-wildfire interface areas. Additionally, wildfire maps were not readily available and will be required to identify the geographic locations where wildfires have taken place in the past and areas prone to wildfires.

Overall Assessment

Buildings constructed of wood are generally more likely to be impacted by buildings constructed with bricks or concrete. While it is not possible to predict when and where a fire will start, the local fire departments area generally, well-equipped and prepared to respond to fires as they arise. Large-scale wildfires are considered unlikely to occur in the area due to the amount of moisture stored in the vegetation and the amount of precipitation that the area receives annually. The status of fire risk in the county and municipalities will continue to be monitored and ongoing and new mitigation efforts to prevent fires and control them when they arise will continue to be developed. The overall risk assessed for this hazard is moderate.

4.4.1.9 Agricultural Epidemic

The decision to include agricultural epidemic as a hazard was based on the perceived vulnerability of the Delaware County economy to the outbreak of an epidemic that would negatively impact agricultural resources. Assets vulnerable to the agricultural epidemic hazard center around animal populations that might be exposed or vulnerable to various outbreaks and the humans that depend on local agriculture for livelihood and sustenance. Recent outbreaks of mad cow disease and other afflictions of livestock and animal populations (including the WNV) have resulted in increased concern for the potential impacts from outbreak to the economic and social health of Delaware County. Although not impacting animals or humans, certain crop-based viruses could also negatively impact the economy of Delaware County.

Data Collected and Used

Data used to support the analysis of this hazard was obtained form the U.S. Department of Agriculture (USDA), the NYS Agricultural Statistics Service, and Delaware County resources.

Exposure and Loss Estimation

To date, Delaware County has not recorded past events of major epidemics impacting crops or livestock. However, agricultural epidemic was identified as a hazard of concern based on local conditions and increased awareness and potential future impacts perceived in relation to this hazard. Therefore, this hazard is included as a hazard under the requirements of DMA 2000.

Evaluation of risks associated with the agricultural epidemic hazard is limited to presentation of potentially exposed resources, including the number of persons, agricultural animals, and farmland within Delaware County and estimates of potential losses based on percentages of total assets at risk.

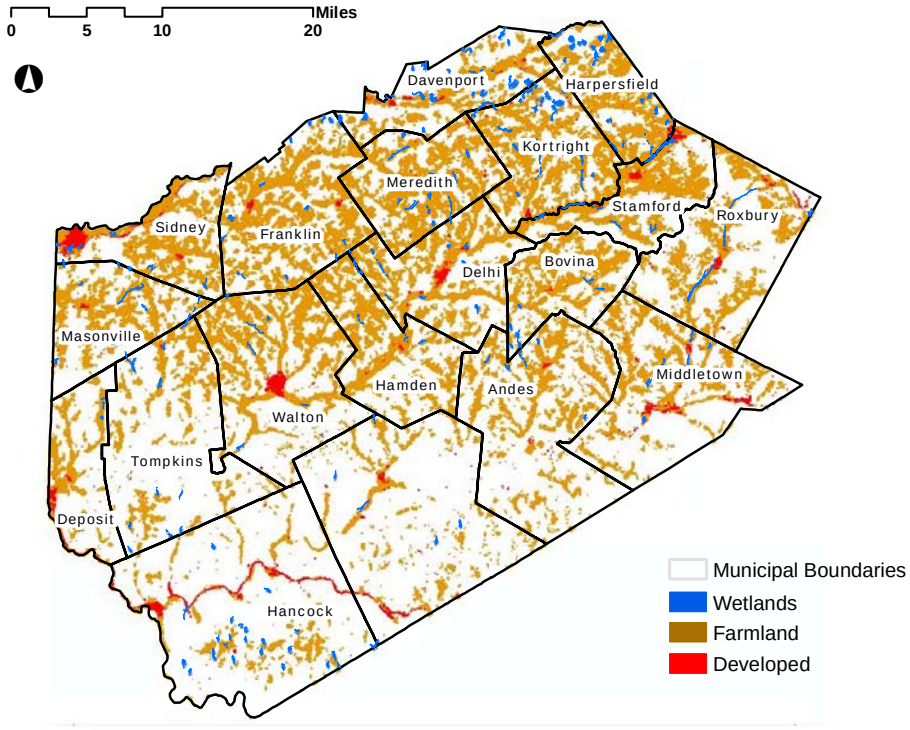
Because the type of disease or affliction is difficult to predict, it is assumed that all people, animals, and crops in Delaware County may be susceptible to some outbreak, although established disease control and prevention measures should be effective in preventing any outbreak from affecting the entire study area.

The potential exposure is based on current economic data related to agriculture in Delaware County. Available information is presented below and provides an overview of the type and amount of assets at risk.

- In 2003, there were 190,300 acres of farmland in Delaware County, comprising 21 percent of the County's total 925,679 acres. There are 780 farms in the County, averaging 244 acres per farm.
- Delaware County ranks 17th in the state for number of farms and 14th for land in farms (New York Agricultural Statistics Service (NASS), 2005).
- According the USDA NASS, the County was home to 35,818 cattle and calves, 967 hogs and 1,926 sheep in 2002.
- Delaware County is considered one of the top 10 counties in NYS for the distribution of beef products.
- Delaware County farmers harvested 8,215 acres of corn (silage and grain), 52 acres in sorghum (silage or greenchop), and 39 acres for potatoes. Acreage for oats, hay and soybeans were withheld from County data to avoid disclosing data for individual farms.
- In 2002, according to the Census of Agriculture, the market value of all agricultural products sold from Delaware County farms was $50.5 million, with total sales averaging $64,111 per farm. The leading products sold were dairy products, cattle and calves, nursery and greenhouse, hay and other crops and Christmas trees (NASS, 2005).

Figure 4-4-14 identifies the farmland areas within the study area that could be affected by an outbreak. The Delaware County Fair is held annually in Walton and this present an occasion at which agricultural epidemic outbreaks could occur (for example, a highly infectious vector).

Figure 4-4-14. Map of Farmland Exposure Area for Agricultural Epidemic in Delaware County Study Area



Essentially, all humans that reside in, or otherwise depend upon agriculture from, Delaware County, are potentially susceptible to the direct (e.g., lost livestock and crops, illness from consumption of infected food) and indirect (e.g., regional economic downturn) impacts associated with an agricultural epidemic. The nature and type of afflictions would vary between species and strains.

The County does not have data on agricultural infrastructure and HAZUS-MH includes limited information on agricultural facilities. Impacts to facilities associated with an epidemic (agriculture) hazard event are difficult to estimate. One can anticipate that costs associated with facilities would include decontamination of impacted areas, rather than destruction of buildings entirely.

Damages and losses that might accompany the epidemic (agricultural) hazard as related to human disease outbreak are primarily limited to effects on humans associated with treating or managing impacted animal populations. Human impacts are anticipated to be minor based on available data. Primary damages or losses associated with an outbreak or outbreaks could include economic losses associated with lost productivity; social losses associated with economic loss, disease, and fatality in the community; adverse impacts on animal hospitals and other animal health care facilities and staff; fear and anxiety associated with the outbreak; and costs to manage impacted crops and animals and decontaminate facilities.

Additional Data and Next Steps

Various algorithms have been developed to predict the spread of disease in large human and animal populations; however, modeling of outbreak occurrence and probability is not appropriate given the data currently available. To help predict and model future events, the planning group will work closely with USDA and local representatives to maintain current data on epidemic hazards, potential impacts and preventive measures (see also Section 5, mitigation strategies).

If value information was available for crops (for example, dollar per acre for various crops) and specific crop and cattle grazing acreages were up to date, an estimate of loss based on assumptions regarding the probability of impact could be made using the percentage loss assumptions discussed earlier and described in FEMA guidance. The planning group will discuss the feasibility and value of such data, weighed against the likelihood of this hazard compared to other hazard events. Such data could also support the evaluation of flood damage to crops and similar evaluations for other hazards that can impact crop and pasture lands.

Overall Vulnerability Assessment

Agricultural epidemics are not considered highly likely to affect large tracts or numbers of animals in the study area; however, the dependence of the local economy on agriculture is such that a major epidemic could have a major adverse impact on Delaware County and the participating municipalities. Infrastructure, building stock, and critical facilities are not likely to be affected by agricultural epidemic, although decontamination and disposal of impacted crops and animals could be costly if a major epidemic occurred. Mitigation activities in Section 5 focus on prevention and education of farmers.

4.4.10 Drought

Although Delaware County generally experiences hot temperatures during the summer months, creating dry conditions, drought events do not typically occur in Delaware County. However, this hazard is of concern based on the local agricultural economy and rural setting, with a large number of residents relying on private wells for water.

Data Collected and Used

Data was collected from FEMA, NOAA NCDC, County, and planning group sources.

Exposure and Loss Estimation

The NOAA NCDC Storm Event database identifies that multiple New York counties, including Delaware County, were impacted by a significant drought event in September 1999 which caused major crop failures and some wells to run dry. Many streams and rivers were also brought to their lowest recorded levels. The crops most affected were corn and hay, which caused many problems for dairy farmers. However, no other major drought events have been recorded for Delaware County. Table 4-4-60 summarized the NCDC data for droughts.

4-4-60. Drought Events for Delaware County and Surrounding Areas (1950 to June 2005)

. Events	Year	Recorded Damages (Property)	Comments
0	1950-1997	$0M	No events documented.
1	1998	$0M	December of 1998 was another very dry month across central New York, continuing a six month period of dry weather that began in early summer. Dry weather and associated drought conditions were most pronounced across the southern tier counties of the state. During December, much of the region received between 1.5 and 2.0 inches of liquid equivalent precipitation. This equates to about half the normal precipitation for the month. Precipitation deficits for the six month period between June and December were greatest over the western Catskills, where totals ran as much as 6 to 7 inches below normal. On the 14th, the Susquehanna River Basin Commission issued a drought watch for much of southern NYS within the Susquehanna and Chemung river basins. This watch called for voluntary water conservation. The watch remained in effect through the end of the month.
1	1999	$50M	A very dry spring and summer caused major crop failures and some wells to run dry. Many streams and rivers were also brought to their lowest recorded levels. The crops most affected were corn and hay, which dealt a major blow to dairy farmers. According to preliminary figures from the NYS Department of Agriculture and Markets, the worst drought damage was reported in Cayuga ($17.7 million), Steuben ($15.3 million) and Madison ($5.9 million) counties. September rains from the remnants of Hurricanes Dennis and Floyd helped to ease the summertime drought conditions although they came too late to help the vegetable and grain crops.
0	2000 - 2005	$0M	No events documents.
2	55 Years	$50.0M or <$1M/yr.	Total property damages associated with the above events; the overall impact shows a low frequency, high impact event over the last 55 years.

Notes: Recorded losses indicate the values shown on the web site for Delaware and other surrounding counties impacted. Source: NOAA NCDC Storm Event Database (NOAA NCDC, 2005).

If a drought would occur, agricultural land is most at risk in terms of economic damage. Table 4-61 shows farmland by town and for the county as a whole that would be exposed to the drought event.

Table 4-4-61. Estimated Flood Exposure for Farmland in Delaware County Study Area

Town	Pasture/Hay	Row Crops	Total Farmland
Andes	6,054	1,657	7,710
Bovina	4,115	752	4,867
Colchester	2,620	736	3,356
Davenport	5,191	282	5,473
Delhi	7,030	1,068	8,097
Deposit	2,971	526	3,496
Franklin	12,183	1,196	13,379
Hamden	6,819	1,431	8,250
Hancock	3,045	518	3,563
Harpersfield	6,088	938	7,026
Kortright	9,665	361	10,026
Masonville	5,182	1,149	6,331
Meredith	10,015	243	10,258
Middletown	4,389	1,879	6,268
Roxbury	4,876	1,866	6,742
Sidney	6,543	1,223	7,765
Stamford	5,785	1,089	6,874
Tompkins	3,971	1,185	5,157
Walton	9,721	1,300	11,021
County	**116,261**	**19,399**	**135,660**

Note: If the average production (dollar value) of crops could be identified on a per acre basis, loss estimates could be developed based on assumed percent damage that could result from a drought. This data will be provided in the final plan or will be developed to support future revisions to the plan.

Additional Data and Next Steps

Historic data available from federal sources indicate that drought has not directly impacted Delaware to a significant degree. However, based on the reliance on private wells and agriculture, future droughts could have a significant impact. Also, as the potential for warming associated with global warming is still being evaluated, one might expect that drought potential could increase in the future. For the revised plan, any additional information regarding localized or county-wide concerns and past impacts (for example, associated with the 1999 drought) will be collected and analyzed. It does not appear that the probability of future drought events can be predicted using currently available historical trend data. However, mitigation for this hazard is warranted although it is a low frequency hazard, because of its high probable impact on the local economy and water supply.

Overall Vulnerability Assessment

With respect to the probability of future drought hazard events, the HAZNY report resulted in a frequency description term of an “infrequent event” for drought. The ground rules for the program quantify this descriptor as an event that occurs between once every 8 years and once every 50 years (inclusive). Based on historical information found on the NOAA website it is estimated that Delaware County will continue to experience drought events on occasion, with the secondary effects causing potential disruption or damage to agricultural activities and creating shortages in water supply within communities. It is considered an infrequent, potentially high-impact hazard for this study area.

4.4.2 Technological Hazards

This section dresses the technological hazard, dam failure.

4.4.2.1 Dam Failure

The Delaware County study area includes a significant number of dams, including high hazard dams that can present the risk of dam breach and subsequent flash flooding. Fifty-six dams are documented in Delaware County. The two largest dams are the Downsville Dam and the Cannonsville Dam, which are associated with the two largest reservoirs in the County, Cannonsville and Pepacton. While a dam failure is a rare event, the impacts could be significant to the County and to NYC, which relies on the two major reservoirs for part of its water supply.

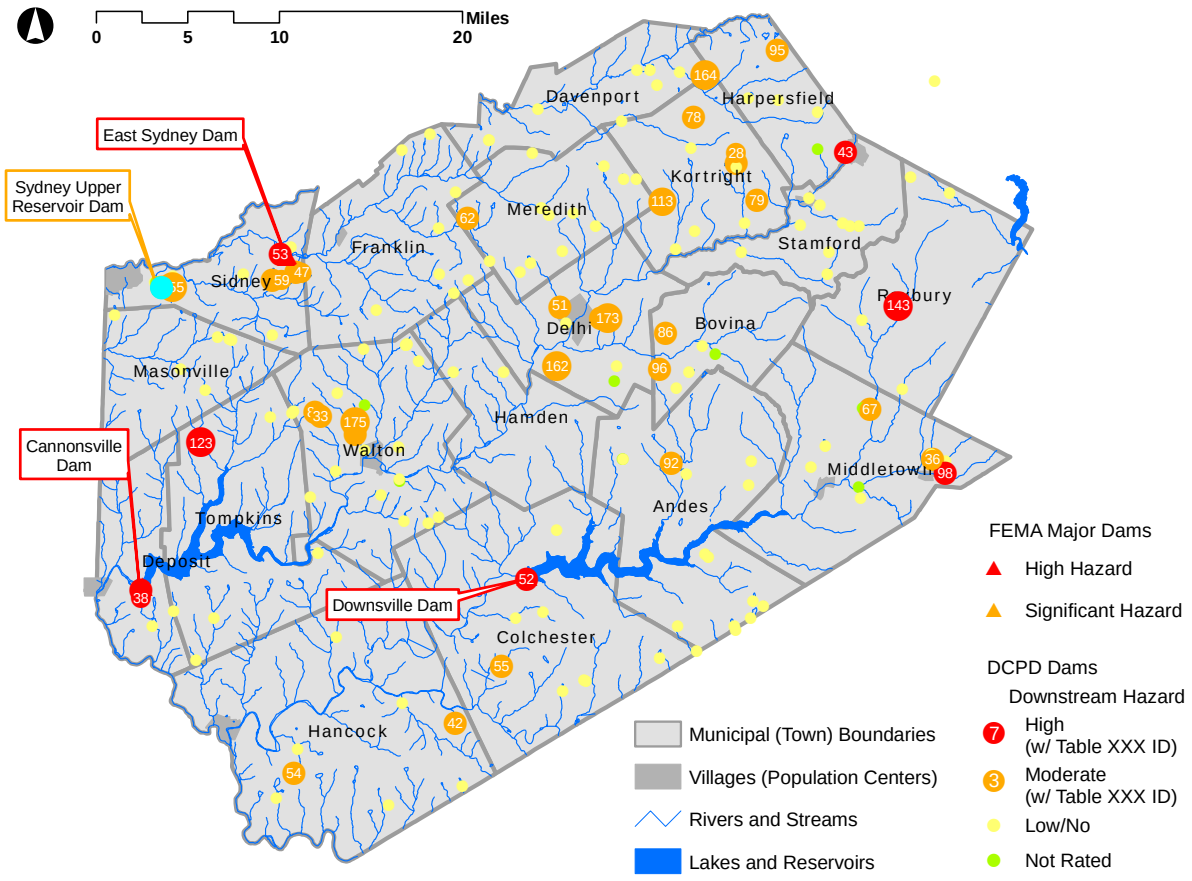
Data Collected and Used

Data to support this analysis was obtained from a number of federal, state, and local sources, including: the National Dam Performance Program, HAZUS-MH, the National Inventory of Dams (USACE in cooperation with FEMA's National Dam Safety Program) and other sources.

Exposure and Loss Estimation

Of the 164 dams located in Delaware County (based on DCGIS dams dataset), four are defined as "major dams." A major dam includes a dam that is 50 feet or more in height, has a normal storage capacity of 5,000-acre-feet or more, or has a maximum storage capacity of 25,00 acre-feet or more. The Downsville Dam (near Downsville), the Cannonsville Dam (near Deposit) are owned by NYC and are classified as "high hazard" dams. The East Sidney Dam, federally owned is also classified as a high hazard dam. The Sidney Upper Reservoir Dam (also known as the Taylor Reservoir Dam), is owned by the Village of Sidney and is a significant hazard dam. Figure 4-4-15 shows major dams in Delaware County and identifies high hazard and significant hazard dams.

Figure 4-4-15. Major Dams in Delaware County Study Area



A dam breach of a major dam would create flash flooding downstream of the dam. Therefore, for the revised plan, Tetra Tech will inventory assets in areas directly down gradient of the major dams, this will provide an idea of the exposure at risk should a dam breach occur. Tetra Tech also will inventory critical facilities in the potential impact area associated with major dams.

Additional Data and Next Steps

It is assumed that data on the integrity of dams is available but may be confidential for reasons of national security. Commercial and government models are available to model a dam breach and can be used in association with HAZUS-MH inventory data. Based on the current quality of existing data on risk, the County may wish to implement a dam breach analysis on selected dams as it furthers its mitigation planning efforts over time. Tetra Tech recommends discussions with appropriate authorities regarding the best means to integrate the dam hazard into the mitigation planning effort, while ensuring data security and the cooperation with appropriate authorities and regulatory agencies.

Overall Vulnerability Assessment

Currently, this hazard is evaluated as a low potential, high impact hazard.

4.4.3 Human-Caused Hazards

This section addresses human-caused hazards, including: water supply contamination.

4.4.3.1 Water Supply Contamination

For this hazard, data on past events and potential future events is limited. Therefore, a qualitative evaluation of the overall potential impact and risk posed by this hazard is presented.

Data Collected and Used

Data for this hazard was obtained from the county, town officials, the U.S. Coast Guard, EPA and NYDEC information, and knowledge of the area. Inventory information regarding water supply sources and wastewater treatment plants in the study area is summarized in Section 4.3.3.

Exposure and Loss Estimation

The HAZUS-MH default data identifies one potable water treatment plant (WTP) in the County (Andes Public Library on Main Street). The Town of Hamden Comprehensive Plan (2000) identifies two public water supply systems, one for Delancy and one for Hamden. Both of these systems are currently undergoing major upgrades costing approximately $2M to ensure both quantity and quality of supply. In addition, two major reservoirs located in the County, provide a portion of the water supply for NYC.

Based on information provided by local officials, the County is served by Community Water Systems (for example, community and business systems that serve the same population year round), Non-Transient Non-Community Water Systems (for example, schools that have their own systems and serve the same persons but not year-round), and Transient Non-Community Water Systems. Based on available information 22,714 persons are served by Community Water Systems that are groundwater only (21160 persons served), groundwater UDI surface water (1,554 persons) or surface water only (142 persons served). This indicates that about 25,000 persons may be served by private water supply wells (the total population is about 48,000 and that served by Community Water Systems is about 23,000). About 2,202 persons are served by Non-Transient, Non-Community Water Systems (fed by groundwater). Approximately, up to 6,131 persons can be served by ground water systems that are Non-Community, Transient Water Systems (for example, campgrounds, etc).

Due to the limited developable land area in the County, and the relatively small average lot sizes, there is a general concern related to the proximity of septic waste disposal systems to potable groundwater wells in areas that rely on individual rather than community waste disposal and water supply systems. This concern is a common theme revealed in available comprehensive planning documents reviewed for the towns and villages in Delaware County.

Potential situations that could impact the water supply in Delaware County include:

- Physical damage to the water supply or delivery system (breaks in pipes, landslides that block water supply intakes, water treatment etc.)
- Hazardous material releases, spills, and leaks that reach surface water supplies or drinking water aquifers
- Terrorist acts that target the water supply
- Bacterial outbreaks, such as *E. coli*
- Insufficient distance between septic disposal and potable groundwater supply systems.

- Mechanical problems with the WTP operations (e.g., breakdown of equipment) that disrupt or hinder the timely and safe delivery of clean water
- Dam breaches that could release reservoir water (see Section 4.4.2).

Given the generally lower priority assigned to this hazard by the HAZNY study and the limited data regarding past occurrences and impacts, no specific modeling was conducted for this hazard. However, the general population served by private wells and public supply areas was documented and mapped. Due to the concern about the release of these maps, they are not included in the plan but are available for review by government officials and the public, as necessary, by contacting Delaware County.

Several instances of contamination to the municipal water systems in the Delaware County study area have been recorded, including:

- *If any data is available, it will be included here in the revised plan.*

Also, is there any data on the potential/actual cost and logistics of providing alternate water supplies should an event occur.

Vulnerable populations are those that live in areas that receive water supply from private wells that could be impacted by contamination, drought, or other sources of interruption in water supply (for example, severe cold events that freeze the well). For those that rely on the public water supply, these persons would be at risk should the public water supply be contaminated or otherwise impacted.

Additional Data and Next Steps

Based on limited data regarding the probability and potential impact of this hazard, a quantitative loss estimate was not completed for this plan. With time, Delaware County and participating municipalities will work with appropriate agencies to collect additional data to support mitigation planning and consideration of potential risks and prioritization of mitigation measures for this hazard.

More stringent environmental regulations and mapping of leaking underground storage tanks could assist in determining hazard areas, vulnerabilities and loss estimates for private water supply wells. Studying potential transportation accident impacts or spill impacts could help identify any potential impacts to the public water supply sources. Increased understanding of potential and actual sources of contamination will support mitigation to reduce the likelihood and impact of future water supply contamination events. Assessing the potential for dam impacts would provide information on the vulnerability of major reservoirs.

To support the analysis of potential mitigation actions, historic water supply remediation or alternate water supply costs could be studied. Costs to repair, restart, or upgrade WTP facilities should a mechanical failure occur also would be useful in studying mitigation options.

The status of drinking water supplies in the County and participating municipalities will continue to be monitored and ongoing and new mitigation efforts to prevent contamination of drinking water resources and mitigate problems when they arise will continue to be developed.

Overall Vulnerability Assessment

Water supply contamination is possible in the study area, although effects are unlikely to impact the entire study area population because the population relies on a variety of water sources. Also, preventative

measures such as monitoring are in place. Should water supply contamination occur, established emergency procedures would be put in place, remediation would occur and any infrastructure would be repaired as needed. Therefore, water supply shortfalls would be short in duration. However, such events can be costly, should they occur. Existing and future mitigation efforts, including those focusing on terrorism mitigation should continue to be developed and employed to reduce the potential impact of such events and prepare the towns to respond to these situations, should they occur.

4.4.4 Additional Data Needs and Next Steps

Several areas were identified in the preceding sections for which certain or additional data would be useful to model risk, vulnerability, and losses. These data and their potential sources and usefulness relative to specific hazards are presented in Table 4-4-62.

Table 4-4-21. Data Needs to Support Future Refinement of Loss and Exposure Estimates

Data Needed	Potential Source	Potential Usefulness	Hazard Evaluations Supported
Spatial and attribute information for overhead and underground utilities (age, type of equipment, past problems, proximity to facilities, etc.)	Private and public utilities, County and Town Public Works Departments	Evaluation of areas prone to power outage	Flood; Severe Winter Storm (Snow and Ice); Severe Storm (Including Hurricane); Wildfire; Water Supply Contamination; Dam Breach
Cost and loss information pertaining to utility failure and blackouts	Private and public utilities, County and Town Public Works Departments	Modeling and estimation of future losses	Flood; Severe Winter Storm (Snow, and Ice); Severe Storm (Including Hurricane); Wildfire; Water Supply Contamination; Dam Breach
Outage, replacement, and maintenance records for utilities (e.g., power lines, sewers, WTPs, etc.) infrastructure	Private and public utilities, County and Town Public Works Departments; County, State, and Federal Transportation Departments	Modeling and prediction of future utility failure events	Flood; Severe Winter Storm (Snow, and Ice); Severe Storm (Including Hurricane); Wildfire; Water Supply Contamination; Dam Breach
Data on the location, severity (property losses, injuries, fatalities, etc.), frequency, and causes of traffic accidents	Transportation Departments, Public Safety Agencies (Police, Fire and Rescue, other); Insurance Companies	Modeling and Prediction of future accident hazard areas, events, and losses	Severe Winter Storm (Ice Storm); Water Supply Contamination
Replacement, expenditure, spatial, back-up power, and maintenance records for transportation infrastructure (roads, bridges, rail lines, airports, etc.) and other critical inventory	Transportation Departments, County and Town Clerk and Treasurers, Public Works Departments	Modeling and Prediction of future accident hazard areas, events, and losses	Severe Winter Storms (Snow and Ice Storm); Sever Storm (Hurricane); Water Supply Contamination
Agricultural Production Value; past impacts on agriculture of specific hazard events	Agricultural, Economic, and other Land Use Departments	Modeling of potential economic impact associated with hazard events	Flood; Severe Storm (Including Hurricane); Infestation; Agricultural Epidemic; Wildfire; Drought; Dam Breach

Data Needed	Potential Source	Potential Usefulness	Hazard Evaluations Supported
Information regarding disease outbreaks and prevention measures (e.g., type and severity of disease, number of people affected, locations, international travel, response and controls, immunizations, cancer registries, losses, etc.)	County, State, and Federal Public Health Departments (e.g., Tompkins County Public Health Department, NYSDH, CDC, etc.)	Prediction of events and losses associated with future outbreaks and response	Infestation; Agricultural Epidemic; Water Supply Contamination
Attribute and spatial information regarding critical facilities and vulnerable infrastructure (e.g., construction materials, security, no. people typically present, "importance" of resource, structural considerations, proximity to residential and economic centers, etc.)	County Assessor, Recorder, Treasurer, HAZUS-MH, land use planning agencies, etc.	Assessment of vulnerability to terrorism and other hazards not currently evaluated by HAZUS-MH	Wildfire; Water Supply Contamination; Dam Breach
Information regarding fires, emergency response, and HazMat responses (e.g., type and severity of event, no. people and structures, affected, locations, response and controls, causes, losses, etc.)	County and Town Fire Marshall; HazMat Teams; County, State, and Federal Environmental Departments	Assessment of vulnerability to fire and chemical release	Wildfire; Water Supply Contamination