Multi-Jurisdictional Natural Hazard Mitigation Plan Ulster County, New York

Prepared for

Ulster County Department of Emergency Communications/Emergency Management
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Prepared by

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PLAN ADOPTION RESOLUTIONS

In accordance with Part 201.6 of the Disaster Mitigation Act of 2000 (DMA 2000), Ulster County, New York, has developed this Multi-Jurisdictional Hazard Mitigation Plan to identify hazards that threaten the County and ways to reduce future damages associated with these hazards.

Following this page are the signed adoption resolutions of the County and all participating jurisdictions that have adopted this plan, authorizing municipal government staff to carry out the actions detailed herein.

Signed resolutions of adoption by all participating jurisdictions shall be inserted following this page after FEMA has reviewed and determined that the Draft plan is approvable.

EXECUTIVE SUMMARY

Across the United States and around the world, natural disasters occur each day, as they have for thousands of years. As the worldôs population and development have increased, so have the effects of these natural disasters. The time and money required to recover from these events often strain or exhaust local resources. The purpose of hazard mitigation planning is to identify policies, actions, and tools for implementation that will, over time, work to reduce risk and the potential for future losses. Hazard mitigation is best realized when community leaders, businesses, citizens, and other stakeholders join together an in effort to undertake a process of learning about hazards that can affect their area and use this knowledge to prioritize needs and develop a strategy for reducing damages.

Section 322, Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (ñthe Stafford Actò), enacted by Section 104 of the Disaster Mitigation Act of 2000 (ñDMA 2000ò), provides new and revitalized approaches to mitigation planning. Section 322 continues the requirement for a State mitigation plan as a condition of disaster assistance, and establishes a new requirement for local mitigation plans. In order to apply for Federal aid for technical assistance and post-disaster funding, local jurisdictions must comply with DMA 2000 and its implementing regulations (44 CFR Part 201.6).

While Ulster County has always sought ways to reduce their vulnerability to hazards, the passage of DMA 2000 helped County officials to recognize the benefits of pursuing a long-term, coordinated approach to hazard mitigation through hazard mitigation planning. The County has received grant funds from the Federal Emergency Management Agency (FEMA) for the purpose of developing this very hazard mitigation plan. Funding was received under the Pre-Disaster Mitigation Grant Program for development of a multi-jurisdictional hazard mitigation plan for the County and as many of its 24 municipalities that chose to participate. This **Ulster County Multi-Jurisdictional Natural Hazard Mitigation Plan** represents the collective efforts of the county and 12 participating jurisdictions, the general public, and other stakeholders. Natural disasters cannot be prevented from occurring. However, over the long-term, the continued implementations of this Plan will gradually, but steadily, lessen the impacts associated with hazard events.

The Ulster County Multi-Jurisdictional Hazard Mitigation Plan has been developed by the Ulster County Hazard Mitigation Planning Team (the ñPlanning Teamò), with support from outside consultants. The efforts of the Planning Committee were headed by the Director of the Ulster County Department of Emergency Communications/Emergency Management (UCECEM). The Planning Committee was supplemented by a Core Planning Group (CPG) and Jurisdictional Assessment Teams (JATs), with one JAT for each of the Countyôs participating jurisdictions.

The plan development process was initiated in earnest in the fall of 2007 with the project initiation meeting held on October 25, 2007. A Kickoff Meeting of the full Core Planning Group was conducted on December 11, 2007. Thereafter, the Core Planning Group met on June 19, 2008; July 17, 2008; and August 7, 2008. Jurisdictional Assessment Teams met individually throughout the plan development process as they deemed necessary.

Community support is vital to the success of any hazard mitigation plan. The Planning Committee provided opportunities for participation and input of the public and other stakeholders throughout the plan development process, both prior to this Draft and before approval of the Final plan, providing citizens and other stakeholders with opportunities to take part in the decisions that will affect their future. On a mitigation planning section of the Ulster County web site, the UCECEM posted information on the plan development process and where to go for additional information or comments beginning in early 2008; this web site has been and continues to be maintained and updated regularly. The County also conducted

numerous other outreach actions throughout the planning process. The public and other stakeholders were invited to attend all of the five Core Planning Group Meetings and were also invited to respond to a survey that was posted on the UCECEM mitigation planning web site. They also spoke about the Mitigation Plan at a meeting of Local Emergency Planning Coordinators and CPG members on January 31, 2008. Jurisdictional Assessment Team members supplemented County efforts by reaching out to the public and other stakeholders within their respective jurisdictions to get the word out through various means and provide opportunities for feedback and participation.

The hazard mitigation planning process consisted of the following key steps:

- Researching a full range of natural hazards to identify which hazards could affect the County;
- Identifying the location and extent of hazard areas;
- Identifying assets located within these hazard areas;
- Characterizing existing and potential future assets at risk;
- Assessing vulnerabilities to the most prevalent hazards; and
- Formulation and prioritization of goals, objectives, and mitigation actions to reduce or avoid long-term vulnerabilities to the identified hazards.

Natural hazards that can affect Ulster County that were studied in detail in the Plan are as follows:

- ***Atmospheric hazards***, including: extreme temperatures, extreme wind, hurricanes and tropical storms, lightning, norôeasters, tornadoes, and winter storms;
- ***Hydrologic hazards***, including: flooding, drought, and dam failures;
- ***Geologic hazards***, including: earthquakes and landslides; and
- ***Other hazards***, including: wildfires.

After evaluating these hazards and assets within the County to which they are vulnerable, the Planning Team developed a mitigation strategy to increase the disaster resistance of the County, along with procedures for monitoring, evaluating and updating the Plan to ensure that it remains a ñliving document.ò

This Draft Plan is currently under review by the Planning Team, NYSEMO, FEMA, and the public and other stakeholders. Later, comments will be incorporated, and the County and all participating jurisdictions will each formally adopt the Final Plan. The Final Plan will include copies of adoption resolutions following Page i.

If you have any questions or comments on the Multi-Jurisdictional Natural Hazard Mitigation Plan for Ulster County, New York, additional information can be obtained by contacting:

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ACKNOWLEDGEMENTS

Throughout the plan development process, the UCECEM worked tirelessly to involve all of its 24 municipalities. These local jurisdictions were not only invited to participate but were truly guided through the process by UCECEM at every stage.

The following municipal entities (Ulster County and 12 of its constituent municipalities) actively participated in the development of this plan:

County of Ulster

Gardner, Town of	*Lloyd, Town of*	*Saugerties, Town of*
Hurley, Town of	*Marbletown, Town of*	*Shandaken, Town of*
Kingston, Town of	*Marlborough, Town of*	*Shawangunk, Town of*
Kingston, City of	*Rosendale, Town of*	*Ulster, Town of*

In addition, the records show that the following stakeholder entities participated by attending at least one meeting and/or responding to at least one questionnaire.

American Red Cross, Ulster County Chapter
The Kingston Hospital
The New York State Thruway Authority

URS Corporation (Wayne, NJ) acted as the plan development consultant providing hazard mitigation planning services.

TABLE OF CONTENTS

Appendices:

List of Tables

List of Figures

SECTION 1 - INTRODUCTION

Purpose

Ulster County is susceptible to a number of different natural hazards. These natural hazards have the potential to cause property loss, loss of life, economic hardship, and threats to public health and safety. While an important aspect of emergency management deals with disaster recovery ï those actions that a community must take to repair damages and make itself whole in the wake of a natural disaster ï an equally important aspect of emergency management involves hazard mitigation. Hazard mitigation measures are efforts taken *before* a disaster happens to lessen the impact that future disasters of that type will have on people and property in the community. They are things you do today to be more protected in the future.

Recognizing the risks that natural hazards pose to Ulster County, the Ulster County Department of Emergency Communications/Emergency Management submitted an application, and was approved for, grant monies from the Federal Emergency Management Agency (FEMA) under the Pre-Disaster Mitigation Program in 2006, to be used to develop a hazard mitigation plan for the County.

This **Ulster County Multi-Jurisdictional Natural Hazard Mitigation Plan** (the ñPlanò) has been developed by the Ulster County Hazard Mitigation Planning Committee (the ñPlanning Committeeò), with support from outside consultants at URS Corporation (ñURS,ò the contractor responsible for providing the Planning Committee with hazard mitigation planning support services). The Plan represents the collective efforts of citizens, elected and appointed government officials, business leaders, volunteers of non-profit organizations, and other stakeholders.

Through the development of this Plan, the Planning Committee has identified the natural hazards that could affect the County, and has evaluated the risks associated with these hazards. The successful implementation of this Plan will make Ulster County more disaster-resistant because the County has taken the initiative to recognize the benefits that can be gained by planning ahead and taking measures to reduce damages before the next disaster strikes. The Plan will also allow Ulster County and participating jurisdictions to comply with the Disaster Mitigation Act of 2000 (DMA 2000) and itsô implementing regulations (44 CFR Part 201.6), thus resulting in eligibility to apply for Federal aid for technical assistance and post-disaster hazard mitigation project funding.

Natural disasters cannot be prevented from occurring. However, over the long-term, the continued implementation of this Plan will gradually, but steadily, lessen the impacts associated with hazard events.

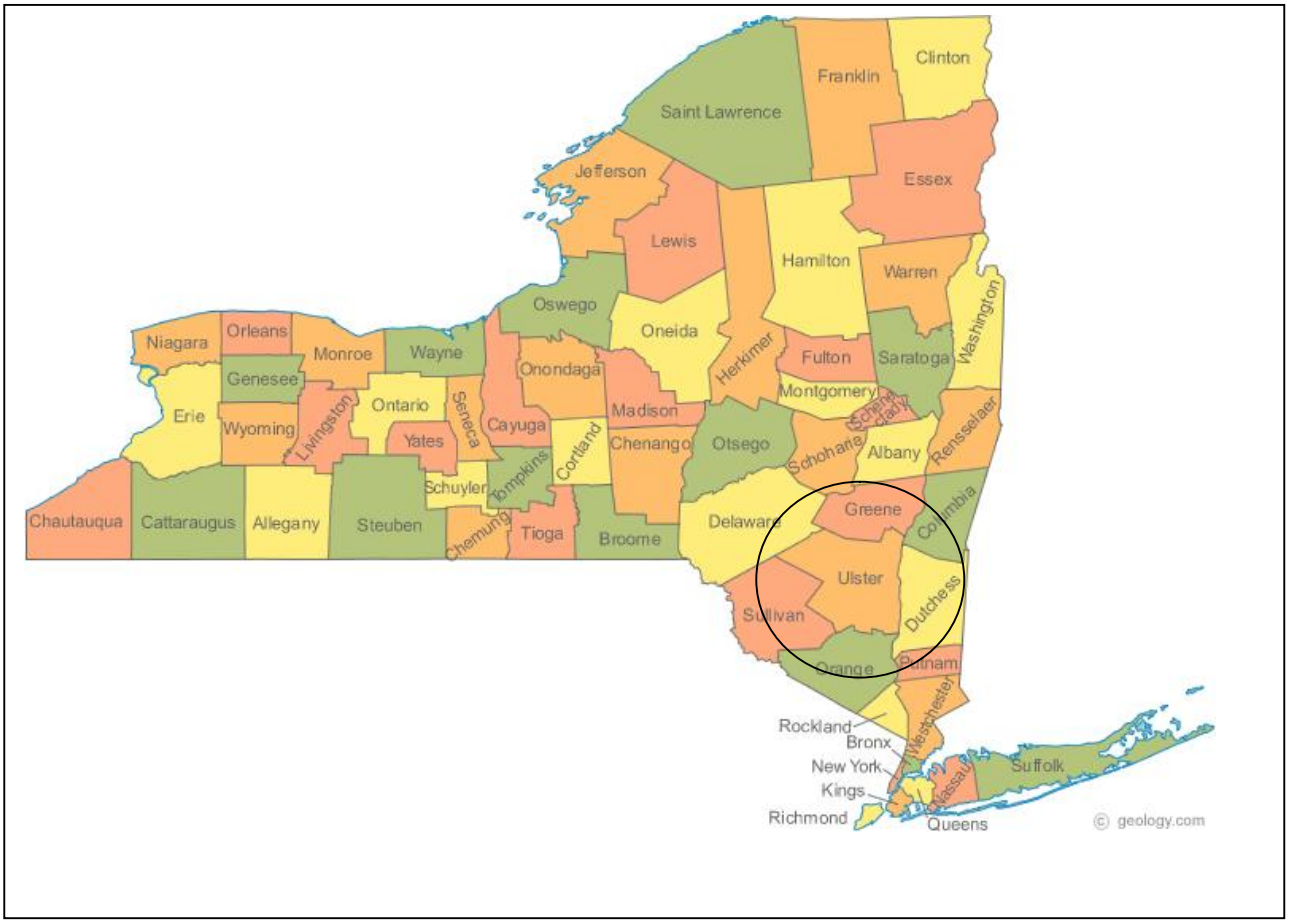
About Ulster County

Overview

Ulster County is located in the southeast part of New York State in the Mid-Hudson Region of the Hudson Valley approximately 70 miles north of New York City and 45 miles south of Albany. Ulster County is the northernmost county and largest county (by land area) in the New York Metropolitan Area, with a total area of 1,161 square miles, of which roughly three percent is water. Ulster County is comparable in size to the State of Rhode Island. The county seat and only large city is Kingston.

Ulster County is bounded by Orange, Sullivan, Delaware, Greene, Columbia, and Dutchess Counties (from Orange County in the south and moving in a clockwise direction). The Hudson River provides the boundary of eastern sections of Ulster County. As of the year 2000 Census, Ulster County had a population of 177,749 people residing in the county. Figure 1.1 depicts the location of Ulster County in relation to the rest of the State of New York.

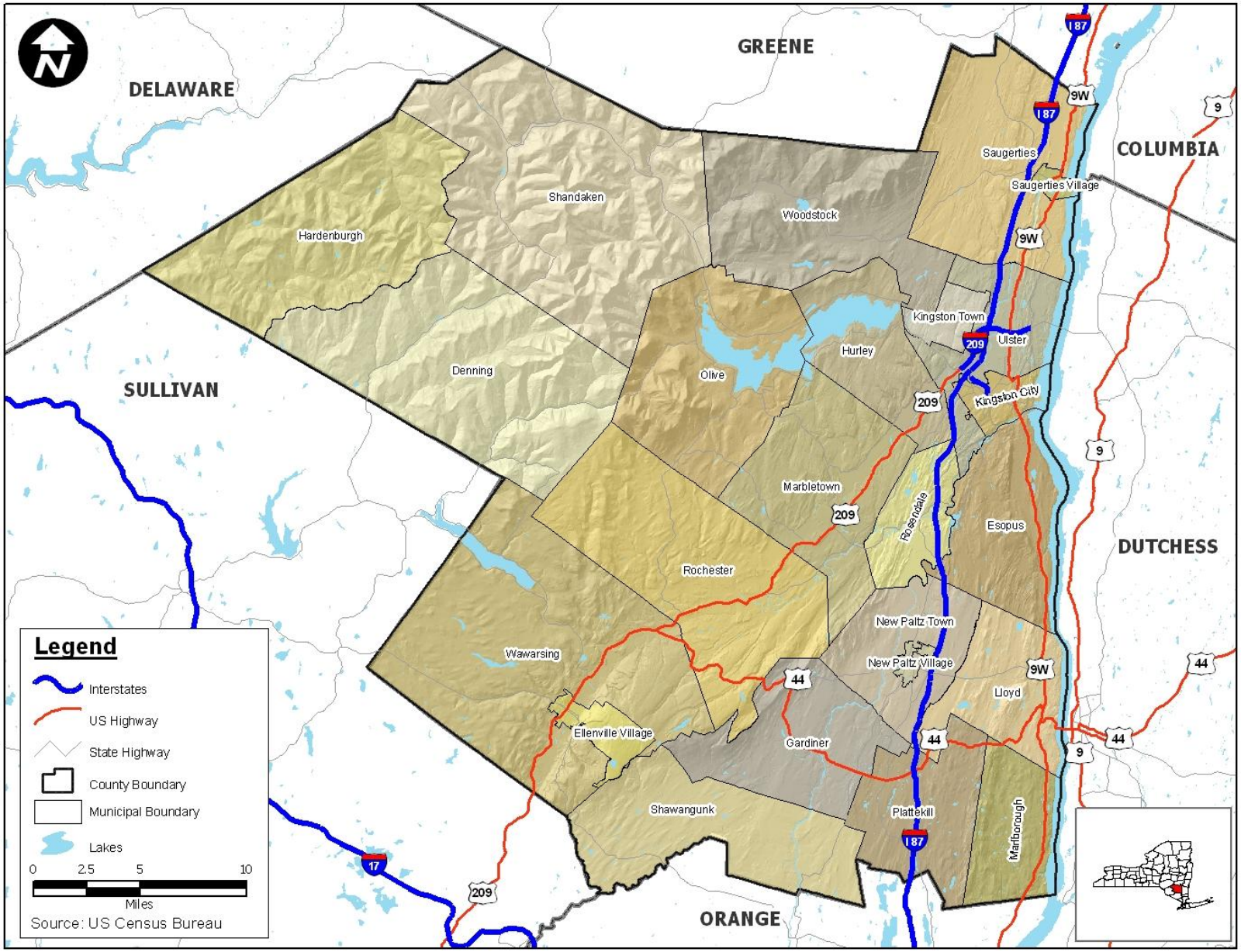
Figure 1.1 - Location of Ulster County in New York State



Ulster County is home to 24 municipalities (20 towns, three villages and one city). They are the City of Kingston; Villages of Ellenville, New Paltz and Saugerties; and Towns of Denning, Esopus, Gardiner, Hardenburgh, Hurley, Kingston, Lloyd, Marbletown, Marlborough, New Paltz, Olive, Plattekill, Rochester, Rosendale, Saugerties, Shandaken, Shawangunk, Ulster, Wawarsing and Woodstock. The location and extent of all these municipalities, as well as significant highways (including the New York State Thruway Interstate 87, which runs north-south through Ulster County), are shown on the base map of the County in Figure 1.2.

Ulster County has a wide variety of natural resources and landscapes including mountains, valleys, rivers, lakes, streams, forests and farmlands. The county is known for its many mountains and parks, u-pick farms and farmers' markets, local wineries and breweries, spas and spiritual retreats, fairs and festivals, luxury resorts.

Figure 1.2 – Base Map of Ulster County



The magnificent Catskill Mountains rise softly above the scenic Hudson River. Ulster County is truly a unique place to visit. It is a year-round vacation center alive with entertainment, adventure, culture and history. In warmer seasons residents and visitors enjoy boating or sailing on the majestic Hudson River; biking, hiking, camping, or rock climbing in the world famous Shawangunk and Catskill Mountains; fishing in the regions many trout streams and lakes; or golfing on some magnificent courses. The countyôs rich agricultural market abounds farm stands and orchards. As the weather cools, the countyôs abundance of open space provides glorious fall foliage. During the winter months, opportunities abound for outdoor sports such as skiing, snow boarding, ice skating, and ice climbing. Ulster County is also home to the oldest street in America: Historic Huguenot Street, a National Historic Landmark District which includes seven original stone houses dating to 1705, a burial ground, reconstructed 1717 French church and museum shop. The historic City of Kingston was the first capital of New York State. Ulster County is known for its artisans, museums or art centers, galleries, performing art centers, pottery shops and art festivals.

Ulster County has a rich history. From its agrarian beginnings, to the dawn of the industrial revolution, and then to its emergence as a regional economic powerhouse in Hudson Valley, the County has been an integral part of the economy of upstate New York. During the 1990s, a dramatic change in economic climate was experienced with the closure of a major industrial plant and the dislocation of hundredsð if not thousandsð of businesses. This had a long-lasting, adverse impact on local workers and families. In the period since, Ulster County has struggled to revitalize its manufacturing base, maintain its legacy in production agriculture, and encourage a vibrant tourism-visitor industry without compromising its unique natural resource endowment. Ulster County is currently implementing economic development strategies to better coordinate the collective activities of the system, and provide focus to the strategic economic development efforts across the County.

In Ulster County:

- The NYC Metropolitan Area connection offers Ulster County access to global markets, intellectual capital, and is relied on by tourism and arts and culture businesses.
- Ulster County has a higher percentage of small businesses than any other county in the region.
- Ulster County has adequate critical infrastructure (water/sewer/transportation) to support growth in many of its central places.

Ulster Countyôs unique location makes it a place that residents from New York City can go to escape the costs, pressures and densities of life in a major metropolis. It also makes the County a place where businesses want to be located that serve the State of New Yorkôs two most important cities. At the same time, Ulster Countyôs location between the Hudson River and the Catskill Mountains ensures that development can not get too intense, especially since the County, the State, the local jurisdictions and private organizations have done an excellent job of ensuring that much of the County will remain in pubic open space.

Ulster County is balancing the objectives of preserving natural, cultural and historic resources; facing the reality of an economy which is undergoing a big change as the nation moves into the post-industrial era; and, seeing development that is driven by agricultural and natural resources as well as the occurrences of the nations largest urban area only 70 miles away. The County is involved in economic development, housing, open space and stormwater and transportation planning. Communities are working to ensure that they are safe, thriving and appealing places to live, work and play. The following recent development trends are expected to continue in the future:

- The County and its jurisdictions will continue to focus on preserving open space throughout the area.

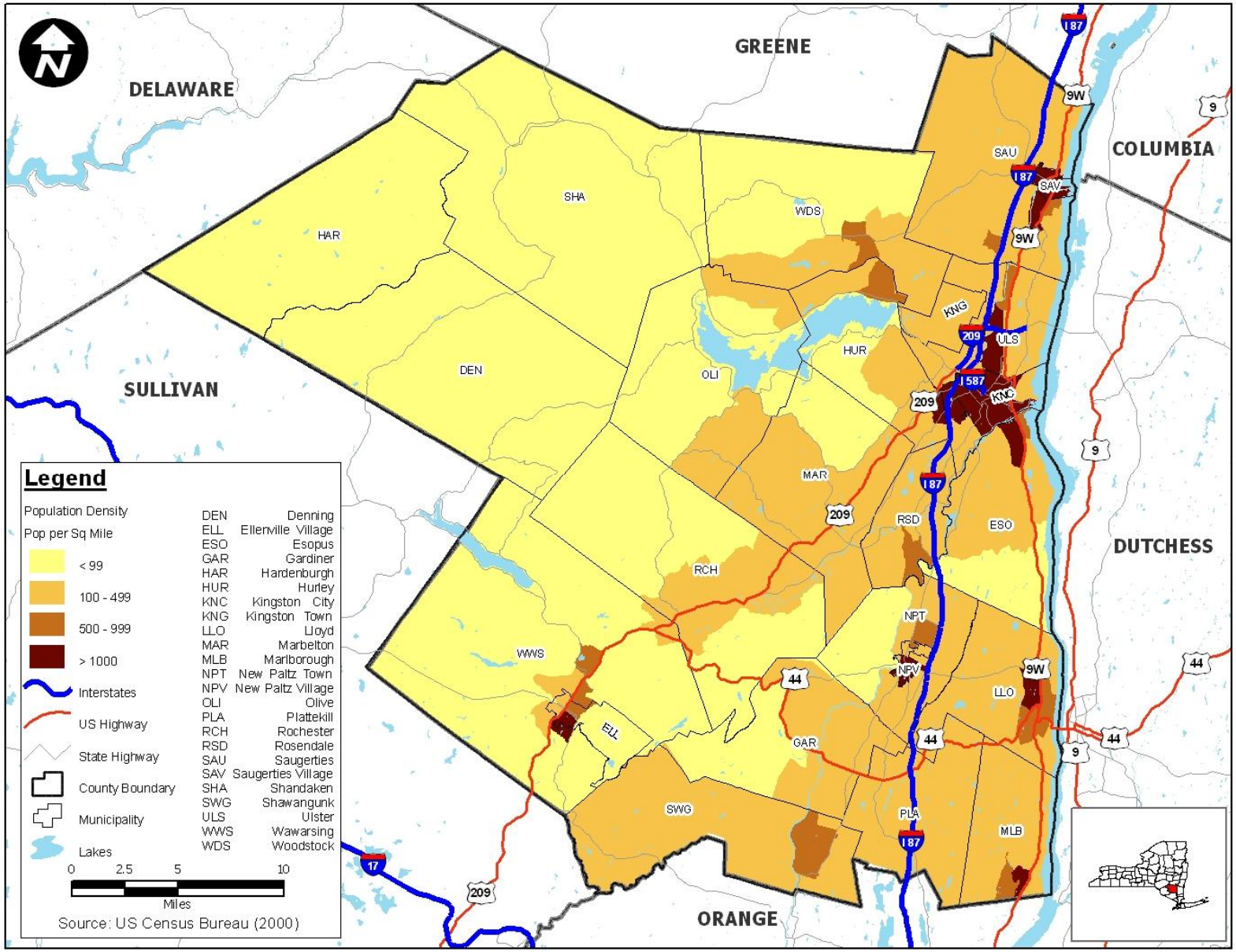
- Most new development will continue to occur in the Hudson River Valley, especially along Interstate Highway 87 corridor.
- Additional development will take place along transportation corridors in the County, particularly in and around existing hamlets that have developed throughout the County.;
- Redevelopment will take place throughout the County, as sites that were vacated due to changes in the economy are reused, modified or replaced.
- Agriculture and natural resources will continue to be a focus of the Ulster County economy.
- Ulster County will continue to be both a recreational destination and driver of the commercial and industrial development in the region.
- Ulster County will continue to be a location where individuals that seek to leave the bustle of the New York City urban area choose to relocate.

Population. According to the US Census, the population of Ulster County in 1990 was 165,304, whereas, in 2000 it increased to 177,749 ï an increase of approximately 7.5 percent over ten years. County-wide, this general upward trend is expected to continue between now and the year 2020. Table 1.1 shows key County population changes and projections (county-wide and for each municipality) as reported in the Ulster County Transportation Plan, while Figure 1.3 presents population density according to the U.S. Census Bureau.

Table 1.1
Ulster County Population Changes and Projections

Municipality	Census Population 1990	Census Population 2000	Population Estimate 2007	Population Projection 2020	Absolute Change Projected 2000-2020	Percent Change Projected 2000-2020
Ulster, County of	**165,304**	**177,749**	**181,860**	**214,999**	**37,250**	**20.96%**
Denning, Town of	524	516	511	716	200	38.76%
Ellenville, Village of	4,243	4,130	3,891	Not reported	Unknown	Unknown
Esopus, Town of	8,860	9,331	9,495	11,531	2,200	23.58%
Gardiner, Town of	4,278	5,238	5,733	8,338	3,100	59.18%
Hardenburgh, Town of	204	208	217	358	150	72.12%
Hurley, Town of	6,741	6,564	6,541	7,764	1,200	18.28%
Kingston, City of	23,095	23,456	22,620	24,656	1,200	5.12%
Kingston, Town of	864	908	915	1,308	400	44.05%
Lloyd, Town of	9,231	9,941	10,749	12,841	2,900	29.17%
Marbletown, Town of	5,285	5,854	6,039	7,654	1,800	30.75%
Marlborough, Town of	7,430	8,263	8,327	10,863	2,600	31.47%
New Paltz, Town of	11,388	12,830	13,804	15,930	3,100	24.16%
New Paltz, Village of	5,463	6,034	6,595	Not reported	Unknown	Unknown
Olive, Town of	4,086	4,579	4,659	5,479	900	19.65%
Plattekill, Town of	8,891	9,892	10,808	13,092	3,200	32.35%
Rochester, Town of	5,679	7,018	7,332	9,418	2,400	34.20%
Rosendale, Town of	6,220	6,352	6,264	7,452	1,100	17.32%
Saugerties, Town of	18,467	19,868	19,559	22,768	2,900	14.60%
Saugerties, Village of	3,915	4,995	3,867	Not reported	Unknown	Unknown
Shandaken, Town of	3,013	3,235	3,090	3,835	600	18.55%
Shawangunk, Town of	10,081	12,022	12,709	15,322	3,300	27.45%
Ulster, Town of	12,329	12,544	12,712	13,844	1,300	10.36%
Wawarsing, Town of	12,348	12,889	13,602	14,589	1,700	13.19%
Woodstock, Town of	6,290	6,241	6,174	7,241	1,000	16.02%

Figure 1.3 –Ulster County population Density



The average percent change between 2000 and 2020 for Ulster County municipalities is roughly a 21 percent increase in population. However, this varies a great deal across municipalities, from a minimum of five percent to a maximum of 72 percent. The three highest projected percent increases are Hardenburgh with a projected increase of 72 percent; Gardiner at 59 percent; and the Town of Kingston at 44 percent. The lowest projected percent increases are the City of Kingston with a projected increase of five percent; the Town of Ulster at ten percent; and Wawarsing at 13 percent.

According to the U.S. Census Bureau, the Ulster County has a total area of 1,161 square miles, of which 1,126 square miles is land and 34 square miles is water.

The 1990 U.S. Census population density per square mile of land in Ulster County was 147 persons per square mile; whereas, in the 2000 U.S. Census, there were 158 persons per square mile ï an increase of 7.5 percent in ten years. By 2020, the population density is projected to be 191 persons per square mile ï an increase of 17.3 percent over the year 2000 values. The population of Ulster County is concentrated in its eastern areas, and decreases significantly moving in westward direction (see Figure 1.3, as per U.S. Census Bureau, Census 2000 Summary File 1, Matrix P1.).

Ulster Countyôs population is also aging. The population is aging faster than state and national averages, as population growth has slowed, with roughly 30 percent of the population potentially retiring by 2026. The overall median age in 2006 has been estimated by the U.S. Census Bureau to be 40.2, up from 38.2 in 2000. However, the percentage of the population over 65 years of age appears to be relatively stable (at 13.3 percent in 2000 and 13.5 percent in 2006).

Income and Employment. In the first half of the current decade both the median household and median family incomes in Ulster County exhibited a greater rise than the national equivalents, according to the U.S. Census Bureau, as shown in Table 1.2. Also, according to the same source, between 2000 and 2006 levels of unemployment and poverty both fell in Ulster County while national levels rose slightly in both categories over the same time period.

Table 1.2
Income and Employment in Ulster County
Source: U.S. Census Bureau

Economic Characteristic	2000		2006	
	Ulster Co.	USA	Ulster Co.	USA
Median Household Income	$42,551	$41,994	$52,725	$48,451
Median Family Income	$51,708	$50,046	$64,040	$58,526
Families Below Poverty Level	7.2%	9.2%	6.8%	9.8%
Individuals Below Poverty Level	11.4%	12.4%	10.6%	13.3%
Unemployed*	4.0%	3.7%	3.0%	4.1%

*As a percentage of the population aged 16 years or more

Transportation Links. Ulster County is linked to the surrounding area by road, notably the New York State Thruway (I-187) which traverses the full extent of the County from north to south in its eastern portion, parallel with the Hudson River. There are currently no passenger railroad services, although there are hopes that some may be reinstated in the future, particularly to link the County by rail to the New York metropolitan area. The County is well served by bus links, including services operated by Trailways, Ulster County Area Transit, and the CiTiBus (City of Kingston Bus Service). While there are three airfields in Ulster County with runways capable of operating substantial fixed-wing aircraft, none currently offer regular scheduled passenger services.

FEMA Disaster Declarations. Disaster declarations, for the county or counties affected by a disaster, are declared by the President of the United States under the authority of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (the ñStafford Actò). FEMA then manages the entire process, including making federally-funded assistance available in declared areas; coordinates emergency rescue and response efforts; provides emergency resources; and provides other related activities/funding in the process of aiding citizens and local governments in a nationally-declared disaster. Tables 1.3 and 1.4 provide a summary of disaster and emergency declarations for the State of New York (based on review of the FEMA web site and the New York State Hazard Mitigation Plan), with an indication as to whether Ulster County was part of the declared area.

Table 1.3
New York State Major Disaster Declarations: 1954 – 2007
(Source: FEMA, online at http://www.fema.gov/news/disasters_state.fema?id=36
NYSEMO, online at http://www.semo.state.ny.us/programs/recovery/History.cfm
And Appendix N of the New York State Hazard Mitigation Plan)

Year	Date	Disaster Type	Disaster Number	Was Ulster County Designated?
2007	31-Aug	Severe Storms, Flooding, and Tornado	1724	no
2007	2-Jul	Severe Storms and Flooding	1710	yes
2007	24-Apr	Severe Storms and Inland and Coastal Flooding	1692	yes
2006	12-Dec	Severe Storms and Flooding	1670	no
2006	24-Oct	Severe Storms and Flooding	1665	no
2006	1-Jul	Severe Storms and Flooding	1650	yes
2005	19-Apr	Severe Storms and Flooding	1589	yes
2004	1-Oct	Tropical Depression Ivan	1565	yes
2004	1-Oct	Severe Storms and Flooding	1564	yes
2004	3-Aug	Severe Storms and Flooding	1534	yes
2003	29-Aug	Severe Storms, Tornadoes and Flooding	1486	no
2003	12-May	Ice Storm	1467	no
2002	16-May	Earthquake	1415	no
2002	1-Mar	Snowstorm	1404	no
2001	11-Sep	World Trade Center Terrorist Attack	1391	yes
2000	21-Jul	Severe Storms	1335	yes
1999	19-Sep	Hurricane Floyd	1296	yes
1998	11-Sep	Severe Storms	1244	no
1998	7-Jul	Severe Storms and Flooding	1233	no
1998	16-Jun	New York Severe Thunderstorms and Tornadoes	1222	no
1998	10-Jan	Severe Winter Storms	1196	no
1996	9-Dec	Severe Storms/Flooding	1148	no
1996	19-Nov	Severe Storms/Flooding	1146	no
1996	24-Jan	Severe Storms/Flooding	1095	yes
1996	12-Jan	Blizzard	1083	yes
1993	2-Apr	World Trade Center Explosion	984	no
1992	21-Dec	Coastal Storm, High Tides, Heavy Rain, Flooding	974	no
1991	16-Sep	Hurricane Bob	918	no
1991	21-Mar	Severe Storm, Winter Storm	898	no
1987	10-Nov	Severe Winter Storms	801	no
1987	15-May	Flooding	792	yes
1985	18-Oct	Hurricane Gloria	750	no
1985	22-Mar	Snow Melt, Ice Jams	734	no
1985	20-Mar	Flooding	733	no
1984	25-Sep	Severe Storms/Flooding	725	no

Table 1.3
New York State Major Disaster Declarations: 1954 – 2007
(Source: FEMA, online at http://www.fema.gov/news/disasters_state.fema?id=36
NYSEMO, online at http://www.semo.state.ny.us/programs/recovery/History.cfm
And Appendix N of the New York State Hazard Mitigation Plan)

Year	Date	Disaster Type	Disaster Number	Was Ulster County Designated?
1984	17-Apr	Coastal Storms/Flooding	702	yes
1977	5-Feb	Snowstorms	527	no
1976	3-Sep	Hurricane Belle	520	no
1976	21-Jul	Severe Storms/Flooding	515	no
1976	29-Jun	Flash Flooding	512	no
1976	19-Mar	Ice Storm, Severe Storms, Flooding	494	no
1975	2-Oct	Severe Storms, Heavy Rain, Landslides, Flooding	487	no
1974	23-Jul	Severe Storms/Flooding	447	no
1973	20-Jul	Severe Storms/Flooding	401	yes
1972	23-Jun	Tropical Storm Agnes	338	yes
1971	13-Sep	Severe Storms/Flooding	311	yes
1970	22-Jul	Heavy Rains, Flooding	290	no
1969	26-Aug	Heavy Rains, Flooding	275	no
1967	30-Oct	Severe Storms/Flooding	233	no
1965	18-Aug	Water Shortage	204	yes
1963	23-Aug	Heavy Rains, Flooding	158	no
1962	16-Mar	Severe Storm, High Tides, Flooding	129	no

Table 1.4
New York State Emergency Declarations: 1954 – 2007
(Source: FEMA, online at http://www.fema.gov/news/disasters_state.fema?id=36
NYSEMO, online at http://www.semo.state.ny.us/programs/recovery/History.cfm
And Appendix N of the New York State Hazard Mitigation Plan

Year	Date	Emergency Type	Declaration Number	Was Ulster County Designated?
2007	23-Feb	Snow	3273	no
2006	15-Oct	Snowstorm	3268	no
2005	30-Sep	Hurricane Katrina Evacuation	3262	yes
2004	3-Mar	Snow	3195	no
2003	23-Aug	Power Outage	3186	yes
2003	27-Mar	Snowstorm	3184	yes
2003	26-Feb	Snowstorm	3173	yes
2002	1-Jan	Snowstorm	3170	no
2000	4-Dec	Snow Storm	3157	no
2000	11-Oct	Virus Threat	3155	yes
1999	18-Sep	Hurricane Floyd	3149	no
1999	10-Mar	Winter Storm	3138	no
1999	15-Jan	Winter Storm	3136	no
1993	17-Mar	Severe Blizzard	3107	not available
1980	21-May	Chemical Waste, Love Canal	3080	no
1978	7-Aug	Chemical Waste, Love Canal	3066	no
1977	29-Jan	Snowstorms	3027	no
1974	2-Nov	Flooding (NYS Barge Canal)	3004	no

Plan Development Process

Multi-Jurisdictional Approach

Ulster County took a multi-jurisdictional approach to preparing its hazard mitigation plan. The County had resources (i.e., funding, data, GIS, etc.) which local jurisdictions lacked. However, the County could not develop the plan on its own. To undertake such a regional planning effort, the County needed to involve its member municipalities since only they have the legal authority to enforce compliance with land use planning and development issues.

Throughout the plan development process, the Ulster County Department of Emergency Communications/Emergency Management (UCECEM) worked tirelessly to involve all of its 53 municipalities. These local jurisdictions were not only invited to participate but were truly guided through the process by UCECEM at every stage. At the beginning of the process, UCECEM was notified by all 53 of its municipalities that they were interested in participating.

The following municipal entities (Ulster County and 12 of its municipalities) participated successfully in the development of this plan by submitting the key deliverables:

County of Ulster

Gardner, Town of	*Lloyd, Town of*	*Saugerties, Town of*
Hurley, Town of	*Marbletown, Town of*	*Shandaken, Town of*
Kingston, Town of	*Marlborough, Town of*	*Shawangunk, Town of*
Kingston, City of	*Rosendale, Town of*	*Ulster, Town of*

A more detailed summary of the participation demonstrated by each municipality in the County, including attendance at meetings and submission of requested deliverables, is presented in Table 1.5.

In addition, the records show that the following four stakeholder entities participated through attending at least one meeting or responding to at least one questionnaire.

American Red Cross, Ulster County Chapter
The Kingston Hospital
The New York State Thruway Authority

Readers are invited to review the contents of ***Appendix F – Planning Committee Membership Information*** for a list of Steering Committee and Core Planning Group members.

Table 1.5
Ulster County Jurisdictions Participation

Municipality	Expressed Interest in Participating	CPG Meetings Attended				Key Deliverables Submitted						Jurisdiction Considered to be Fully Participating
		Kickoff Meeting	Progress Meeting	Risk Assessment Q & A	Mitigation Working Session	Wish List	Land Use and Development Questionnaire	Hazard Identification Questionnaire	Capabilities Assessment Questionnaire	Mitigation Prioritization / Implementation Worksheets	NFIP Actions Worksheets	
Ulster, County of	■	■	■	■	■	■	■	■	■	■	N/A	■
Denning, Town of												
Ellenville, Village of												
Esopus, Town of												
Gardiner, Town of	■			■	■	■	■	■	■	■	■	■
Hardenburgh, Town of												
Hurley, Town of	■	■		■	■	■	■	■	■	■	■	■
Kingston, City of	■				■	■	■	■	■	■	■	■
Kingston, Town of	■	■		■	■	■	■	■	■	■	■	■
Lloyd, Town of	■	■		■	■	■	■	■	■	■	■	■
Marbletown, Town of	■	■	■	■	■			■		■	■	■
Marlborough, Town of	■			■	■	■	■	■	■	■	■	■
New Paltz, Town of												
New Paltz, Village of	■								■			
Olive, Town of												
Plattekill, Town of												
Rochester, Town of	■											
Rosendale, Town of	■	■	■	■	■	■	■	■		■	■	■
Saugerties, Town of	■	■			■	■		■		■	■	■
Saugerties, Village of												
Shandaken, Town of	■				■		■	■	■	■	■	■
Shawangunk, Town of	■			■		■		■		■	■	■
Ulster, Town of	■	■		■	■	■	■	■	■	■	■	■
Wawarsing, Town of	■											
Woodstock, Town of												

While the County did retain the services of a consultant (URS Corporation) to guide participants through the process and author the plan, participating jurisdictions contributed throughout the overall planning process, as follows:

- Each participating jurisdiction provided staff to participate in the overall county-wide Core Planning Group (CPG). The jurisdictionôs CPG member(s) were lead members of their municipalityôs Jurisdictional Assessment Team (JAT). JATs were responsible for reviewing information, data and documents, submitting feedback to the Consultant, completing questionnaires/forms, reaching out to the public and other stakeholders in their respective jurisdictions, developing a unique mitigation strategy for their municipality, and reviewing and commenting on draft documents. *More information on the planning team structure and roles/responsibilities is presented later in this section.*
- The Consultant provided **"*Guidance Memorandum 1- Assessing Community Support, Building the Planning Team, and Engaging the Public and Other Stakeholders*"** at the project outset (November 9, 2007). This memorandum was prepared to provide Ulster County and its participating jurisdictions with suggestions for: assessing community support, building the planning team and engaging the public and other stakeholders throughout the plan development process and prior to plan approval. The Jurisdictional Assessment Team for each municipality used this memorandum as a guide for outreach, documented their completed activities in the memorandumôs ñ**Outreach Log**ò. The County and 11 jurisdictions provided a summary of their outreach activities to the Consultant for incorporation into the plan.
- Participating jurisdictions provided feedback during the Hazard Identification and Hazard Profile steps of the process (Sections 2 and 3.a of the plan, respectively) through their completion and submittal of a **Hazard Identification Questionnaire** to the Consultant. This questionnaire summarized the Consultantôs evaluation of a full range of natural hazards, including whether or not each hazard was recommended for inclusion in the plan and why. Municipalities were asked to provide information as to whether or not they concurred with the consultantôs findings, and information on impacts from past events in their respective communities. Local responses were used by the Consultant to supplement hazard information obtained through research of past disaster declarations in the County, review of the New York State Hazard Mitigation Plan (2008), and review of readily available online information from reputable sources (such as federal and state agencies). The County and 12 jurisdictions returned this questionnaire or provided a statement of full concurrence with the Consultantôs findings.
- Participating jurisdictions provided feedback during the evaluation of Land Uses and Development Trends step of the process (Section 3.d of the plan) through their completion and submittal of a **Land Uses and Development Trends Questionnaire** to the Consultant. This questionnaire asked jurisdictions to: (1) describe development trends occurring within their jurisdiction, such as the predominant types of development occurring, location, expected intensity, and pace by land use; and (2) describe any regulations/ordinances/codes their jurisdiction enforces to protect new development from the effects of natural hazards. Local responses were used by the Consultant to supplement information presented in the County Cross-Acceptance Report. The County and eight jurisdictions returned this questionnaire.
- Participating jurisdictions provided feedback during the Capability Assessment step of the process (Section 4 of the plan) through their completion and submittal of a **Capability Assessment Questionnaire** to the Consultant. This questionnaire asked respondents to examine their jurisdictionôs abilities to implement and manage a comprehensive mitigation strategy, which includes a range of mitigation actions. The questionnaires requested information pertaining to existing plans, polices, and regulations that contribute to or hinder the ability to implement hazard mitigation actions. They also requested information pertaining to the legal

and regulatory capability, technical and administrative capacity, and fiscal capability of each jurisdiction. The County and nine jurisdictions submitted completed questionnaires illustrating their capability to implement a mitigation strategy.

- Participating jurisdictions provided feedback regarding **problem areas in need of mitigation and possible mitigation alternatives**. Some municipalities provided this type of information to the consultant separately, either via email or separate written correspondence. Their feedback is included in Section 6 of the plan. At a working session of the Core Planning Group on August 7, 2008, participating jurisdictions were asked to consider range of various types of hazard mitigation actions, and identify a mitigation strategy for their municipality. Ulster County and 12 participating jurisdictions have submitted a unique mitigation strategy.
- The Consultant provided **"*Guidance Memorandum #2 – Plan Maintenance Procedures: Monitoring, Evaluating and Updating the Plan***ò in June 2008. This memorandum provided participants with an overview of the requirements regarding plan maintenance, types of plan maintenance activities that can be selected to meet the requirements, and some examples of plan maintenance strategies from other FEMA-approved plans in FEMA Region 2. Participating jurisdictions were asked to review this information, coordinate with their Jurisdictional Assessment Team, and provide comments back to UCECEM regarding what types of plan maintenance activities their community was in favor of, versus any elements their community like to see excluded. Jurisdictions were asked to submit their feedback to UCECEM. They were advised that lack of feedback would be interpreted to indicate that their jurisdiction had no particular preferences regarding this plan element. In turn, UCECEM reviewed feedback received and developed a county-wide plan maintenance strategy that best reflected the expressed desires of the full team.
- The Consultant provided ñ***Guidance Memorandum #3 – Plan Integration***ò in June 2008. The memorandum summarized requirements in terms of how mitigation recommendations will be integrated into job descriptions, or existing planning mechanisms such as comprehensive plans, capital improvement plans, zoning and building codes, site reviews, permitting and other planning tools, where such tools are appropriate. Various ways that the hazard mitigation plan can be integrated into local planning mechanisms were presented, along with sample text from other plans approved by FEMA Region 2. Participating jurisdictions were asked to review this information, coordinate with their Jurisdictional Assessment Team, and provide comments back to UCECEM regarding what types of plan integration activities their community was in favor of, versus any elements their community like to see excluded. Jurisdictions were asked to submit their feedback to UCECEM. They were advised that lack of feedback would be interpreted to indicate that their jurisdiction had no particular preferences regarding this plan element. In turn, UCECEM reviewed feedback received and developed a county-wide plan maintenance strategy that best reflected the expressed desires of the full team.

Ulster County Hazard Mitigation Planning Committee

This Plan has been developed by the **Ulster County Hazard Mitigation Planning Committee (the "Planning Committee")**, with support from an outside consulting firm (URS Corporation, ñURSò). The efforts of the Planning Committee were headed by the Director of the Ulster County Department of Emergency Communication/Emergency Management. The Plan represents the collective efforts of citizens, elected and appointed government officials, business leaders, volunteers of non-profit organizations, and other stakeholders.

The overall **Planning Committee** consisted of members of Ulster County, each participating jurisdiction, and the public and other stakeholders. The overall Planning Committee did not meet together in one

place during the planning process. Instead, a team concept was used to more evenly distribute responsibilities and to make best of use of every participantôs unique capabilities.

As shown in Figure 1.4, the overall Planning Committee was divided into a **Core Planning Group (CPG)** and a series of **Jurisdictional Assessment Teams (JATs),** with one JAT for each of the Countyôs participating jurisdictions.

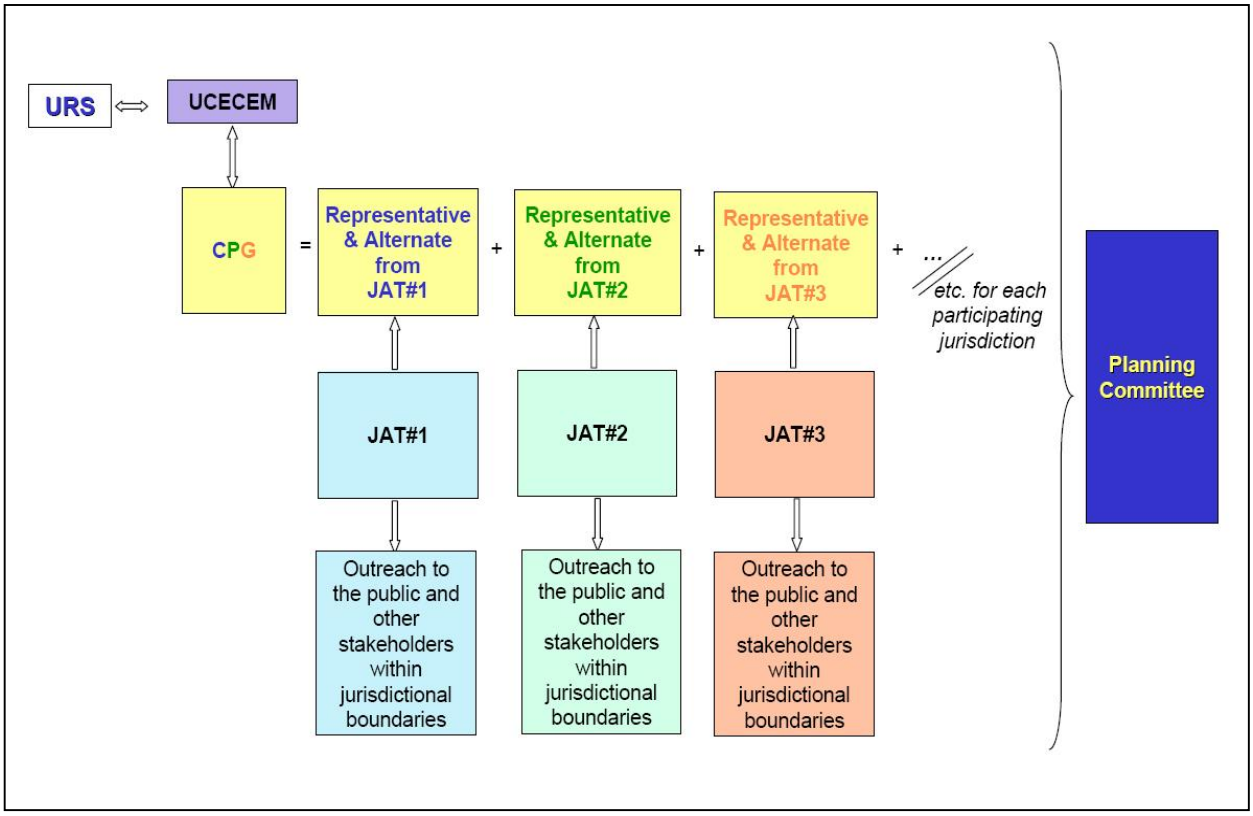


Figure 1.4 – Planning Committee Organizational Structure

This team concept was beneficial for two reasons: (1) the Consultant and the Countyôs main point of contact was the Ulster County Planning Committee and the CPG; and (2) JATs with intimate local knowledge were best suited for coordination and outreach within their respective jurisdictions.

All members of the CPG and the JATs were also members of the overall Planning Committee. The CPG included head members of each JAT (the County and each of the municipalities who elected to participate in the process). The Ulster County Planning Committee was responsible for managing the overall plan formulation activities. The CPG was responsible for attending CPG meetings and providing information and feedback, and coordinating an outreach program within their municipalityôs JAT and beyond to the public and other stakeholders. Each JAT was responsible for coordinating and facilitating local efforts, sending CPG representatives to meetings, providing information and feedback, involving the public and local community stakeholders in the planning process, assessing mitigation alternatives, selecting a course of action to be followed for their community, adopting the plan, and participating in plan monitoring and implementation.

With regard to meetings, UCECEM was responsible for setting meeting dates and times, securing a meeting facility, and notifying all team members of upcoming meetings. They also played a very large

role in reminding CPG members of certain project deadlines. The Consultant prepared meeting agendas, handouts, PowerPoint presentations, and meeting minutes. UCECEM distributed meeting minutes via email, and ensured that all meeting materials and report deliverables were posted on the County web site.

The plan development process was initiated in earnest in the fall of 2007 with the Ulster County **Hazard Mitigation Plan Project Initiation Meeting held on October 25, 2007.** At this meeting, the consultant met with the UCECM to refine the project work plan, discuss schedule and the anticipated level of County labor support. The Consultant provided a ñWish Listò of information, data and documents they hope each participating jurisdiction can submit for their review and incorporation into the plan. The Consultant also provided Guidance Memorandum #1 regarding assessing community support, building the planning team, and engaging the public. At this meeting, expectations regarding the CPG Project Kickoff Meeting were discussed. Handouts included the project scope of work, targeted implementation schedule and Wish List.

While Jurisdictional Assessment Teams met individually throughout the plan development process as they deemed necessary, the following is an overview of CPG meetings held during the plan development process.

- December 11, 2007 ï Core Planning Group Kickoff Meeting. This was the first meeting of the Core Planning Group. Participants were provided with an overview of: the intent of the project; the organizational structure of the planning group; the plan development process overall; the role of participating jurisdictions, contractors, the public and other stakeholders; what it means to participate; key deliverables; data collection/supporting documents; the project timeline; and next steps. Handouts included the PowerPoint presentation, targeted implementation schedule, Wish List, sources of information on hazard mitigation planning, project Fact Sheet and Guidance Memo #1.
- June 19, 2008 ï Core Planning Group Progress Meeting. This meeting was conducted to provide an overview of plan development progress and continued work to be completed. The Consultant provided an overview of the Hazard Identification and Hazard Profile steps, and the ongoing Risk Assessment portion of the draft plan.
- July 17, 2008 ï Risk Assessment Question and Answer Session. The purpose of the meeting was to provide CPG members with an opportunity to ask questions and submit feedback on the recently distributed Risk Assessment Interim Deliverable. The Risk Assessment Interim Deliverable comprised the following working chapters of the draft report: Hazard Identification, Hazard Profiles, Asset Identification, Vulnerability Assessment, Range of Mitigation Actions to be Considered.
- August 7, 2008 ï Mitigation Strategy Working Session. At this working session, attendees conducted an evaluation and prioritization of hazard mitigation actions and developed an implementation strategy for selected mitigation actions. For jurisdictions not present, or those who were present but who needed more time to complete the Prioritization and Implementation Strategy sheets, an opportunity was provided for jurisdictions to do so remotely. Following this meeting, the County and 12 participating jurisdictions had evaluated, prioritized, and developed a strategy for at least one mitigation action.
- Date TBD ï Presentation of Final Plan.

Additional information, such as meeting agendas, presentations, handouts, and minutes were posted on the Ulster County hazard mitigation planning web site at:

http://www.ulstercountyny.gov/emergencyservices/management/haz_mit/index.html

The Role of the Contractors in the Plan Development Process

This Hazard Mitigation Plan is the Countyôs plan; as such, its success rests on the decisions and directions set by the Planning Committee members throughout the plan development process. URS was contracted by Ulster County to work with the UCECEM and the Planning Committee to assist them in developing a plan that would meet the requirements of DMA 2000. **URS was the lead firm for this assignment**, doing so from their local office in Wayne, New Jersey. URS was the direct County point of contact, assisted in the hazard identification and risk assessment, lead the hazard mitigation planning efforts, authored the final document, and provided overall contract administration.
URS assisted the Planning Committee by conducting the analyses necessary to provide the team members with the information they needed to make sound decisions, and helped guide them through the necessary steps of the plan development process. The Planning Committee, in turn, took the lead by including the local community, assessing the alternatives, and ultimately selecting the course of action to be followed. At the end of the planning process, URS prepared this Plan text (with feedback from the Planning Committee) to document the groupôs efforts, along with hazard information and findings, in a manner consistent with applicable regulations (DMA 2000), criteria (44 CFR Part 201.6), and guidance (FEMAôs Mitigation Planning ñHow-Toò Guides; FEMAôs Multi-Hazard Mitigation Planning Guidance document of March 2004, revised November 2006).

A series of three Guidance Memorandums were distributed to UCECEM and the Core Planning Group by URS Corporation, at various meetings and also were posted on the Countyôs mitigation planning web site. These three memos provide a summary of key information presented in DMA 2000, its implementing regulations (IFR), and the FEMA How-To Guides for three key topic areas. The memos are intended to serve as a supplement ï and not as a replacement ï to the FEMA documents. Each memo provides suggestions to municipalities in a certain topic area, and requests feedback from each municipality at the end of the process regarding their decisions. A summary of the Guidance Memos is presented below.

Guidance Memorandum #1 – Assessing Community Support, Building the Planning Team, and Engaging the Public and Other Stakeholders , dated November 11, 2007, describes the project and its goal of identifying the risks associated with natural hazards in Ulster County. It is centered on developing the structure of the Planning Committee and identifying the jurisdictions that are interested in participating in the plan; reaching out to various parties (general public, local residents, business owners, non-profit organizations, community leaders and other stakeholders) during the development and maintenance processes; identifying the role of contractors in the planning process; and ultimately, documenting the planning process.

Guidance Memorandum #2 - Plan Maintenance Procedures: Monitoring, Evaluating and Updating the Plan, dated June 3, 2008, highlights the essential steps necessary for monitoring, evaluating and maintaining the plan, and its value as a vital tool for mitigating hazards and reducing risk. The memo stresses several key factors that need to be undertaken by the Planning Committee: organizing resources, i.e., identifying and organizing interested parties, including the public, during the planning process; assessing the risks, i.e., identifying the natural hazards that generally affect Ulster County; how the communities will be impacted by the hazards; and developing a mitigation plan, i.e., once the risks have been identified, the Planning Committee determines the methods and strategies for avoiding or minimizing the risks. The memo also conveys the importance of following the regulations that require the plan to be monitored, evaluated and updated within a five-year cycle, and the importance of periodically measuring the effectiveness of the actions contributing to the overall success of the plan.

Guidance Memorandum #3 - Plan Integration, dated June 3, 2008, recapitulates the importance of using existing processes and resources by the Planning Committee during plan implementation; thus, saving time and effort in meeting the planôs goals and objectives. The memo states that by following the

requirements and key steps previously discussed, the next essential goal is taking action by integrating the objectives into daily activities and by implementing the plan in a timely manner.

The memos are valuable tools that guide the team members through each step toward the establishment of the hazard mitigation plan. As such, these memos assist the Planning Committee through the planning process that leads to the formal adoption of the plan.

In addition, URS also: (1) Distributed questionnaires for CPG member completion, as described previously beginning on Page 1-9. They were the: Hazard Identification Questionnaire, Land Uses and Development Trends Questionnaire, Capability Assessment Questionnaire; (2) Assisted the CPG through preparation of a project Fact Sheet (discussed on Page 1-18) and development of a project web site (discussed beginning on Page 1-16); and (3) presented at each CPG meeting to guide participating jurisdictions through the process, and advise CPG members regarding each step of the process such as hazards identified and profiled, risks and vulnerabilities identified, possible types of mitigation solutions, etc.

Public Involvement in the Plan Development Process

The role of public involvement in the plan development process is to provide the general public with some variety of means to not only learn about the process that the Planning Committee is undertaking, but to voice concerns and to provide input throughout the planning process. CPG members undertook a range of activities to: (a) alert the public to the fact that the Planning Committee was working to develop this Hazard Mitigation Plan, and (b) provide the public an opportunity to participate with a forum to ask questions, and submit comments and/or suggestions on the process.

The Planning Committee pursued a variety of different ways to provide the public with an opportunity to become involved and engaged during the planning process, in addition to ensuring that the participating jurisdictions were also fully aware of the process and were able to contribute and voice their concerns as well as the general public. As such, the following key activities were employed:

- Ulster County Multi-jurisdictional Mitigation Planning web site
- *Plan Facts* fact sheet
- Core Planning Group Meetings open to the public
- Other Outreach Activities by UCECEM and CPG Members

Ulster County Multi-Jurisdictional Mitigation Planning Web Site

The CPG made an effort to involve the public and other stakeholders in the process during the drafting stage of the plan in part through a mitigation planning web site. The Ulster County Web site contains a new section on the county-wide multi-jurisdictional hazard mitigation planning process. It can be found online at:

http://www.ulstercountyny.gov/emergencyservices/management/haz_mit/index.html

The web site was initiated in Early 2008 and will continue to be maintained and updated by UCECEM on a regular basis. The additional web pages were incorporated into the site for the purpose of informing the public (including businesses, local citizens and the residents that are part of the Ulster County communities) about the importance of hazard mitigation planning and their opportunity to participate and provide feedback during the process. In this section, the UCECEM provides general information about the process, the organizational structure of the planning team, meeting information (agendas,

presentations, handouts, and minutes), other reference materials, a link for the Risk Assessment Interim Deliverable and the Draft Plan, and more. Contact information for the UCECEM Coordinator is also provided and individuals are invited to reach out to this person for information on how to become involved or to provide comments. The image below is a screen-capture of the main mitigation planning web page on the County's site.

Other jurisdictions have documented that they supplemented this by creating similar pages or links on their jurisdiction web sites to the overall county mitigation planning pages, including the Towns of Saugerties, Marbletown, Marlborough, Hurley, and Shandaken, and the City of Kingston.

On the All Natural Hazards Mitigation Planning page, topics are organized under the following main categories: General Information, Planning Group Work Chart, Meeting Schedule, Useful Links, Press Releases, Planning Group Information, Participating Jurisdictions, The Draft Plan, and Contact Information.

- The *General Information* section informs the reader about hazard mitigation and the hazard mitigation plan, the purpose and need for the plan, and a general overview of the process. It also

points out the by implementing the hazard mitigation plan over the long-term, the damages and loss of life, as a result of a natural disaster, may be diminished.

- The *Planning Group Organizational Structure* section contains a flowchart representation of the participating entities in the plan development process.
- The *Meetings* section offers a listing of all the meetings held during 2007 and 2008 with the Core Planning Group. The meeting agenda, minutes and other documents pertinent to each meeting can be found in this section for viewing or downloading.
- The *Participating Jurisdictions* section lists all entities that either participated fully in the planning process, contributed some input, were consulted, or expressed interest.
- The *Core Group Deliverables* section forms a repository of all forms, questionnaires, and worksheets that participating jurisdictions were asked to submit.
- The *Document Repository* section provides contact details for interested parties without an internet connection wishing to access the library of hard copies of all documents related to the plan established at the Ulster County Emergency Management Offices.
- The *Draft Plan* section contains the Draft Plan in Adobe PDF format, as well as the Risk Assessment Interim Deliverable.
- Under *Useful Links*, the reader can find links to various FEMA and New York State Office of Emergency Management (NYSEMO) web pages with information on hazard mitigation, the guidelines, DMA 2000 and other related topics.
- The *More Information* section provides contact information for the UCECEM Director regarding the County Multi-Jurisdictional Hazard Mitigation Plan.

PlanFacts

The CPG made an effort to involve the public and other stakeholders in the process during the drafting stage of the plan in part through a fact sheet. The Planning Committee increased public awareness of the hazard mitigation plan process by providing a two-page summation on hazard mitigation facts and the mitigation planning process to the public, community leaders, business owners, local residents and other stakeholders in the plan. The flyer, entitled *Ulster County Multi-Jurisdictional Natural Hazard Mitigation Planning Project PlanFacts*, furnishes pertinent plan data that explains the purpose and need for the mitigation plan in Ulster County.

The two-page flyer begins by providing a basic understanding to ñWhat is hazard mitigation?ò It then contains information on the plan development process and how jurisdictions can participate in the plan or prepare their own hazard mitigation plans in compliance with DMA 2000 requirements. It also provides an overview of the Hazard Mitigation Planning Committee members and their roles; the steps in the mitigation process (goals, objectives, natural hazards evaluation, etc.); the plan scheduled target completion date; and a point of contact at UCECEM for more information.

PlanFacts was distributed to the attendees at the Core Planning Group Kickoff Meeting on December 11, 2007. It was also posted by several Core Planning Group Members on local notice boards throughout the county. The Fact Sheet can be found electronically at the Ulster County Emergency Management web site address given above.

PlanFacts was also distributed in hard copy format widely throughout the County by CPG members. Locations that it has been posted/distributed include Local libraries, fire departments, and City/Town Halls. A copy of the full fact sheet is presented below:

Ulster County Multi-Jurisdictional Natural Hazard Mitigation Planning Project

PLAN FACTS

Town of Ulster, April 2005: Flooding of State Route 28.

New Paltz, April 2007: Washout of the sole means of access and egress to the Mountain View Nursing and Rehabilitation Centre.

April 2005 flooding of homes along the Rondout Creek.

WHAT IS HAZARD MITIGATION?

Natural hazards have the potential to cause property damage, loss of life, economic hardship, and threats to public health and safety.

Hazard mitigation measures are the things you do today to be more protected in the future. They are measures taken before a disaster happens to reduce the impact that future disasters will have on people and property in the community. Mitigation reduces the risk of loss and creates a more disaster-resistant and sustainable community. Hazard mitigation measures are essential to breaking the typical disaster cycle of damage, reconstruction, and repeated damage.

PURPOSE AND NEED FOR THE PLAN

Hazard mitigation plans are developed BEFORE a disaster strikes. The plans identify community policies, actions, and tools for long-term implementation to reduce risk and potential for future losses. Adopted, implemented and maintained on an ongoing basis, these plans will gradually, but steadily, lessen the impacts associated with hazard events in Ulster County.

As of November 1, 2004 communities that do not have a FEMA-approved hazard mitigation plan in place are no longer eligible for FEMA project grant monies under programs such as the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance Program (FMA) and Pre-Disaster Mitigation Grant Program (PDM).

Ulster County Multi-Jurisdictional Natural Hazard Mitigation Planning Project — PLANFACTS

PARTICIPATION

Jurisdictions located within Ulster County who wish to be recognized by FEMA as being compliant with DMA 2000 must either: (a) participate with the County in the multi-jurisdictional plan development process and formally adopt the final plan, or (b) prepare their own hazard mitigation plan. All jurisdictions in Ulster County are being invited to participate in the multi-jurisdictional planning process.

Active participation in a mitigation planning process is the only way a jurisdiction can be seen in FEMA's eyes as a 'participating jurisdiction' that has met the requirements of DMA 2000 and is therefore eligible to apply for Federal funds for hazard mitigation projects. Participation includes attending meetings, providing feedback and reaching out to the public and other key stakeholders in the community, and adopting the final plan.

Participation has other advantages as well:

- Because Ulster County has hired a consulting team to conduct the analyses and author the plan, participation involves relatively little effort on the part of jurisdictions.
- Because Ulster County has received Federal grant monies to develop the plan, participation involves no cost to local jurisdictions - only allocation of staff time to participate in the process.
- Multi-jurisdictional hazard mitigation plans are practical for addressing issues that do not recognize political boundaries.
- Over time, implementation of the plan will reduce economic damages resulting from future natural disasters.

STRUCTURE

Elected and appointed government officials, business leaders, volunteers of non-profit organizations, citizens, and other stakeholders who choose to participate will become part of our overall Ulster County Multi-Jurisdictional Hazard Mitigation Planning Committee. To keep meeting sizes to workable numbers, the Planning Committee will be broken up into a Core Planning Group and Jurisdictional Assessment Teams.

The Core Planning Group (CPG) will include representatives of Ulster County and any of the county's jurisdictions who elect to participate in the process. The CPG will manage the overall plan formulation activities and contribute to the decision making process. Representatives on the CPG will coordinate the plan efforts by organizing outreach by means of a team concept through the Jurisdictional Assessment Teams (JATs).

The JATs will include representatives from the individual participating jurisdictions. They will be responsible for local community involvement in the multi-jurisdictional mitigation plan.

Regardless of team, all participating jurisdictions must:

- Coordinate and facilitate local efforts.
- Attend meetings.
- Provide information and feedback.
- Involve the public and community stakeholders in the planning process.
- Assess mitigation alternatives.
- Select a course of action to be followed for their communities.
- Implement the plan and monitor its progress.

PROCESS

- Research a full range of natural hazards.
- Identify subset of significant hazards; these will be the focus of the plan.
- Identify location and extent of hazard areas.
- Identify assets located within hazard areas.
- Characterize existing and potential future assets at risk.
- Assess vulnerabilities to the identified hazards.
- Evaluate and prioritize goals, objectives, and hazard mitigation actions.
- Implement the Plan and monitor its progress.

SCHEDULE

The mitigation plan development process will occur over approximately one year, beginning in mid-October of 2007. A Draft Plan is targeted for completion in August of 2008.

OUR WEBSITE

A Multi-Jurisdictional Hazard Mitigation Planning Page is currently under development on the County's web site. We encourage you to check back for additional information and updates at: www.co.ulster.ny.us.

FOR MORE INFORMATION

Thank you for your interest! For questions or other feedback, please contact:

Arthur R. Snyder, Director
Ulster County Emergency Communications/Emergency Management
238 Golden Hill Lane
Kingston, New York 12401-6440
Phone: (845) 331-7000
Fax: (845) 331-1738
E-Mail: asnyi@co.ulster.ny.us

Page 2 of 2 — November 2007

Open Public Meeting

The CPG made an effort to involve the public and other stakeholders in the process during the drafting stage of the plan in part through making two of its five CPG meetings open to interested parties.

- December 11, 2007 ï Core Planning Group Kickoff Meeting. This was the first meeting of the Core Planning Group. Participants were provided with an overview of: the intent of the project; the organizational structure of the planning group; the plan development process overall; the role of participating jurisdictions, contractors, the public and other stakeholders; what it means to participate; key deliverables; data collection/supporting documents; the project timeline; and next steps. Handouts included the PowerPoint presentation, targeted implementation schedule, Wish List, sources of information on hazard mitigation planning, project Fact Sheet and Guidance Memo #1.
- June 19, 2008 ï Core Planning Group Progress Meeting. This meeting was conducted to provide an overview of plan development progress and continued work to be completed. The Consultant provided an overview of the Hazard Identification and Hazard Profile steps, and the ongoing Risk Assessment portion of the draft plan.
- July 17, 2008 ï Risk Assessment Question and Answer Session. The purpose of the meeting was to provide CPG members with an opportunity to ask questions and submit feedback on the recently distributed Risk Assessment Interim Deliverable. The Risk Assessment Interim Deliverable comprised the following working chapters of the draft report: Hazard Identification, Hazard Profiles, Asset Identification, Vulnerability Assessment, Range of Mitigation Actions to be Considered.

- August 7, 2008 ï Mitigation Strategy Working Session. At this working session, attendees conducted an evaluation and prioritization of hazard mitigation actions and developed an implementation strategy for selected mitigation actions. For jurisdictions not present, or those who were present but who needed more time to complete the Prioritization and Implementation Strategy sheets, an opportunity was provided for jurisdictions to do so remotely. Following this meeting, the County and 12 participating jurisdictions had evaluated, prioritized, and developed a strategy for at least one mitigation action.
- Date TBD ï Presentation of Final Plan.

Other Outreach Activities by UCECEM and CPG Members

In addition to the web site, fact sheet, and open public meetings held, the Core Planning Group (through their respective JATs) undertook the actions summarized in chronological order in Table 1.6 to raise awareness of the plan development process and provide the public and other stakeholders with a forum for participating in - and providing feedback throughout - the plan development process. While participating jurisdictions have provided comments, to date, no feedback from the public or other stakeholders has been received. Comments received in time to be incorporated into the Final will be reviewed by the Consultant and UCECEM and integrated into the plan as applicable. As this is a living document, other comments will be considered for integration during future maintenance cycles and plan updates.

Table 1.6
Summary of Jurisdiction Outreach Activities

Date	Jurisdiction	Action
11/15/07	Ulster County	Invitation to kickoff meeting to Chief Elected officials and CEMP committee members.
11/16/07	Ulster County	Page on County website dedicated to the Hazard Mitigation Plan went live
11/19/07	Ulster County	Participation in planning effort by emailing from UCAA.
11/20/07	Ulster County	Letters from Greene Co. OES, spoke to fire chiefs in Highland, Kingston, Shandaken Hwy, Rosendale supervisor-elect, RE: Planning Effort
11/26/07	Ulster County	Email and letters with Kingston Hospital and SUNY Ulster, RE Planning Effort
11/27/07	Ulster County	Letters w/Ulster BOCES & Sullivan County RE Planning effort
11/27/07	Ulster County	Community Involvement by discussing hazard mitigation planning at Criminal Justice/Safety Committee meeting of Legislature.
11/29/07	Ulster County	Letters/email with Sheriff and Red Cross RE planning effort
11/30/07	Town of Saugerties	Placed link on town website to County Mitigation Plan website page
12/5/07	Town of Lloyd	Presentation to Town Board and community members info RE: Haz Mit Plan and requested ongoing input. Indicated that there would be meetings upcoming to discuss mitigation action plans.
12/5/07	Town of Marbletown	Placed link on town website to County Mitigation Plan website page
12/7/07	Ulster County	Spoke to Lower Esopus Watershed Chair
12/10/07	Ulster County	Public Notice of open meeting in the Daily Freeman.
12/12/07	Town of Rosendale	Town Board Meeting with local media coverage: Made public Information about plan.
1/2/08	City of Kingston	Public meeting with City Council to describe intent of plan.
1/8/08	Town of Gardiner	Town Board Meeting: Presentation on Plan and Core Group. Participation Resolution to be passed by The Town Board.

Table 1.6 Summary of Jurisdiction Outreach Activities		
1/9/08	Town of Lloyd	Town Board Regular Meeting: Presented information concerning outreach efforts to community. Fire Dept and Police Dept. on hand to discuss Emergency Response and incidents in the Town.
1/14/08	Ulster County	Participation in planning effort by speaking to NYSP zone captain.
1/15/08	Ulster County	Engaging community support by addressing UC Town Supervisors Assoc monthly meeting
1/16/08	City of Kingston	Posted info notice in City Hall, alert public of pending Mitigation Plan,.
1/22/08	Ulster County	Engaging community involvement by discussing Haz Mit planning at monthly Criminal Justice/Safety Committee meeting of legislature.
1/28/08	Town of Hurley	Discussion of Multi Jurisdictional Hazard Mitigation Plan at board Meeting.
2/1/08	Town of Saugerties	Ongoing: Mention of Plan in various public forums and on local public access TV23
2/5/08	Town of Rosendale	Public Outreach to Creekside residents via email and correspondence.
2/11/08	Ulster County	Placed notice in Daily Freeman re: plan and capability assessment meeting.
2/12/08	Town of Rosendale	Dept Head Meeting: inform dept heads of UC Hazard Mitigation Process
2/14/08	Ulster County	Conducted open Meeting, re: Capability Assessment Review.
2/14/08	Ulster County	Engaging community involvement - spoke to NYSP Lt. J. Michaels
2/15/08	Town of Gardiner	Meeting w/Highway Supt, Town Supervisor and Code officer, reviewing wish list and land uses and development, trends, deliverables.
2/18/08	Ulster County	Engaging community involvement - contact with NYS Bridge Authority.
2/19/08	City of Kingston	Discussed project at neighborhood meeting.
2/19/08	Town of Lloyd	Sent informational handout to town depts, local library, Fire Dept, Town Hall.
2/22/08	Ulster County	Engaging community involvement - spoke to Cornell Cooperative Extension Re: economic impact of drought on farming; spoke to Soils & Water re: capabilities.
2/25/08	Town of Hurley	Meeting passed Resolution #2008-63 resolving Town's participation in development of Haz Mit Plan.
2/26/08	Ulster County	Discussion about Haz Mit planning at monthly Criminal Justice/Safety committee meeting of Legislature.
3/1/08	Town of Kingston	Town Board Meeting: update Town Board and public regarding Mitigation Project.
3/3/08	Ulster County	Interview with Wallkill Valley Times re: Haz Mit Planning process.
3/4/08	City of Kingston	City Council discussed participation.
3/28/08	Town of Rosendale	Training: Flood Response Workshop attended by several town staff.
4/1/08	Town of Kingston	Meeting with Town of Kingston Bldg Inspector, Mr. Clark Kimble regarding Hazard Mitigation Plan.
4/1/08	Town of Marlborough	Update comprehensive Emergency Management Plan at meeting with Emergency Preparedness Committee.
4/8/08	Town of Gardiner	Public Meeting at Town Board Monthly meeting to update on planning process.
4/10/08	Town of Lloyd	Emergency Response Meeting: meet with key Emergency responders, Town Engineer, Town Bldg Inspector and stormwater

Table 1.6 Summary of Jurisdiction Outreach Activities		
		coordinator, and Town Board Members to discuss past incidents and brainstorm ideas for future mitigation.
4/15/08	Town of Ulster	Emergency Services Meeting with Fire Chiefs from all five fire districts, discussing Hazard Mitigation in each district.
4/16/08	Town of Rosendale	Stakeholders' Meeting to discuss ACOE Reconnaissance Study
4/21/08	Ulster County	Discussed Haz Mit planning at monthly meeting of Criminal Justice/Safety committee meeting.
4/24/08	Town of Rosendale	Flood Control Inspection: Information gathering
4/28/08	Town of Rosendale	ACOE Meeting @ UCCC to discuss Federal funding of projects
5/1/08	Town of Marlborough	Town Board Meeting: Introduced updated plan to public.
5/7/08	Town of Ulster	Meeting with Town of Ulster Planner, Mr. Alan Sorenson, AICP discussion regarding mitigation plan.
5/15/08	Town of Lloyd	Drainage Committee Meeting: monthly meeting dedicated to considering and brainstorming ideas for mitigation of recurrent problems of flooding in the town. Committee entertained local citizens and heard their concerns.
5/22/08	Town of Rosendale	Town Supervisor's Meeting regarding support of RCWC activities.
5/27/08	Ulster County	Discussed Haz Mit planning at Criminal Justice/Safety committee meeting of Legislature.
5/30/08	Ulster County	Engaging community involvement - email with NYSP.
6/1/08	Town of Ulster	Town Board Meetings updating town Board and public on project status request input from public and Town Board.
6/1/08	Town of Kingston	Town Board Meeting updating public and Town Board the status of the project and request public comment and input.
6/3/08	Ulster County	Engaging community involvement - Email with Towns of Rosendale and Marlboro re: mitigation actions.
6/4/08	Ulster County	Engaging community involvement - Spoke w/Village of New Paltz.
6/9/08	Town of Rosendale	Flood Mapping and Management Seminar to discuss state and local regulations and activities.
6/11/08	Town of Rosendale	Town Board Meeting to discuss Flood maps
6/19/08	Ulster County	Public meeting on status of Hazard Mitigation Plan at County Bldg.
6/25/08	City of Kingston	Linked City website to County website for Info on Ulster County Hazard Mitigation Plan
6/26/08	Town of Rosendale	Dept Head Meeting to discuss UC Hazard Mitigation Plan.
6/30/08	Town of Rosendale	DEC Meeting at New Paltz to discuss Federal money and non-Federal Partners
7/1/08	Town of Ulster	Meeting with John Morrow, Chairman of Comprehensive Plan Committee, discussion regarding hazard plans in Town of Ulster that could save lives.
7/1/08	Town of Marlborough	Linked comprehensive Emergency Mgmt Plan to website for public education, www. Marlboroughny.com
7/1/08	Town of Marlborough	Notice to encourage public to go to Ulster County website for Natural Haz Mit Plan info.
7/2/08	City of Kingston	Radio interview WCNY: discussed city participation in plan.
7/8/08	Town of Rosendale	Public Information Meeting to discuss public impact on Emergency Action Plan for Sturgeon Pool.
7/9/08	Town of Rosendale	Town Board Meeting for public information with local media coverage
7/14/08	Town of Hurley	Posted participation news on Town website, added link to Ulster Counties Website and Info.

Table 1.6 Summary of Jurisdiction Outreach Activities		
7/17/08	Town of Lloyd	Outreach phone calls and letter to those parcel owners in flood prone areas in response to a call from County Bldg Dept, government. Homeowners were informed of the counties effort in mitigation (including possible purchase of their homes) and were invite
7/18/08	Town of Gardiner	Public Meeting of Gardiner Dem. Committee (nominating caucus) to update on planning process.
7/20/08	Town of Gardiner	Meeting w/Chiefs and other members of Gardiner Fire Dept. to update process. Request for assistance in identifying appropriate mitigation projects.
7/21/08	Town of Rosendale	Emails w/info to Highway Superintendent, Building Inspector, Police Chief, Water/Sewer Superintendant of Planning Mtg.
7/22/08	Town of Gardiner	Fire Co. Meeting w/line officers of Shaw Vly Fire Co. to update on planning process and request for assistance in identifying appropriate mitigation projects.
7/22/08	Ulster County	Discussion of Haz Mit Plan at Criminal Justice/Safety Committee meeting of Legislature.
7/23/08	Town of Gardiner	Public meeting of Gardiner Fire Dist Board of Fire Commissioners updating on planning process and request for assistance in identifying appropriate mitigation projects.
7/24/08	Town of Rosendale	Strategy Meeting to discuss Hazard Mitigation Plan and Core Deliverables.
7/24/08	Town of Gardiner	Town of Gardiner Republican Comm. Mtg. - planning process update.
7/28/08	Town of Hurley	Discussion and posting of Risk Assessment Interim Deliverable in Town Clerk's Office.
8/1/08	Town of Shandaken	Link town website to County Emergency Management Plan. Information for town residents about NIMS and Ulster County Hazard Mitigation.
10/1/08	Town of Gardiner	Meeting with Gardiner Association of Businesses
10/15/08	Town of Gardiner	Meeting with Property Owners of Rutsonville

Public Response to Outreach Activities

Near the end of the planning process, UCECEM solicited feedback from CPG members regarding response to outreach activities in their municipalities. While municipalities generally indicated positive reactions and support, the Town of Gardner was able to provide some more detailed comments that arose from locally-held meetings and presentations:

- Local fire districts and volunteer fire companies expressed interest in using the Plan to pursue funding for wildfire mitigation programs, such as Community Wildfire Protection Planning (e.g. *Firewise*), and prescribed burns.

- Attendees at town board meetings in which elements of the plan were discussed regarded the effort as worthwhile and were particularly interested in whether the efforts of neighboring municipalities (as well as state and Federal agencies) could be coordinated when addressing the issue of flooding.

- Several speakers at a meeting of the Gardiner Association of Businesses in which the plan was presented considered the Plan to be a worthwhile effort and were pleased that the Town was participating in developing the plan.

Involvement of Other Stakeholders in the Plan Development Process

In order to meet Federal requirements, the plan development process must be open to stakeholders beyond planning group members and the general public. That is, opportunities must be available for other stakeholders (such as businesses, neighboring communities, academia, other relevant private and non-profit interests, and other interested parties) to become involved in the planning process.

As with the general public, other stakeholders must be provided with some variety of means to not only learn about the process that the Planning Committee is undertaking, but to voice concerns and to provide input throughout the planning process. With support and guidance from URS, each JAT took the lead in pursuing a range of activities to: (a) alert other stakeholders to the fact that the planning was working to develop this Hazard Mitigation Plan, and (b) provide other stakeholders with a forum to ask questions, and to submit comments and/or suggestions on the process or directly participate.

The Core Planning Group determined that outreach activities to the general public as summarized in the previous section would also reach and provide the same opportunities for other stakeholders such as businesses, neighboring communities, academia, other relevant private and non-profit interests, and other interested parties. In addition, targeted outreach to key stakeholder groups included:

- Greene, Sullivan and Orange Counties (immediately adjacent to Ulster County)
- Ulster Boards of Cooperative Educational Services
- American Red Cross, Ulster County Chapter
- Lower Esopus Watershed Consortium
- Kingston Hospital
- Central Hudson Gas & Electric Corporation
- New York State Police
- New York State Thruway Authority
- New York State Bridge Authority
- New York City Department of Environmental Protection
- SUNY New Paltz
- SUNY Ulster

Review and Incorporation of Existing Plans, Studies, Reports, and Technical Information

In the process of preparing this hazard mitigation plan, many other existing plans, studies, reports, and technical information were evaluated. These sources are noted throughout this report as various topics are discussed. In summary, the development of this hazard mitigation plan included the review and incorporation as applicable of data from the following sources:

- Readily available on-line information from federal and state agency web sites including: FEMA, NYSEMO, NY State Department of Environmental Conservation, US Forest Service National Avalanche Center, US Geological Survey, National Oceanic and Atmospheric Administration (including National Weather Service and National Climatic Data Center, and the National Severe Storms Laboratory),U.S. Army Cold Regions Research and Engineering Laboratory USGS National Geomagnetism Program, National Drought Mitigation Center Drought Impact Reporter, USGS National Earthquake Information Center, NASA Space Environment Center, and the US Department of Transportation Federal Highway Authority.

- Ulster Tomorrow ï Sustainable Economic Development Plan and Strategy Planning Report 2007
- New York State Hazard Mitigation Plan (January 2008)
- FEMA Q3 Flood Data and municipal Flood Insurance Studies
- Ulster County GIS
- Ulster County HAZNY Analysis
- Ulster County Comprehensive Emergency Management Plan
- USGS Earthquake History of New York State
- NY State Geological Survey NEHRP Soil Class Mapping
- NY State Landslide Inventory Mapping
- USGS National Landslides Program Landslide Mapping
- National Agricultural Statistics Service, Ulster County Profile 2002
- American Farmland Trust Agricultural Economic Development for the Hudson Valley, Technical Report and Recommendations 2004
- HAZUS-MH database for emergency facilities and utilities
- Stanford University National Performance of Dams Program web site
- New York State Historic Preservation Office GIS shape files for state and federally listed historic and cultural resources
- FEMA NFIP Community Status Book
- FEMA data for NFIP Repetitive Loss Properties and Community Rating System communities
- FEMAôs ñNFIP Floodplain Management Requirements: a Study Guide and Desk Reference for Local Officials (FEMA-480)ò
- USGS Landslide Overview Map of the Conterminous United States, prepared in hard copy format in 1982 by Dorothy H. Radbruch-Hall, Roger B. Colton, William E. Davies, Ivo Lucchitta, Betty A. Skipp, and David J. Varnes (Geologic Survey Professional Paper 1183), compiled digitally by Jonathan W. Godt (USGS Open File Report 97-289), as viewed on NationalAtlas.gov
- American Society of Civil Engineers (ASCE) Standard 7-98: Minimum Design Loads for Buildings and Other Structures
- FEMAôs ñMulti-Hazard Identification and Risk Assessmentò (1997)
- American Society of Civil Engineers ñWind Zones in the United Statesò map
- American Meteorological Society ñGlossary of Meteorologyò
- In addition, to conduct their Capability Assessments, local jurisdictions considered relevant plans, codes, and ordinances currently in place such as building codes, zoning ordinances, subdivision ordinances, special purpose ordinances, site plan review requirements, growth management ordinances, comprehensive plans, capital improvements plans, economic development plans, emergency response plans, post-disaster recovery plans, post-disaster recovery ordinances, and real estate disclosure ordinances. For additional information, please see the ñCapabilities and Resourcesò section of this plan.

Regulatory Compliance

This Hazard Mitigation Plan was prepared in a manner consistent with applicable regulations, criteria, and guidance. The Planôs components address the local hazard mitigation planning requirements of the DMA 2000. The Planning Group used FEMAôs Multi-Hazard Mitigation Planning Guidance document of March 2004 (Revised July 2008) as a guide. This document contains what is known as a Crosswalk Reference Document for FEMA reviewers to track where in a document various criteria are addressed. Each criteria must be addressed satisfactorily for a plan to be approved by FEMA. There are three exceptions, with regard to assessing vulnerability. They are:

- Assessing Vulnerability: Identifying Structures: §201.6(c)(2)(ii)(A)
- Assessing Vulnerability: Estimating Potential Losses: §201.6(c)(2)(ii)(B)
- Assessing Vulnerability: Analyzing Development Trends: §201.6(c)(2)(ii)(C)

For these three criteria, highlighted in gray in Table 1.7, actions are strongly encouraged by FEMA, though not required by the DMA 2000 Interim Final Rule. While FEMA encourages communities to address such criteria, they are not required for Plan approval. For the Ulster County Multi-Jurisdictional Hazard Mitigation Plan, these three criteria were addressed to the greatest extent practicable in the time available and using the best readily-available data.

The following table summarizes specific requirements in the Interim Final Rule, and whether the regulation implementing DMA 2000 is addressed in this plan. Information in this plan is presented in the order of the plan review criteria for NYSEMO/FEMA reviewerôs ease in evaluating compliance.

Table 1.7
FEMA Plan Review Criteria

FEMA Plan Review Criteria	Addressed in this Plan
Prerequisites	
Adoption by the Local Governing Body: §201.6(c)(5)	Placeholder following page i
Multi-Jurisdictional Plan Adoption: §201.6(c)(5)	Placeholder following page i
Multi-Jurisdictional Planning Participation: §201.6(a)(3)	Section 1, Apdx F
Planning Process	
Documentation of the Planning Process: §201.6(b) and §201.6(c)(1)	Section 1 and Apdx. A
Risk Assessment	
Identifying Hazards: §201.6(c)(2)(i)	Section 2
Profiling Hazards: §201.6(c)(2)(i)	Section 3
Assessing Vulnerability: Overview: §201.6(c)(2)(ii)	Section 3 and Apdx. A-C
Assessing Vulnerability: Addressing Repetitive Loss Properties: §201.6(c)(2)(ii)	Section 3
Assessing Vulnerability: Identifying Structures: §201.6(c)(2)(ii)(A)	Section 3 and Apdx. C
Assessing Vulnerability: Estimating Potential Losses: §201.6(c)(2)(ii)(B)	Section 3
Assessing Vulnerability: Analyzing Development Trends: §201.6(c)(2)(ii)(C)	Section 3
Multi-Jurisdictional Risk Assessment: §201.6(c)(2)(iii)	Section 3
Mitigation Strategy	
Local Hazard Mitigation Goals: §201.6(c)(3)(i)	Section 5
Identification and Analysis of Mitigation Actions: §201.6(c)(3)(ii)	Sections 6 - 7 and Apdx. D
Identification and Analysis of Mitigation Actions: NFIP Compliance: §201.6(c)(3)(iii)	*Sections 6 - 7 and Apdx. D*
Implementation of Mitigation Actions: §201.6(c)(3)(iii)	Section 8 and Apdx. E
Multi-Jurisdictional Mitigation Actions: §201.6(c)(3)(iv)	Section 8 and Apdx. E
Plan Maintenance Process	
Monitoring, Evaluating, and Updating the Plan: §201.6(c)(4)(i)	Section 9
Incorporation into Existing Planning Mechanisms: §201.6(c)(4)(ii)	Section 9
Continued Public Involvement: §201.6(c)(4)(iii)	Section 9

Document Organization

This Multi-Jurisdictional Hazard Mitigation Plan for Ulster County is organized into the following major sections.

Introduction. Plan purpose, overview of Ulster County, summary of plan development process, document organization, and key terms.

Identification of Potential Hazards. Documentation of the Planning Committeeôs evaluation of a full range of natural hazards, and indication of which hazards were identified for inclusion in this plan (and why) versus those that were not identified (and why not).

Risk Assessment. Hazard profiles, identification and characterization of assets in hazard areas, damage estimates, and summary of land uses and development trends in hazard areas.

Capabilities and Resources. Overview of local, state, and federal resources for hazard mitigation.

Mitigation Goals. Summary of hazard mitigation goals for the State Hazard Mitigation Plan and also for this county-wide multi-jurisdictional hazard mitigation plan.

Range of Alternative Mitigation Actions Considered. Summary of mitigation actions considered by participating jurisdictions.

Action Item Evaluation and Prioritization. Information regarding the methodology and process followed by participating jurisdictions to evaluate and prioritize unique hazard mitigation actions for their communities.

Implementation Strategy. Summary of hazard mitigation actions selected by each participating jurisdiction.

Plan Maintenance. Procedures selected for monitoring, evaluating, and updating this mitigation plan; including participation of the public and other stakeholders in plan maintenance, and plan integration.

Key Terms

For the purpose of clarity throughout this document, the following definitions are briefly outlined:

- **Hazard mitigation** is the method by which measures are taken to reduce, eliminate, avoid or redirect natural hazards in order to diminish or eradicate the long-term risks to human life and property.

- A **natural hazard** is any hazard that occurs or results from acts of nature such as floods, earthquakes, hurricanes, tornadoes and coastal storms, to name a few.

- A **hazard mitigation plan** is a well-organized and well-documented evaluation of the natural hazards and the extent that the events will occur. In addition, the plan identifies the vulnerability to the effects of the natural hazards typically present in a certain area, as well as the goals,

objectives and actions required for minimizing future loss of life and property damage as a result of natural hazards.

- **Hazard mitigation planning** is the process of managing actions taken by individual citizens and professional organizations involved in mitigation activities. The process involves carrying out plans to reduce loss of life, injuries and damage to property, as well as reducing the costs associated with losses from natural hazards. It is a long-term process with benefits best realized over time.

- A **disaster** is any catastrophic event that causes loss of life, injuries and widespread destruction to property. For the purpose of this document, a disaster is the result of a natural hazard, whether anticipated (such as flash flood warnings) or fortuitous (such as earthquakes).

- The term **human-caused hazards** refers to technological hazards + terrorism, where ñtechnological hazardsò are incidents that arise from human activities such as the manufacture, transportation, storage, and use of hazardous materials, where the incidents are accidental and their consequences unintended; and ñterrorismò is the intentional, criminal, and/or malicious acts resulting from the use of Weapons of Mass Destruction (WMD), including biological, chemical, nuclear, and radiological weapons; arson, incendiary, explosive and armed attacks; industrial sabotage and intentional hazardous materials releases; and cyberterrorism.

SECTION 2 – IDENTIFICATION OF POTENTIAL HAZARDS FOR ULSTER COUNTY, NEW YORK

FEMAôs current regulations and interim guidance require, at a minimum, an evaluation of a full range of natural hazards. An evaluation of ñhuman-causedò hazards (i.e., technological hazards and/or terrorism) is encouraged, though not required, for plan approval under DMA 2000. Ulster County has chosen to focus solely on natural hazards at this time. Human-caused hazards can be evaluated in future versions of the plan, as it is a ñliving documentò which will be monitored, evaluated and updated regularly.

After consideration of a full range of natural hazards, Ulster County has identified several hazards that are addressed in this Multi-Jurisdictional Hazard Mitigation Plan. These hazards were identified through an extensive process that utilized input from Planning Group members, review of the Ulster County Hazards New York (HAZNY) analysis, research of past disaster declarations in the County, and review of the New York State Hazard Mitigation Plan (2008). Readily available online information from reputable sources (such as federal and state agencies) was also evaluated to supplement information from these key sources.

The following table (Table 2.1) presents the full range of natural hazards considered and provides a brief description of the hazard. Subsequently, Table 2.2 documents the evaluation process for the hazards listed in Table HI.1 to determine the hazards worthy of further consideration in the plan. For each hazard considered, Table HI.2 indicates whether or not the hazard was identified as a significant hazard to be addressed in the plan, how this determination was made (i.e. the sources of information that were consulted while researching each hazard) and why this determination was made. The table summarizes not only those hazards that *were* identified (and why) but also those that *were not* identified (and why not).

Some of these hazards are considered to be interrelated or cascading (e.g., hurricanes can cause wind damage and flooding), but for preliminary hazard identification purposes these individual hazards have been broken out separately. It should also be noted that some hazards, such as earthquakes or winter storms may impact a large area yet cause little damage, while other hazards, such as a tornado, may impact a small area yet cause extensive damage within that area.

Because this Hazard Mitigation Plan is a living document, hazard events not identified for inclusion at this time could be addressed during future evaluations and updates of the plan if deemed necessary by the Planning Group at that time.

Lastly, Table 2.3 provides a summary checklist of the hazard identification and evaluation process noting which of the 23 initially identified hazards are considered significant enough for further evaluation through Ulster Countyôs multi-jurisdictional hazard risk assessment (marked with a ñ☑ò).

Table 2.1
Descriptions of the Full Range of Initially Identified Hazards

Hazard	Description
ATMOSPHERIC	
Avalanche	A rapid fall or slide of a large mass of snow down a mountainside.
Extreme Temperatures	Extreme heat and extreme cold constitute different conditions in different parts of the country. Extreme cold can range from near freezing in the South to temperatures well below zero in the North. Similarly, extreme heat is typically recognized as the condition whereby temperatures hover ten degrees or more above the average high temperature for a region for an extended period.
Extreme Wind	Wind is air that is in constant motion relative to the surface of the earth. Extreme wind events can occur suddenly without warning. They can occur at any time of the day or night, in any part of the country. Extreme winds pose a threat to lives, property, and vital utilities primarily due to the effects of flying debris and can down trees and power lines. Extreme winds are most commonly the result of hurricanes, tropical storms, norôeasters, severe thunderstorms and tornadoes, but can also occur in their absence as mere ñwindstorms.ò One type of windstorm, the downburst, can cause damage equivalent to a strong tornado.
Hailstorm	Any storm that produces hailstones that fall to the ground; usually used when the amount or size of the hail is considered significant. Hail is formed when updrafts in thunderstorms carry raindrops in to parts of the atmosphere where the temperatures are below freezing.
Hurricane and Tropical Storm	Hurricanes and tropical storms are classified as cyclones and defined as any closed circulation developing around a low-pressure center in which the winds rotate counter-clockwise in the Northern Hemisphere (or clockwise in the Southern Hemisphere) and with a diameter averaging 10 to 30 miles across. When maximum sustained winds reach or exceed 39 miles per hour, the system is designated a tropical storm, given a name, and is closely monitored by the National Hurricane Center. When sustained winds reach or exceed 74 miles per hour the storm is deemed a hurricane. The primary damaging forces associated with these storms are high-level sustained winds, heavy precipitation and tornadoes. Coastal areas are also vulnerable to the additional forces of storm surge, wind-driven waves and tidal flooding which can be more destructive than cyclone wind. The majority of hurricanes and tropical storms form in the Atlantic Ocean, Caribbean Sea and Gulf of Mexico during the official Atlantic hurricane season, which extends from June through November.
Lightning	Lightning is a discharge of electrical energy resulting from the buildup of positive and negative charges within a thunderstorm, creating a ñboltò when the buildup of charges becomes strong enough. This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit. Lightning rapidly heats the sky as it flashes, but the surrounding air cools following the bolt. This rapid heating and cooling of the surrounding air causes thunder. On average, 73 people are killed each year by lightning strikes in the United States.
Nor'easter	Similar to hurricanes, norôeasters are ocean storms capable of causing substantial damage to coastal areas in the Eastern United States due to their associated strong winds and heavy surf. Nor'easters are named for the winds that blow in from the northeast and drive the storm up the East Coast along the Gulf Stream, a band of warm water that lies off the Atlantic coast. They are caused by the interaction of the jet stream with horizontal temperature gradients and generally occur during the fall and winter months when moisture and cold air are plentiful. Norôeasters are known for dumping heavy amounts of rain and snow, producing hurricane-force winds, and creating high surf that causes severe beach erosion and coastal flooding.
Tornado	A tornado is a violently rotating column of air that has contact with the ground and is often visible as a funnel cloud. Its vortex rotates cyclonically with wind speeds ranging from as low as 40 mph to as high as 300 mph. Tornadoes are most often generated by thunderstorm activity when cool, dry air intersects and overrides a layer of warm, moist air forcing the warm air to rise rapidly. The destruction caused by tornadoes ranges from light to catastrophic depending on the intensity, size and duration of the storm.
Winter Storm	Winter storms may include snow, sleet, freezing rain, or a mix of these wintry forms of precipitation. Blizzards, the most dangerous of all winter storms, combine low temperatures, heavy snowfall, and winds of at least 35 miles per hour, reducing visibility to only a few yards. Ice storms occur when moisture falls and freezes immediately upon impact on trees, powerlines, communication towers, structures, roads and other hard surfaces. Winter storms and ice storms

Table 2.1
Descriptions of the Full Range of Initially Identified Hazards

Hazard	Description
	can down trees, cause widespread power outages, damage property, and cause fatalities and injuries to human life.
HYDROLOGIC	
Coastal Erosion	Landward displacement of a shoreline caused by the forces of waves and currents. Coastal erosion is measured as the rate of change in the position or horizontal displacement of a shoreline over a period of time. It is generally associated with episodic events such as hurricanes and tropical storms, norôeasters, storm surge and coastal flooding but may also be caused by human activities that alter sediment transport. Construction of shoreline protection structures can mitigate the hazard, but may also exacerbate it under some circumstances.
Dam Failure	Dam failure is the collapse, breach, or other failure of a dam structure resulting in downstream flooding. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and severe property damage if development exists downstream of the dam. Dam failure can result from natural events, human-induced events, or a combination of the two. The most common cause of dam failure is prolonged rainfall that produces flooding. Failures due to other natural events such as hurricanes, earthquakes or landslides are significant because there is generally little or no advance warning.
Drought	A prolonged period of less than normal precipitation such that the lack of water causes a serious hydrologic imbalance. Common effects of drought include crop failure, water supply shortages, and fish and wildlife mortality. High temperatures, high winds, and low humidity can worsen drought conditions and also make areas more susceptible to wildfire. Human demands and actions have the ability to hasten or mitigate drought-related impacts on local communities.
Flood	The accumulation of water within a water body which results in the overflow of excess water onto adjacent lands, usually floodplains. The floodplain is the land adjoining the channel of a river, stream ocean, lake or other watercourse or water body that is susceptible to flooding. Most floods fall into the following three categories: riverine flooding, coastal flooding, or shallow flooding (where shallow flooding refers to sheet flow, ponding and urban drainage).
Ice Jams	A formation of ice over a body of water that limits the flow of the water due to freezing. Ice jam flooding occurs when warm temperatures and heavy rain cause the snow to melt rapidly, causing frozen rivers or lakes to overflow. As the water lifts, the ice thatôs formed on top of the body of water breaks into small pieces of varying sizes. These pieces or large chunks of ice tend to float downstream and often pile up near narrow passages or near obstructions, such as bridges and dams. This accumulation can impact the integrity of the structures and also cause upstream flooding as water backs up behind the obstruction.
Storm Surge	A storm surge is a large dome of water often 50 to 100 miles wide and rising anywhere from four to five feet in a Category 1 hurricane up to more than 30 feet in a Category 5 storm. Storm surge heights and associated waves are also dependent upon the shape of the offshore continental shelf (narrow or wide) and the depth of the ocean bottom (bathymetry). A narrow shelf, or one that drops steeply from the shoreline and subsequently produces deep water close to the shoreline, tends to produce a lower surge but higher and more powerful storm waves. Storm surge arrives ahead of a stormôs actual landfall and the more intense the hurricane is, the sooner the surge arrives. Storm surge can be devastating to coastal regions, causing severe beach erosion and property damage along the immediate coast. Further, water rise caused by storm surge can be very rapid, posing a serious threat to those who have not yet evacuated flood-prone areas.
Wave Action	The characteristics and effects of waves that move inland from an ocean, bay, or other large body of water. Large, fast moving waves can cause extreme erosion and scour and their impact on buildings can cause severe damage. During hurricanes and other high-wind events, storm surge and wind increase the destructiveness of waves and cause them to reach higher elevations and penetrate further inland.
GEOLOGIC	
Earthquake	A sudden, rapid shaking of the Earth caused by the breaking and shifting of rock beneath the surface. This movement forces the gradual building and accumulation of energy. Eventually, strain becomes so great that the energy is abruptly released, causing the shaking at the earthôs surface which we know as an earthquake. Roughly 90 percent of all earthquakes occur at the boundaries where plates meet, although it is possible for earthquakes to occur entirely within

Table 2.1
Descriptions of the Full Range of Initially Identified Hazards

Hazard	Description
	plates. Earthquakes can affect hundreds of thousands of square miles; cause damage to property measured in the tens of billions of dollars; result in loss of life and injury to hundreds of thousands of persons; and disrupt the social and economic functioning of the affected area.
Expansive Soils	Soils that will exhibit some degree of volume change with variations in moisture conditions. The most important properties affecting degree of volume change in a soil are clay mineralogy and the aqueous environment. Expansive soils will exhibit expansion caused by the intake of water and, conversely, will exhibit contraction when moisture is removed by drying. Generally speaking, they often appear sticky when wet, and are characterized by surface cracks when dry. Expansive soils become a problem when structures are built upon them without taking proper design precautions into account with regard to soil type. Cracking in walls and floors can be minor, or can be severe enough for the home to be structurally unsafe.
Landslide	The movement of a mass of rock, debris, or earth down a slope when the force of gravity pulling down the slope exceeds the strength of the earth materials that comprise to hold it in place. Slopes greater than 10 degrees are more likely to slide, as are slopes where the height from the top of the slope to its toe is greater than 40 feet. Slopes are also more likely to fail if vegetative cover is low and/or soil water content is high.
Land Subsidence	The gradual settling or sudden sinking of the Earthôs surface due to the subsurface movement of earth materials. Causes of land subsidence include groundwater pumpage, aquifer system compaction, drainage of organic soils, underground mining, hydrocompaction, natural compaction, sinkholes, and thawing permafrost.
Tsunami	A series of waves generated by an undersea disturbance such as an earthquake. The speed of a tsunami traveling away from its source can range from up to 500 miles per hour in deep water to approximately 20 to 30 miles per hour in shallower areas near coastlines. Tsunamis differ from regular ocean waves in that their currents travel from the water surface all the way down to the sea floor. Wave amplitudes in deep water are typically less than one meter; they are often barely detectable to the human eye. However, as they approach shore, they slow in shallower water, basically causing the waves from behind to effectively ñpile upò, and wave heights to increase dramatically. As opposed to typical waves which crash at the shoreline, tsunamis bring with them a continuously flowing ówall of waterô with the potential to cause devastating damage in coastal areas located immediately along the shore.
Volcano	A mountain that opens downward to a reservoir of molten rock below the surface of the earth. While most mountains are created by forces pushing up the earth from below, volcanoes are different in that they are built up over time by an accumulation of their own eruptive products: lava, ash flows, and airborne ash and dust. Volcanoes erupt when pressure from gases and the molten rock beneath becomes strong enough to cause an explosion.
OTHER	
Wildfire	An uncontrolled fire burning in an area of vegetative fuels such as grasslands, brush, or woodlands. Heavier fuels with high continuity, steep slopes, high temperatures, low humidity, low rainfall, and high winds all work to increase risk for people and property located within wildfire hazard areas or along the urban/wildland interface. Wildfires are part of the natural management of forest ecosystems, but most are caused by human factors. Over 80 percent of forest fires are started by negligent human behavior such as smoking in wooded areas or improperly extinguishing campfires. The second most common cause for wildfire is lightning.

Table 2.2
Documentation of the Hazard Evaluation Process

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
ATMOSPHERIC HAZARDS			
Avalanche	NO	• Review of US Forest Service National Avalanche Center web site • Review of NY State Hazard Mitigation Plan • Review of FEMAôs Multi-Hazard Identification and Risk Assessment • Ulster County HAZNY • Input from Planning Group	• Avalanches are not included in the NY State Hazard Mitigation Plan, and are not discussed for NY on the US Forest Service Avalanche Center web site. • While avalanches are not unknown in northern New York State, the topography and climate in Ulster County do not support conditions required for the occurrence of significant avalanches. • Avalanches are not included in the Ulster County HAZNY.
Extreme Temperatures	**YES**	• Review of NY State Hazard Mitigation Plan • Review of NOAA National Climatic Data Center (NCDC) Database • Ulster County HAZNY • Review of FEMAôs Multi-Hazard Identification and Risk Assessment • Input from Planning Group	• Extreme heat events are mentioned in the NY State plan as a discrete hazard. Extreme cold is mentioned in the context of winter storms. • The state plan records two significant extreme heat events affecting Ulster County since 1994 and shows that the percentage of the population most susceptible to extreme heat (under 5yrs and over 65yrs) is 18.4%, which is lower than in most other counties in the state. • NCDC reports 8 significant extreme temperature events for areas including Ulster County between February 1993 and March 2007 (including 4 extreme summer heat events and 4 extreme winter cold events). For these events there are no recorded property damages but there are a number of attributed injuries across the affected areas. • Extreme temperatures were ranked 14th out of 27 (ñModerately High Hazardò) among all the hazards included in the Ulster County HAZNY study.
Extreme Wind	**YES**	• Review of NY State Hazard Mitigation Plan • Review of FEMAôs Multi-Hazard Identification and Risk Assessment • Review of NOAA NCDC Storm Events Database • Review of American Society of Civil Engineers (ASCE) Standard 7-02 (Minimum Design Loads for Buildings and	• Extreme wind events are included in the NY State plan and the Ulster County HAZNY in the context of hurricane and tornado events. • The state plan ranks Ulster County as 13th out of 62 counties in the state for the threat of extreme wind and vulnerability to extreme wind loss. • Ulster County is located in a climate region that is highly susceptible to numerous types of extreme wind events including severe thunderstorms, hurricanes, tropical storms, norôeasters and severe winter storms. • According to FEMA, Ulster County is located in a wind zone where extreme windspeeds of 160mph are possible.

Table 2.2
Documentation of the Hazard Evaluation Process

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
		Other Structures) • Ulster County HAZNY • Input from Planning Group	• NCDC reports 46 high wind events (wind speed > 50 knots/58 mph) associated with severe thunderstorms for Ulster County since 1997. These events have caused more than $650,000 in property damage but no recorded deaths or injuries. • The 3 second wind gust for Ulster County for building design purposes as per ASCE 7-02 is 90 mph. The standard also shows south eastern Ulster County is located in a Special Wind Region, i.e. an area where wind anomalies are known to occur and in which wind speeds may be substantially higher than specified.
Hailstorm	NO	• Review of NY State Hazard Mitigation Plan • Review of FEMAôs Multi-Hazard Identification and Risk Assessment • Review of NOAA NCDC Storm Events Database and NOAA NSSL website • Ulster County HAZNY • Input from Planning Group	• The state plan includes hailstorms as a discrete hazard, and records one hailstorm event of 1 inch diameter or greater in Ulster County in the period 2005-7. • NCDC reports 49 severe hailstorm events (3/4 inch diameter hail or greater) for Ulster County between May 1975 and January 2008. For these events there are $34,000 recorded property damages and $500,000 crop damages, but no recorded deaths or injuries • NCDC reports only one event in which ñdamagingò hail (at least 2 inches in diameter) fell in Ulster County (City of Kingston ï August 13, 2003). • According to NSSL data Ulster County is located in a part of the country with the lowest annual number of days with hailstorms (less than 2), and where the annual average number of damaging hail events is less than 0.25. • Hailstorms are not included in the Ulster County HAZNY. • There are minimal hazard mitigation techniques available to reduce hailstorm impacts outside of the emergency preparedness procedures and severe weather warning systems already in place (i.e. mass public notifications that recommend immediate protective actions). • The only municipality in Ulster County to report that it considers hailstorms to be a significant hazard is the Town of Marlborough, which has both the highest proportion and total acreage of agricultural land use in the County. In the absence of more detailed information about hailstorm risks and losses, there is not sufficient overall concern to warrant further investigation in this

Table 2.2
Documentation of the Hazard Evaluation Process

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
			plan. Future updates may revisit this hazard in more detail.
Hurricane and Tropical Storm	**YES**	• Review of NY State Hazard Mitigation Plan • Analysis of NOAA historical tropical cyclone tracks • Review of NOAA National Hurricane Center website • Review of NOAA NCDC Storm Events Database • Review of FEMAôs Multi-Hazard Identification and Risk Assessment • Ulster County HAZNY • Input from Planning Group	• Hurricane and tropical storm events are discussed in the state plan, which includes FEMA mapping showing Ulster County located in a hurricane-prone area where extreme wind speeds of 160 mph are possible. • Ulster County has been included in the area covered by major disaster declarations due to hurricanes or tropical storms on three occasions since 1985. • NOAA historical records indicate 2 hurricane tracks and 13 tropical storm tracks passing within 50 miles of the Ulster County seat between 1863 and 2007. • The most recent of these events was Tropical Storm Beryl, which passed along the southern border of the county in 1994. • According to the NHC the estimated return period for a category 1 hurricane in the New York City area is 17 years, rising to 370 years for a category 5 event • Hurricanes were ranked 15th out of 27 (ñModerately High Hazardò) among all the hazards included in the Ulster County HAZNY study.
Lightning	**YES**	• Review of NY State Hazard Mitigation Plan • Review of NOAA NCDC Storm Events Database, NOAA lightning statistics, and National Severe Storms Laboratory (NSSL) web site • Review of FEMAôs Multi-Hazard Identification and Risk Assessment • Ulster County HAZNY • Input from Planning Group	• Lightning is not considered as a discrete hazard in the NY State Hazard Mitigation Plan or the Ulster County HAZNY. • According to NOAA and FEMA data, Ulster County is located in an area of the country that experiences an average of less than 40 thunder events and 1 - 4 lightning flashes per square kilometer per year. For comparison, large areas of the country experience more than 100 events per year and more than 10 flashes per square kilometer. • NOAA records that New York State has experienced the fifth most deaths from lightning in the USA from 1959 to 1994. • NCDC reports 18 lightning events for Ulster County between August 1993 and January 2008. These events have resulted in 2 recorded injuries and $700,000 in property damage.
Nor'easter	**YES**	• Review of NY State Hazard Mitigation Plan • Review of NOAA NCDC Storm Events Database • Review of FEMAôs	• Norôeasters are discussed in the state plan as a common cause of flooding and snowstorms, particularly in the south eastern part of the state. • NYSEMO has classified norôeasters as a moderate hazard (second only to flooding) in

Table 2.2
Documentation of the Hazard Evaluation Process

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
		Multi-Hazard Identification and Risk Assessment • Ulster County HAZNY • Input from Planning Group	the planning area covering Ulster County. • Although not specifically included in the Ulster County HAZNY, the county has been affected by numerous norôeasters, with the principal impacts being heavy snowfall and flooding, and the HAZNY ranks ñSevere Stormsò 4th out of 27 (ñModerately High Hazardò) among the list of all hazards.
Tornado	**YES**	• Review of NY State Hazard Mitigation Plan • Review of NOAA NCDC Storm Events Database and National Severe Storms Laboratory (NSSL) web site • Review of FEMAôs Multi-Hazard Identification and Risk Assessment • Ulster County HAZNY • Input from Planning Group	• The state plan acknowledges that New York State has a definite vulnerability to tornadoes, with an average annual occurrence of 6 tornadoes per year since 1950. • Tornadoes are ranked as a moderate hazard in the planning area covering Ulster County. • NCDC reports 11 tornado events in Ulster County between September 1975 and January 2008. These events have resulted in no recorded deaths and only a handful of injuries but have caused $3.1 million in property damage. The most severe being two F2 tornadoes that struck the county in March 1976 and July 1986. • NSSL tornado probability data indicate that while Ulster County is in an area that experiences less than 1 tornado event per year, life-threatening and damaging tornado events remain a possibility. • Tornadoes were ranked 7th out of 27 (ñModerately High Hazardò) among all hazards included in the Ulster County HAZNY.
Winter Storm	**YES**	• Review of NY State Hazard Mitigation Plan • Review of FEMAôs Multi-Hazard Identification and Risk Assessment • Review of NOAA NCDC Storm Events Database • New York State Climate Office web site • Ulster County HAZNY • Input from Planning Group	• Winter storms including heavy snow and ice storms are discussed in the state plan, which notes that Ulster County averages approximately 60 inches of snowfall per year. The statewide average is 65 inches, with 60% of the state experiencing at least 70 inches annually. • The state plan ranks winter/ice storms as a moderate risk in the planning area covering Ulster County. • The website of the New York State Climate Office records that some areas of higher ground in western Ulster County experience annual average snowfalls of 100 inches and more. • The NY State plan ranks Ulster County 26th out of 62 counties in the state for most threatened by snow and vulnerable to snow losses. The plan also ranks Ulster County 42nd out of 62 for most vulnerable to ice storms and

Table 2.2
Documentation of the Hazard Evaluation Process

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
			ice storm losses. • NCDC reports that Ulster County has been affected by 77 significant snow and ice events between January 1987 and March 2007. • FEMA records show that Ulster County has been included in one snow-related declared disaster in the last 30 years and two snow-related emergency declarations. • There has been one presidential disaster declaration due to ice storm in Ulster County since 1953. • Ice Storms were ranked 9th out of 27 (ñModerately High Hazardò) among all the hazards included in the Ulster County HAZNY study.
HYDROLOGIC HAZARDS			
Coastal Erosion	NO	• Review of NY State Hazard Mitigation Plan • Review of FEMAôs Multi-Hazard Identification and Risk Assessment	• While coastal erosion is identified as a hazard and discussed in the NY State plan, it does not apply to Ulster County since the county has no tidal coastline.
Dam Failure	**YES**	• Review of NY State Hazard Mitigation Plan • Review of New York State Department of Environmental Conservation (NYSDEC) Bureau of Flood Protection and Dam Safety web site • Review of U.S. Army Corps of Engineers National Inventory of Dams database • Review of Stanford Universityôs National Performance of Dams Program web site • Review of FEMAôs Multi-Hazard Identification and Risk Assessment • Ulster County HAZNY • Input from Planning Group	• Dam Failure is briefly discussed in the state plan as a potential cause of flooding. • The USACE NID lists 53 dams of all types in Ulster County, of which 9 are classified as high hazard, 29 are significant hazard, and 18 are low hazard. • The Stanford University NPDP lists an additional two dams in Ulster County, of which one is classified as low hazard and the other is unclassified. • Dam Failures were ranked 18th out of 27 (ñModerately Low Hazardò) among all the hazards included in the Ulster County HAZNY study.

Table 2.2
Documentation of the Hazard Evaluation Process

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Drought	**YES**	• Review of NY State Hazard Mitigation Plan • Review of FEMAôs Multi-Hazard Identification and Risk Assessment • Review of NOAA NCDC Database • Review of National Drought Mitigation Center /NOAA web sites • Ulster County HAZNY • Input from Planning Group	• Drought is discussed in the state plan, which records that since 1993 Ulster County has been affected by two significant local droughts and one statewide drought event. • NCDC reports that Ulster County has been affected by five drought events of varying severity since 1993. • According to the Palmer Drought Severity Index data released by NOAA, Ulster County experienced moderate drought during 41 weeks and severe drought in one week between January 1998 and December 2007. • Droughts were ranked 23rd out of 27 (ñModerately Low Hazardò) among all the hazards included in the Ulster County HAZNY study.
Flood	**YES**	• Review of NY State Hazard Mitigation Plan • Review of NOAA NCDC Storm Events Database • Review of FEMAôs Multi-Hazard Identification and Risk Assessment • Review of FEMAôs NFIP Community Status Book and Community Rating System (CRS) • Review of FEMA Q3 flood data for Ulster County • Ulster County HAZNY • Input from Planning Group	• Flooding is described in the state plan as the primary natural hazard in the State of New York and is discussed in comprehensive detail. • Two thirds of all Federal disaster declarations covering Ulster County have involved flooding. • Ulster County has been affected by 12 flood-related Presidential disaster declarations since 1953, with six major flood disaster declarations covering areas including Ulster County since 2004. • NCDC records around 100 flood events affecting Ulster County since March 1993. One fatality, one injury, and almost $25 million in property damage was attributed to these events. • According to Q3 data, 7% of Ulster County and 2% of all residential properties lie within the identified 100-year floodplain. Ulster County ranks as the 10th most threatened and vulnerable to flood loss out of the 62 counties in the state on this basis. • All jurisdictions covered by this plan participate in the NFIP but none participate in the CRS. Ulster County ranks 14th out of 62 for the total number of NFIP policies and 12th for the total dollar amount of NFIP coverage. Ulster county ranks 15th in the state for the total number of NFIP claims since 1978, but 10th for the total dollar amount of claims paid. • Flooding was ranked 3rd out of 27 (ñModerately High Hazardò) among all the hazards included in the Ulster County HAZNY study, and was the highest ranked of all natural hazards.

Table 2.2
Documentation of the Hazard Evaluation Process

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Ice Jams	**YES**	• Review of NY State Hazard Mitigation Plan • Review of FEMAôs Multi-Hazard Identification and Risk Assessment • USACE Cold Regions Research & Engineering Laboratory Ice Jams Database • Ulster County HAZNY • Input from Planning Group	• Ice jams are mentioned as a significant cause of flooding in the state plan ï New York State has experienced more ice jam events than any other U.S. state except Montana in the period 1867 through 2007. • USACE CRREL Ice Jams mapping indicates ice jam incidents at 12 locations on rivers in Ulster County from 1875 to 2007. • Ice jams were ranked 25th out of 27 (ñModerately Low Hazardò) among the all the hazards included in the Ulster County HAZNY study.
Storm Surge	NO	• Review of NY State Hazard Mitigation Plan • Review of U.S. Army Corps of Engineers SLOSH model data • Review of FEMAôs Multi-Hazard Identification and Risk Assessment	• While storm surge is discussed in the state plan under flood hazard and hurricane/tropical storm hazard, storm surges are essentially considered a coastal phenomenon and since Ulster County is located more than 50 miles from the nearest coastline, they are not regarded as a hazard for the purposes of this plan.
Wave Action	NO	• Review of NY State Hazard Mitigation Plan • Review of FEMAôs Multi-Hazard Identification and Risk Assessment	• While waves are discussed in the state plan under flood hazard, damage-causing waves are considered a coastal phenomenon, and since Ulster County is located more than 50 miles from the nearest coastline, they are not regarded as a hazard for the purposes of this plan.
GEOLOGIC HAZARDS			
Earthquake	**YES**	• Review of NY State Hazard Mitigation Plan • Review of USGS Earthquake Hazards Program web site • Review of New York City Area Consortium For Earthquake Loss Mitigation website • Review of FEMAôs Multi-Hazard Identification and Risk Assessment • Ulster County HAZNY • Input from Planning Group	• Earthquake events are discussed in the state plan, since earthquakes have occurred in and around the State of New York in the past. • The state plan ranks Ulster County 23rd out of 62 counties for potential annualized earthquake losses and 31st out of 62 for potential annualized earthquake loss per capita. • According to USGS seismic hazard maps, the peak ground acceleration (PGA) with a 10% probability of exceedance in 50 years for Ulster County is between 3%g and 4%g. FEMA recommends that earthquakes be further evaluated for mitigation purposes in areas with a PGA of 3%g or more. • USGS records do not show the historic occurrence of any earthquakes of magnitude 3 or greater in Ulster County. Earthquakes of lesser magnitude are generally too small be to be felt and are not considered to be the cause

Table 2.2
Documentation of the Hazard Evaluation Process

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
			of damage. • Earthquakes were ranked 24th out of 27 (ñModerately Low Hazardò) among all the hazards included in the Ulster County HAZNY study.
Expansive Soils	NO	• Review of NY State Hazard Mitigation Plan • Review of FEMAôs Multi-Hazard Identification and Risk Assessment • Review of USDA Natural Resources Conservation Service (NRCS) Soil Websites • Input from Planning Group • Ulster County HAZNY	• Expansive soils are not identified as a hazard in the NY State plan or the Ulster County HAZNY. • According to FEMA and USDA sources, Ulster County is located in an area that has a ñslight to moderateò clay swelling potential. • According to USDOT FHA Report No. FHWA-RD-76-82, Ulster County lies in an area mapped as non-expansive, except for a small area in the northeastern part of the county, which is potentially of low expansive character and/or low frequency of occurrence. • New York State building codes are based on the International Building Code (2000, with 2001 supplement), in which Chapter 18 includes provisions for building on expansive soils (through design, removal or stabilization) so that new construction will be protected.
Landslide	**YES**	• Review of NY State Hazard Mitigation Plan • Review of USGS Landslide Incidence and Susceptibility Hazard Map • Review of New York State Geological Survey GIS database of historic landslides in New York Review of FEMAôs Multi-Hazard Identification and Risk Assessment • Ulster County HAZNY • Input from Planning Group	• Landslides are discussed in the NY state plan, which gives Ulster County a weighted rank of 9th out of 62 counties in the state for susceptibility to landslides, and 19th out of 62 for vulnerability to losses from landslides. • Mapping based on the NYSGS landslide inventory presented in the state plan appears to show five landslide events occurring in Ulster County up to 1989. Tables in the state plan record only a single historic landslide incident in Ulster County since 1837, an event which caused two fatalities in 1921. • USGS landslide hazard maps indicate ñHigh landslide incidenceò (more than 15% of the area is involved in landsliding) for a narrow area immediately adjacent to the Hudson River in Ulster County. A portion of the southern part of the county is identified as ñModerate incidenceò, and the northwestern part of the county is identified as ñHigh susceptibility but moderate incidenceò. The remainder of the county (approximately 70%) is identified as ñLow incidenceò.

Table 2.2
Documentation of the Hazard Evaluation Process

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Land Subsidence	NO	• Review of NY State Hazard Mitigation Plan • Review of FEMAôs Multi-Hazard Identification and Risk Assessment • Review of USGS Fact Sheet 165-00 Land Subsidence in the U.S. • Ulster County HAZNY • Input from Planning Group	• The state plan delineates certain areas that are susceptible to land subsidence hazards in New York. While mapping in the plan depicts a narrow band of carbonate karst rock (in which there can be the potential for subsidence caused by sinkholes) crossing the southern portion of Ulster County, collapses that have resulted in structural damage are not reported. • While there is a history of mining in Ulster County (principally to extract lime for the production of cement), due to the robust nature of the geological strata in which these activities were carried out, it is assumed that there is no significant risk of land subsidence due to mine collapse. • Land subsidence is not included in the Ulster County HAZNY.
Tsunami	NO	• Review of NY State Hazard Mitigation Plan • Review of FEMAôs Multi-Hazard Identification and Risk Assessment	• Tsunamis are not discussed in the state plan. Since the southernmost border of Ulster County is located approximately 70 miles from open ocean, and no record exists of a catastrophic Atlantic basin tsunami impacting the mid-Atlantic coast of the United States, FEMA mitigation planning guidance suggests that locations on the U.S. East Coast have a relatively low tsunami risk and need not conduct a tsunami risk assessment at this time.
Volcano	NO	• Review of NY State Hazard Mitigation Plan • Review of USGS Volcano Hazards Program web site	• No volcanoes are located within approximately 2,000 miles of Ulster County.
OTHER HAZARDS			
Wildfire	**YES**	• Review of NY State Hazard Mitigation Plan • Review of NOAA NCDC Storm Events Database • Review of NYSEMO and NYSDEC web sites • Review of FEMAôs Multi-Hazard Identification and Risk Assessment • Ulster County HAZNY • Input from Planning Group	• While NYSEMO and NCDC records do not show any wildfire events in Ulster County since 1903, wildfires are discussed in the state plan as a hazard of concern, and wildfires are ranked as a moderate risk in the planning area covering Ulster County. • Forest fires were ranked 10th out of 27 (ñModerately High Hazardò) among the list of all hazards included in the Ulster County HAZNY study. • According to available GIS data, approximately 70% of the county area is forested, and wildfire hazard risks are expected to increase as development along the urban/wildland interface increases.

Table 2.3
Summary Results of the Hazard Identification and Evaluation Process

ATMOSPHERIC

- ☐ Avalanche
- ☑ Extreme Temperatures
- ☑ Extreme Wind
- ☐ Hailstorm
- ☑ Hurricane and Tropical Storm
- ☑ Lightning
- ☑ Norôeaster
- ☑ Tornado
- ☑ Winter Storm

HYDROLOGIC

- ☐ Coastal Erosion
- ☑ Dam Failure
- ☑ Drought
- ☑ Flood
- ☑ Ice Jams
- ☐ Storm Surge
- ☐ Wave Action

GEOLOGIC

- ☑ Earthquake
- ☐ Expansive Soils
- ☑ Landslide
- ☐ Land Subsidence
- ☐ Tsunami
- ☐ Volcano

OTHER

- ☑ Wildfire

☑ = Hazard considered significant enough for further evaluation through Ulster Countyôs multi-jurisdictional hazard risk assessment.

SECTION 3a- RISK ASSESSMENT: HAZARD PROFILES

Overview

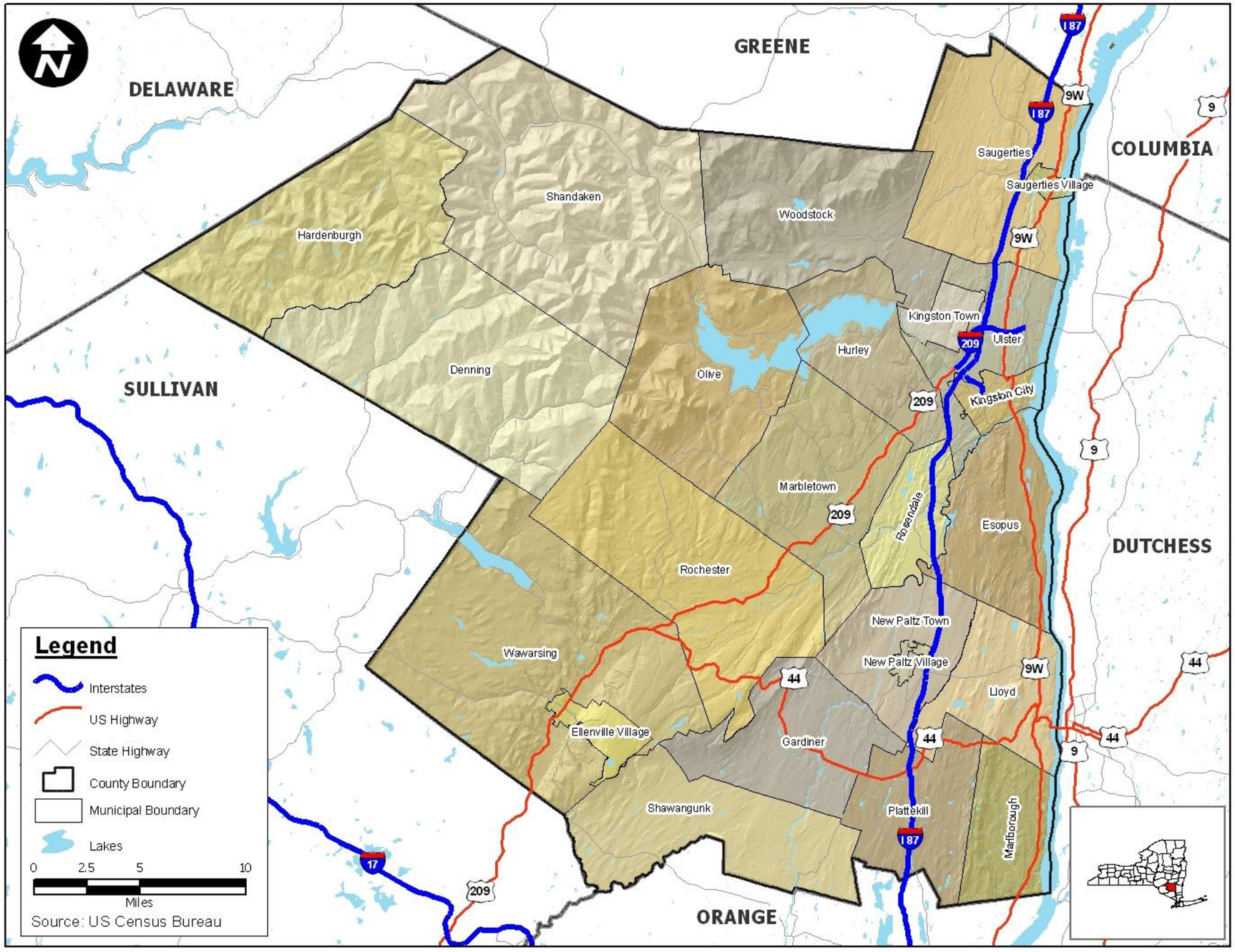
Detailed profiles of hazards identified in the previous section as worthy of further evaluation in the overall risk assessment are provided in this section. Each hazard profile includes a description of the hazard and its causes and impacts, the location and extent of areas subject to the hazard, known historical occurrences, and the probability of future occurrences. The profiles also include specific information noted by members of the planning committee and other stakeholders, including unique observations or relevant anecdotal information regarding individual historical hazard occurrences and individual jurisdictions.

The following table summarizes each hazard, and whether or not it has been identified as a hazard worthy of further evaluation for each of the 24 jurisdictions in the County. Following Table 3a.1, Figure 3a.1 presents a map of Ulster County for reference, including the most significant transport links and the location and boundaries of each participating jurisdiction.

Table 3a.1
Summary of Profiled Hazards by Jurisdiction

Jurisdiction	Extreme Temperatures	Extreme Wind	Hurricane / Tropical Storm	Lightning	Nor'easter	Tornado	Winter Storm	Dam Failure	Drought	Flood	Ice Jam	Earthquake	Landslide	Wildfire
Ulster, County of	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Denning, Town of	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Ellenville, Village of [1]	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Esopus, Town of	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Gardiner, Town of	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Hardenburgh, Town of	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Hurley, Town of	■	■	■	■	■	■	■	■	■	■	■	■		■
Kingston, City of	■	■	■	■	■	■	■		■	■	■	■		■
Kingston, Town of	■	■	■	■	■	■	■		■	■	■	■	■	■
Lloyd, Town of	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Marbletown, Town of	■	■	■	■	■	■	■	■	■	■	■	■		■
Marlborough, Town of	■	■	■	■	■	■	■	■	■	■	■	■	■	■
New Paltz, Town of	■	■	■	■	■	■	■	■	■	■	■	■		■
New Paltz, Village of	■	■	■	■	■	■	■		■	■	■	■		■
Olive, Town of	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Plattekill, Town of	■	■	■	■	■	■	■	■	■	■	■	■		■
Rochester, Town of	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Rosendale, Town of	■	■	■	■	■	■	■	■	■	■	■	■		■
Saugerties, Town of	■	■	■	■	■	■	■		■	■	■	■	■	■
Saugerties, Village of	■	■	■	■	■	■	■		■	■	■	■	■	■
Shandaken, Town of	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Shawangunk, Town of	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Ulster, Town of	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Wawarsing, Town of	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Woodstock, Town of	■	■	■	■	■	■	■	■	■	■	■	■	■	■

Figure 3a.1: Ulster County Base Map



Extreme Temperatures

Extreme temperatures principally affect the health and safety of the human population, although they can also impact livestock, agricultural crops, and may also cause damage to infrastructure and property. This section provides detailed profiles of both extreme high and extreme low temperatures.

Description – Extreme Temperatures

Extreme Cold

According to National Oceanic and Atmospheric Administrationôs (NOAA) National Weather Service (NWS), the term ñextreme coldò constitutes different conditions in different parts of the country, ranging from near freezing in the South to temperatures well below zero in the North.

In the South, temperatures near or just below freezing can cause pipes to burst in homes that are poorly insulated or without heat. In the North, where most buildings are insulated to a degree that can protect against most common winter temperatures for the area, long spells of below zero temperatures can result in increased numbers of people using space heaters and fireplaces to stay warm, thus increasing the risk of household fires and carbon monoxide poisoning. In addition, extreme cold can cause rivers to freeze, and ice jams to form, leading to flooding. Regardless of location, freezing temperatures can cause severe damage to crops and other vegetation; increased strain on community shelter facilities providing refuge from the cold to homeless populations and others in need; and an increased likelihood that automobiles/buses will fail to start. Local sources also report that fire departments are called to a noticeably higher number of chimney fires during periods of extreme cold.

Extreme cold can have severe negative impacts on human beings, including frostbite (an injury to the body that is caused by freezing) and hypothermia (the unintentional lowering of the bodyôs core temperature to below 95 degrees Fahrenheit, which typically causes uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness, and apparent exhaustion). The NWS reports that extreme cold causes the death of roughly 26 people per year nationwide (based on a 10-year average). High winds during a period of extreme cold can exacerbate these affects, as the winds work to carry heat away from the body.

According to the New York State Climate Office, extreme cold events in New York State occur regularly, and are most common between October and March. They are most likely to occur in the northern and western portions of the state, and occur less often as one travels south toward New York City and Long Island. The record coldest temperature in New York State is -52° at Stillwater Reservoir (northern Herkimer County) on February 9, 1934 and also at Old Forge (also northern Herkimer County) on February 18, 1979. Some 30 communities have recorded temperatures of -40° or colder, most of them occurring in the northern one-half of the state and the remainder in the Western Plateau Division and in localities just south of the Mohawk Valley.

Extreme Heat

FEMA defines the term ñextreme heatò as the condition whereby temperatures hover ten degrees or more above the average high temperature for a region, and last for several weeks. Extreme heat can also contribute to increased demand on energy supplies resulting from increased air conditioning usage, and an associated increased potential for power shortages or outages; and increased demand on medical offices,

hospitals, etc. as individuals suffering from various heat related health effects seek medical attention or shelter in air conditioned facilities.

The National Oceanic and Atmospheric Administrationôs (NOAA) National Weather Service (NWS) has reported that heat waves occur during most summers in at least some part(s) of North America. East of the Rocky Mountains, high temperatures are often combined with high humidity. Highest temperatures of record and average relative humidity would be sufficient to cause heat-related health effects in all states. Health effects associated with extreme heat can begin with air temperatures as low as 80 degrees Fahrenheit and concurrent relative humidity of at least 40 percent.

Extreme heat can have severe negative impacts on human beings, including heat-related illnesses such as sunburn, fatigue, and heat cramps, heat exhaustion, and heat strokes. The NWS reports that heat waves cause the death of roughly 175 people per year nationwide. High humidity levels during a period of extreme heat can exacerbate these affects. Similarly, periods of extreme heat in urban areas can also result in magnified impacts on human health. This is primarily due to the combined affects of pollutant concentrations, high temperatures/humidity, and poor air circulation.

According to the New York State Climate Office, extreme heat events in New York State occur regularly, and are most common between May and mid-September. They are least likely to occur in the northern and western portions of the state, and occur more often as one travels south toward New York City and Long Island. The New York City area and most of the Hudson Valley record an average of from 18 to 25 days with such temperatures during the warm season, but in the Northern and Southern Plateaus the normal quota does not exceed 2 or 3 days. While temperatures of 100° are rare, many long-term weather stations, especially in the southern one-half of the State, have recorded maximums in the 100° to 105° range on one or more occasions. The highest temperature of record in New York State is 108° at Troy on July 22, 1926. Temperatures of 107° have been observed at Lewiston, Elmira, Poughkeepsie, and New York City.

Location and Extent – Extreme Temperatures

Ulster County is located in a region of the country that is susceptible to extreme heat and extreme cold. During periods of extreme temperature conditions the effects will be felt over widespread geographic areas, and it is generally assumed that Ulster County and all of its municipalities are uniformly exposed to extreme heat and extreme cold. The effects of extreme temperatures will be primarily limited to the elderly and homeless populations, with occasionally minor, sporadic property damages (i.e., bursting pipes) and damages to crops and other vegetation.

Historical Occurrence – Extreme Temperatures

Extreme Cold

According to NOAAôs National Climatic Data Center (NCDC), there were a total of 55 extreme cold events in New York State between February 1993 and October 2007 (or an average of about 3.8 extreme cold events per year), resulting in 13 deaths and $533,000 in property damages. Of these, eight were located in Ulster County, resulting in $50,000 in property damages. All but three of these events occurred between October and March, the time of year when extreme cold events are most common in the area. The three outstanding events occurred only days apart in late April and early May of 2002, where temperatures fell to or below 32 degrees across portions of Ulster and Dutchess Counties where the growing season had already started. Despite the freeze, no crop or plant damages were reported to the National Weather Service.

New York State has received no Federal Disaster or Emergency Declarations due solely to extreme temperatures.

Some recent notable extreme cold events as reported by the NCDC include:

April 27, 2002
A cold high pressure system settled into the Mid Hudson Valley during the overnight hours of April 26-27. Under a mostly clear sky, and light wind, temperatures fell to or below 32 degrees across portions of Ulster and Dutchess Counties where the growing season had already started. No damage has been reported to the National Weather Service with this freeze.

January 25-26, 2007
An arctic airmass moved into east central New York State late Thursday night on January 25th, and remained in place into Friday, January 26th. Early morning low temperatures on Friday ranged between zero and ten degrees below zero, with some temperatures as low as 15 degrees below zero across higher elevations of the Adirondacks. In addition, northwest winds of 10 to 15 mph produced wind chills as low as 25 to 30 degrees below zero early Friday morning, especially across higher elevations.

January 15-16, 2008
A period of gusty north to northwest winds in the 15 to 30 mph range, with higher gusts. This wind, combined with ambient temperatures ranging from zero to 15 below zero, resulted in dangerous wind chills across eastern New York during the night of January 15 through the morning of the 16th. Equivalent wind chill readings ranged from 25 to 30 below zero in the Mid Hudson Valley, to as low as 50 below zero across the Western Adirondacks. The brutal cold spell resulted in many closed schools and businesses on the 16th. The cold also resulted in a scattering of frozen and broken water pipes.

Extreme Heat

According to NOAAôs National Climatic Data Center (NCDC), there were a total of 38 extreme heat events in New York State between February 1993 and October 2007 (or an average of about 2.6 extreme heat events per year), resulting in 86 deaths and 51 injuries. Of these, eleven were located in Ulster County, resulting in 50 injuries. Of the eleven located in Ulster County, seven were unseasonably warm temperatures occurring during the winter months between October and March. No property or crop damages were reported.

Some recent notable extreme heat events as reported by the NCDC include:

June 7, 1999
On June 7, the season's second Bermuda High brought the first 90 degree temperature of 1999 to much of eastern New York. At the Albany International Airport it was the first official 90 degree temperature since August 16, 1997. The temperature did not stop there, but soared all the way to 95 degrees. This value tied the daily record for the date last set in 1925. The combination of heat and humidity produced a heat index between 100 and 105 degrees during the hottest portion of the day. There were no unusual problems or power outages reported due to the excessive heat.

July 4-6, 1999
An intense Bermuda high pumped heat along with very high humidity across eastern New York, especially on July 5 and 6. Temperatures soared to 90 or higher most everywhere while dewpoints climbed well into the 70s. At the Albany International airport, the temperature peaked at 94 on July 5 and 95 on July 6. However, after combining humidity values, the heat index reached as high as 105 on both days. At the Dutchess County airport near Poughkeepsie, the temperature crested at 99 degrees both days. On July 5, the dewpoint reached 79 to produce a heat index of 119 degrees! The heat index peaked around 110 degrees on July 6. The sultry air mass set the stage for a large severe thunderstorm outbreak during the afternoon of July 6 across eastern New York.

August 8-9, 2001
A strong Bermuda high developed early in August and brought the most extensive heat wave of the summer to eastern New York and adjacent New England between August 6 and 9. Officially, at the Albany International Airport, there were four consecutive days of 90 degrees or higher, the longest such stretch in over 6 years. The heat wave reached its peak on August 8 and 9. During those days, the high reached 100 and 102 at Poughkeepsie respectively. On those same days the Albany International Airport reached 93 and 96. The 96 was a new daily maximum record for August 9, eclipsing the old record of 94 set in 1949. Humidity levels were also high, which produced heat indices between 105 and 110 near Albany, and 110 to 115 closer to Poughkeepsie. The high heat indices did cause some heat related problems. St. Clare's Hospital in Schenectady reported 9 cases of heat-related symptoms. The victims were all children campers at the Pattersonville Camp also in Schenectady County. Four more campers were treated at the campsite. While there no other heat related problems reported to the National Weather Service, the heat led to record state electricity consumption, three days in a row! Governor Pataki closed down the State government at 200 PM on August 9 to conserve power. Hot weather also caused the railroad bridge to malfunction between the cities of Albany and Rensselaer, resulting in delays for four of Amtrakôs passenger trains on August 9.

Probability of Occurrence – Extreme Temperatures

Extreme temperature events will remain a very frequent occurrence in Ulster County, and the probability of future occurrences in Ulster County is certain (somewhat higher for extreme heat than extreme cold).

Based on historical records over the last 14.5 years, in New York State, extreme temperature events can be expected to occur approximately 6.4 times per year, with extreme cold events more likely to occur than extreme heat events (extreme cold events can be expected to occur approximately 3.8 times per year while extreme heat events can be expected approximately 2.6 times per year). This trend is slightly different in Ulster County, where extreme temperature events can be expected to occur approximately 1.3 times per year, with extreme heat events more likely to occur than extreme cold events (extreme heat events can be expected to occur approximately 0.8 times per year while extreme cold events can be expected approximately 0.6 times per year).

While the impact of such occurrences on people and property is typically minimal, it is anticipated that the threat to human lives and safety is increasing due to relatively high percentages of elderly populations in many of Ulster Countyôs municipal jurisdictions (ranging from a minimum of 5.3 percent in the Village of New Paltz to a maximum of 19.7 percent in the Town of Hardenburgh, with an average of 14.1 percent).

Extreme Wind

Description – Extreme Wind

Wind, as defined by the American Meteorological Society, is air that is in constant motion relative to the surface of the earth. Since vertical components of atmospheric motion are relatively small, especially near the surface of the earth, meteorologists use the term ñwindò to denote almost exclusively the horizontal component. Extreme winds are most commonly the result of tornadoes, hurricanes, tropical cyclones, extratropical cyclones (northeasters), destructive wind, and thunderstorms, but can also occur in their absence as mere ñwindstormsò.

Extreme wind events might occur over large, widespread areas or in a very limited, localized area. They can occur suddenly without warning. They can occur at any time of the day or night, at any location within Ulster County. Extreme winds pose a significant threat to lives, property, and vital utilities due to flying debris, such as rocks, lumber, fuel drums, sheet metal and loose gear of any type that can be picked up by the wind and hurled with great force. Extreme winds also down trees and power lines, often resulting in power outages across an affected area.ò

(1) Tornadoes: Tornadoes are the most commonly known type of windstorm causing the most damage to property and life and all is due to severe winds. As researched by FEMA, there are, on average, 10 severe windstorms, classified as tornadoes, in the United States defined as F4 or F5 on the Fujita scale. (The Fujita scale reflects how much wind damage results from a tornado expressed in wind speeds. For example, wind speeds can vary between 50 and 250 mph in a typical F5 tornado.)

(2) Hurricanes: A hurricane is a tropical storm with winds that have reached a constant speed of 74 mph or more. Hurricane winds blow in a large spiral around a relative calm center known as the "eye." The "eye" is generally 20 to 30 miles wide.

(3) Coastal Storms: Coastal storms include both tropical cyclones and extratropical cyclones. The National Weather Service defines these terms as follows:

- Cyclone: An area of low pressure around which winds blow counterclockwise in the Northern Hemisphere. Also the term used for a hurricane in the Indian Ocean and in the Western Pacific Ocean.

- Tropical Cyclone: A cyclone that forms over tropical or sub-tropical waters around centers of low barometric pressure. Tropical cyclones derive their energy from the ocean. Tropical cyclones can be further broken down according to maximum sustained winds, as follows:

Tropical Depression:	Winds < 39mph
Tropical Storm:	39 mph ÒWinds < 74 mph
Hurricane: *	Winds Ó74 mph

** Note that "hurricanes" are tropical cyclones that develop over the Atlantic Ocean, northeast Pacific Ocean, or south Pacific Ocean. Similar storms that develop over the western North Pacific Basin are referred to as "typhoons" (or, if maximum sustained winds are at least 150 mph, "super typhoons").*

- Extratropical Cyclone: A non-tropical cyclone that forms around a center of low barometric pressure and derives its energy from the atmosphere. Extratropical cyclones are more commonly referred to as ñwinter storms.ò Extratropical storms can be experienced on both the East and West Coasts of the United States. On the East Coast, extratropical cyclones are often called ñNorôeastersò due to the direction of the storm winds.

(4) Destructive Wind: Destructive wind is a windstorm that poses a significant threat to life and property and destroying everything in its path. Destructive wind can also cause damage by flying debris, such as rocks, lumber, fuel drums, sheet metal and loose gear of any type which can be picked up by the wind and hurled with great force.

(5) Thunderstorms: A thunderstorm is a combination of moisture, rapidly rising warm air and forceful winds capable of lifting air thatôs either warm or cold. They also contain lightning and thunder.

Location – Extreme Winds

Extreme wind events are experienced in every region of the United States. A useful tool for determining the location of the extreme wind hazard area in a jurisdiction is depicted in Figure 3a.2 - Wind Zones in the United States. This map of design wind speeds was developed by the American Society of Civil Engineers. It divides the United States into four wind zones, geographically representing frequency and magnitude of potential extreme wind events. The figure shows that a single wind zone covers Ulster County and its jurisdictions; Zone II ï Hurricane Susceptible, with a design wind speed for shelters of 160 miles per hour.

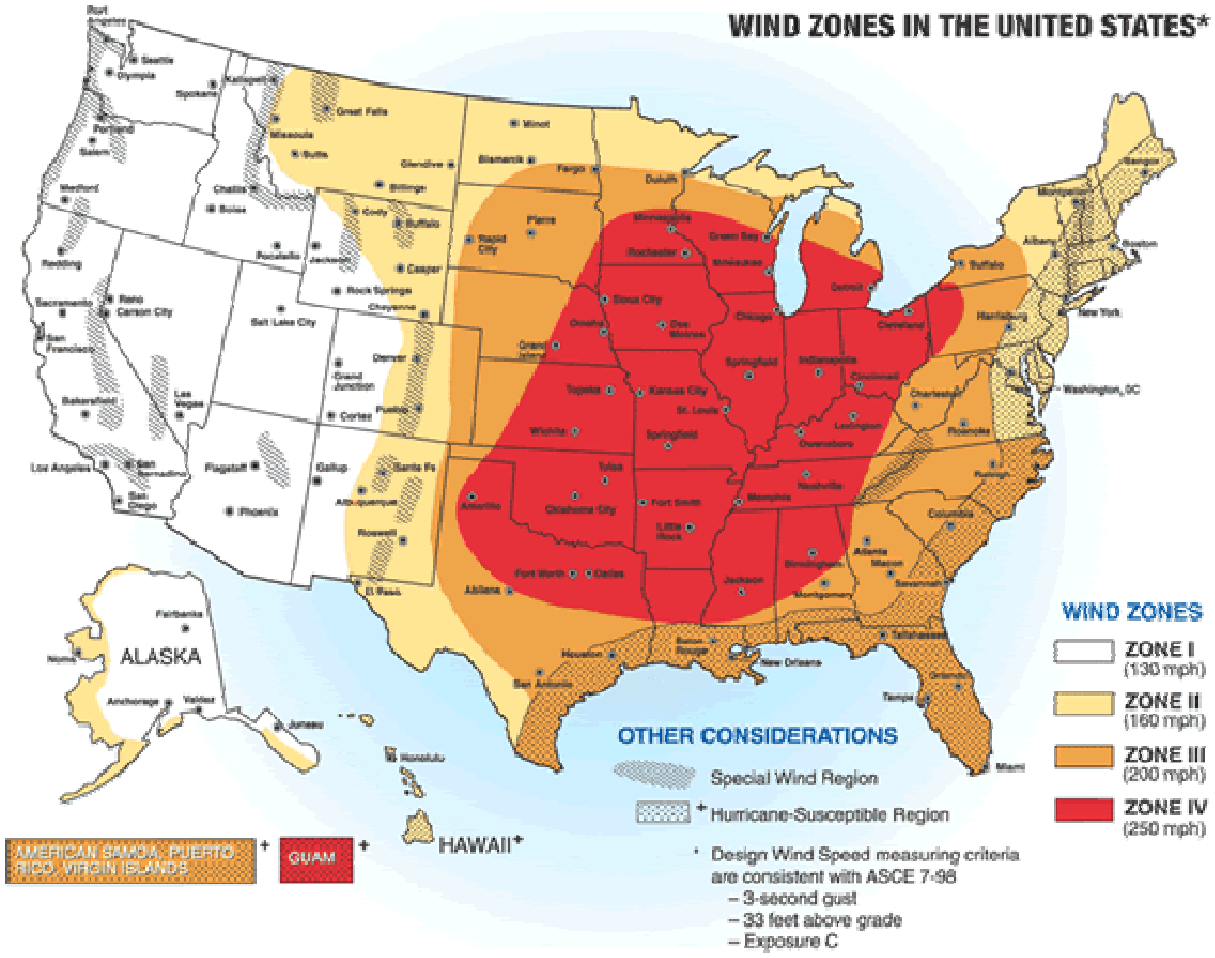


Figure 3a.2 - Wind Zones in the United States

Extent – Extreme Winds

The severity of a severe wind event depends upon the maximum sustained winds experienced in any given area. Extreme winds pose a significant threat to lives, property and infrastructure due to direct wind forces but also flying debris, such as rocks, lumber, fuel drums, sheet metal and loose gear of any type that can be picked up by the wind and hurled with great force. Extreme winds also down trees and power lines that often result in power outages across an affected area. Table 3a.2 illustrates the severity and typical effects of various wind speeds, as obtained from the NOAA NCDC web site.

Table 3a.2
Severity and Typical Effects of Various Speed Winds

Maximum Wind Speeds	Equivalent Saffir-Simpson Scale* (Hurricanes)	Equivalent Fujita Scale (Tornadoes)	Severity	Typical Effects
40-72 mph *(35-62 kt)*	Tropical Storm = 39-73 mph	F0	Minimal	Some damage to chimneys; breaks twigs and branches off tress; pushes over shallow-rooted trees; damages signboards; some windows broken; hurricane wind speed begins at 73 mph.
73-112 mph *(63-97 kt)*	Cat 1 = 74-95mph Cat 2 = 96-110 mph Cat 3 = 111-130 mph	F1	Moderate	Peels surfaces off roofs; mobile homes pushed off foundations or overturned; outbuildings demolished; moving autos pushed off the roads; trees snapped or broken.
113-157 mph *(98-136 kt)*	Cat 3 = 111-130 mph Cat 4 = 131-155 mph Cat 5 > 155 mph	F2	Considerable	Roofs torn off frame houses; mobile homes demolished; frame houses with weak foundations lifted and moved; boxcars pushed over; large trees snapped or uprooted; light-object missiles generated.
158-206 mph *(137-179 kt)*	Cat 5 > 155 mph	F3	Severe	Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forests uprooted; heavy cars lifted off the ground and thrown; weak pavement blown off roads.
207-260 mph *(180-226 kt)*	? Cat 5 > 155 mph	F4	Devastating	Well constructed homes leveled; structures with weak foundations blown off some distance; cars thrown and disintegrated; large missiles generated; trees in forest uprooted and carried some distance away. The maximum wind speeds of hurricanes are not likely to reach this level.
261-318 mph *(227-276 kt)*	N/A	F5	Incredible	Strong frame houses lifted off foundations and carried considerable distance to disintegrate; automobile-sized missiles fly through the air in excess of 300 ft (100 m); trees debarked; incredible phenomena will occur. The maximum wind speeds of hurricanes are not expected to reach this level.
Greater than 319 mph *(277 kt)*	N/A	F6	N/A	The maximum wind speeds of tornadoes are not expected to reach this level. The maximum wind speeds of hurricanes are not expected to reach this level.

** The Saffir-Simpson Scale is a five-category wind speed / storm surge classification scale used to classify Atlantic hurricane intensities. The Saffir-Simpson values range from Category 1 to Category 5. The strongest SUSTAINED hurricane wind speeds correspond to a strong F3 (Severe Tornado) or possibly a weak F4 (Devastating Tornado) value. Whereas the highest wind gusts in Category 5 hurricanes correspond to moderate F4 tornado values, F5 tornado wind speeds are not reached in hurricanes.*

Previous Occurrences – Extreme Winds

Ulster County has experienced numerous types of damaging extreme wind events in the past including severe thunderstorms, tornadoes, hurricanes, tropical storms and norôeasters.

According to NOAAôs NCDC, 275 recorded high wind events have affected Ulster County between May 1997 and February 2008 (data includes wind events greater than 50 knots, with the exception of tornado events which are addressed separately within this section). These incidents resulted in a reported total of three deaths, five injuries and caused an estimated $13.98 million in property damages. Some recent notable events include the following:

November 6, 1994
High winds downed trees and power lines. Especially hard hit was Kingston, where trees fell on

homes and vehicles. One death and $0.5 million in property damages were reported during this event.

December 24, 1994
A coastal storm which moved over extreme southeast New York on the morning of December 24th brought high winds to parts of eastern New York, downing trees, tree limbs and power lines. Especially hard hit were Olive, Woodstock and Hurley where large trees were uprooted and several homes sustained significant damage as trees fell on them (with an estimated $0.5 million in property damage).

March 19, 1996
A strong low pressure system produced damaging winds. In Ulster County trees were blown down in Kingston, Woodstock and Wawarsing resulting in an estimated $89,000 in property damages.

May 29, 1998
Thunderstorm winds downed trees and power lines. An elderly man was instantly killed at Ellenville in Ulster County, when a large tree limb fell on him.

July 1, 2001
In Ulster County, microbrust damage was surveyed by National Weather Service personnel on the east side of Gardiner. Winds were estimated to be around 100 mph and the damage was generally contained within a semi-circle to the west of Ireland Corners. Large trees were snapped or taken down in an area bounded by Route 44-55, Route 208 and Marabac Road. One tree fell on an automobile, crushing it. Meanwhile to the south of the Route 208 intersection, another tree fell onto the roof of a house. At the same location, a chimney toppled onto another vehicle. At the same time, thunderstorm winds blew down numerous trees in the City of New Paltz. Total estimated property damages in Ulster County totaled $65,000.

November 13-14, 2003
A steep pressure gradient between a low pressure area in the east and a high pressure system building across the Ohio Valley, brought the second major wind event of the fall season to eastern New York. Since the storm was slow moving, this turned out to be a two day high wind event. A roof over gas pumps at a Stewarts in Rosendale in Ulster County was badly damaged. A large tree fell onto a house near Kingston, damaging the roof. Downed live power lines caused a brush fire outside of New Paltz. One injury and $275,000 in property damages were attributed to this storm in Ulster County.

July 22, 2006
A thunderstorm over the lower Catskills shortly before daybreak became severe. It produced a wet-microburst wind gust estimated at 70 to 80 miles an hour in Ellenville. The strong wind blew down about 30 trees, destroyed a car, and damaged 2 homes. The estimated cost of the damage was 35 thousand dollars.

December 1, 2006
A tree was blown onto an apartment building, crashing through the roof and killing an individual inside in Wawarsing. This occurred from strong winds, well ahead of any thunderstorms.

Probability of Occurrence – Extreme Winds

Extreme wind events will remain a very frequent occurrence in Ulster County, and the probability of future occurrences in Ulster County is certain. The entire planning area is susceptible to a wide variety of recurring events that cause extreme wind conditions including severe thunderstorms (most frequent), tornadoes, hurricanes, tropical storms and norôeasters.

Table 3a.3 illustrates a summary of wind-related events in both New York and Ulster County based on historic occurrences reported in NOAAôs NCDC Storm Events Database during the 58 year period of record from 1950 to 2008, and provides an associated average annual number of storms. It shows an average annual number of high wind events in Ulster County of 4.74 based on historical occurrences, which agrees with the NOAA National Severe Storms Laboratoryôs estimate of the mean number of days per year with one or more severe wind events (winds of at least 57.5 miles per hour) in Ulster County is approximately five. Table 3a.3 does not include hurricanes, tropical storms, tornadoes or extratropical storms.

Table 3a.3
Average Annual Number of Wind Events (Statewide vs. Ulster County)
(Source: NOAA's NCDC Storm Events Database for the period January 1, 1950 – February 28, 2008)

Event Type	Total Number of Events in New York State	Total Number of Events in Ulster County	Average Annual Number of Events in New York State	Average Annual Number of Events in Ulster County
Thunderstorm and High Wind Events	8,591	275	148.12	4.74

Extreme winds are a probabilistic natural phenomenon: it is impossible to predict in what years windstorms will occur or how severe the winds will be. Wind hazards are often expressed in terms of wind frequencies or recurrence intervals, such as a 10-year wind or a 100-year wind. A ñ100-year windò means that there is a 1 percent chance in any given year of a wind at the 100-year or higher wind speed. A 10-year wind means that there is a 10 percent chance in any given year of a wind at the 10-year or higher wind speed. Wind recurrence intervals donôt mean that windstorms occur exactly at these intervals; rather, they express probabilities of winds. Thus, a given location may experience two 100-year windstorms in a short time period or go several decades without experiencing a 10-year windstorm.

Extreme winds can occur during tornadoes, hurricanes, tropical cyclones, extratropical cyclones (northeasters), destructive wind, and thunderstorms, but can also occur in their absence as mere ñwindstorms.ò Extreme winds have a history of occurrence throughout Ulster County, and are highly likely to occur in the future.

The degree of wind hazard risk at a particular site is characterized by the wind speeds expected at the site with recurrence intervals of 10-, 25-, 50-, 100-, and 2000- years. The FEMA Benefit-Cost Module for Wind Hazard Risk (Version 1.0, 01/20/95) provides wind speed data for various return periods at a series of mileposts located along US Gulf and Atlantic coastlines. The data is provided for locations at the coast and for locations 200 km (approximately 125 miles) inland. For the purposes of estimating wind data applicable for Ulster County, milepost 2550 was assumed to most closely resemble conditions in Ulster County. This milepost is located midway between milepost 2500 (located on the New Jersey shore) and milepost 2600 (located on the east end of Long Island). Table 3a.4 illustrates wind speed data for Ulster County and the surrounding area. FEMAôs Hurricane Benefit Cost Analysis module was used to obtain

wind speeds at distances between 85 miles inland (southern Ulster County) to 125 miles inland (northern Ulster County).

Table 3a.4
Wind Speed Probabilities for Ulster County and Surrounding Area
(Milepost 2550, as per FEMA B-C Module – Wind, Version 1.0, January 20, 1995)

Recurrence Interval	Annual Probability of Occurrence (%)	Wind Speed At the Coast – New York City approx. (mph)	Wind Speed At 85 Miles Inland - Southern Ulster County (mph)	Wind Speed At 95 Miles Inland (mph)	Wind Speed At 105 Miles Inland (mph)	Wind Speed At 115 Miles Inland (mph)	Wind Speed At 125 Miles Inland – Northern Ulster County (mph)
10	10	51	38	37	35	34	32
25	4	77	66	65	64	62	61
50	2	92	81	80	79	77	76
100	1	101	94	93	92	90	90
2000	0.05	138	133	132	131	130	130

Importing this data into FEMAôs Hurricane Benefit Cost Analysis module allows the user to generate the estimated annual number of wind events that reach various strengths. These estimates are calculated from the wind recurrence interval data, wind speed data, and the number of miles inland the site is from the nearest milepost. ñExpected annual numberò of windstorms does not mean that this number of windstorms occurs every year, but rather ñexpectedò indicates the long-term statistical average number of windstorms per year. Table 3a.5 illustrates the expected annual number of wind events of various magnitudes at various distances from the coast for Ulster County and surrounding areas, while Table 3a.6 illustrates the associated annual probability of occurrence.

Table 3a.5
Expected Annual Number of Wind Events of Various Magnitudes
At Various Distances from the Coast
For Ulster County and Surrounding Areas
(Milepost 2550, as per FEMA B-C Module – Wind, Version 1.0, January 20, 1995)

Storm Class (Saffir-Simpson Scale)	Wind Speed (mph)	Expected Annual Number of Wind Events				
		Wind Speed At 85 Miles Inland - Southern Ulster County (mph)	Wind Speed At 95 Miles Inland (mph)	Wind Speed At 105 Miles Inland (mph)	Wind Speed At 115 Miles Inland (mph)	Wind Speed At 125 Miles Inland – Northern Ulster County (mph)
0	60-73	0.0197	0.0195	0.0194	0.0193	0.0192
1	74-95	0.0193	0.0184	0.0175	0.0166	0.0158
2	96-110	0.0057	0.0052	0.0048	0.0044	0.0041
3	111-130	0.0017	0.0016	0.0015	0.0014	0.0013
4	131-155	0.0004	0.0004	0.0004	0.0004	0.0004
5	>155	0.0001	0.0001	0.0001	0.0001	0.0001

Table 3a.6
Annual Probability of Wind Events of Various Magnitudes
At Various Distances from the Coast
For Ulster County and Surrounding Areas
(Milepost 2550, as per FEMA B-C Module – Wind, Version 1.0, January 20, 1995)

Storm Class (Saffir-Simpson Scale)	Wind Speed (mph)	Annual Probability of Wind Events				
		Wind Speed At 85 Miles Inland - Southern Ulster County (mph)	Wind Speed At 95 Miles Inland (mph)	Wind Speed At 105 Miles Inland (mph)	Wind Speed At 115 Miles Inland (mph)	Wind Speed At 125 Miles Inland – Northern Ulster County (mph)
0	60-73	1.97%	1.95%	1.94%	1.93%	1.92%
1	74-95	1.93%	1.84%	1.75%	1.66%	1.58%
2	96-110	0.57%	0.52%	0.48%	0.44%	0.41%
3	111-130	0.17%	0.16%	0.15%	0.14%	0.13%
4	131-155	0.04%	0.04%	0.04%	0.04%	0.04%
5	>155	0.01%	0.01%	0.01%	0.01%	0.01%

Hurricanes and Tropical Storms

Hazards Associated with Hurricane and Tropical Storm Events

Hurricanes and tropical storms are particular types of *events*. The *hazards* associated with a hurricane or tropical storm event are: high winds, flooding (including storm surge), coastal erosion, and wave action. Each of the unique hazards associated with hurricane and tropical storm events are summarized briefly below, and addressed specifically elsewhere in the plan. Hurricane and tropical storm events are discussed in the remainder of this section.

- Winds. After making landfall, hurricane winds can remain at or above hurricane force well inland (sometimes more than 100 miles). In addition, hurricanes can also spawn tornadoes. Typically, the more intense a hurricane is, the greater the tornado threats. High winds are addressed separately in this document.
- Flooding. Upon making landfall, a hurricane rainfall can be as high as 20 inches or more in a 24-hour period, with amounts in the 10 to 15 inch range being most common. If the storm is large and moving slowly, the rainfall amounts can be much higher. Heaviest rainfall tends to be along the coastline, but sometimes there is a secondary maximum further inland. Following a hurricane, inland streams and rivers can flood and trigger landslides. Flooding can also be caused when drainage system capacities are exceeded. Flooding is addressed separately in this document.
- Storm Surge. Even more dangerous than the high winds of a hurricane is the storm surge, a dome of ocean water that is basically pushed ashore by the hurricane winds. Hurricane storm surge can be as much as 20 feet at its peak and 50 to 100 miles wide, depending on hurricane strength and depth of offshore waters. Generally, the stronger the hurricane and the shallower the offshore water depths, the higher the storm surge. Most hurricane fatalities and coastal damages are attributable to storm surge, as opposed to hurricane winds. Storm surge can cause the most damage when it occurs during high tides. Storm surge can come ashore as much as five hours in advance of the time that a hurricane makes landfall. There are no ocean shorelines in Ulster County, and storm surge is not a hazard in Ulster County.
- Coastal Erosion. The currents created by the tide and storm surge, combined with wave action, can severely erode coastlines. Many buildings withstand hurricane force winds until their foundations, undermined by erosion, are weakened and fail. There are no ocean shorelines in Ulster County, and coastal erosion is not a hazard in Ulster County.
- Wave Action**.** Hurricanes and tropical storms are also associated with significant wave action, which can damage not only buildings but infrastructure and protective features along ocean shorelines. There are no ocean shorelines in Ulster County, and wave action is not a hazard.

Description – Hurricanes and Tropical Storms

A **hurricane** is a severe tropical cyclone with winds that have reached a constant speed of 74 miles per hour or more. Hurricane winds blow in a large spiral around a relative calm center known as the "eye." The "eye" is generally 20 to 30 miles wide, and the system can extend outward from the eye by up to 400 miles. In the Northern Hemisphere, circulation is in a counterclockwise motion around the eye. These storms are usually short in duration but are extremely powerful and cause the greater amount of damage due to significant storm surges and high winds. If these systems have wind speeds of between 39 and 73 miles per hour, they are classified as **tropical storms**.

In the Atlantic basin, hurricanes and tropical storms are most likely to occur between June 1st and November 30th, with the peak number of events typically occurring between mid-August and late October.

Location – Hurricanes and Tropical Storms

No one jurisdiction within Ulster County is any more likely to have the path of such a system traverse within its borders than any other location. Because of the size of hurricane and tropical storm systems, areas within Ulster County can still be affected even when the eye makes landfall outside of Ulster County. The hazards associated with hurricane and tropical storm events have distinct hazard area locations, discussed in other sections of this report. For Ulster County, these include wind and flood hazards.

Extent – Hurricanes and Tropical Storms

The magnitude or severity of hurricanes is categorized by the Saffir-Simpson scale. The Saffir-Simpson Scale is a five-category wind speed / storm surge classification scale used to classify Atlantic hurricane intensities. The scale is used to give an estimate of the potential property damage and flooding that can be expected. The Saffir-Simpson values range from Category 1 to Category 5, as shown in Table 3a.7. Wind speed is the determining factor in the scale, as storm surge values are highly dependent on the slope of the continental shelf in the landfall region.

Note that, for tropical storms (not represented on the scale), winds are between 39 and 73 miles per hour and typical effects include breakage of twigs and branches off tress, toppling of shallow-rooted trees, and some damage to signboards and windows.

Table 3a.7
The Saffir-Simpson Hurricane Scale

Category	Wind Speed (miles per hour)	Storm Surge (feet above normal sea level)	Expected Damage	Photo Example
1	74-96 mph	4-5 ft	Minimal: Damage is done primarily to shrubbery and trees, unanchored mobile homes are damaged, some signs are damaged, no real damage is done to structures	
2	96-110 mph	6-8 ft	Moderate: Some trees are toppled, some roof coverings are damaged, and major damage is done to mobile homes.	
3	111-130 mph	9-12 ft	Extensive: Large trees are toppled, some structural damage is done to roofs, mobile homes are destroyed, and structural damage is done to small homes and utility buildings.	
4	131-155 mph	13-18 ft	Extreme: Extensive damage is done to roofs, windows, and doors; roof systems on small buildings completely fail; some curtain walls fail.	
5	Greater than 155 mph	Greater than 18 ft	Catastrophic: Roof damage is considerable and widespread, window and door damage is severe, there are extensive glass failures, and entire buildings could fail.	

** Source: FEMA's How-To #2, page 2-23*

The magnitude or severity of hurricane and tropical storm events will increase under the following conditions:

- as the storm category increases;
- as the diameter of the storm system increases;
- as the systemôs forward speed decreases;
- as rainfall amounts increase;
- as the quantity of people, structures and infrastructure in the affected areas increases.

For the sake of clarity, we will also point out that, for communities with mapped erosion, surge, or wave action zones, the magnitude or severity will also increase with increasing degree of erosion, surge and/or wave action. However, there are no mapped erosion, surge or wave action hazard areas in Ulster County.

Previous Occurrences – Hurricane and Tropical Storm Events

Hurricanes and tropical storms have impacted Ulster County and its participating jurisdictions in the past, and will continue to do so in the future.

Ulster County has an active history of hurricanes and tropical storms. According to NOAA historical records, 25 hurricane or tropical storm tracks have passed within 65 miles of Ulster County since 1861. This includes two Category 2 hurricanes; three Category 1 hurricanes; and 20 tropical storms. Of the 25 recorded storm events, three tracks traversed directly through Ulster County (one Category 1 hurricane in 1878 and two tropical storms in 1893 and 1949).

Ulster County was recently impacted by the remnants of both Hurricane Ivan in September 2004 and Hurricane Floyd in September 1999, both of which were Tropical Depressions by the time they reached Ulster County.

September 1999
Remnants of Hurricane Floyd impacted the western portions of Ulster County with high winds, heavy rains, and some flooding. Information received from local sources reports that this event caused significant property damage in the Town of Saugerties and left some residents without power for almost a week.

September 2004
Remnants of Hurricane Ivan impacted the County with high winds, heavy rains, and some flooding.

Probability of Occurrence – Hurricane and Tropical Storm Events

Internet resources on NOAAôs Atlantic Oceanographic and Meteorological Laboratory (AOML) web site were researched to gain an understanding of the relative likelihood of Ulster County being impacted by a coastal storm as compared to other locations in the Atlantic Basin (see Figure 3a.3). Based upon a review of this data, it was determined that Ulster County and its jurisdictions have roughly a six to 12 percent chance of being impacted by a named coastal storm in any given year.

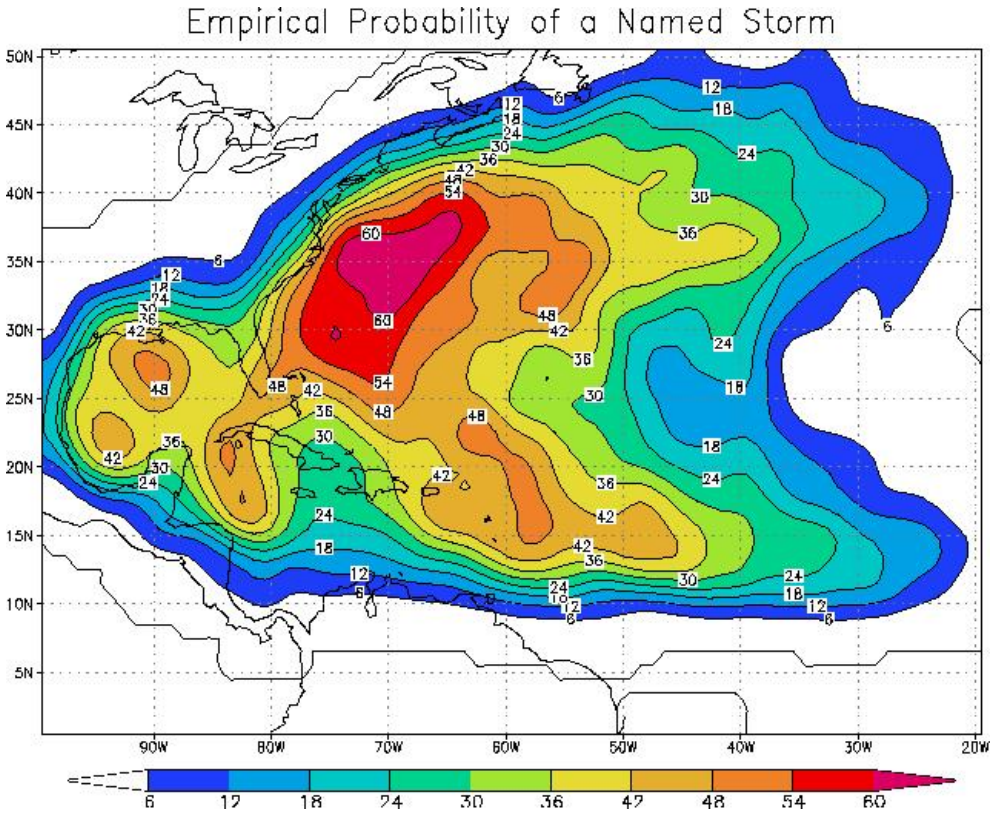


Figure 3a.3 - Empirical Probability of a Named Storm (Atlantic Basin)

Lightning

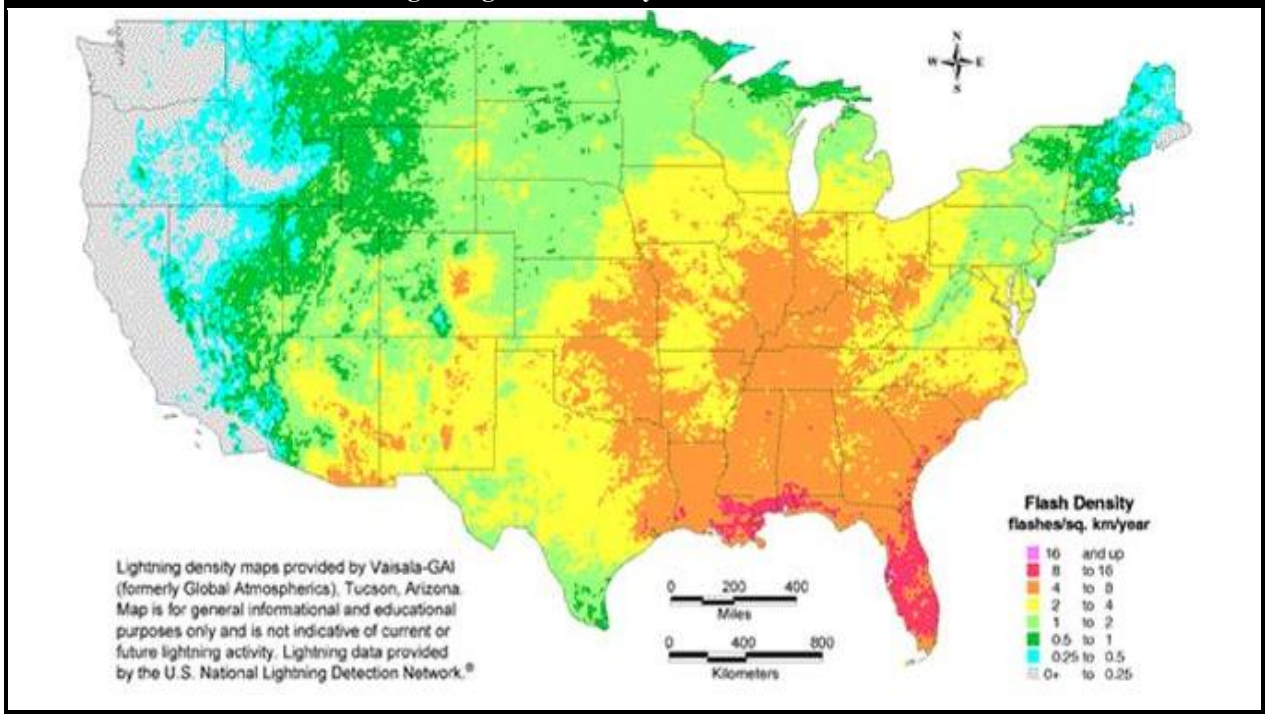
Description – Lightning

Lightning is a discharge of electrical energy resulting from the buildup of positive and negative charges within a thunderstorm, creating a ñboltò when the buildup of charges becomes strong enough. This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit. Lightning rapidly heats the sky as it flashes, but the surrounding air cools following the bolt. This rapid heating and cooling of the surrounding air causes thunder. On average, 73 people are killed each year by lightning strikes in the United States.

Location - Lightning

Ulster County is located in a region of the country that is susceptible to lightning strike, though not as susceptible as southeastern states. Figure 3a.4 shows a lightning flash density map for the years 1996-2000 based upon data provided by Vaisalaôs U.S. National Lightning Detection Network (NLDN®).

Figure 3a.4
Lightning Flash Density in the United States



Source: Vaisala U.S. National Lightning Detection Network

Extent - Lightning

All areas of Ulster County are equally susceptible to lightning strike. While lightning occurs randomly anywhere and anytime, the most common location for lightning fatalities and injuries to people is in open areas such as parks, beaches, golf courses and other recreational areas. Ulster County remains susceptible

to lightning deaths and injuries due to the large number of people who engage in outdoor activities, particularly more so along the shoreline of its coastal jurisdictions.

Previous Occurrences – Lightning

NOAA records that New York State has experienced the fifth most deaths from lightning in the United States from 1959 to 1994.

NCDC reports 18 lightning events for Ulster County between August 1993 and January 2008. These events have resulted in two recorded injuries and $703,000 in property damage. Some notable examples include:

July 15, 1997
At Highland in the Town of Lloyd, a 180 foot by 120 foot storage facility was burned to the ground following a lightning strike causing an estimated $250,000 in damages.

July 4, 1999
Lightning from a thunderstorm struck two different houses, one in Ulster and another in Kingston. The first strike, at 119 Dewitt Street in Kingston ignited a fire that was contained to a storage room. The second lightning strike hit a tree, destroying it. The flames from the tree damaged a roof at 98 Katrine Lane, in the town of Ulster. In addition, the lightning resulted in as many as 3,500 residents without power in the Mid Hudson Valley.

August 10, 2003
Lightning from a thunderstorm struck a pole next to a house on Hardenburg Road in Rifton, in the Town of Esopus. The lightning was conducted through electrical wires and traveled into a nearby home striking a man in his basement. The man was not seriously injured. Another lightning strike from the same storm struck a house on Glasco Turnpike in Saugerties. The house was set ablaze, destroying the home and killing two dogs.

Probability of Future Occurrences – Lightning

The probability of occurrence for future lightning events in Ulster County is certain. According to NOAA, Ulster County is located in an area of the country that experiences an average of one to three lightning flashes per square kilometer per year (in the order of 1,000 to 3,000 flashes countywide per year). Given this regular frequency of occurrence, it can be expected that future lightning events will continue to threaten life and cause minor property damages throughout Ulster County.

Nor'easters

Description – Nor'easters

Similar to hurricanes, norôeasters are ocean storms capable of causing substantial damage in the Eastern United States due to their associated strong winds and heavy precipitation. Nor'easters are named for the winds that blow in from the northeast and drive the storm up the East Coast along the Gulf Stream, a band of warm water that lies off the Atlantic coast. They are caused by the interaction of the jet stream with horizontal temperature gradients and generally occur during the fall and winter months when moisture and cold air are plentiful.

Norôeasters are known for dumping heavy amounts of rain and snow, producing hurricane-force winds, and creating high surf that causes severe beach erosion and coastal flooding. There are two main components to a nor'easter: (1) a Gulf Stream low-pressure system (counter-clockwise winds) generated off the southeastern U.S. coast, gathering warm air and moisture from the Atlantic, and pulled up the East Coast by strong northeasterly winds at the leading edge of the storm; and (2) an Arctic high-pressure system (clockwise winds) which meets the low-pressure system with cold, arctic air blowing down from Canada. When the two systems collide, the moisture and cold air produce a mix of precipitation and have the potential for creating dangerously high winds and heavy seas. As the low-pressure system deepens, the intensity of the winds and waves will increase and cause serious damage to coastal areas as the storm moves northeast. Norôeasters can be extremely large (up to 1,000 miles in diameter) and their duration can last for days and multiple tidal cycles, often causing major coastal flooding, erosion and damages that might even exceed the impacts of shorter-term hurricane events.

While there are a variety of indicators for norôeaster intensity, Table 3a.8 describes the Dolan-Davis Norôeaster Intensity Scale which is based on coastal storm erosion, degradation and property damage.

Table 3a.8
Dolan-Davis Nor'easter Intensity Scale

Storm Class	Beach Erosion	Dune Erosion	Overwash	Property Damage
1 WEAK	Minor changes	None	No	No
2 MODERATE	Modest; mostly to lower beach	Minor	No	Modest
3 SIGNIFICANT	Erosion extends across beach	Can be significant	No	Loss of many structures at local level
4 SEVERE	Severe beach erosion and recession	Severe dune erosion or destruction	On low beaches	Loss of structures at community-scale
5 EXTREME	Extreme beach erosion	Dunes destroyed over extensive areas	Massive in sheets and channels	Extensive at regional-scale; millions of dollars

Source: Federal Emergency Management Agency

Location– Nor'easters

Norôeasters threaten the entire Atlantic Coast of the United States, and while coastal areas are most directly exposed to the damaging forces of such storm systems their impact is often felt far inland. Ulster County is located in an area that is extremely susceptible to norôeasters. No one jurisdiction within Ulster County is any more likely to have the path of such a system traverse within its borders than any other location.

Extent – Nor'easters

All areas throughout Ulster County are susceptible to the norôeaster hazard effects of extreme wind, flooding and heavy snowfall. Norôeasters are most notable for snow accumulations in excess of nine inches, accompanied by high, sometimes gale force winds and storm surge in coastal areas. Major property damages and power outages are also common.

NYSEMO has classified norôeasters as a moderate hazard (second only to flooding) in the planning area covering Ulster County.

Although not specifically included in the Ulster County HAZNY, the county has been affected by numerous norôeasters, with the principal impacts being high winds, heavy snowfall and flooding, and the HAZNY ranks ñSevere Stormsò 4th out of 27 (ñModerately High Hazardò) among the list of all hazards.

Historical Occurrences – Nor'easters

Ulster County has a lengthy history of devastating impacts wrought by norôeasters. This includes damages caused by the effects of extreme wind, heavy snowfall and flooding. Some notable examples include:

Blizzard of 1993
The Storm of the Century, also known as the ô93 Superstorm, No-Name Hurricane, the White Hurricane, or the (Great) Blizzard of 1993, was a large cyclonic storm that occurred on March 12ï March 15, 1993, on the East Coast of North America. It is unique for its intensity, massive size and wide-reaching effect. At its height the storm stretched from Canada to Central America, but its main impact was on the Eastern United States and Cuba. States of emergency were declared by local towns in Ulster County.

February 23-25, 1998
This norôeaster resulted in heavy snowfall across Ulster County, including a recorded 25 inches at Slide Mountain in western Ulster County.

December 30, 2000
Many areas received the most snow to fall in a single storm since January 1996, and one local death was blamed on the weather when a man blowing snow had a heart attack. Area police, utilities and public works crews reported few storm-related problems. During the mid-afternoon, snow was piling up at a rate of 2 inches per hour in Kingston, where a snow emergency was declared.

Probability of Future Occurrences

Norôeasters will remain a very frequent occurrence for Ulster County, and the probability of future occurrences affecting all of Ulster Countyôs jurisdictions is certain.

Tornado

Hazards Associated with Tornado Events

Tornadoes are particular types of events. The hazard associated with a tornado event is high winds. The high wind hazard is addressed specifically elsewhere in the plan. Tornado events are discussed in the remainder of this section.

Description – Tornado Events

The American Meteorological Society, ñGlossary of Meteorologyò defines a tornado as violently rotating column of air that has contact with the ground and extends downward from a cumulonimbus cloud. Tornado wind speeds can range from as low as 40 mph to as high as 318 mph. Tornadoes often accompany thunderstorms and hurricanes. Tornadoes can occur at any time of the year but are more prevalent during the spring and summer months.

Location – Tornado Events

Tornadoes can occur anywhere in the US. They have struck in all 50 states, with the highest concentration on the central plains and in the southeastern states, such as Oklahoma, Texas, and Florida. No one jurisdiction within Ulster County is any more likely to have a tornado touch down within its borders than any other location. The hazard associated with tornado events (high winds) have distinct hazard area locations, discussed in other sections of this report.

Extent – Tornado Events

The magnitude or severity of a tornado is dependent upon wind speed and is categorized by the Fujita Scale, presented in Table 3a.9. Tornadoes are typically considered to be ñsignificantò for F2 or F3 on the Fujita Scale and ñviolentò for F4 and F5.

Table 3a.9
The Fujita Scale: Tornado Magnitude
(Source: NOAA)

Scale	Wind Estimate (mph)	Damage Type	Damage Description
F0	< 73	Light	Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged.
F1	73 - 112	Moderate	Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
F2	113 - 157	Considerable	Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
F3	158 - 206	Severe	Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
F4	207 - 260	Devastating	Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated.
F5	261 - 318	Incredible	Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yards); trees debarked; incredible phenomena will occur.

Previous Occurrences – Tornado Events

Tornadoes are a particular type of high wind event which have been recorded by NOAAôs NCDC 11 times between September 1975 and February 2008. In total, the eleven tornadoes in Ulster County have reportedly caused $3.13 million in property damages and three injuries (though no deaths or crop damages were reported). A summary of information available on all eleven events is presented in Table 3a.10.

Table 3a.10
Tornadoes Reported in Ulster County
(Source: NOAA's NCDC Storm Events Database for the period September 1975 to February 2008)

Date	Affected Municipality	Deaths	Injuries	Property Damage	Crop Damage	Magnitude	Length	Width
09/20/75	Ulster (Town)	0	1	$25,000	$0	F1	7 miles	167 yards
03/21/76	Warwarsing	0	0	$0	$0	F2	0 miles	30 yards
03/21/76	Warwarsing	0	0	$25,000	$0	F1	0 miles	30 yards
06/30/76	Marbletown	0	0	$25,000	$0	F1	1 miles	100 yards
07/21/83	Denning	0	0	$25,000	$0	F0	1 miles	300 yards
5/12/84	Rochester	0	0	$25,000	$0	F0	unknown	unknown
10/5/85	Ulster (Town)	0	0	$250,000	$0	F1	0 miles	43 yards
7/26/86	Warwarsing/Shawang unk	0	2	$2.5m*	$0	F2	1 mile	100 yards
9/10/93	Saugerties (Town)	0	0	$50,000	$0	F1	0 miles	50 yards
6/26/98	Hardenburgh	0	0	$150,000	$0	F1	6 miles	200 yards
5/18/00	Esopus	0	0	$50,000	$0	F2	0 miles	50 yards

Source: NOAA's National Climatic Data Center
*Notes: Casualty and damage information are the total reported for the event, not necessarily the total for the county. Magnitude refers to the Fujita Scale. *Includes damage in Sullivan County*

The NCDC database includes descriptions of the three most recent tornados that have been recorded in the County:

- September 9, 1993: A small F1 tornado touched down in Saugerties tearing half the roof off a house and uprooting some trees.

- June 26, 1998: One thunderstorm in Ulster County spawned an F1 tornado in the vicinity of Mongaup Mountain, in the Town of Hardenburgh. This tornado had a non-continuous damage path that included massive tree damage.

- May 18, 2000: A strong cold front crossed eastern New York late on May 18. At the same time, very strong winds aloft moved over the area. The combination of the instability, and lift ahead of the front, spawned a line of thunderstorms. A series of microbursts began in Ulster County about a mile northwest of the center of Esopus. They knocked down several clusters of trees as they neared State Highway Route 9W, while moving in an easterly direction. Embedded within the

microburst, an F1 tornado, touched down briefly to the east of Black Creek and 9W, less than a tenth of a mile south of the center of Esopus. The track of the tornado was about a quarter mile long and 25 to 50 yards wide with numerous trees pushed about 70 degrees to the left of the storm track. There was little property damage due to the tornado, but it was sighted by nearby residents

Probability of Occurrence – Tornado Events

For tornado events, this plan indicates the probability of future occurrences in terms of frequency based on historical events. According to the NOAA National Climatic Data Center, Ulster County has experienced 11 recorded tornadoes in the 32 year period between 1975 and 2008, or an average of 0.34 tornadoes per year in that period. When annualized over the full time period covered by the NOAA database, this annual occurrence falls to 0.19 tornadoes per year in the County. Table 3a.11 illustrates a comparative summary of tornado events in both New York State and Ulster County, and provides an associated average annual number of storms for each type.

Table 3a.11
Probability of Occurrence of Tornadoes
(Source: NOAA's NCDC Storm Events Database for the period January 1, 1950 – February 28, 2008)

Category	Total Number of Events	Probability of Occurrence*	Average Annual Number of Events
New York			
F0	125	35.4%	2.2
F1	148	41.9%	2.6
F2	47	13.3%	0.8
F3	24	6.7%	0.4
F4	6	0.02%	0.1
F5	0	0%	0.0
Unable to Determine	13	0.04%	0.2
Total, New York	*353*		*6.3*
Ulster County			
F0	2	18.2%	0.03
F1	6	54.5%	0.55
F2	3	27.3%	0.27
F3	0	0%	0.00
F4	0	0%	0.00
F5	0	0%	0.00
Unable to Determine	0	0%	0.00
Total, Ulster County	*11*		*0.34*

*The probability of occurrence is presented in terms of frequency within the set of recorded historical events. The probability of occurrence has been calculated by dividing the number of events of a given magnitude by the total number of events for all categories. e.g.: the probability of occurrence of a tornado of magnitude F1 in the State as a whole has been determined as 148/353 = 0.419. i.e. if a tornado were to touch down in new York State, there is a 42% chance that it will be of magnitude F1.

Winter Storm / Ice Storm

Hazards Associated with Winter Storm / Ice Storm

Severe winter storms are particular types of events. They are characterized by the hazards of high winds, extreme cold, heavy precipitation (in the form of snow and/or ice), and sometimes wave action, coastal erosion and flooding. Ulster County has no identified areas of mapped coastal erosion or wave action hazards. Winter storm and ice storm events are discussed in general terms in this section of the document; their specific hazards are discussed elsewhere in the plan.

Description – Winter Storms / Ice Storms

Winter storms consist of cold temperatures and heavy snow or ice. Because winter storms are regular, annual occurrences in Ulster County, they are considered hazards only when they result in damage to specific structures and/or overwhelm local capabilities to handle disruptions to traffic, communications, and electric power.

Winter storms and ice storms typically occur in New York from late October until mid-April. Peak months for these events for Ulster County and its jurisdictions would be December through March.

Northeasters are one type of winter storm that is common in Ulster County. These storms usually form off the US East Coast near the Carolinas then follow a track northward along the coast until they blow out to sea, hence the term ñnortheasterò. Occasionally they are large enough to cover a majority of the state. Northeasters are most notable for snow accumulations in excess of nine inches accompanied by high winds (sometimes gale force) and storm surges.

Statewide, according to NOAA data average annual snowfall ranges from a low of approximately 10 ï 20 inches in the New York City / Long Island area, to over 200 inches in the north of the State, in the Adirondack Mountains. For most of Ulster County, average annual snowfall ranges from 50 to 75 inches per year, although some areas in the western part of the County experience annual snowfalls of up to 100 inches. This can very greatly from one year to the next, particularly if several major extended-period storms impact the area (during which snowfall totals can approach or exceed annual averages).

Location – Winter Storms / Ice Storms

Severe winter storms and ice storms can occur anywhere in the County; generally no single jurisdiction within Ulster County is any more likely to be impacted by a severe winter storm or ice storm within its borders than any other location. The hazards associated with this event have distinct hazard area locations, discussed in other sections of this report.

Extent – Winter Storms / Ice Storms

A severe winter storm can adversely affect roadways, utilities, business activities and can cause loss of life, frostbite, or freezing. The most common effect of winter storms and ice storms is traffic accidents, interruptions in power supply and communications; and the failure of inadequately designed and/or maintained roofing systems. Power outages and temperatures below freezing for extended periods of time can cause pipes to freeze and burst. Heavily populated areas tend to be significantly impacted by losses of power and communications systems due to downed lines. Distribution lines can be downed by

the weight of snow or ice, or heavy winds. When limbs and lines fall on roadways, transportation routes can be adversely affected and buildings, automobiles can be damaged. Heavy snow loads can cause roof collapse for residential, commercial, and industrial structures in cases of inadequate design and/or maintenance. Severe winter storms can also cause extensive coastal flooding, coastal erosion, and wave damage. If significant snowfall amounts melt quickly, inland flooding can occur as bankfull conditions are exceeded or in areas of poor roadway drainage.

The severity of the effects of winter storms and ice storms increases as the amount and rate of precipitation increase. In addition, storms with a low forward velocity are in an area for a longer duration and become more severe in their affects. Storms that are in full force during the morning or evening rush hours tend to have their affects magnified because more people are out on the roadways and directly exposed. Storms that arrive at high tide can also have exacerbated affects in coastal areas.

The magnitude of a severe winter storm or ice storm can be qualified into five main categories by event type, as shown below:

- Heavy Snowstorm: Accumulations of four inches or more of snow in a six-hour period, or six inches or more of snow in a twelve-hour period.
- Sleet Storm: Significant accumulations of solid pellets which form from the freezing of raindrops or partially melted snowflakes causing slippery surfaces posing hazards to pedestrians and motorists.
- Ice Storm: Significant accumulations of rain or drizzle freezing on objects (tress, power lines, roadways, etc.) as it strikes them, causing slippery surfaces and damage from the sheer weight of ice accumulation.
- Blizzard: Wind velocity of 35 miles per hour or more, temperatures below freezing, considerable blowing snow with visibility frequently below one-quarter mile prevailing over an extended period of time.
- Severe Blizzard: Wind velocity of 45 miles per hour, temperatures of 10 degrees Fahrenheit or lower, a high density of blowing snow with visibility frequently measured in feet prevailing over an extended period of time.

Previous Occurrences – Winter Storms / Ice Storms

In Ulster County, severe winter snow and ice storms are normal and expected.

A review of the New York State Hazard Mitigation Plan in conjunction with data from NOAA and FEMA shows that Ulster County has been specifically included in one snow-related declared disaster in the last 30 years (DR-1083, 1/12/1996) and two snow-related emergency declarations (EM-3173, 12/26/2002, and EM-3184, 3/27/2003).

In addition to this information, a review of the NOAA National Climatic Data Centerôs database yielded more than 1,000 significant snow and ice events reported in the State of New York between 1996 and 2007. Of these, 77 are reported as having affected Ulster County. These events are reported as being responsible for property damage totaling more than $16,900,000, although this includes damage reported in counties besides Ulster County that were affected by the same events. More recent winter storm events have been observed but not yet added to the NCDC database: for example, local sources have reported that a winter storm affecting the Town of Lloyd occurred on March 5, 2008, causing damage to structures, blocked roads, and downed power lines.

Event descriptions given by the NCDC for most of the 77 events recorded in the County are generic, but are summarized in Table 3a.12,

Probability of Occurrence – Winter Storms / Ice Storms

This plan indicates the probability of future occurrences in terms of frequency based on historical events. Using the historical data presented above, and the generic descriptions of the events recorded in Ulster County by the NCDC, Table 3a.12 summarizes the occurrence of winter storm events and their annual occurrence. , Ulster County and its participating jurisdictions have experienced 77 winter storms / ice storms between 1996 and 2007, ï an average of 7 events per year.

Table 3a.12
Occurrence of Winter Storms/Ice Storms, Ulster County (1996 – 2007)
(Source: NOAA's NCDC Storm Events Database)

Type	Total Number of Events	Average Annual Number of Events
Winter Storm	42	3.8
Heavy Snow	22	2.0
Snow/Freezing Rain	7	0.6
Freezing Rain	4	0.4
Blizzard	1	0.1
Ice Storm	1	0.1
Total	77	3.8

Winter storm events will remain a very frequent occurrence in Ulster County, and the probability of future occurrences in the County is certain, but the impacts of snow and ice storms are more likely to be major disruptions to transportation, commerce and electrical power as well as significant overtime work for government employees, rather than large scale property damages and/or threats to human life and safety.

Dam Failure

Description – Dam Failure

Dam failure is the breakdown, collapse or other failure of a dam structure characterized by the uncontrolled release of impounded water that results in downstream flooding. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and severe property damage if development exists downstream. There are varying degrees of failure, and an unexpected or unplanned dam breach is considered one type of failure. A breach is an opening through a dam which drains the water impounded behind it. A controlled breach is a planned, constructed opening and not considered a dam failure event, while an uncontrolled breach is the unintentional discharge from the impounded water body and considered a failure.

Dam failure can result from natural events, human-induced events or a combination of the two. Natural occurrences that may cause dam failure include hurricanes, floods, earthquakes and landslides; human-induced actions may include the deterioration of the foundation or the materials used in dam construction. In recent years, dams have also received considerably more attention in the emergency management community as potential targets for terrorist acts.

Dam failure presents a significant potential for disaster, in that significant loss of life and property would be expected in addition to the possible loss of power and water resources. The most common cause of dam failure is prolonged rainfall that produces flooding. Failures due to other natural events such as hurricanes, earthquakes or landslides are significant because there is generally little or no advance warning. The best way to mitigate dam failure is through the proper construction, inspection, maintenance and operation of dams, as well as maintaining and updating Emergency Action Plans for use in the event of a dam failure.

Federal guidelines for dam Safety issued by FEMA classify dams into three categories of Low, Significant, and High hazard potential, based on the probable loss of human life and the impacts on economic, environmental, and lifeline interests that would result from failure or misoperation of the dam. These categories are not intended to imply any judgment regarding the structural condition of the dam or the probability of failure.

> *Low Hazard Potential*: Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the ownerôs property.
>
> *Significant Hazard Potential:* Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.
>
> *High Hazard Potential*: Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

Ulster County Dams

The National Inventory of Dams (NID) maintained by the U.S. Army Corps of Engineers (USACE) records 53 dams in Ulster County, of which nine are classified as High Hazard Potential, 26 are classified as Significant Hazard Potential, and the remainder Low Hazard Potential. The location of all 53 dams recorded in the USACE NID is presented in Figure 3a.5, and more detailed information for the 35 dams classified as having High and Significant Hazard Potential are presented in Table 3a.13. The database of the National Performance of Dams Program (NPDP), based at Stanford University, lists two additional dams in Ulster County, however, one is classified as Low Hazard Potential, and the other is unclassified. The New York State Department of Environmental Conservation also lists a number of small, low hazard dams in addition to those listed by USACE and the NPDP.

Table 3a.13
High/Significant Potential Hazard Dams, Ulster County
(Source: USACE NID)

Dam Name	Municipality	River/Stream	Owner	Storage (Acre-Feet)	Hazard Potential
Alder Lake Dam	Hardenburgh	Alder Creek	NYS DEC	480	S
Ashokan Dam	Olive	Esopus Creek	City of New York DEP Corona	512,500	H
Beecher Lake Dam	Hardenburgh	Beecher Brook	Zen Studies Society, Inc.	190	S
Binnewater Reservoir Dam & Dike	Ulster	Tr-Esopus	City of Kingston	50	S
Binnewater Road Dam	Rosendale	Tr-Rondout	Imar Records Center, Inc.	8	S
Bridgeview Plaza Dam	New Paltz Town	None	Bridgeview Builders of Highland, Inc.	75	S
Camino Lake Dam	New Paltz Town	Tr-Wallkill	James E Rappa	22	S
Cape Pond Dam	Wawarsing	Beer Kill	Cape Pond, Inc.	3,605	S
Cooper Lake Dam & West Dike	Woodstock	Saw Kill	City of Kingston	3,683	H
Covino Pond Dam	Shawangunk	Tomy Kill	A Covino	37	S
Day Pond Dam	Shandaken	Panther K	Rick Day	2	S
Diamond Mills Paper Company Dam	Saugerties	Esopus Creek	Saugerties Dam Property, Inc.	830	H
Forest Lake Dam	Hardenburgh	Tr-Beaver	Dungkar Gompa Society, Inc.	250	S
Highland Lower Reservoir Dam	New Paltz Town	Tr-Hudson	Town of Lloyd Highland Water District	27	S
Highland Water District Reservoir Dam & Dike	New Paltz Town	Tr-Hudson	Town of Lloyd Highland Water District	92	S
Honk Falls Dam	Wawarsing	Rondout Creek	Recycled Paper Corporation	1,504	H
Kingston Reservoir #2 Dam	Woodstock	Saw Kill	City of Kingston	125	H
Lake Maratanza Dam	Ellenville Village	Tr-Verkee	Village of Ellenville	323	S
Lyon Lodge Dam	Wawarsing	Lyon Creek	Litis Investment Corporation	224	S
Marlborough Water District Reservoir Dam & Dike	Marlborough	Tr-Hudson	Marlborough Water District	53	S
Merriman Dam	Wawarsing	Rondout	City of New York DEP Corona	202,800	H

Table 3a.13
High/Significant Potential Hazard Dams, Ulster County
(Source: USACE NID)

Dam Name	Municipality	River/Stream	Owner	Storage (Acre-Feet)	Hazard Potential
Mountain Reservoir Dam	Rosendale	Tr-Rondout	Town of Rosendale	11	S
Muddy Brook Pond Dam	Shandaken	Muddy Brook	Camp Woodland, Inc.	3	S
New Paltz Lower Reservoir Dam	New Paltz Town	Tr-Kleine	Village of New Paltz	2	S
New Paltz Middle Reservoir Dam	New Paltz Town	Tr-Kleine	Village of New Paltz	2	S
New Paltz Reservoir Dam	New Paltz Town	Tr-Kleine	Village of New Paltz	3	S
New Paltz Upper Reservoir Dam	New Paltz Town	Tr-Kleine	Village of New Paltz	8	S
Pecks Dam	Gardiner	Tr-Mara K	Gorden Peck	96	S
Pine Hill Lake Dam	Shandaken	Birch Creek	NYS DEC	116	H
Pinebush Lake Dam	Shawangunk	Tomy Kill	Pine Bush Lake Estate	38	S
Sturgeon Pool Dam	Esopus	Wallkill	CH Energy Group	10,894	H
Tillson Lake Dam	Gardiner	Palmaghat	U & U Realty, Inc.	394	H
Vincent Dunn Pond Dam	Rochester	Tr-Rondout	Vincent Dunn	15	S
Vrasidas Dam	Rochester	Mombaccus	Matthew Vrasidas	4	S
Winnisook Lake Dam	Shandaken	Esopus Creek	Winnisook, Inc.	135	S

TR- : Tributary of

Of the nine ñhigh hazardò dams in Ulster County, there are three that have been classified by USGS as ñmajorò dams and represent the most significant hazard risk based on the potential consequences of a dam failure. According to USGS, major dams are described as 50 feet or more in height, or with a normal storage capacity of 5,000 acre-feet or more, or with a maximum storage capacity of 25,000 acre-feet or more. In Ulster County, these include the Ashokan Reservoir Dam in Olive (water supply); the Rondout Reservoir Dam in Wawarsing (water supply); and the Sturgeon Pool Dam in Esopus (hydroelectric).

The most accurate method to estimate exposure to and potential losses from the dam failure hazard uses data produced through detailed dam failure inundation studies. These studies are often prepared by the owners of dam facilities as part of their own emergency action plans. Such plans have been previously completed for the three major high hazard dams in Ulster County mentioned above, and the corresponding inundation mapping is presented in Figures 3a.6 though 3a.8. These maps were developed by digitizing the inundation envelope resulting from dam failures under wet weather conditions from scanned hard copies of the original mapping, supplied by New York State Department of Environmental Conservation, who were unable to provide the original source GIS files. The areas shown as vulnerable to inundation in Figures 3a.6 through 3a.8 should be regarded as approximate indications of the possible consequences of events subject to a great deal of hydrologic uncertainty.

Figure 3a.5: Ulster County Dams

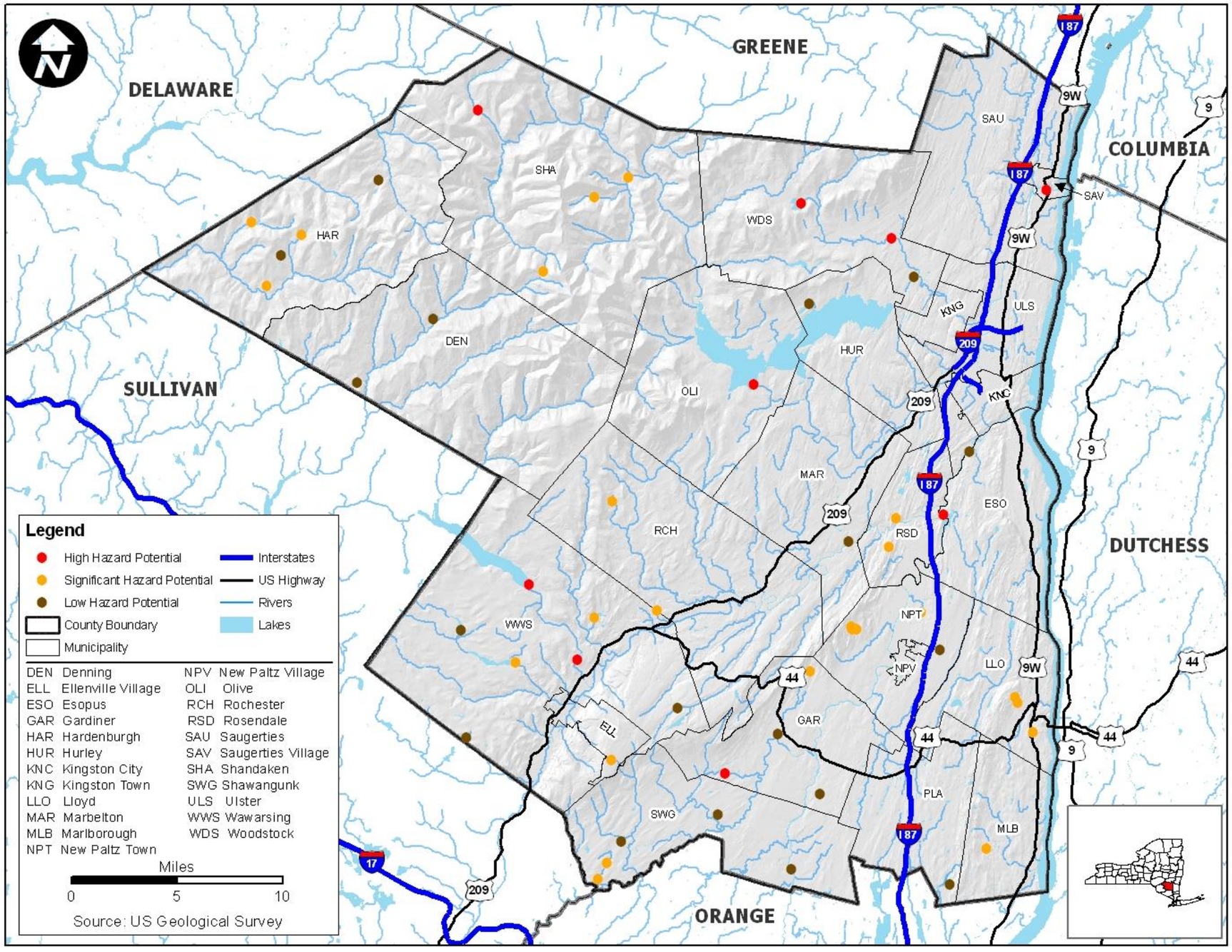


Figure 3a.6: Potential Area Affected by Failure of the Ashokan Reservoir Dam

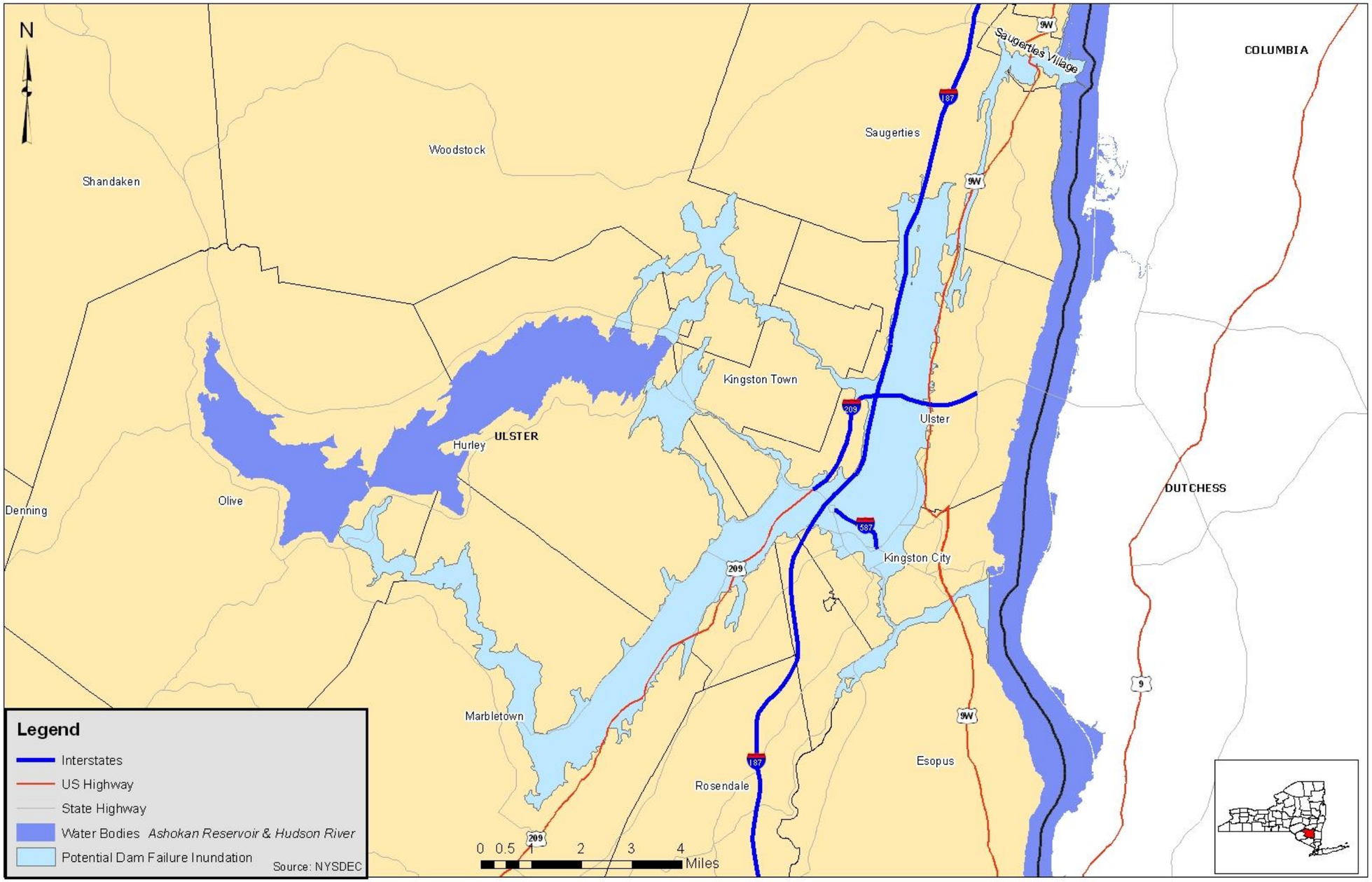


Figure 3a.7: Potential Area Affected by Failure of the Rondout Reservoir Dam

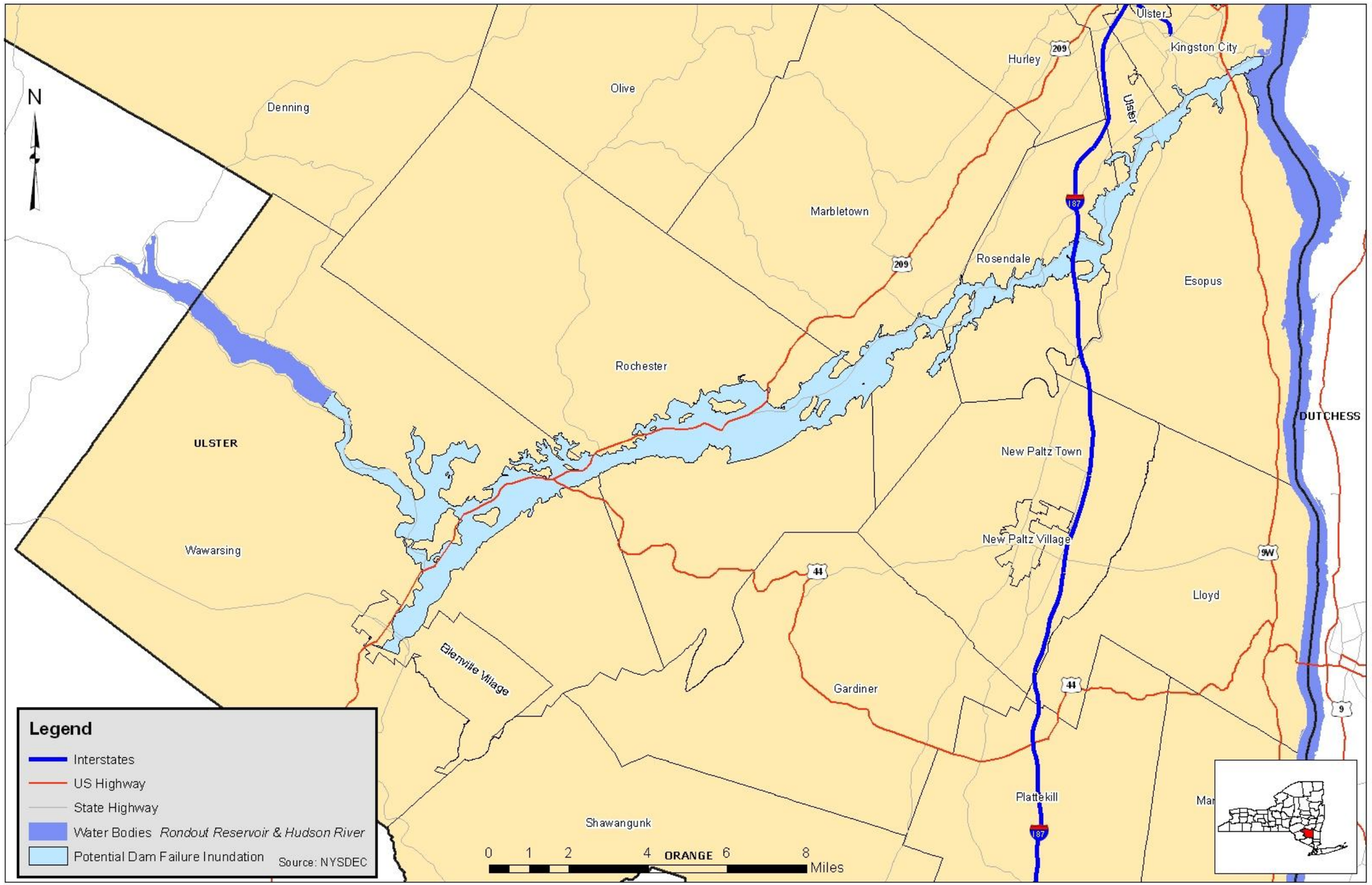
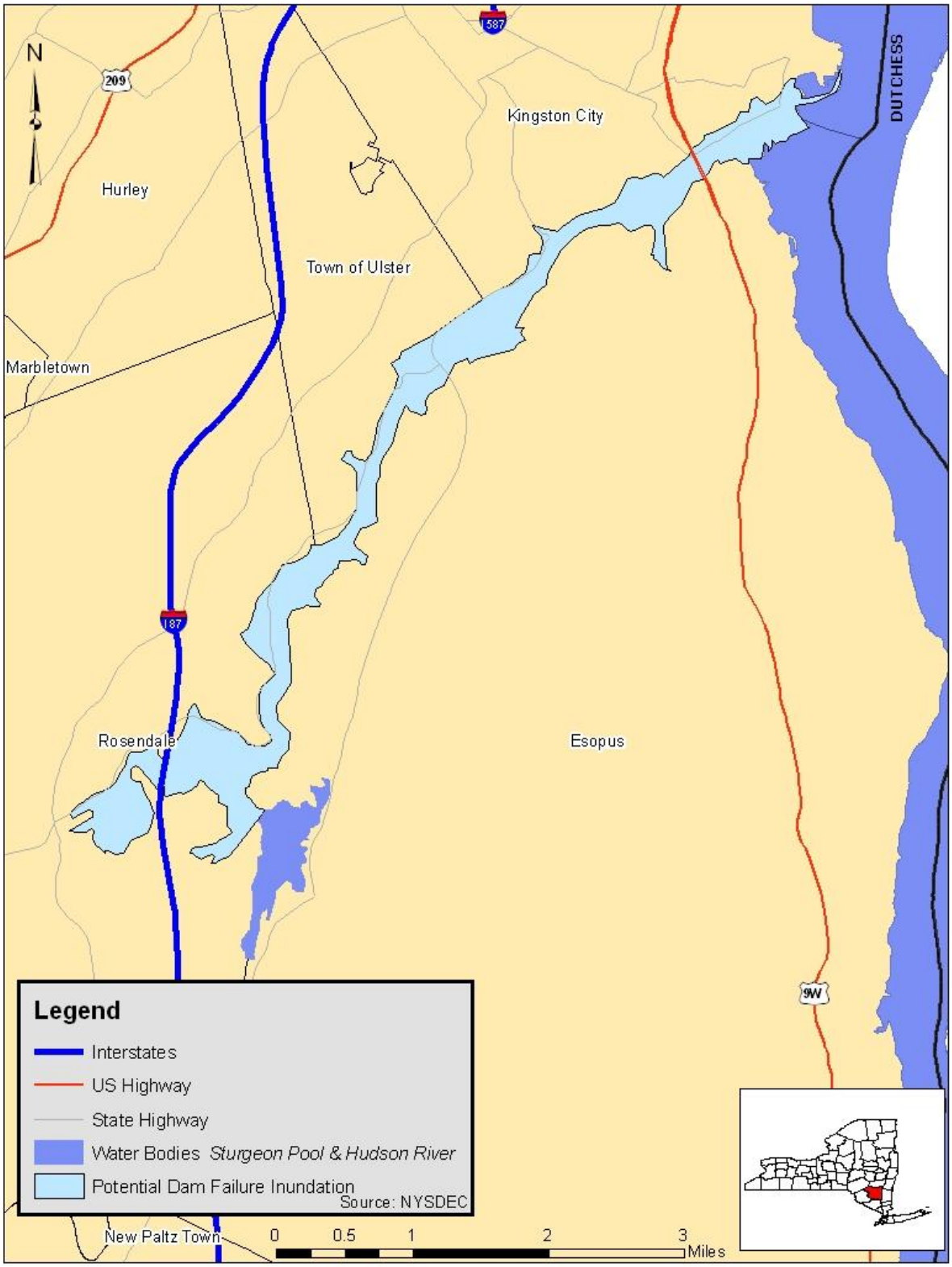


Figure 3a.8: Potential Area Affected by Failure of the Sturgeon Pool Dam



The potential exposure to damage or loss caused by failure of these three dams has been estimated using GIS to compute the value of improved property that is potentially affected by the dam failure inundation envelopes presented in Figures 3a.6 through 8. The potential exposures are presented by municipality in Table 3a.14. The proportion of structure values actually realized as damage following a dam failure will depend on the depth and velocity of the floodwaters, which in turn will depend on the hydrologic conditions leading up to the failure.

Table 3a.14
Estimated Potential Exposure of Improved Property to Dam Failure*

Ashokan Reservoir			
Municipality	**Exposed Improved Value**	**Total Municipal Improved Value**	**Exposed Value as % of Municipal Total**
Esopus	$9,075,666	$823,898,937	1%
Hurley	$88,714,554	$682,669,402	13%
Kingston (City)	$683,190,267	$1,922,939,212	36%
Kingston (Town)	$17,618,016	$57,541,463	31%
Marbletown	$50,141,875	$1,023,631,875	5%
Olive	$1,506,991	$719,961,895	0.2%
Saugerties (Town)	$27,825,641	$1,217,383,571	2%
Saugerties (Village)	$45,558,542	$275,716,843	17%
Ulster (Town)	$497,598,018	$1,189,900,886	42%
Woodstock	$55,234,884	$1,253,634,748	4%
Total	*$1,476,464,455*	*$9,167,278,832*	*16%*
Rondout Reservoir			
Municipality	**Exposed Improved Value**	**Total Municipal Improved Value**	**Exposed Value as % of Municipal Total**
Ellenville	$13,979,848	$47,291,413	30%
Esopus	$39,197,028	$823,898,937	5%
Kingston City	$90,978,885	$1,922,939,212	5%
Marbletown	$41,615,369	$1,023,631,875	4%
Rochester	$87,635,226	$564,685,441	16%
Rosendale	$97,006,175	$469,479,238	21%
Ulster (Town)	$7,170,716	$1,189,900,886	1%
Wawarsing	$92,723,100	$776,636,457	12%
Total	*$470,306,346*	*$6,818,463,459*	*7%*
Sturgeon Pool			
Municipality	**Exposed Improved Value**	**Total Municipal Improved Value**	**Exposed Value as % of Municipal Total**
Esopus	$16,421,040	$823,898,937	2%
Kingston (City)	$82,540,175	$1,922,939,212	4%
Rosendale	$13,852,702	$469,479,238	3%
Ulster (Town)	$5,469,549	$1,189,900,886	0.5%
Total	*$118,283,466*	*$4,406,218,273*	*3%*

*Exposure has been estimated only for the three major high hazard dams in Ulster County.

Table 3a.13 indicates that while there is comparatively little risk of economic damage from a failure of the Sturgeon Pool dam (only 3% of the improved value within the impacted municipalities would be affected), the risk of damage from failure of either the Ashokan or Rondout Reservoir dams is significant, with more than a third of all improved property in the Town of Ulster and the City of Kingston potentially affected by a failure of the Ashokan Reservoir dam. In terms of the percentage of values affected, the Village of Ellenville and the Town of Rosendale would be most affected by a failure of the Rondout Reservoir dam.

Historical Occurrences – Dam Failure

According to NPDP records, there have been 43 dam failures in New York State since 1868, of which only one occurred in Ulster County: The NPDP records indicate that The Diamond Mills Paper Company Dam in the Village of Saugerties experienced a failure in 1978. Although detailed information related to the consequences of the recorded failure was not readily available, the NPDP event report mentions deterioration of spillways, inoperable outlets, and a general lack of maintenance as contributory causes. Further research reveals that this dam is currently one of 16 in New York State deemed unsafe by the New York State Department of Environmental Conservation, and that the owner has failed to carry out maintenance or provide emergency action plans. Investigations by NYDEC and USACE, most recently in 2005, have raised concerns regarding the safety of the dam, which is classified as a High Hazard Potential dam.

Local sources also report that the Tillson Lake Dam in the Town of Gardiner suffered a failure in the 1930s, although there are no definitive records regarding subsequent injuries or loss of life. Despite reports that the dam was drained for repairs in the 1990s, the safety of this dam remains a concern to the local community.

Probability of Occurrence – Dam Failure

The probability of a dam failure occurrence in Ulster County is relatively low due to routine inspection, repair and maintenance programs carried out by the NYSDEC, which serves to ensure the safety and integrity of dams in New York and, thereby, protect people and property from the consequences of dam failures. However, the possibility of a future failure event is likely increasing due to aging dam structures that may be in need of repair or reconstruction, and occasional problems related to private dam ownersô degree of cooperation with State regulatory agencies.

Drought

Description – Drought

The general term ñdroughtò is defined by the US Geological Survey (USGS) as, ña prolonged period of less-than-normal precipitation such that the lack of water causes a serious hydrologic imbalance.ò As stated in FEMAôs, ñMulti-Hazard Identification and Risk Assessment ñ (1997), drought is the consequence of a natural reduction in the amount of precipitation expected over an extended period of time, usually a season or more in length.

According to the National Oceanic and Atmospheric Administrationôs (NOAAôs) Drought Information Center, there are four types of drought:

- Meteorological Drought ï A measure of precipitation departure from normal.
- Agricultural Drought ï When the amount of moisture in soil does not meet the needs of a particular crop.
- Hydrological Drought ï When both surface and subsurface water supplies are below normal.
- Socioeconomic Drought - When a water shortage begins to affect people.

Meteorological droughts are typically defined by the level of ñdrynessò when compared to an average, or normal amount of precipitation over a given period of time. Agricultural droughts relate common characteristics of drought to their specific agricultural-related impacts (when the amount of moisture in soil does not meet the needs of a particular crop). Hydrological drought is directly related to the effect of precipitation shortfalls on surface and groundwater supplies. Human factors, particularly changes in land use, can alter the hydrologic characteristics of a basin. Socio-economic drought is the result of water shortages that affect people and limit the ability to supply water-dependent products in the marketplace.

Drought conditions typically do not cause property damages or threaten lives, but rather drought effects are most directly felt by agricultural sectors. At times, drought may also cause community-wide impacts as a result of acute water shortages (regulatory use restrictions, drinking water supply and salt water intrusion). The magnitude of such impacts correlates directly with local groundwater supplies, reservoir storage and development densities. In general, impacts of drought can include significant adverse consequences to:

- Public water supplies for human consumption
- Rural water supplies for livestock consumption and agricultural operations
- Water quality
- Natural soil water or irrigation water for agriculture
- Water for forests and for fighting forest fires
- Water for navigation and recreation.

Another potential impact of local concern to some Ulster County municipalities is that some drought conditions cause salt water to migrate north up the Hudson River, impacting some local potable water sources, and requiring the issuing of notices alerting the public of the condition and of special measures to be followed.

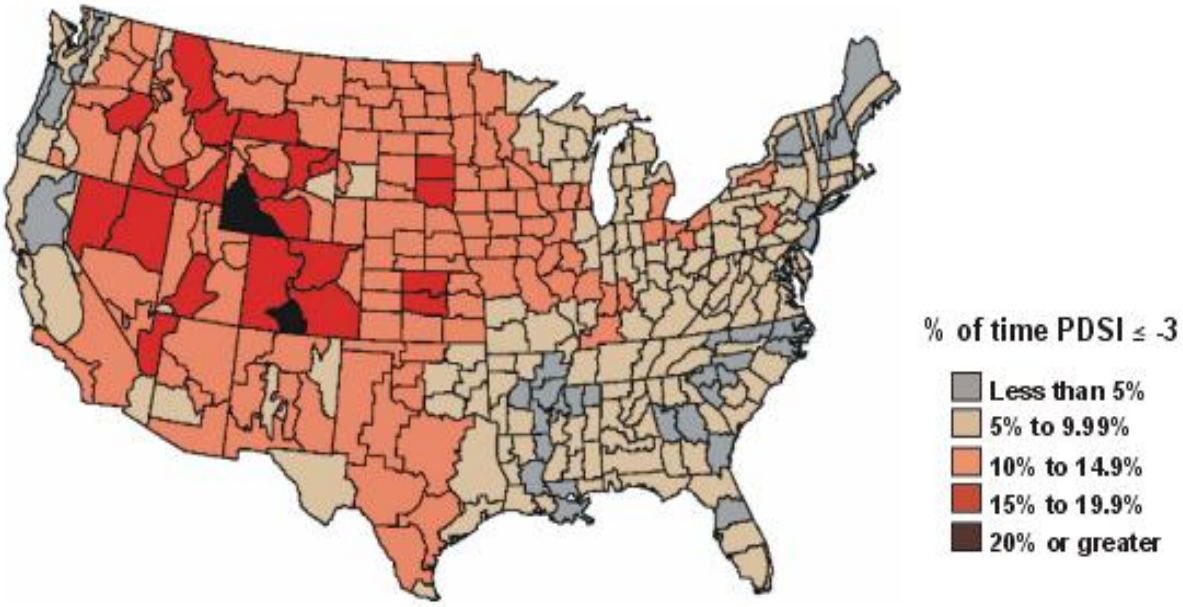
The severity of these impacts depends not only on the duration, intensity, and geographic extent of a specific drought event, but also on the demands made by human activities and vegetation on regional water supplies.

Location and Extent – Drought

Droughts occur in all parts of the country and at any time of year, depending on temperature and precipitation over time. Arid regions are more susceptible to long-term or extreme drought conditions, while other areas (including Ulster County) tend to be more susceptible to short-term, less severe droughts.

Figure 3a.9 shows the Palmer Drought Severity Index (PDSI) Summary Map for the United States from 1895 to 1995. PDSI drought classifications are based on observed drought conditions and will range from -0.5 (incipient dry spell) to -4.0 (extreme drought). According to the PDSI map, Ulster County is in a zone that experienced severe drought conditions between 5 and 10 percent of the 100-year period during 1895 to 1995, meaning that severe drought conditions are a relatively low risk for Ulster County. However, short term droughts of less severity are more common and may occur several times in a decade.

Figure 3a.9: Palmer Drought Severity Index Summary Map for the United States



While the extent of drought impacts for Ulster County may include all of the issues listed above, the most severe effects of drought in the County are likely to be experienced by farmers, who can suffer heavy financial losses due to crop damage or loss. Figure 3a.10 shows the extent, location and distribution of agricultural land across Ulster County, and Table 3a.15 presents a breakdown of agricultural land by municipality. It is evident from the figure and the table that municipalities in the south and central areas of the County are most at risk from agricultural losses due to drought, with the Town of Marlborough clearly the municipality most vulnerable to agricultural losses. Although at first glance the proportions of municipality areas devoted to agriculture may not appear to be significant, local sources regard agriculture as one of the most important sectors of the County economy.

Figure 3a.10: Ulster County Agricultural Land

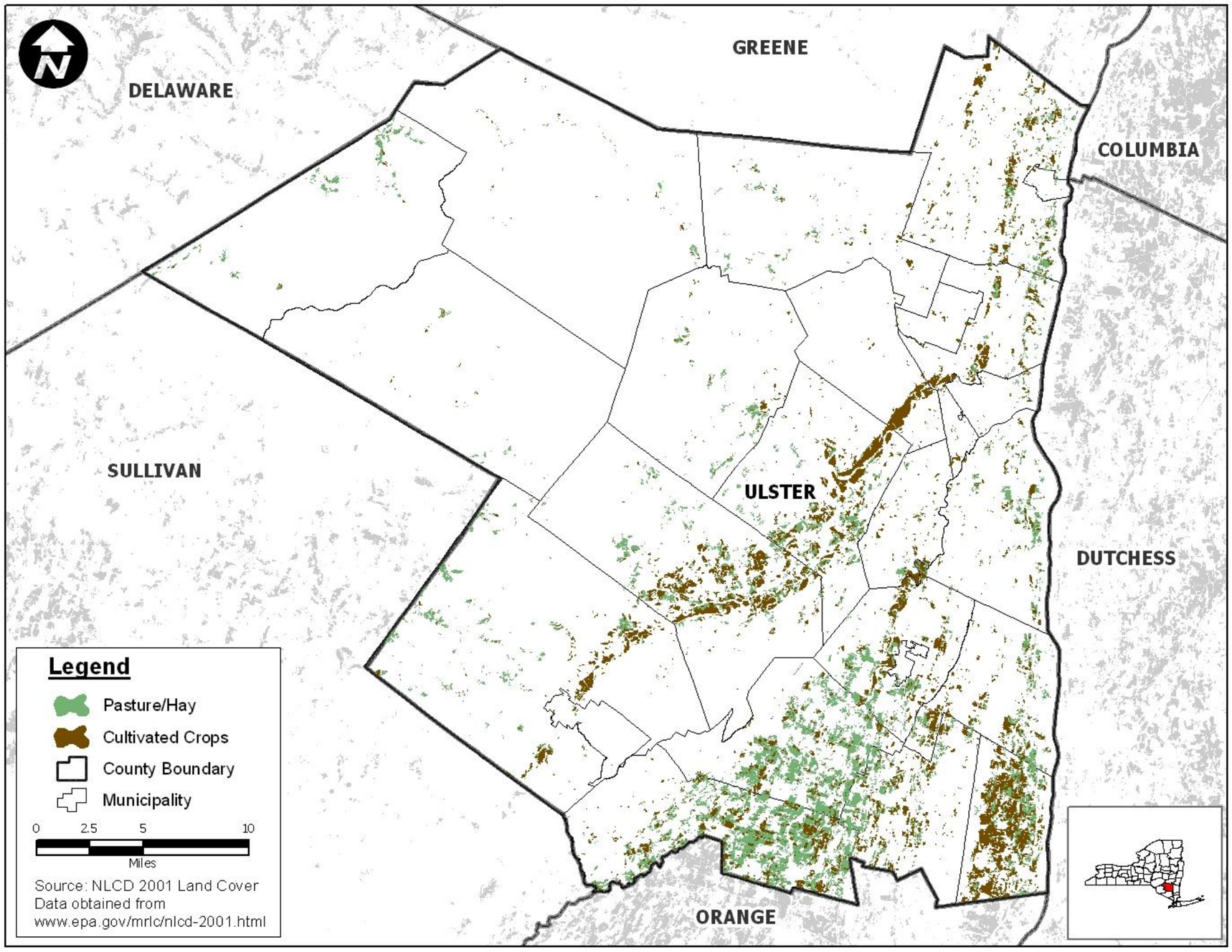


Table 3a.15
Distribution of Agricultural Land in Ulster County
(Source: Ulster County GIS)

Municipality	Total Area (Acres)	Cultivated Cropland (Acres)	Cultivated Cropland (%)	Pasture Land (Acres)	Pasture Land (%)
Denning	64,658	54	0.1%	149	0.2%
Ellenville	5,350	38	0.7%	0	0.0%
Esopus	23,524	823	3.5%	1,117	4.7%
Gardiner	27,495	1,430	5.2%	5,866	21.3%
Hardenburgh	51,004	83	0.2%	914	1.8%
Hurley	21,993	932	4.2%	33	0.1%
Kingston City	4,681	90	1.9%	2	0.0%
Kingston Town	4,285	129	3.0%	74	1.7%
Lloyd	19,694	1,429	7.3%	1,381	7.0%
Marbletown	34,814	3,123	9.0%	1,985	5.7%
Marlborough	15,472	5,032	32.5%	1,806	11.7%
New Paltz	19,741	1,751	8.9%	1,865	9.4%
New Paltz Village	1,002	52	5.2%	40	4.0%
Olive	41,492	263	0.6%	652	1.6%
Plattekill	22,039	1,807	8.2%	2,219	10.1%
Rochester	56,085	3,890	6.9%	2,254	4.0%
Rosendale	11,972	432	3.6%	231	1.9%
Saugerties	38,731	2,289	5.9%	1,351	3.5%
Saugerties Village	1,050	20	1.9%	30	2.8%
Shandaken	78,924	92	0.1%	232	0.3%
Shawangunk	35,306	3,153	8.9%	7,637	21.6%
Ulster	16,159	1,351	8.4%	522	3.2%
Wawarsing	79,654	1,619	2.0%	1,729	2.2%
Woodstock	42,809	271	0.6%	471	1.1%
Ulster County Total	*717,936*	*30,153*	*4.2%*	*32,558*	*4.5%*

Previous Occurrences – Drought

Historical occurrences of drought in Ulster County have been identified using the NOAA NCDC database, which records the following five significant drought events which specifically list Ulster County as an affected area since August 1993:

- *August 31, 1993:* A prolonged period of drought during the summer of 1993 decimated much of the agriculture in southeast New York. A drought alert advisory was issued on August 5, 1993 by the New York State Drought management Task Force for Delaware, Dutchess, Sullivan and Ulster Counties. Other counties hit hard by drought included Albany, Rensselaer, Columbia and Greene. Estimates of feed grain losses in these counties were well over 40 percent and in some cases nearly 100 percent. Especially hard hit were hay and corn crops as well as other fruits and vegetables. Some preliminary estimates of total crop damage were $8 million in Columbia County and $4 million in Greene County.

- *November 1, 1993*: The August 1993 drought alert advisory was upgraded to a drought warning by the New York State Drought Management Task Force for Delaware, Dutchess, Greene, Otsego, Schoharie, Sullivan, and Ulster Counties. Further, the Delaware River Basin Commission continued the drought warning for the basin which includes small sections of Broome, Chenango, Greene, Schoharie and Ulster Counties and much of Delaware and Sullivan Counties.

- *August 9, 1995:* the New York State Drought Task force declared a "Drought Watch" for the Catskills (Delaware, Greene, Otsego, Schoharie, Sullivan and Ulster counties), and the Hudson-Mohawk Region (Albany, Columbia, Dutchess, Fulton, Oneida, Herkimer, Montgomery, Rensselaer, Saratoga, Schenectady, and Washington Counties). The Hudson and Mohawk Valleys including the Catskills experienced extreme drought conditions while areas north of the Mohawk Valley and north of Saratoga County in the Hudson Valley saw severe drought conditions. At the end of August precipitation deficits of six to 12 inches were common in the extreme drought area. The drought produced a reduction in corn yield due to the shorter and slender ears. Hay yields were also down as many areas saw a very small second cutting or none at all. Wells ran dry in many communities and a Water Emergency was declared in Herkimer County and the Town of Deerfield in Oneida County.

- *April 1, 1999:* April 1999 was officially the second driest April on record in Albany and the driest of this century. Only 0.60 inches of rain fell at the Albany International Airport and only 0.56 inches at the N.W.S. office located on the University at Albany (SUNY) Campus. Rainfall amounts were a little bit higher to the south of Albany, but still fell well short of normal. The combination of low rainfall, along with frequent gusty winds, turned the underbrush into very dry tinder. This scenario led to numerous brush fires during the month across the Berkshires.

- *August 1, 1999:* August 1999 was the peak of the long term drought across Eastern New York that began in July of 98. The fourteen month stretch, ending in August, saw rainfall and melted snowfall throughout the region only tallying up to about 80 percent of normal. At the Albany International Airport 35.41 inches of water equivalent was recorded from July 98 through August 99, compared to the thirty year normal of 42.82 inches. The long term drought combined with the heat of the summer, resulted in a drought warning across much of the region as well as a declaration of agricultural disaster. The Mohawk Valley and Western Adirondacks were especially hard hit. The drought resulted in record low levels of the Mohawk River, numerous forest fires across the Adirondacks, and many wells going completely dry. Most communities implemented voluntary or mandatory water restrictions.

Probability of Occurrence – Drought

If the occurrences mentioned above are considered to be separate events, Ulster County has experienced five droughts during the 14 year period from 1993 through early 2007, as reported in the NOAA NCDC database, or an average of 0.36 drought events per year.

Past drought occurrences can be expected to be a sound indicator of the probability of future drought occurrences for Ulster County. Certain parts of the country are more susceptible to being impacted by a drought than others are. Arid parts of the country tend to be at greater risk of experiencing long-term droughts, while more humid parts of the country tend to be more susceptible to short-term droughts. According to the USGS Division of Water Resources, Ulster County and its jurisdictions fall within what is described as a ñhumid regionò and is more likely to experience a short-term drought.

Floods

Description – Floods

FEMAôs NFIP defines the general term ñfloodingò as ña general and temporary condition of partial or complete inundationé from overflow of inland or tidal waters, unusual and rapid accumulation or runoff of surface waters from any source, or a mudflow.ò According to FEMAôs *NFIP Floodplain Management Requirements: a Study Guide and Desk Reference for Local Officials* (FEMA-480), most floods fall into the following three categories:

- **Riverine Flooding – Flooding that occurs along a channel** (where a ñchannelò is defined as a feature on the ground that carries water through and out of a watershed, whether natural channels such as rivers and streams, or man-made channels such as drainage ditches).
    - Overbank flooding occurs along a channel as excess flows overflow channel banks. Overbank flooding occurs when downstream channels receive more rain or snowmelt from their watershed than normal, or a channel is blocked by an ice jam or debris.
    - Flash floods are a type of riverine flooding typically caused when a significant amount of rainfall occurs in a very short duration. Flash flooding is characterized by a rapid rise in water level and high velocity flows. Flash floods can also be caused by ice jams (ice jam flooding, which can be upstream of an intact jam or downstream of a jam that has broken downstream) or dam breaks.
- **Coastal Flooding – Flooding that occurs along the coasts of oceans, the Gulf of Mexico, and large lakes** (i.e., the Great Lakes). Hurricanes and severe storms cause most coastal flooding, including ñNorôeastersò which are severe storms that occur in the Atlantic basin that are extratropical in nature with winds out of the northeast.
    - Storm surge is one characteristic of coastal flooding caused as persistent high winds and changes in air pressure work to push water on shore, often on the order of several feet.
- **Shallow Flooding – Flooding that occurs in flat areas where a lack of channels means water cannot drain away easily.**
    - Sheet flow occurs when there are inadequate or no defined channels, and floodwaters spread out over a large area at a somewhat uniform depth. Sheet flow occurs after intense or prolonged rainfalls during which rain cannot soak into the ground.
    - Ponding occurs when runoff collects in a depression and cannot drain out. Ponding floodwaters do not move or flow away; they will remain until the water infiltrates into the soil, evaporates, or is pumped away.
    - Urban drainage flooding occurs when the capacity of an urban drainage system is exceeded. An urban drainage system comprises the ditches, storm sewers, retention ponds and other facilities constructed to store runoff or carry it to a receiving stream, lake or the ocean. Urban drainage flooding can also occur in areas protected by levees, as water collects on the protected side of the levee when pump capacities are exceeded during severe storms.

Floods are considered hazards when people and property are affected. Historically, development in floodplains was often a necessity, as water bodies provided a means of transportation, electricity, water supply, and often supported the livelihood of local residents (i.e., fishing, farming, etc.). Today, development in floodplains is more often spurred by the aesthetic and recreational value of the floodplain. Flooding is widely regarded as the most common major natural hazard in New York State.

The **National Flood Insurance Program (NFIP)** was established by Congress with the passage of the National Flood Insurance Reform Act of 1968. Through this program, Federally-backed flood insurance is made available to homeowners, renters, and businesses in a community if that community adopts and enforces a floodplain management ordinance to reduce future flood damages within its floodplains. This includes not only preventative measures for new development, but also corrective measures for existing development. FEMA also administers the Community Rating System (CRS), a program under which communities choosing to implement floodplain management actions that go beyond the minimum requirements of the NFIP become eligible for discounts on flood insurance premiums for properties within that community. At present, every individual municipality in Ulster County is an active member of the NFIP, although none have so far become eligible for the CRS.

In addition to providing flood insurance, the NFIP also studies and maps the nationôs floodplains, preparing its findings in Flood Insurance Rate Maps (FIRMs) and Flood Insurance Studies (FISs). FEMA also prepares digital Q3 Flood Data files, which contain digital flood hazard mapping. Using GIS, these digital maps can be overlaid upon a communityôs existing GIS base map. FEMA Q3 Flood Data and the Ulster County GIS formed the basis of this analysis of the flood hazard for Ulster County.

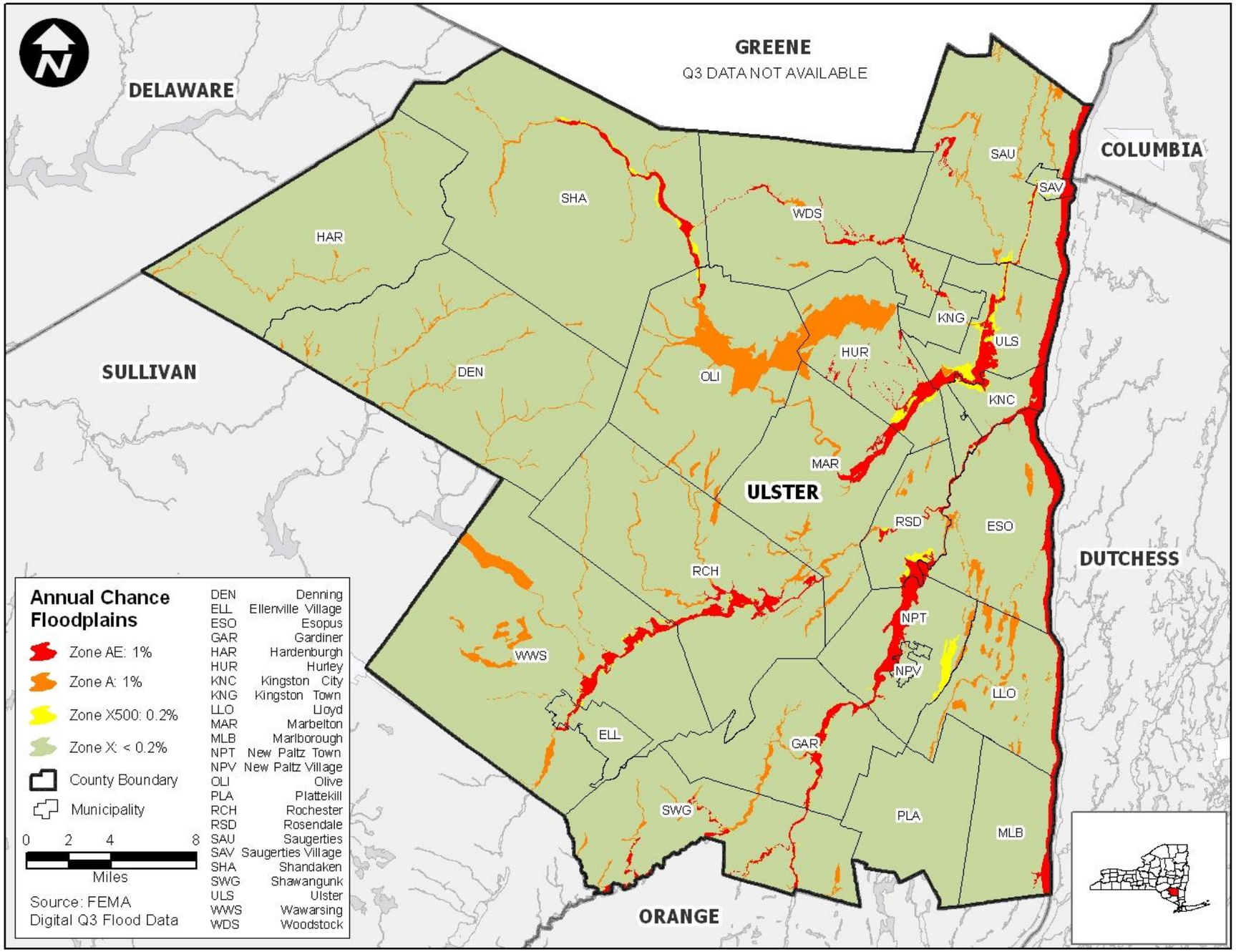
Location and Extent – Floods

Ulster County and its jurisdictions experience several types of flooding. While the Hudson River is tidally influenced, Ulster County is sufficiently far from the open ocean to be essentially unaffected by coastal flooding. Basically, flooding in Ulster County is caused by from riverine flooding, shallow flooding resulting from urban drainage issues, and ice jams. Flooding from ice jams is considered a separate hazard under this mitigation plan and is addressed in a separate plan section.

The extent of flooding associated with a 1 percent probability of occurrence ï the ñ100-year floodò or ñbase floodò ï is used as regulatory boundaries by a number of federal, state and local agencies. Also referred to as the ñspecial flood hazard areaò, this boundary is a convenient tool for assessing vulnerability and risk in flood prone. FEMAôs Q3 Flood Data was used to identify the location of flood hazard areas in Ulster County. According to the Q3 data, high/moderate flood risk zones exist in all Ulster County communities except for the Town of Plattekill, as shown in Figure 3a.11. This Figure illustrates the mapped flood risk using FEMA zone designations, which are explained in more detail below:

High Risk Areas	Zones A and AE: These are areas with a 1% chance of being flooded in any given year (the ñ100-yearò floodplain). AE zones are those areas where the Base Flood Elevation (BFE ï the ñ100-year flood) has been determined analytically. A Zones are areas where the base floodplain has been mapped by approximate methods and the BFE has not been determined.
Moderate Risk Areas	Zone X500: These are areas lying between the ñ100-yearò and ñ500-yearò (0.2% annual chance of flooding) floodplain limits. They also include areas of shallow flooding with average depths of less than one foot, or drainage areas less than one square mile.
Low Risk Areas	Zone X: These are areas outside of the 500-year floodplain, where the flood hazard is minimal. They may include areas of ponding or with local drainage problems not significant enough to warrant detailed study or designation as base floodplain.
Possible Risk Areas	Zone D: Areas where there are possible but undetermined flood hazards. There are no mapped D Zones in Ulster County.

Figure 3a.11: Ulster County Flood Hazard Areas



The mapped Q3 flood data is not exact, and in some cases flood hazard area boundaries may not match landform boundaries. While limitations in the data should be recognized, this represents best readily available GIS data at the time of the study and is generally deemed suitable for mitigation planning purposes. Preliminary Digital Flood Insurance Rate Maps (DFIRMS) were released in late 2007 for a subset of Ulster County municipalities. Since the new DFIRMS are preliminary, not county-wide, and are being appealed in some locations for which they were available, the decision was made to use the Q3 data for this initial version of the plan. Final DFIRMS are targeted for release in spring 2009, and the sections of the plan dealing with flooding should be revised accordingly during the first plan update.

FEMAôs Q3 flood mapping was overlaid upon the Ulster County GIS Base Map to summarize the Q3 flood mapping and flood risk areas for all municipalities in Ulster County, and the collated data is presented in Tables 3a.16 and 3a.17.

Table 3a.16
Summary of FEMA Q3 Flood Data by Municipality: Land in Hazard Areas

Municipality	Total Land Area (Acres)	High Flood Risk (Acres)	Moderate Flood Risk (Acres)	Low Flood Risk (Acres)	Land in High Flood Risk %	Land in Moderate Flood Risk %
Denning	64,652	1,502	0	63,151	2.3%	0.0%
Ellenville	5,351	112	26	5,214	2.1%	0.5%
Esopus	23,521	1,485	28	22,008	6.3%	0.1%
Gardiner	27,493	1,335	121	26,036	4.9%	0.4%
Hardenburgh	51,002	606	0	50,397	1.2%	0.0%
Hurley	21,985	5,071	382	16,532	23.1%	1.7%
Kingston City	4,284	491	196	3,596	11.5%	4.6%
Kingston Town	4,681	95	28	4,558	2.0%	0.6%
Lloyd	19,690	2,066	1	17,621	10.5%	0.0%
Marbletown	34,754	2,464	1	32,289	7.1%	0.0%
Marlborough	15,406	78	4	15,323	0.5%	0.0%
New Paltz Town	19,743	2,535	746	16,462	12.8%	3.8%
New Paltz Village	1,002	83	0	920	8.3%	0.0%
Olive	41,470	6,502	71	34,897	15.7%	0.2%
Plattekill	22,026	0	0	22,026	0.0%	0.0%
Rochester	56,085	3,355	85	52,644	6.0%	0.2%
Rosendale	11,972	1,169	380	10,422	9.8%	3.2%
Saugerties Town	38,716	1,924	193	36,589	5.0%	0.5%
Saugerties Village	1,040	209	34	796	20.1%	3.3%
Shandaken	78,947	1,756	485	76,705	2.2%	0.6%
Shawangunk	35,311	1,932	188	33,164	5.5%	0.5%
Ulster Town	16,165	1,955	682	13,526	12.1%	4.2%
Wawarsing	79,186	4,812	263	74,111	6.1%	0.3%
Woodstock	43,095	1,133	129	41,822	2.6%	0.3%
Ulster County Total	*717,577*	*42,672*	*4,042*	*670,810*	*6%*	*1%*

In total only 7% of the County area lies within high or moderate flood risk zones, according to current Q3 mapping data. The Town of Hurley has the highest proportion of its area within a high flood risk zone, of which a significant portion is accounted for by the Ashokan Reservoir. The Towns of New Paltz and Ulster and the Village of Saugerties have the highest proportions of land area within high flood risk zones (colored red and orange in Figure 3a.8).

Table 3a.17
Summary of FEMA Q3 Flood Data by Municipality: Improved Property Values in Hazard Areas

Municipality	Total Value	Value in High Flood Risk Area	Value in Moderate Flood Risk Area	Value in Low Flood Risk Area	Value in High Flood Risk Area %	Value in Moderate Flood Risk Area %
Denning	$51,126,978	$21,617,425	$0	$29,509,553	42.3%	0.0%
Ellenville	$47,291,413	$9,359,267	$61,729	$37,870,417	19.8%	0.1%
Esopus	$823,898,937	$159,394,633	$0	$664,504,303	19.3%	0.0%
Gardiner	$612,092,899	$73,924,289	$0	$538,168,609	12.1%	0.0%
Hardenburgh	$50,791,094	$18,811,933	$0	$31,979,161	37.0%	0.0%
Hurley	$639,336,069	$28,215,156	$1,851,007	$609,269,905	4.4%	0.3%
Kingston City	$1,922,939,212	$120,587,695	$23,790,321	$1,778,561,196	6.3%	1.2%
Kingston Town	$57,541,463	$13,158,951	$110,244	$44,272,268	22.9%	0.2%
Lloyd	$856,612,633	$126,783,351	$0	$729,829,282	14.8%	0.0%
Marbletown	$993,766,725	$284,190,349	$0	$709,576,376	28.6%	0.0%
Marlborough	$722,416,282	$9,309,836	$0	$713,106,447	1.3%	0.0%
New Paltz Town	$578,833,042	$45,648,801	$2,884,821	$530,299,421	7.9%	0.5%
New Paltz Village	$238,672,524	$25,644,975	$0	$213,027,549	10.7%	0.0%
Olive	$377,496,142	$46,524,745	$759,869	$330,211,527	12.3%	0.2%
Plattekill	$556,675,301	$0	$0	$556,675,301	0.0%	0.0%
Rochester	$564,685,441	$88,234,903	$207,779	$476,242,760	15.6%	0.0%
Rosendale	$469,479,238	$59,624,007	$4,081,968	$405,773,263	12.7%	0.9%
Saugerties Town	$1,217,383,571	$154,365,881	$1,854,880	$1,061,162,810	12.7%	0.2%
Saugerties Village	$275,716,843	$29,352,730	$1,345,693	$245,018,420	10.6%	0.5%
Shandaken	$402,760,909	$158,294,060	$10,585,951	$233,880,898	39.3%	2.6%
Shawangunk	$1,093,099,620	$304,030,659	$0	$789,068,961	27.8%	0.0%
Ulster Town	$1,189,900,886	$108,283,423	$32,342,013	$1,049,275,449	9.1%	2.7%
Wawarsing	*$391,482,171*	$80,835,965	$22,857	$310,623,349	20.6%	0.0%
Woodstock	*$1,250,466,647*	$167,520,588	$675,825	$1,082,270,233	13.4%	0.1%
Ulster County Total	*$15,384,466,039*	*$2,133,713,622*	*$80,574,959*	*$13,170,177,459*	*13.9%*	*0.5%*

The GIS analysis indicates that the towns of Denning, Hardenburgh, and Shandaken have the greatest proportions of improvement property values in high flood risk zones, with significantly more than a third of all the total improved property value affected in each case. However, the towns of Shawangunk and Marbletown have the highest total dollar values of improved property within the high flood risk zone.

Previous Occurrences – Floods

Floods have occurred in Ulster Countyôs communities in the past, and will continue to do so in the future. Ulster County and its component municipalities have generally been impacted by riverine flooding and shallow flooding. A picture of the flooding history of Ulster County in terms of damage to private property over the last three decades or so can be derived from the recorded flood losses and payments data from the NFIP. This data is presented in Table 3a.18, along with the total number of current policies, the total coverage values, and key dates associated with the municipalitiesô participation in the NFIP. At the time of writing, none of the municipalities in Ulster County were eligible for participation in FEMAôs Community Rating System (CRS), under which municipalities implementing and enforcing floodplain management measures above beyond the NFIP minimum requirements are rewarded with discounted flood insurance premiums. All data in Table 3a.18 is current as of June 30, 2008.

The table shows that Ulster County NFIP insured flood losses have totaled more than $9 million since 1978, or more than $300,000 per year. Actual flood losses community-wide are likely to be higher, since this value only includes NFIP payouts and does not include losses incurred by non-policy holders, losses for which a claim was not submitted, or losses for which payment on a claim was denied.

Table 3a.18
FEMA NFIP Policy and Claim Information for Ulster County Jurisdictions
Source: www.fema.gov / www.bsa.nfipstat.com

NFIP Participating Communities in Ulster County, NY	Community Number	Date Entered NFIP	Current Effective FIRM Date	NFIP Policies In Force	Insurance in Force ($)	Total Number of Losses	Total Payments ($)
Denning	361439	5/25/1984	5/25/1984	13	$2,241,300	4	$83,782
Ellenville	360975	7/5/1983	7/5/1983	22	$4,566,600	21	$300,246
Esopus	360855	7/5/1984	7/5/1984	18	$5,360,100	8	$54,166
Gardiner	360856	9/30/1982	7/16/1997	26	$7,027,000	7	$54,142
Hardenburgh	361578	7/20/1984	3/16/1989	1	$350,000	0	$0
Hurley	360857	7/3/1985	8/18/1992	35	$6,442,000	24	$637,051
Kingston City	360858	5/1/1985	5/1/1985	90	$9,189,300	57	$658,311
Kingston Town	361218	8/27/1982	4/5/1988	40	$4,959,600	11	$35,387
Lloyd	361012	9/17/1982	7/5/2000	25	$5,320,000	19	$438,226
Marbletown	361219	10/22/1982	8/5/1991	20	$4,954,700	8	$144,546
Marlborough	361220	12/5/1984	12/5/1984	8	$1,639,300	5	$89,047
New Paltz Town	360859	9/30/1982	11/1/1985	46	$10,380,900	23	$263,428
New Paltz Village	361544	4/15/1982	10/15/1985	42	$5,605,000	8	$352,096
Olive	360860	11/1/1984	11/1/1984	47	$11,203,500	15	$63,791
Plattekill	361221	9/29/1978	NSFHA*	5	$3,912,500	3	$55,593
Rochester	360861	3/16/1983	2/6/1991	33	$7,787,400	29	$82,653
Rosendale	360862	11/1/1985	11/1/1985	47	$9,451,300	10	$169,411
Saugerties Town	360863	8/19/1985	9/30/1992	73	$14,536,300	19	$231,843
Saugerties Village	361504	9/10/1982	8/5/1985	29	$5,988,400	12	$59,621
Shandaken	360864	1/17/1985	2/17/1989	176	$30,533,700	142	$978,802
Shawangunk	360865	9/30/1982	9/30/1982	29	$6,134,100	4	$34,204
Ulster Town	360866	5/1/1985	5/1/1985	125	$20,025,700	154	$3,402,723
Wawarsing	360867	9/15/1983	9/15/1983	61	$11,779,900	50	$903,155
Woodstock	360868	9/27/1991	9/27/1991	112	$24,415,300	37	$100,743
Ulster County Totals				*1,123*	*$213,803,900*	*670*	*$9,192,967*

*NSFHA: No Special Flood Hazard Area ï all Zone C (determined to be outside the 500-year floodplain)

The average NFIP payment for the County overall was approximately $13,700 per individual loss. Almost 50% of all NFIP losses in Ulster County (in terms both of actual losses and dollar loss amounts) have occurred in just two municipalities ï the Towns of Shandaken and Ulster. In the Town of Ulster, NFIP payments have averaged more than $22,000 per loss, while average payments in Shandaken have been approximately $6,900 per loss. The highest average is in the Village of New Paltz, where payments have been more than $39,000 per loss. Only the Town of Hardenburgh has not experienced any flood damage resulting in NFIP payments. According to the current flood mapping, no areas within the town of Plattekill are identified as lying within any identified floodplain. However, there is at least one NFIP-

insured property within the Town which has suffered flood losses and which has received NFIP payments as a result. This property may lie within an area that experiences shallow flooding or local drainage problems that have yet to warrant detailed studies or designation as part of the base floodplain.

Repetitive Losses

FEMA defines a repetitive loss property as any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling 10-year period, since 1978. A repetitive loss property may or may not be currently insured by the NFIP. Currently there are over 122,000 repetitive loss properties nationwide, and approximately 7,000 in New York State.

According to FEMA repetitive loss property records, there are currently 71 ñnon-mitigatedò repetitive loss properties located in Ulster County as of August 27, 2008. These properties are associated with a total of 183 individual losses and more than $4.5 million in claims payments under the NFIP since March 1980 (the earliest recorded date of loss), as shown in Table 3a.19, while Table 3a.20 identifies the number and type of repetitive loss properties that are located in each identified flood hazard zone for each municipality.. The approximate areas where RL properties are clustered are plotted in Figures 3a.12 and 3a.13 in comparison with the extent of the mapped A/AE Zones (the Base/100-year floodplain). These figures do not show areas of the County where occasional RL properties are located in isolation or widely spaced and they show only the approximate areas covering clusters of RL properties, since the component data is subject to the 1974 Privacy Act. This legislation prohibits the public release of any information regarding individual NFIP claims or information which may lead to the identification of associated individual addresses and property owners. However, while this information is not available to the general public, the County may subsequently obtain comprehensive RL property data from FEMA for the purposes of targeted mitigation of RL areas or individual RL structures.

Two thirds (16 out of 24) of the municipalities in Ulster County are identified as having at least one Repetitive Loss (RL) property, with 28 (almost 40%) of these properties located in just one municipality, the Town of Ulster. The two municipalities with the next highest number of RL properties are the City of Kingston and the Town of Shandaken, with 12 each. Slightly more than three quarters of all RL properties are single-family residential buildings, while only 8% are non-residential. Data to permit a further breakdown of the non-residential structures into commercial, institutional, and so on was not readily available at the time of writing.

The average repetitive loss property in Ulster County has experienced 2.6 loss events: 69% have experienced two losses, 20% have experienced three, and 11% have experienced more than three, including two properties in the City of Kingston and the Town of Lloyd that are recorded as having experienced 8 losses each.

Table 3a.20 and Figures 3a.12 and 3a.13 indicate that the majority of RL properties (62%) are located in the 100-year floodplain, and the remainder are approximately equally distributed across the 500-year floodplain and areas of minimal or no identified flood risk. Of the RL properties which are single family residential structures, 70% are located in the 100-year floodplain.

To summarize, almost one third of all NFIP payments in Ulster County may be attributable to just 6% of insured properties in the County (depending on how many of these properties remain insured by the NFIP).

Table 3a.19
NFIP Repetitive Loss Property Statistics (as of August 27, 2008)
(Source: FEMA Region 2)

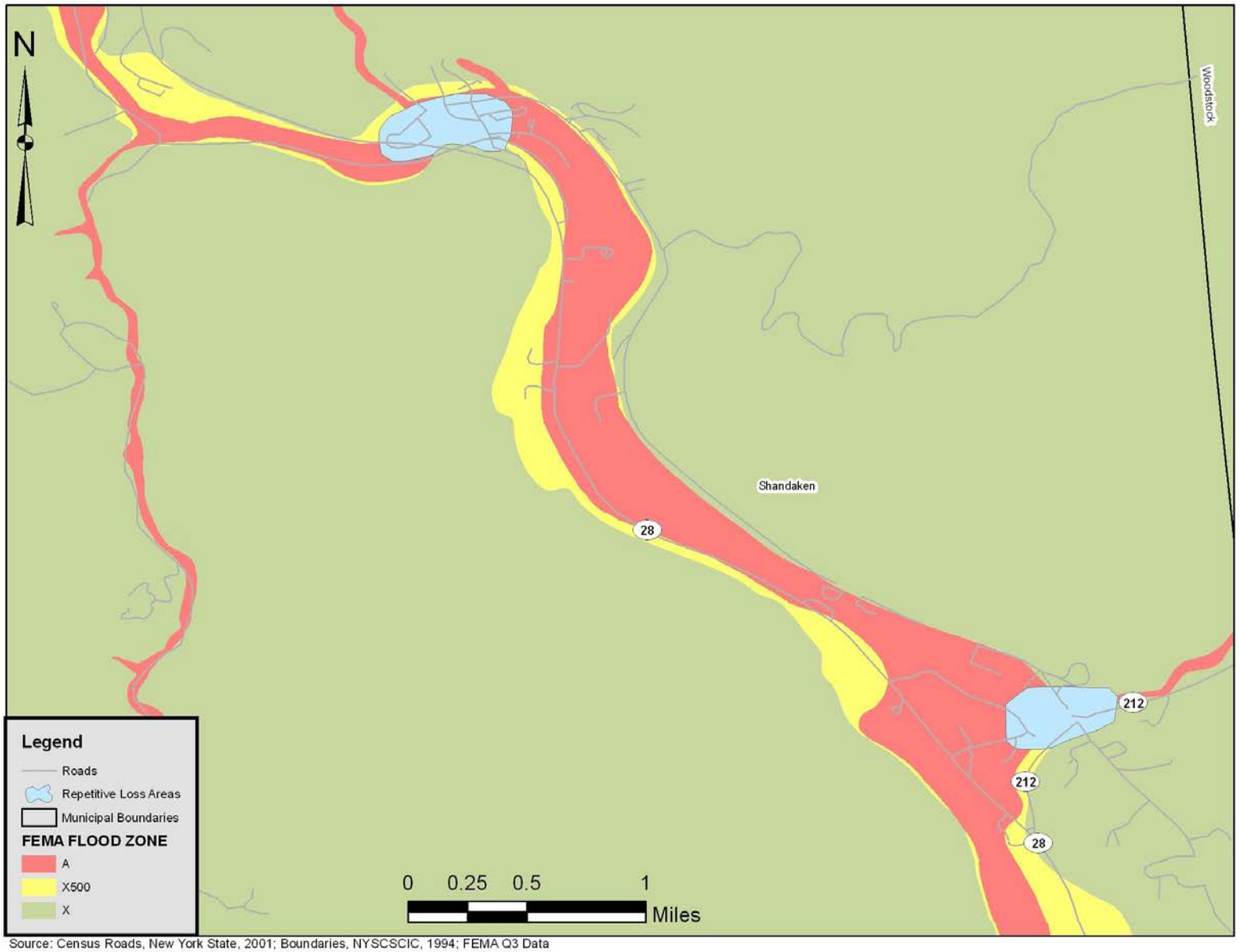
Jurisdiction	Single Family			Other Residential			Non-Residential			Total		
	Properties	Losses	Payments	Properties	Losses	Payments	Properties	Losses	Payments	Properties	Losses	Payments
Denning, Town of										0	0	$0
Ellenville, Town of	1	2	$40,864							1	2	$40,864
Esopus, Town of										0	0	$0
Gardiner, Town of				1	2	$14,444				1	2	$14,444
Hardenburgh, Town of										0	0	$0
Hurley, Town of	1	2	26,289.48							1	2	$26,289
Kingston, City of	10	27	$380,666	1	2	$55,584	1	2	$39,950	12	31	$476,199
Kingston, Town of										0	0	$0
Lloyd, Town of				1	2	$13,357	1	8	$421,966	2	10	$435,322
Marbletown, Town of										0	0	$0
Marlborough, Town of										0	0	$0
New Paltz, Town of	1	2	$31,034							1	2	$31,034
New Paltz, Village of				1	3	$329,603				1	3	$329,603
Olive, Town of										0	0	$0
Plattekill, Town of	1	3	$55,594							1	3	$55,594
Rochester, Town of	1	2	$2,211							1	2	$2,211
Rosendale, Town of	1	2	$62,281							1	2	$62,281
Saugerties, Town of	2	4	$127,490							2	4	$127,490
Saugerties, Village of	1	2	$3,968							1	2	$3,968
Shandaken, Town of	10	24	$480,591	1	2	$7,369	1	2	$5,135	12	28	$493,095
Shawangunk, Town of										0	0	$0
Ulster, Town of	22	65	$1,961,274	3	7	$193,150	3	6	$127,779	28	78	$2,282,204
Wawarsing, Town of	4	8	$127,746				1	2	$7,936	5	10	$135,682
Woodstock, Town of							1	2	$6,110	1	2	$6,110
Totals	**55**	**143**	**$3,300,010**	**8**	**18**	**$613,506**	**8**	**22**	**$608,874**	**71**	**183**	**$4,522,390**

Table 3a.20
Repetitive Loss Properties by Municipality and Location in Mapped Flood Hazard Zones
(Source: FEMA Region 2)

Jurisdiction	A Zone (100-Year Floodplain)			X500 Zone (500-Year Floodplain)			Other Zone (>500-Year Floodplain)		
	Single-Family	Other Residential	Non-Residential	Single-Family	Other Residential	Non-Residential	Single-Family	Other Residential	Non-Residential
Denning, Town of							1		
Ellenville, Town of								1	
Esopus, Town of									
Gardiner, Town of									
Hardenburgh, Town of									
Hurley, Town of	1								
Kingston, City of	8	1	1				1		
Kingston, Town of				1					
Lloyd, Town of			1		1				
Marbletown, Town of									
Marlborough, Town of									
New Paltz, Town of	1								
New Paltz, Village of					1				
Olive, Town of									
Plattekill, Town of				1					
Rochester, Town of	1								
Rosendale, Town of				1					
Saugerties, Town of				2					
Saugerties, Village of	1								
Shandaken, Town of	5			4			1	1	1
Shawangunk, Town of									
Ulster, Town of	19	3	1				3		2
Wawarsing, Town of*	1			1		2	1		
Woodstock, Town of									
Totals	***37***	***4***	***3***	***10***	***2***	***2***	***7***	***2***	***3***

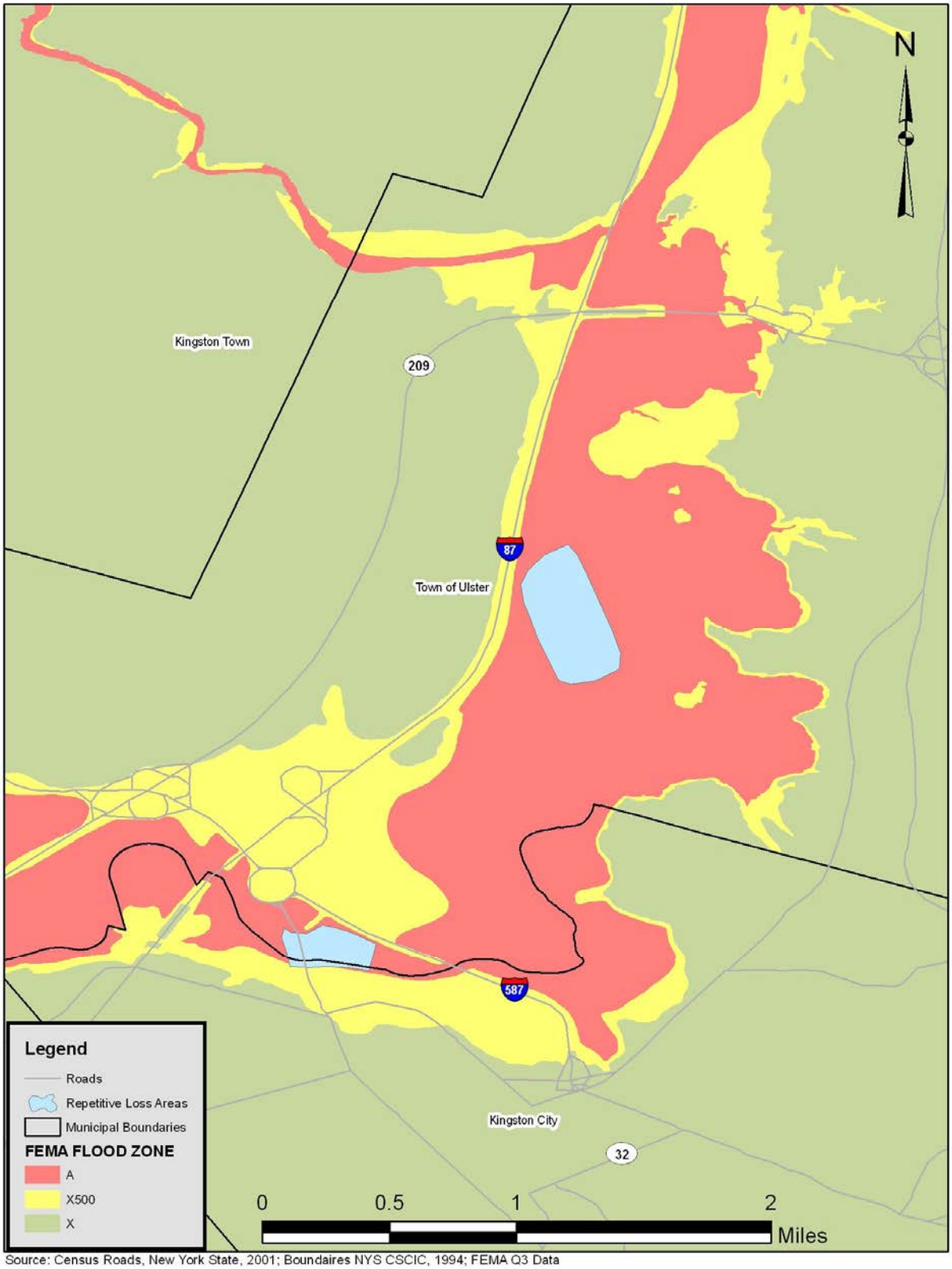
*Totals do not exactly match those in Table 3a.18 since address details were incomplete

Figure 3a.12: NFIP Repetitive Loss Property Clusters ï Town of Shandaken



Source: Census Roads, New York State, 2001; Boundaries, NYSCSCIC, 1994; FEMA Q3 Data

Figure 3a.13: NFIP Repetitive Loss Property Clusters ï Town of Ulster/City of Kingston



Source: Census Roads, New York State, 2001; Boundaires NYS CSCIC, 1994; FEMA Q3 Data

Flood Disaster Declarations

The New York State Hazard Mitigation Plan reports Ulster County as having been affected by 12 Presidential Disaster Declarations related to flooding from 1953 to August 2007. Only neighboring Delaware County has been subject to a greater number of disaster declarations in New York State. In recent years, Ulster County has been affected by six major flood disaster declarations, as summarized in Table 3a.21. The Table also indicates which form of post-disaster assistance the County became eligible for after the declaration.

Through the Public Assistance (PA) Program, FEMA provides supplemental Federal disaster grant assistance for debris removal, emergency protective measures, and the repair, replacement, or restoration of disaster-damaged, publicly owned facilities and the facilities of certain Private Non-Profit (PNP) organizations. The Individual Assistance Program (IA) provides money or direct assistance to individuals, families and businesses in an area whose property has been damaged or destroyed and whose losses are not covered by insurance. It is meant to assist with critical expenses that cannot be covered in other ways, rather than to restore damaged property to its condition before the disaster.

Table 3a.21
Major Flood Disaster Declarations Affecting Ulster County
(Source: NYSEMO)

Disaster #	Description	Declared Date and Incident Period	Damages*
DR-1534	Severe storms and flooding: Ulster County: PA only	8/03/2004 (5/13/04 ï 6/17/04)	$14m
DR-1564	Severe storms and flooding: Ulster County: PA & IA	10/01/2004 (8/29/04 ï 9/16/04)	$18.03m
DR-1564	Tropical Depression Ivan: Ulster County: PA & IA	10/01/2004 (9/16/04 ï 9/24/04)	$15.1m
DR-1589	Severe storms and flooding: Ulster County: PA & IA	4/9/2005 (4/2/05 ï 4/4/05)	$66.21m
DR-1650	Severe storms and flooding: Ulster County: PA & IA	7/1/2006 (6/26/06 ï 7/10/06)	$246.33m
DR-1710	Severe storms, inland and coastal and flooding: Ulster County: PA & IA	4/27/2007 (4/14/07 ï 4/18/07)	$12.76m

*Includes damages in areas outside Ulster County

According to data made available by the National Climatic Data Center (NCDC), there have been 100 recorded flood events affecting Ulster County between March 1993 and March 2008, causing reported damages totaling just under $25 million, including damages incurred outside Ulster County. Table 3a.22 presents significant flood events recorded for Ulster County in the NCDC database for which some detailed information was available.

In addition to information from NCDC and NYSEMO, local sources have provided some further information about the significant flooding experienced by the Town of Ulster in 2005, 2006, and 2007. These events damaged approximately 150 residential structures in the town, most of which were mobile homes in parks adjacent to Rondout and Esopus Creeks, and caused several significant sewer breaks. In total the town received more than $870,000 in Public Assistance funds from FEMA for these events. The areas in the Town of Ulster most affected by these events were in the vicinity of Orlando Street, Buckley Street, Sandy Road, Brabant Road, Creek Locks Road, Farm to Market Road, Parish Lane, and County Route 28. Local sources report that flooding along the Twaalfskill Creek near Highland in the Town of Lloyd in April 2007 and March 2008 caused serious damage to local roads, and estimate that flooding has caused nearly $2 million in damages in the last three years alone.

Examples of the conditions during these floods and the resulting damage are presented in Figures 3a.14 and 3a.15.

Figure 3a.14: Flood Damage in Boiceôs Mobile Home Park, Farm to Market Road, Town of Ulster, April 2005.

Figure 3a.15: Flooding in Orlando Street, Town of Ulster, April 2007.

Table 3a.22
Selected Recent Flood Events in Ulster County
(Source: NOAA NCDC)

Date	Affected Municipalities	Description	Reported Property Damage*
3/8/1995	New Paltz (Town), Rosendale	A combination of snowmelt and heavy rain resulted in flooding along the Rondout, Esopus and Wallkill Creeks in Ulster County. The Rondout Creek went half a foot over flood stage at Rosendale. Flooding along the Wallkill closed Springtown Rd. in New Paltz. Another creek caused flooding in the Town of Bloomington where Creek Locks Rd. was closed for a time.	$50,000
11/11/1995	Shandaken, Saugerties (Town), Woodstock	An intense low pressure system produced three to four inches of rain across this region which resulted in flooding. In Saxton, the Kaaterskill Creek overflowed its banks which resulted in the closing of route 32A and the evacuation of six to ten families. In Phoenicia the Esopus Creek flooded and a state of emergency was declared at 1145PM EST on Saturday 11/12/95 . Several families were evacuated in Woodland Valley. In Woodstock minor flooding occurred as the Saw Kill Creek reached flood stage.	$100,000
1/19/1996	Multiple	An intense area of low pressure which was located over the Mid-Atlantic region on Friday morning January 19th produced unseasonably warm temperatures, high dewpoints and strong winds. This resulted in rapid melting of one to three feet of snow. In addition to the rapid snowmelt one to three inches of rain fell as the system moved northeast along the coast. This resulted in widespread flooding across Ulster County. Federal Disaster Assistance was made available by presidential declaration. Small streams flooded across the entire county which resulted in many roads being washed out. Extensive flooding also occurred along the Hudson River and Esopus Creek. In the mountainous terrain of Ulster County road washouts were more numerous. In the Town of Shandaken five town roads were destroyed and several homes were damaged. In the Town of Hardenburgh three quarters of the roads were washed out. In New Paltz homes were flooded near the wetlands along route 299 due to the Wallkill Creek. Flooding also occurred in the Towns of Denning, Olive, Woodstock, Saugerties and Kingston. Evacuations occurred in the Phoenicia-Shandaken area and in the Town of Kingston.	$10,000,000
1/24/1996	Esopus, Kingston (Town)	A low pressure system which tracked across the northern Great Lakes on the 24th of January produced addition rain across the already ground soaked region. Additional runoff along with high tides along the Hudson River created flooding over two days along the Rondout Creek between Eddyville and the Hudson River and along the Hudson River in Kingston.	$60,000
1/27/96	Multiple	A low pressure system over the upper Great Lakes produced a general rainfall of one to two inches across eastern New York with up to three inches of rain across parts of the Catskills. This amount of rainfall on already saturated soil brought many small streams out of their banks across Ulster County. The Wallkill River, Rondout Creek and Esopus Creek also flooded in Ulster County. Evacuations occurred along the Esopus Creek and route 28 was closed between Phoenicia and Mount Tremper. Along the Rondout Creek at Eddyville flooding was widespread and severe. Numerous roads were washed out across the county and the Towns of Shandaken and Hardenburgh declared a local state of emergency.	$400,000
7/13/1996	Rochester	Not available	$70,000

Table 3a.22
Selected Recent Flood Events in Ulster County
(Source: NOAA NCDC)

Date	Affected Municipalities	Description	Reported Property Damage*
10/20/1996	Lloyd, Ellenville	Not available	$12,000
11/9/1996	Hardenburgh	From Friday morning November 8 to Saturday morning November 9, a slow moving low pressure system tracked from northern Pennsylvania to northern New York. This system dumped 2 to 4 inches of rain across much of the Catskills, which produced flooding in parts of Ulster County. A state of emergency was declared in the Town of Hardenburgh from early Saturday morning through early afternoon. Many roads were closed and washed out across the town as the Dry Brook flowed well out of its banks.	$40,000
2/12/1996	Countywide	Not available	$300,000
1/9/1998	New Paltz (Town), Esopus	On January 8 and 9, mild weather along with significant rain and snowmelt resulted in small stream flooding across Ulster County. Small streams flooded roadways throughout the county, with the most significant flooding occurring in the New Paltz and Eddyville area.	
5/10/1998	Kingston (Town), Saugerties (Town)	Low pressure off the Mid-Atlantic coast produced 3 to 7 inches of rain across the Catskill Mountains in Greene County. The rain fell on fairly wet ground and forced the Esopus Creek to spill out of its banks both above and below the Ashokan Reservoir. The creek flooded above the dam on May 10 and crested just over flood stage at Mount Tremper during the evening hours. Below the Ashokan Reservoir the creek flooded from the early morning hours of May 11 to the early afternoon hours of May 13. The creek crested approximately three feet over flood stage at Mount Marion. The flood waters caused problems mainly between Kingston and Saugerties. Flooding occurred in a trailer park in the Town of Saugerties. Several trailers were surrounded by water but no evacuations were necessary. Minor flooding also occurred in the Kingston Plaza area.	$10,000
6/14/1998	Shandaken, Kingston (Town)	Over the weekend of June 12 through 14, a slow moving low pressure system just off the southern New England coast produced very heavy rains across much of the Catskills and eastern Mohawk Valley. Three day precipitation totals reached 8 to10 inches in some locations. In Ulster County, the Esopus Creek above the Ashokan Reservoir flooded. At Mount Tremper, the creek crested at 12.5 feet late Sunday afternoon June 14. Flood stage at Mount Tremper is 11 feet. In the Town of Kingston, the Saw Kill flooded several roads.	$45,000
6/30/1998	Multiple	A cold front triggered severe thunderstorms and flash flooding across Dutchess and Ulster Counties. Severe thunderstorms downed trees and wires across several locations in both these counties. Approximately 2,000 customers were without power for several hours. A thunderstorm blew a tree down on a house at Gardiner in Ulster County. Severe thunderstorms also contained large hail. Torrential rains from the storms produced flash flooding across Ulster and Southern Dutchess Counties. In Ulster County, roads were flooded in Rosendale, New Paltz, Shawangunk, Marlboro and Ellenville. At Glasco, in Saugerties Town, four residents of an apartment building were evacuated due to a flooded stream that washed out part of the foundation.	$16,000
7/14/2000	Denning	A very moist air mass moved over the Mohawk Valley and Southern Catskills during the afternoon on	$27,000

Table 3a.22
Selected Recent Flood Events in Ulster County
(Source: NOAA NCDC)

Date	Affected Municipalities	Description	Reported Property Damage*
		July 14. A cold front stalled to the west of the region. This scenario allowed for a cluster of thunderstorms to develop. In Ulster county, Denning was especially hard hit. Doppler radar estimated between 8 and 10 inches of rain fell in a few hours during the late afternoon and evening hours as thunderstorms became virtually stationary over the area. Massive flooding caused almost every road in Denning to be washed out, including County Route 46 (Greenville Road). Five families had to be evacuated. Small bridges were also washed out. The hamlet of Sundown suffered the most damage with all but one road devastated. A trailer was destroyed while other houses had damage to their foundations. Other portions of homes were torn away.	
12/17/2000	Multiple	A complex storm system began to evolve on Saturday December 16 across the Mississippi Valley. A surface low tracked north into the Eastern Great Lakes by December 17. At the same time, the associated upper level trough became negatively tilted as it moved toward the northeast on Sunday. This allowed for rapid cyclogenesis. Unseasonably warm and moist air was transported northward from the Gulf of Mexico. This scenario brought a record breaking rainstorm to eastern New York. Six towns in Ulster County declared a local state of emergency, including Woodstock, Gardiner, Rosendale, Hardenburgh, Denning and Kingston, due to widespread flooding in these towns. In Shandaken a 15 year old boy drowned as he and four other boy scouts attempted to cross the swollen West Branch of the Neversink River while descending Slide Mountain. The remaining four boy scouts were rescued and treated for hypothermia, then released from a nearby hospital.	$500,000
8/3/2001	Kingston (Town)	A cold front, moving into a warm humid airmass, produced scattered thunderstorms across eastern New York on the afternoon of August 3. A couple of the storms became severe. One produced torrential rainfall in Kingston, Ulster County. 1.82 inches of rain was reported in just 30 minutes. This rainfall resulted in the flooding and closure of several roadways in that town.	$20,000
8/10/2003	New Paltz (Town)	Isolated thunderstorms developed during the evening hours of August 10 over Dutchess and Ulster counties. These storms were slow moving and prolific rainmakers. Heavy rains flooded Route 299 in Libertyville near New Paltz in Ulster County. Both roads were closed. Numerous basements were also flooded in that town.	$10,000
9/23/2003	New Paltz (Town)	A strong cold front produced a line of showers and thunderstorms across eastern New York on the morning of September 23. Heavy rains resulted in flash flooding in the town of New Paltz in Ulster County. Route 32 flooded in that town submerging a taxi at the intersection of Route 32 and Sunset Ridge Road. The driver was not injured. By 4 pm, city firefighters in New Paltz had assisted in pumping 18 flooded basements out. The storms resulted in scattered power outages.	$18,000
5/13/2004	Shandaken	On May 13th, a cold front propagated through New York State, touching off a line of strong to severe thunderstorms that brought significant damage to a portion of the area. Numerous roadside culverts were washed out, and roads were closed due to the heavy amounts of rain that fell in very short periods of time	$500,000

Table 3a.22
Selected Recent Flood Events in Ulster County
(Source: NOAA NCDC)

Date	Affected Municipalities	Description	Reported Property Damage*
		in Greene, Warren, and Ulster Counties. Pine Hill, in Ulster County, reported the highest amount of loss, suffering approximately $500,000 in damage to structures and roadways.	
8/30/2004	Kingston (City)	A series of slow moving thunderstorms produced at least two inches of rainfall in a short time in Ulster County. With an already saturated ground, extensive flash flooding resulted, as portions of Broadway, Washington Avenue and Elizabeth Street were closed in the city of Kingston. The worst of the flooding occurred along Main Street, where two-foot water depths were recorded. In addition, a large sinkhole appeared on Pearl Street between Green Street and Washington Avenue.	Not available
9/18/2004	Hardenburgh	All roads in Hardenburgh closed due to flooding. Town supervisor declared a state of emergency.	Not available
2/4/2005	Multiple	State of Emergency declared throughout entire county due to widespread flooding**.** Many roads reported to be closed throughout Ulster County.	$275,000
10/14/2005	New Paltz (Town)	Law Enforcement official reported many roads in New Paltz are closed due to flooding.	Not available
4/15/2007	New Paltz (Town), Ulster (Town)	Heavy rainfall led to flooding of numerous creeks and streams throughout the county. The Verkeerderkill Creek exceeded bankfull around 1655 EST on the 15th, flooding adjacent portions of Ulsterville Road in Walker Valley. Additional flooding was reported around 2313 LST near New Paltz, where several roads were closed due to high water, including Route 299 to Mountain Rest Road, and from Dug Road to Kleinkill Drive. A state of emergency was declared by 0745 EST on the 16th due to the widespread flooding. Mandatory evacuations also occurred along the Esopus Creek in the town of Ulster around 1430 EST on the 16th.	$3,200,000
6/19/2007	Hardenburgh	Several roads were washed out near Turnwood as a result of very heavy rainfall.	$25,000
3/9/2008	New Paltz (Town), Shawangunk, Hurley	Heavy rainfall led to flooding across portions of Ulster county. Several roads were closed, including Route 213 and Mountain Road in Ulsterville, Ulsterville Road and Pirog Road in Ulsterville, several roads in downtown New Paltz, and Route 9 West between Saugerties and Ulster. The flooding of fields was also reported west of County Route 7 and State Route 52 near Ulsterville, where water approached houses. In addition, a mudslide occurred in Hurley, closing Hurley Mountain Road.	$10,000

*May include damage incurred outside Ulster County

Probability of Occurrence – Floods

The probability of occurrence of a flood at a given location (the odds of being flooded) is expressed in percentages as the chance of a flood of a specific magnitude occurring in any given year. The ñ100-year floodò has a 1% chance of occurring in any given year. The 100-year flood is often also referred to as the ñbase floodò. This probability of occurrence might imply that a 100-year flood would reoccur only once every 100 years; in reality, this is not the case. A 100-year flood can happen multiple times in a single year, or not at all for more than 100 years. Properties located in FEMA-mapped A- and V-Zones are within the footprint of the 100-year floodplain. FEMA A-Zones represent the 100-year floodplain

For all floodplains, there is an associated water surface elevation. This elevation is unique to any given location on the map (in other words, 100-year flood levels vary from one community to the next throughout Ulster County, and also within individual communities).

Within the 100-year floodplain, flooding can occur at less than the 100-year flood level, and also more than the 100-year flood level. The 100-year flood represents a flood of high magnitude ï it is a deep and widespread event. The 500-year flood is of a greater magnitude, and would be deeper and more widespread than a 100-year event. However, it is not as likely to occur. Smaller floods, with magnitudes of 10-years or 50-years for example, are also possible within the 100-year floodplain. These are not as deep or as widespread as a 100-year flood would be, however, they are much more likely to occur.

The term ñ100-year floodò can often be confusing to someone not intimately familiar with flooding or statistics. FEMAôs *NFIP Floodplain Management Requirements: a Study Guide and Desk Reference for Local Officials* (FEMA-480), suggests that another way to look at flood risk is to think of the odds that a 100-year flood will happen some time during the life of a 30-year mortgage of a home in the floodplain. Figure 3a.16 illustrates these odds, over various time periods for different size floods. In any given year, a property in the 100-year floodplain has a 10 percent chance of being flooded by a 10-year flood, and a 1 percent chance of being flooded by a 100-year flood. This may not sound particularly risky at first glance. However, over a 30ï year period, that same location has a 96 percent chance of being flooded by a 10-year flood and a 26 percent chance of being flooded by a 100-year flood.

Figure 3a.16: Odds of Being Flooded

WHAT ARE THE ODDS OF BEING FLOODED?

The term "100-year flood" has caused much confusion for people not familiar with statistics. Another way to look at flood risk is to think of the odds that a 100-year flood will happen sometime during the life of a 30-year mortgage—a 26% chance for a structure located in the SFHA.

Chance of Flooding over a Period of Years

Time Period	Flood Size 10-year	25-year	50-year	100-year
1 year	10%	4%	2%	1%
10 years	65%	34%	18%	10%
20 years	88%	56%	33%	18%
30 years	96%	71%	45%	26%
50 years	99%	87%	64%	39%

Even these numbers do not convey the true flood risk because they focus on the larger, less frequent, floods. If a house is low enough, it may be subject to the 10- or 25-year flood. During a 30-year mortgage, it may have a 26% chance of being hit by the 100-year flood, but the odds are 96% (nearly guaranteed) that it will be hit by a 10-year flood. Compare those odds to the only 1-2% chance that the house will catch fire during the same 30-year mortgage.

Ice Jams

Description – Ice Jam

Ice jams form when ice floating downstream in a river stalls and begins to build into a jam, forming a dam. The ñreservoirò behind the dam quickly fills with water until out of bank flooding occurs. The observed effect can be very similar to flash flooding, and sudden flooding downstream may be caused by the sudden failure or release of the ice jam. Ice jams generally form at locations where the ice transport downstream is reduced by an obstruction or a significant hydrologic change. Natural obstructions in the river can include bends, intact sheet ice cover, or a decrease in channel slope. Man-made obstructions can include bridges, existing dams, waterline crossings, and other constructions in the channel.

Ice jams and resulting floods can occur during fall freeze-up from the formation of frazil ice (a collection of loose, randomly oriented needle-shaped ice crystals) during midwinter periods when stream channels freeze solid forming anchor ice, and during spring breakup when rising water levels from snowmelt or rainfall break existing ice cover into large floating masses that lodge at bridges or other constructions. Damage from ice jam flooding may exceed that caused by open water flooding ï flood elevations are usually higher than predicted for free-flow conditions and water levels may change rapidly. During cold weather, there is a reduction in evapotranspiration, infiltration (due to frozen ground) and surface storage, (due to the filling of ground depressions with snow and ice), which result in more water being delivered to the channel. Therefore for equal amounts of total available water during cold and warm seasons, the amount of excess water available for runoff will be greater during the cold season. Additional damage may be caused by the force of floating ice colliding with buildings, other structures, and automobiles.

Location – and Extent: Ice Jams

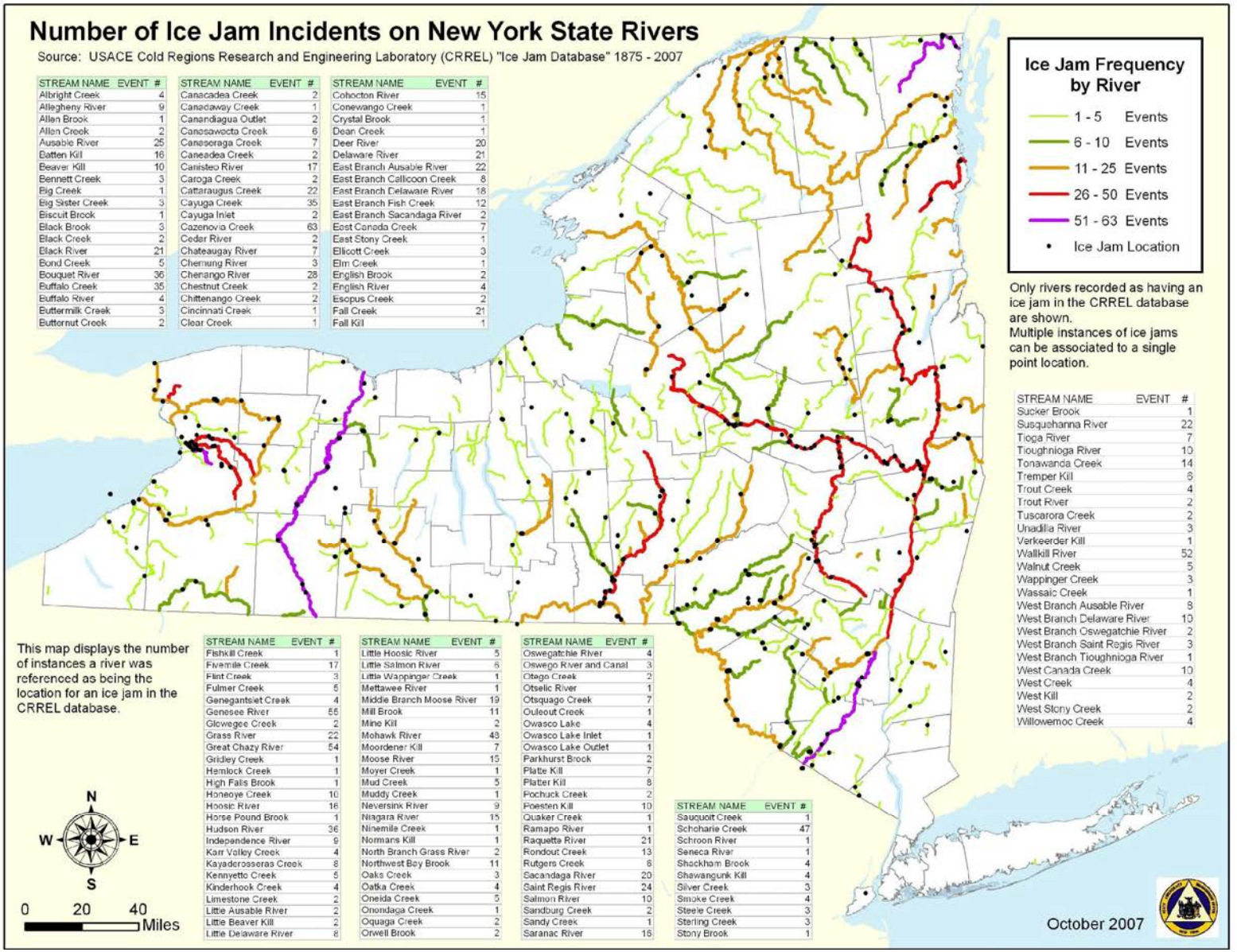
The identification of particular areas prone to ice jam flooding is difficult since the hazard can be extremely localized. However, available research and historic data suggests that ice jam flood hazard is most common in areas of flat terrain where the climate included extended periods of temperature below zero. Ice jams are very common in the north east United States, and according to data from the USACE Cold Region Research and Engineering Laboratory (USACE CRREL), 1,442 ice jam events have been recorded in New York State between 1867 and 2008, a number exceeded only by the State of Montana.

Figure 3a.17 shows the locations of ice jam incidents that have been recorded by the CRREL in New York State from 1875 to 2007. Multiple instances of ice jams may be associated with a single point location. Rivers and streams flowing through Ulster County on which more than one ice jam incident has been recorded by CRREL are presented in Table 3a.23.

Table 3a.22
Rivers and Streams in Ulster County with Recorded Ice Jam Incidents
(Source: USACE; CRREL)

River/Stream Name	Number of Recorded Ice Jam Incidents
Wallkill River	52
Rondout Creek	13
Mill Brook	11
Platte Kill	7
Shawangunk Kill	4
Esopus Creek	2

Figure 3a.17: Ice Jam Incidents in New York State



STREAM NAME	EVENT #
Albright Creek	4
Allegheny River	9
Allen Brook	1
Allen Creek	2
Ausable River	25
Batten Kill	16
Beaver Kill	10
Bennett Creek	3
Big Creek	1
Big Sister Creek	3
Biscuit Brook	1
Black Brook	3
Black Creek	2
Black River	21
Bond Creek	5
Bouquet River	36
Buffalo Creek	35
Buffalo River	4
Buttermilk Creek	3
Butternut Creek	2

STREAM NAME	EVENT #
Canacadea Creek	2
Canadaway Creek	1
Canandiagua Outlet	2
Canesawocta Creek	6
Canoseraga Creek	7
Caneadea Creek	2
Canisteo River	17
Caroga Creek	2
Cattaraugus Creek	22
Cayuga Creek	35
Cayuga Inlet	2
Cazenovia Creek	63
Cedar River	2
Chateaugay River	7
Chemung River	3
Chenango River	28
Chestnut Creek	2
Chittenango Creek	2
Cincinnati Creek	1
Clear Creek	1

STREAM NAME	EVENT #
Cohocton River	15
Conewango Creek	1
Crystal Brook	1
Dean Creek	1
Deer River	20
Delaware River	21
East Branch Ausable River	22
East Branch Callicoon Creek	8
East Branch Delaware River	18
East Branch Fish Creek	12
East Branch Sacandaga River	2
East Canada Creek	7
East Stony Creek	1
Ellicott Creek	3
Elm Creek	1
English Brook	2
English River	4
Esopus Creek	2
Fall Creek	21
Fall Kill	1

STREAM NAME	EVENT #
Sucker Brook	1
Susquehanna River	22
Tioga River	7
Tioughnioga River	10
Tonawanda Creek	14
Tremper Kill	6
Trout Creek	4
Trout River	2
Tuscarora Creek	2
Unadilla River	3
Verkeerder Kill	1
Wallkill River	52
Walnut Creek	5
Wappinger Creek	3
Wassaic Creek	1
West Branch Ausable River	8
West Branch Delaware River	10
West Branch Oswegatchie River	2
West Branch Saint Regis River	3
West Branch Tioughnioga River	1
West Canada Creek	10
West Creek	4
West Kill	2
West Stony Creek	2
Willowemoc Creek	4

STREAM NAME	EVENT #
Fishkill Creek	1
Fivemile Creek	17
Flint Creek	3
Fulmer Creek	6
Genegantslet Creek	4
Genesee River	55
Glowegee Creek	2
Grass River	22
Great Chazy River	54
Gridley Creek	1
Hemlock Creek	1
High Falls Brook	1
Honeoye Creek	10
Hoosic River	16
Horse Pound Brook	1
Hudson River	36
Independence River	9
Karr Valley Creek	4
Kayaderosseras Creek	8
Kennyetto Creek	5
Kinderhook Creek	4
Limestone Creek	2
Little Ausable River	2
Little Beaver Kill	2
Little Delaware River	8

STREAM NAME	EVENT #
Little Hoosic River	5
Little Salmon River	6
Little Wappinger Creek	1
Mettawee River	1
Middle Branch Moose River	19
Mill Brook	11
Mine Kill	2
Mohawk River	43
Moordener Kill	7
Moose River	15
Moyer Creek	1
Mud Creek	5
Muddy Creek	1
Neversink River	9
Niagara River	15
Ninemile Creek	1
Normans Kill	1
North Branch Grass River	2
Northwest Bay Brook	11
Oaks Creek	3
Oatka Creek	4
Oneida Creek	5
Onondaga Creek	1
Oquaga Creek	2
Orwell Brook	2

STREAM NAME	EVENT #
Oswegatchie River	4
Oswego River and Canal	3
Otego Creek	2
Otselic River	1
Otsquago Creek	7
Outeout Creek	1
Owasco Lake	4
Owasco Lake Inlet	1
Owasco Lake Outlet	1
Parkhurst Brook	2
Platte Kill	7
Platter Kill	8
Pochuck Creek	2
Poesten Kill	10
Quaker Creek	1
Ramapo River	1
Raquetta River	21
Rondout Creek	13
Rutgers Creek	6
Sacandaga River	20
Saint Regis River	24
Salmon River	10
Sandburg Creek	2
Sandy Creek	1
Saranac River	16

STREAM NAME	EVENT #
Sauquoit Creek	1
Schoharie Creek	47
Schroon River	1
Seneca River	1
Shackham Brook	4
Shawangunk Kill	4
Silver Creek	3
Smoke Creek	4
Steele Creek	3
Sterling Creek	3
Stony Brook	1

Previous Occurrences – Ice Jams

The USACE CRREL mapping indicates that ice jam incidents for which some details are available have been recorded at 12 locations within Ulster County. Table 3a.24 presents details for those recorded ice jam events in Ulster County for which at least the date and location were available.

Table 3a.24
Historical Occurrences of Ice Jams in Ulster County

Date	River/Stream	Municipality	Details/Description
2/20/2008	Wallkill River	New Paltz	Flooding along Springtown Road between Kleine Kill Drive and Dug Road, and between Route 299 and Mountain West Road.
3/4/2007	Wallkill River	Gardiner	At junction of Wallkill River/Shawangunk Kill
2/23/2003	Wallkill River	Gardiner	Not available
2/23/2003	Rondout Creek	Rosendale	Not available
2/25/2000	Wallkill River	Gardiner	Flooding in vicinity of Route 44 bridge, some farm fields inundated
1/25/1999	Wallkill River	New Paltz	Springtown Road closed due to flooding between Dug Road and Mt. Rest
1/24/1999	Shawangunk Kill	Shawangunk	Road flooding, mainly in Orange County
1/29/1996	Wallkill River	New Paltz	Minor flooding for 1.5 miles between Tall Pines Lane and Ulster County Fairground
1/24/1996	Wallkill River	Gardiner	Minor flooding between Walden and Montgomery (Orange County) attributed to ice jam at Gardiner
3/16/1994	Wallkill River	Gardiner	Not available
3/10/1994	Rondout Creek	Rosendale	Not available
2/4/1982	Wallkill River	Gardiner	Not available
2/4/1982	Rondout Creek	Rosendale	Not available
2/11/1981	Esopus Creek	Shandaken	Not available
2/2/1981	Esopus Creek	Shandaken	Not available
1/25/1964	Shawangunk Kill	Shawangunk	Not available
3/18/1963	Shawangunk Kill	Shawangunk	Not available
3/13/1962	Rondout Creek	Rosendale	Not available
2/25/1961	Shawangunk Kill	Shawangunk	Not available
1/22/1959	Rondout Creek	Rosendale	Not available
3/16/1948	Rondout Creek	Rosendale	Not available
3/4/1945	Rondout Creek	Rosendale	Not available
2/8/1941	Rondout Creek	Rosendale	Not available
3/15/1940	Rondout Creek	Rosendale	Not available
3/12/1936	Rondout Creek	Kingston	"Portions of é Kingston, in New York state, was inundated, and a score of barges, tugs and other craft were swept down Rondout Creek until they were halted by an ice jam and remoored. Three watermen were rescued. Nine Ulster county hamlets were abandoned due to rising waters on the Wallkill river. . . . Fog hitting from the Hudson River today disclosed a fleet of tugs and barges jammed in a huge ice pack where they were swept by raging Rondout Creek yesterday. No one was believed to be aboard. Watchers said they counted 20 or 30 vessels. In the group was a 100-foot steam yacht. This and others were torn away from dry docks a mile and a half up Rondout Creek when an ice jam broke*
3/4/1934	Rondout Creek	Rosendale	Not available
3/3/1926	Wallkill River	Gardiner	Not available

*As reported by *The Caledonian-Record*, March 13, 1936

In addition to data sourced from USACE CRREL, local sources have indicated stormwater discharges are occasionally impeded by ice jams in the Town of Lloyd, most recently in March 2008.

A superseded version of the New York State Hazard Mitigation Plan (approved by FEMA in January 2005) mentions that an ice jam flooding event took place in Ulster County in January 1976, but gives no further details or description.

Probability of Occurrence – Ice Jams

Due to the nature of the terrain and the climate in Ulster County, ice jam events are essentially certain to occur, although whether or not such events will cause significant damage is less easy to predict, since records of actual damage caused by ice jams are scarce. The available data also does not easily allow for an average number of occurrences per year to be computed, since location data is inexact in many cases. Using the total number of incidents presented in Table 3a.IJ1, the number of ice jam incidents affecting rivers and streams flowing through Ulster County can be approximately estimated as 0.67 per year.

Earthquakes

Description – Earthquakes

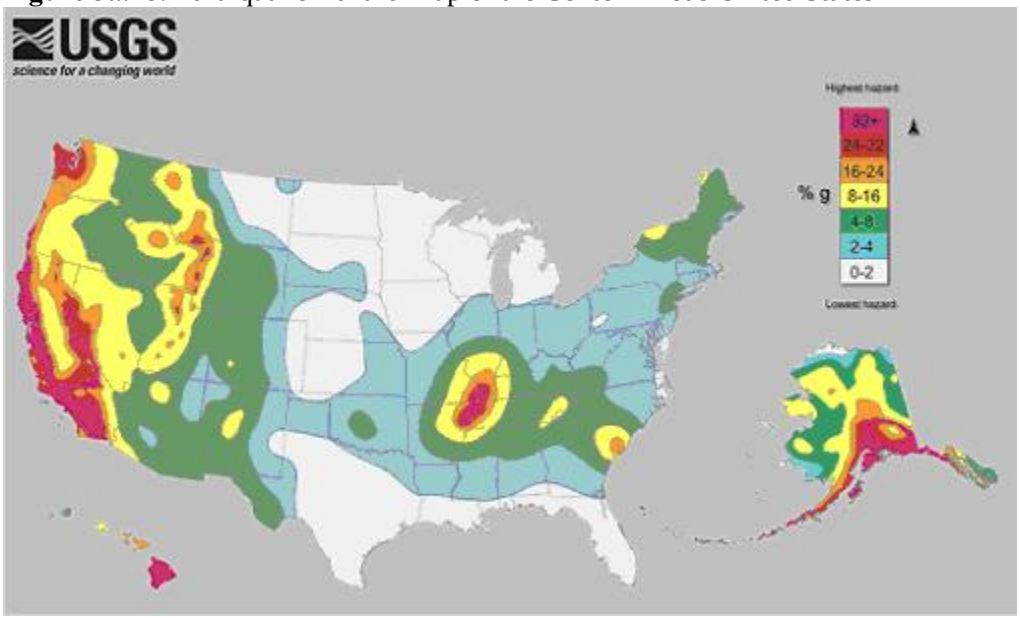
FEMA defines the term ñearthquakeò as a sudden, rapid shaking of the Earth caused by the breaking and shifting of rock beneath the Earthôs surface. This movement forces the gradual buildup and accumulation of energy. Eventually, strain becomes so great that the energy is abruptly released, causing the shaking at the earthôs surface which we know as an earthquake.

According to the USGS Earthquake Hazards Program, most earthquakes (approximately 90%) occur at the boundaries where the plates meet, although it is possible for earthquakes to occur entirely within plates. Ulster County is significantly distant from any plate boundaries. Regardless of where they are centered, earthquakes can impact locations at ï and well beyond ï their point of origin. They are often accompanied by ñaftershocksò ï secondary quakes in the earthquake sequence. Aftershocks are typically smaller than the main shock, and can continue over a period of weeks, months, or years from the main shock. In addition to the effects of ground shaking, earthquakes can also cause landslides and liquefaction under certain conditions. Liquefaction occurs when unconsolidated, saturated soils exhibit fluid-like properties due to intense shaking and vibrations experienced during an earthquake. Together, ground shaking, landslides, and liquefaction can damage or destroy buildings, disrupt utilities (i.e., gas, electric, phone, water), and sometimes trigger fires.

Location – Earthquakes

Earthquakes are possible within any of Ulster Countyôs communities. Figure 3a.18 show an earthquake hazard map for the conterminous United States prepared by the USGS Earthquake Hazards Program. It shows that the earthquake hazard is low relative to other parts of the country (for example the west coast of the USA), but the possibility for noticeable earthquakes does exist in New York State.

Figure 3a.18: Earthquake Hazard Map of the Conterminous United States



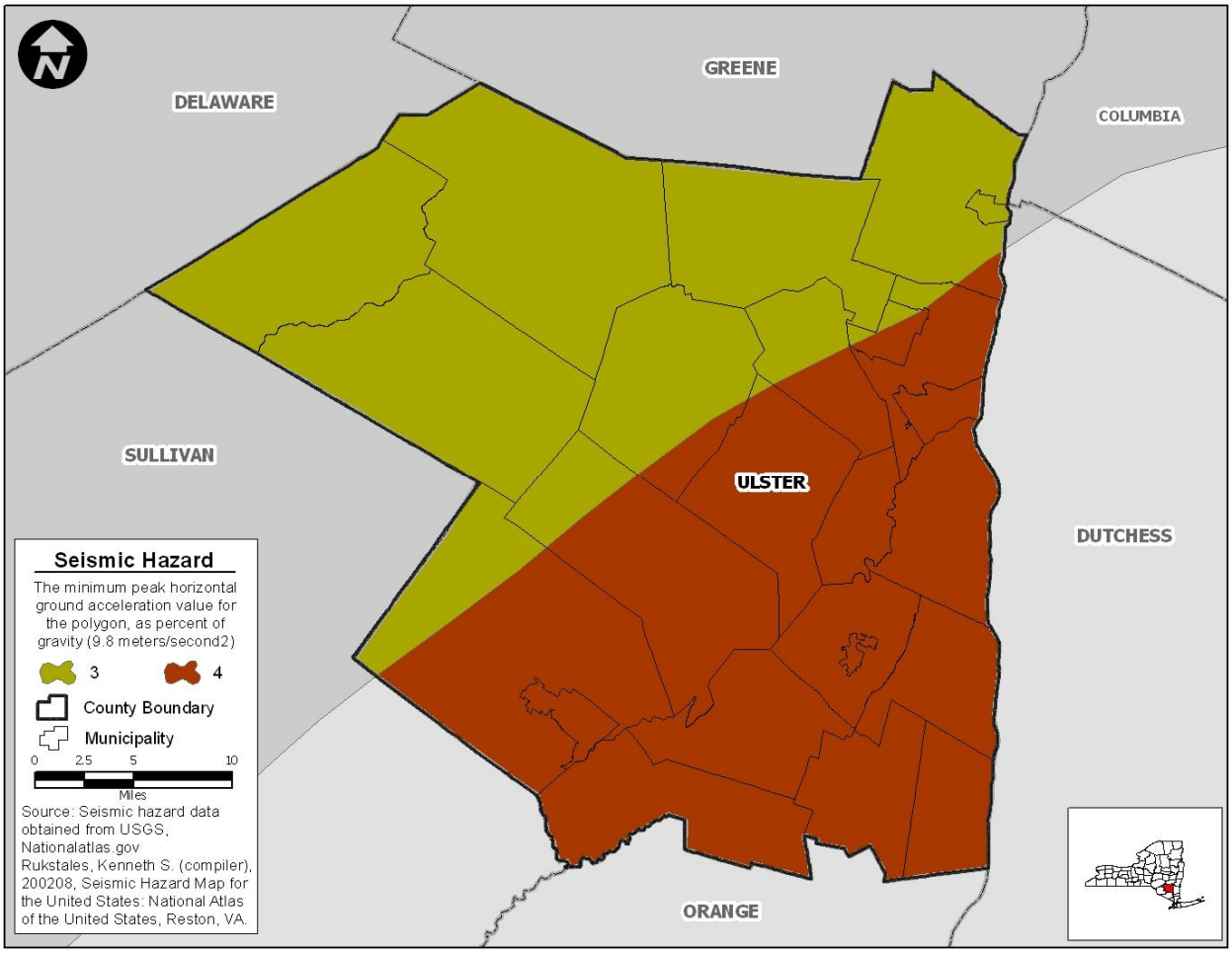
Extent – Earthquakes

The severity of an earthquake at a given location depends on the amount of energy released at the epicenter, and the locationôs distance from the epicenter. The terms ñmagnitudeò and ñintensityò are two terms used to describe the severity of an earthquake. An earthquakeôs ñmagnitudeò is a measurement of the total amount of energy released while its ñintensityò is a measure of the effects of an earthquake at a particular place. Another way to express an earthquakeôs severity is to compare its acceleration to the normal acceleration due to gravity. Peak Ground Acceleration (PGA) measures the rate of change in motion of the earthôs surface and expresses it as a percent of the established rate of acceleration due to gravity (9.8 m/sec^2). Figure 3a.19 shows that, for Ulster County, PGA values of between 3 and 4%g have a 10 percent chance of being exceeded over 50 years. All of Ulster County has some degree of exposure to the earthquake hazard. While there are two mapped degrees of exposure, it is important to note that the effects at these low levels would be very similar. The GIS files used to generate Figure 3a.19 were used to estimate the extent of exposed land area in each municipality to the various degrees of earthquake hazard, as presented in Table 3a.25.

Table 3a.25
Extent of Earthquake Hazard Zones in Ulster County Municipalities

Municipality	Total Area (Acres)	Zone 3 Area (Acres)	Zone 3 Area %	Zone 3 Area (Acres)	Zone 4 Area %
Denning	64,658	64,658	100%	0	0%
Ellenville	5,350	0	0%	5,350	100%
Esopus	23,524	0	0%	23,524	100%
Gardiner	27,495	0	0%	27,495	100%
Hardenburgh	51,004	51,004	100%	0	0%
Hurley	21,993	11,625	53%	10,368	47%
Kingston City	4,681	1,634	35%	3,047	65%
Kingston Town	4,285	0	0%	4,285	100%
Lloyd	19,694	0	0%	19,694	100%
Marbletown	34,814	436	1%	34,379	99%
Marlborough	15,472	0	0%	15,472	100%
New Paltz	19,741	0	0%	19,741	100%
New Paltz Village	1,002	0	0%	1,002	100%
Olive	41,492	35,894	87%	5,598	13%
Plattekill	22,039	0	0%	22,039	100%
Rochester	56,085	11,652	21%	44,433	79%
Rosendale	11,972	0	0%	11,972	100%
Saugerties	38,731	37,254	96%	1,477	4%
Saugerties Village	1,050	1,050	100%	0	0%
Shandaken	78,924	78,924	100%	0	0%
Shawangunk	35,306	0	0%	35,306	100%
Ulster	16,159	2,068	13%	14,091	87%
Warwarsing	79,654	21,571	27%	58,083	73%
Woodstock	42,809	42,809	100%	0	0%
Ulster County Total	*717,936*	*360,580*	*50%*	*357,356*	*50%*

Figure 3a.19: Ulster County Earthquake Hazard Zones



An approximate relationship between PGA, magnitude, and intensity is shown in Table 3a.26. Using Table 3a.DD, one can approximate that, for an earthquake of expected severity for Ulster County and its participating jurisdictions (PGA values of 3 to 4%g), perceived shaking would be light to moderate (depending upon the distance from the epicenter) and potential damage could range from none to very light (also depending upon the distance from the epicenter).

Table 3a.26
Earthquake Magnitude/Intensity Comparison

PGA	Magnitude	Intensity	Perceived Shaking	Potential Damage
< 0.17	1.0 - 3.0	I	Not Felt	None
0.17 ï 1.4	3.0 ï 3.9	II - III	Weak	None
1.4 – 9.2	**4.0 – 4.9**	**IV – V**	**IV. Light** **V. Moderate**	**IV. None** **V. Very Light**
9.2 - 34	5.0 ï 5.9	VI ï VII	VI. Strong VII. Very Strong	VI. Light VII. Moderate
34 - 124	6.0 ï 6.9	VIII - IX	VIII. Severe IX. Violent	VIII. Moderate/Heavy IX. Heavy
> 124	7.0 and higher	X and higher	Extreme	Very Heavy

Sources: (1) FEMA Mitigation Planning "How-To" Guide 386-2 (as reported in the New York State Hazard Mitigation Plan 2005; (2) Wald, D., et al., 1999, Relationship between Peak Ground Acceleration, Peak Ground Motion, and Modified Mercalli Intensity in California", Earthquake Spectra, V. 15, p. 557-564; (3) Community Internet Intensity, USGS Modified Mercalli Intensity, and Instrumental Intensity. 1999. http://www-socal.wr.usgs.gov/ciim/pubs/ciim/node5.html (July 27, 2003).

An earthquake with a 10 percent chance of exceedance over 50 years in Ulster County would have a PGA of 3 to 4%g and an intensity ranging from only IV to V, which would result in light to moderate perceived shaking, and damages ranging from none to very light. For comparison purposes, an earthquake of intensity IV on the Modified Mercalli Scale would most likely cause vibrations similar to heavy trucks driving over roads, or the sensation of a jolt. Hanging objects would swing; standing cars would rock; windows, dishes and doors would rattle; and, in the upper ranges of intensity IV, wooden walls and frames would creak. An earthquake of intensity V on the Modified Mercalli Scale would be felt outdoors, awaken sleepers, disturb or spill liquids, displace small unstable objects, swing doors, and cause shutters and pictures to move.

As noted in the New York State Hazard Mitigation Plan, soil type can have an impact on the severity of an earthquake at a given location. For example, soft soils (i.e., fill, sand) are more likely to amplify ground motion during an earthquake. Liquefaction is also more likely to occur in areas of soft soils. In contrast, harder soils (i.e., granite) tend to reduce ground motion during an earthquake. Figure 3a.20 shows soil types in five basic categories with varying degrees in likelihood of amplifying the affects of an earthquake, with Category A being far less likely to amplify the seismic motion than Category E.

Tables 3a.27 and 3a.28 presents the areas of each soil type quantified for each municipality and the improved values within those areas. This table indicates that the municipalities with the highest prevalence of soil types most likely to amplify the effects of seismic activity (Categories D and E) are Saugerties (both Town and Village), Ulster Town, Rosendale, and Shawangunk. Over the County as a whole, the most prevalent soil type is Category B (more than 50% of the County), indicating a generally low overall risk that the effects of earthquakes may be amplified by the soil type.

To clarify the data in Table 3a.28, percentages of improved values have only been presented for Categories D and E, which are the most likely to amplify the effects of seismic activity. The greatest concentrations of improved property value underlain by soil Category E are in the Towns of Saugerties and Ulster.

Figure 3a.20: Ulster County Geological Soil Classification

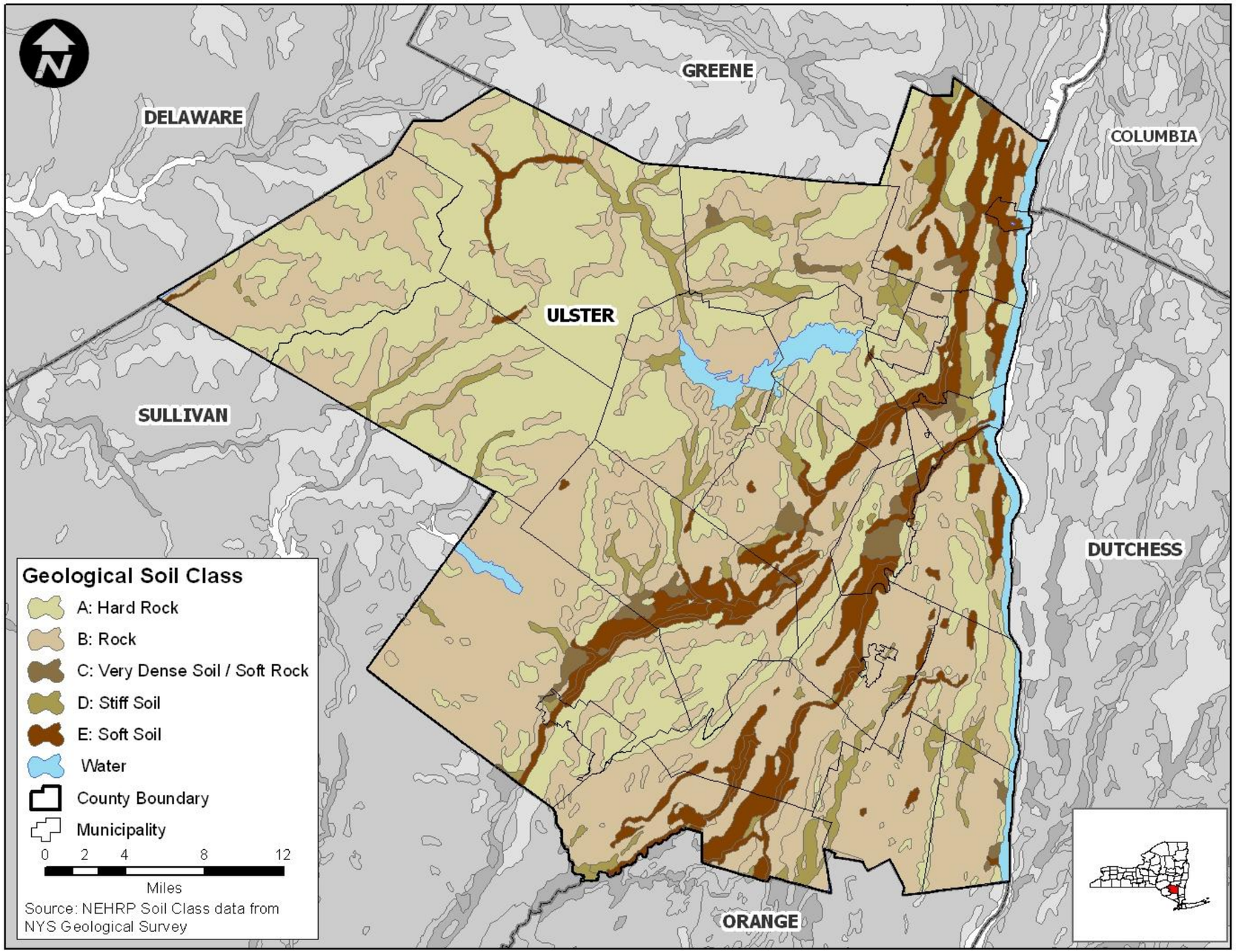


Table 3a.27
Ulster County Geological Soils Classification: Land Areas
Source: NEHRP – NYS Geological Survey

Municipality	Total Acres	A		B		C		D		E		Unclassified	
		Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Denning	64,658	40,161	62.1%	21,781	33.7%	0	0.0%	2,552	3.9%	165	0.3%	0	0.0%
Ellenville Village	5,350	2,795	52.2%	2,007	37.5%	140	2.6%	174	3.3%	235	4.4%	0	0.0%
Esopus	23,524	6,012	25.6%	13,074	55.6%	0	0.0%	1,042	4.4%	2,962	12.6%	435	1.8%
Gardiner	27,495	2,453	8.9%	18,872	68.6%	0	0.0%	707	2.6%	5,463	19.9%	0	0.0%
Hardenburgh	51,004	21,917	43.0%	28,410	55.7%	0	0.0%	399	0.8%	225	0.4%	53	0.1%
Hurley	21,993	9,163	41.7%	7,621	34.7%	0	0.0%	102	0.5%	1,871	8.5%	3,236	14.7%
Kingston City	4,681	1,515	32.4%	2,755	58.9%	0	0.0%	370	7.9%	41	0.9%	0	0.0%
Kingston Town	4,285	965	22.5%	1,044	24.4%	641	15.0%	503	11.7%	899	21.0%	233	5.4%
Lloyd	19,694	5,072	25.8%	12,803	65.0%	0	0.0%	703	3.6%	1,022	5.2%	94	0.5%
Marbletown	34,814	6,753	19.4%	19,492	56.0%	1,098	3.2%	1,977	5.7%	5,367	15.4%	128	0.4%
Marlborough	15,472	1,841	11.9%	11,818	76.4%	554	3.6%	923	6.0%	132	0.9%	204	1.3%
New Paltz	19,741	1,142	5.8%	13,551	68.6%	0	0.0%	604	3.1%	4,444	22.5%	0	0.0%
New Paltz Village	1,002	71	7.1%	850	84.9%	0	0.0%	57	5.6%	24	2.4%	0	0.0%
Olive	41,492	14,650	35.3%	19,996	48.2%	0	0.0%	3,061	7.4%	4	0.0%	3,781	9.1%
Plattekill	22,039	1,373	6.2%	18,320	83.1%	0	0.0%	2,047	9.3%	299	1.4%	0	0.0%
Rochester	56,085	13,850	24.7%	30,551	54.5%	1,318	2.4%	2,171	3.9%	8,195	14.6%	0	0.0%
Rosendale	11,972	3,496	29.2%	3,272	27.3%	2,028	16.9%	160	1.3%	3,015	25.2%	0	0.0%
Saugerties	38,731	7,255	18.7%	14,027	36.2%	1,691	4.4%	2,109	5.4%	13,103	33.8%	546	1.4%
Saugerties Village	1,050	0	0.0%	148	14.1%	0	0.0%		0.0%	794	75.6%	108	10.3%
Shandaken	78,924	59,230	75.0%	15,057	19.1%	0	0.0%	2,737	3.5%	1,900	2.4%	0	0.0%
Shawangunk	35,306	488	1.4%	24,306	68.8%	0	0.0%	3,317	9.4%	7,184	20.3%	11	0.0%
Ulster	16,159	4,879	30.2%	4,410	27.3%	446	2.8%	1,062	6.6%	5,012	31.0%	350	2.2%
Wawarsing	79,654	16,058	20.2%	55,165	69.3%	1,512	1.9%	983	1.2%	4,564	5.7%	1,373	1.7%
Woodstock	42,809	15,572	36.4%	21,355	49.9%	1,028	2.4%	4,854	11.3%	0	0.0%	0	0.0%
County Total	*717,936*	*236,713*	*33.0%*	*360,683*	*50.2%*	*10,455*	*1.5%*	*32,613*	*4.5%*	*66,921*	*9.3%*	*10,552*	*1.5%*

Table 3a.28
Ulster County Geological Soils Classification: Improved Property Values
Source: NEHRP – NYS Geological Survey

Municipality	Total Value	A	B	C	D		E		Unclassified
		Value	Value	Value	Value	%	Values	%	Value
Denning	$51,126,978	$23,018,453	$23,303,738	$0	$4,589,435	9.0%	$215,556	0.4%	$0
Ellenville Village	$47,291,413	$9,912,081	$8,646,123	$3,453,374	$13,472,961	28.5%	$11,523,366	24.4%	$0
Esopus	$823,898,937	$195,874,692	$319,672,737	$0	$114,227,210	13.9%	$104,432,418	12.7%	$89,695,175
Gardiner	$612,092,899	$16,977,802	$520,885,499	$0	$5,076,020	0.8%	$69,156,010	11.3%	$0
Hardenburgh	$50,791,094	$6,107,368	$43,538,299	$0	$427,033	0.8%	$0	0.0%	$718,597
Hurley	$682,669,402	$179,618,441	$372,717,073	$0	$134,778	0.0%	$86,868,321	13.6%	$703,530
Kingston City	$1,922,939,212	$299,413,315	$507,528,517	$612,718,037	$204,334,740	10.6%	$287,347,173	14.9%	$11,605,114
Kingston Town	$57,541,463	$24,197,537	$20,430,691	$0	$12,913,466	22.4%	$0	0.0%	$0
Lloyd	$856,612,633	$145,346,548	$617,733,927	$0	$46,010,184	5.4%	$17,931,405	2.1%	$29,594,008
Marbletown	$1,023,631,875	$342,262,434	$500,852,185	$60,980,029	$24,850,422	2.5%	$64,803,662	6.5%	$264,405
Marlborough	$722,416,282	$55,497,399	$552,532,722	$65,984,495	$13,630,952	1.9%	$12,099,792	1.7%	$22,673,809
New Paltz	$578,833,042	$27,386,806	$470,658,124	$0	$23,315,793	4.0%	$57,474,627	9.9%	$0
New Paltz Village	$238,672,524	$29,347,046	$208,222,754	$0	$0	0.0%	$1,103,682	0.5%	$0
Olive	$719,961,895	$47,685,070	$289,597,400	$0	$40,215,180	10.7%	$0	0.0%	$0
Plattekill	$556,675,301	$26,463,439	$489,154,185	$0	$38,629,255	6.9%	$2,430,651	0.4%	$0
Rochester	$564,685,441	$84,941,061	$320,192,049	$28,888,450	$14,236,612	2.5%	$116,429,519	20.6%	$0
Rosendale	$469,479,238	$103,321,783	$71,800,505	$219,308,097	$3,127,086	0.7%	$71,923,639	15.3%	$0
Saugerties	$1,217,383,571	$147,886,263	$428,770,765	$130,853,020	$74,490,284	6.1%	$389,504,712	32.0%	$45,883,372
Saugerties Village	$275,716,843	$0	$81,389,434	$0	$0	0.0%	$182,303,144	66.1%	$12,025,355
Shandaken	$402,760,909	$70,477,555	$145,679,218	$0	$94,424,014	23.4%	$92,181,732	22.9%	$0
Shawangunk	$1,093,099,620	$1,120,004	$912,713,739	$0	$95,516,015	8.7%	$81,698,564	7.5%	$2,055,675
Ulster	$1,189,900,886	$380,954,507	$214,305,005	$8,973,079	$269,702,893	22.7%	$299,777,782	25.2%	$16,192,383
Wawarsing	$391,482,171	$59,097,376	$229,733,084	$24,038,668	$6,534,312	1.7%	$70,943,141	18.1%	$317,144
Woodstock	$1,250,466,647	$202,541,226	$845,257,210	$75,097,579	$127,575,624	10.2%	$0	0.0%	$0
County Total	*$15,384,466,039*	*$2,479,448,206*	*$8,195,314,983*	*$1,230,294,827*	*$1,227,434,270*	*9.0%*	*$215,556*	*0.4%*	*$231,728,566*

Previous Occurrences - Earthquakes

As noted in the New York State Mitigation Plan, although the probability of damaging earthquakes in New York State is low, earthquakes do occur on a regular basis in New York. Figure 3a.21 illustrates the location of significant (magnitude 5.0 or greater) earthquake epicenters in New York, as obtained from the New York State Hazard Mitigation Plan, for earthquakes that occurred between 1737 and May 1986. Table 3a.29 presents details for earthquakes recorded in New York State since 1737 that were recorded in the NYS statistical yearbook. The only recorded event which specifically mentions Ulster County was the February 1855 incident, which is listed as a cryoseismic event. Cryoseisms (also known as ñfrost quakesò) are generally caused by a sudden cracking action in frozen soil or rock saturated with water or ice. As water seeps down into the rock, it freezes and expands, putting stress on surrounding rock. This builds up until it is relieved explosively in a cryoseism.

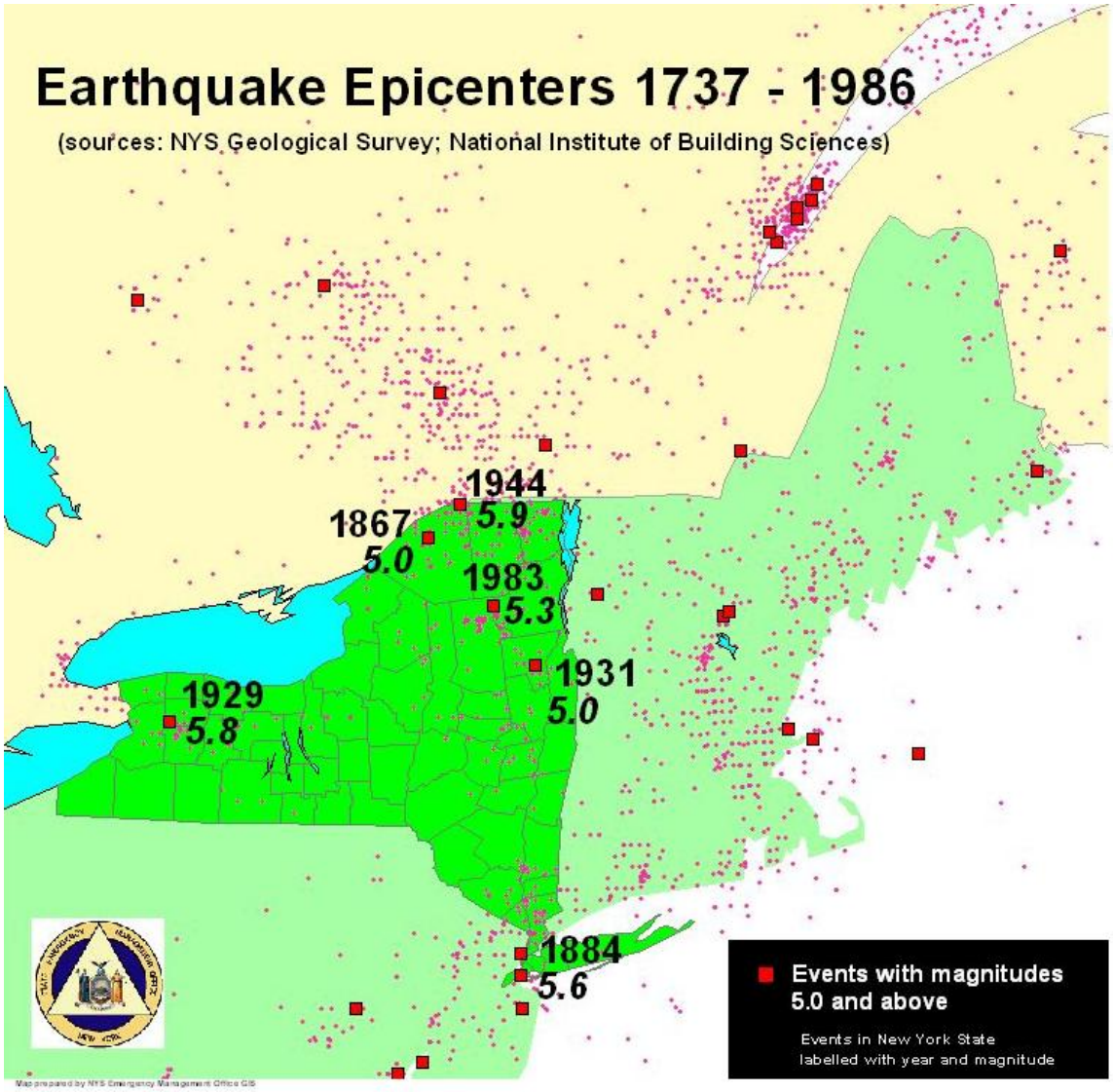


Figure 3a.21: Significant Earthquake Epicenters in New York State (1737-1986)

Table 3a.29
Earthquake History Throughout New York State (1737 – 2005)
Source: NYSEMO / NYS Statistical Yearbook 2006

Date	Location	Size	Damage Description
December 18, 1737	New York City	5.2	Bells rang, several chimneys fell
January 16, 1840	Herkimer	3.7	No reference and/or No damage reported
September 2, 1847	Offshore NYC	3.5	No reference and/or No damage reported
September 9, 1848	Rockland Lake	V	Felt by many
March 12, 1853	Lowville	VI	Machinery knocked over
February 7, 1855	**Saugerties**	**VI**	**Cryoseism**
October 23, 1857	Buffalo (Lockport)	4.0	Bells rang, crocks fell from shelves
December 18, 1867	Canton	4.7	Sleepers awakened
December 11, 1874	Tarrytown	3.4	No reference and/or No damage reported
November 4, 1877	Lyon Mountain[1]	VII	Chimneys down, walls cracked, window damaged, crocks overturned
August 10, 1884	New York Bight (NYC)	5.2	Chimneys and bricks fell, walls cracked
May 28, 1897	Dannemora	4.5	No reference and/or No damage reported
February 3, 1916	Schenectady	3.8	Broke windows, people thrown out of bed
March 18, 1928	Saranac Lake	4.0	No reference and/or No damage reported
August 12, 1929	Attica	5.2	250 chimneys fell, brick buildings damaged, Attica prison walls, wells went dry
April 20, 1931	Warrensburg	4.8	Chimneys fell, church spire twisted
April 15, 1934	Dannemora	3.9	House shifted
July 9, 1937	Brooklyn	3.5	No reference and/or No damage reported
September 5, 1944	Corwall, Ontario/Massena, NY	5.8	Nearly all chimneys fell, buildings damaged, $2 million damage
September 5, 1944	Corwall, Ontario/Massena, NY	4.5	Chimneys destroyed, houses damaged
September 3, 1951	Rockland County	3.6	No reference and/or No damage reported
January 1, 1966	Attica	4.7	Chimneys and walls damaged
June 13, 1967	Attica	3.9	Chimneys and walls damaged
May 23, 1971	Blue Mountain Lake	4.1	No reference and/or No damage reported
May 23, 1971	Blue Mountain Lake	3.5	No reference and/or No damage reported
June 7, 1974	Wappingers Falls	3.0	Windows broken
June 9, 1975	Plattsburgh (Altona)	3.5	Chimneys and fireplaces cracked
November 3, 1975	Raquette Lake	4.0	No reference and/or No damage reported
February 2, 1983	Scarsdale-Lagrangeville	3.0	Chimneys cracked

Table 3a.29
Earthquake History Throughout New York State (1737 – 2005)
Source: NYSEMO / NYS Statistical Yearbook 2006

Date	Location	Size	Damage Description
October 7, 1983	Goodnow, Adirondack Mountains	5.1	Tombstones rotated, some cracked chimneys, windows broken, walls damaged
October 19, 1985	Ardsley	4.0	Windows broken, walls damaged
June 17, 1991	Richmondville	4.0	No reference and/or No damage reported
March 10, 1992	East Hampton, Suffolk County	4.1	No reference and/or No damage reported[2]
April 20, 2000	Newcomb	3.8	Aftershock of the 1983 event. No damage reported
April 20, 2002	Au Sable Forks	5.1	Cracked walls, chimneys fell, road collapsed, power outages
May 24, 2002	Au Sable Forks	3.1	Aftershock of the April 20, 2002 event, no damage reported

Probability of Occurrence – Earthquakes

Earthquakes cannot be predicted. They strike without warning, at any time of the year, and at any time of the day or night. Earthquake hazard maps ï sometimes referred to as ñPGA mapsò ï are used as a tool to project the likelihood of a various intensity quake being exceed at a certain location over a given period of time. They depict the Peak Ground Acceleration (PGA), expressed as a percentage of the force of gravity that can be expected to be exceeded at a given location for a particular probability of exceedance over a specific time frame. Figure 3a.15 is an example of an earthquake hazard map as prepared by the USGS Earthquake Hazards Program. It shows PGA values that have a 10 percent chance of being exceeded over 50 years.

As Figure 3a.AA shows, the earthquake hazard is relatively low but shows some degree of variation across the county, with higher hazard areas being in the southeastern half of the county and lower hazard areas being in the southwestern half of the county. Figure 3a.15 shows that, for Ulster County, PGA values of between 3%g and 4%g have a 10 percent chance of being exceeded over 50 years.

As stated above, according to the currently available earthquake hazard mapping of New York State, there is a 10 percent chance over 50 years that an earthquake with a PGA of greater than 3%g to 4%g will be centered within Ulster County and/or its participating jurisdictions. This earthquake, if it did occur, would likely have associated with it light to moderate perceived shaking and little to no damage.

Landslides

Description - Landslides

According to the USGS National Landslide Information Center (NLIC), the term ñlandslideò is defined as the movement of a mass of rock, debris, or earth down a slope. The force of gravity acting upon a steep (or sometimes, even a moderately steep) slope is the primary cause of a landslide. Slope failure occurs when the force of gravity pulling the slope downward exceeds the strength of the earth materials that comprise the slope to hold it in place. In addition to the force of gravity, other contributing factors to landslides can include rainfall and/or rapid snowmelt, earthquakes, volcanic activity, changes in groundwater, and human-induced modifications to existing slopes.

The potential for a landslide to occur exists in every state in the country wherever very weak or fractured materials are resting on a moderate to steep slope (typically, a slope steep enough to make walking difficult). However, not all moderate to steep slopes are prone to landslides. As slope stability increases, the susceptibility to landslides decreases. Key factors in slope stability are:

- Soil Type. Certain types of soil are more stable on slopes than others. For example, as noted in the New York State Hazard Mitigation Plan, glacial till is one type of soil that tends to stand up well to the landslide tendency while glacial lake clay soils tend to have a higher risk for landslides.
- Terrain. The degree of the slope and the height from top of the slope to its toe also affect slope stability. The New York State Hazard Mitigation Plan indicates that the steeper the slope the higher the risk for landslides to occur (all other things being equal). They note that minor landslides called ñslumpsò can occur with very minor slopes, and that landslides are most likely on slopes greater than or equal to 10 degrees. In terms of the height of the slope, the State Plan notes that relief greater than 40 feet is generally accepted to be the threshold where the potential becomes more significant.
- Vegetative Cover. Slopes with little or no vegetative cover are more prone to landslides than other more vegetated slopes.
- Soil Water Content. As soil water content increases, slope stability decreases. Periods of sustained above-average precipitation, short duration rainfall events with significant precipitation, and snowmelt events can all add to soil water content and increase susceptibility to landslides.

Landslides can be triggered by natural events or by humans. Natural events include erosion, decreases in vegetative cover to do natural causes and/or seasonal changes, and ground shaking from earthquakes. Human caused triggers include altering the slope gradient, increasing the soil water content, and removal of vegetative cover.

Location and Extent - Landslides

Areas that are commonly considered to be safe from landslides include areas that have not experienced landslides in the past, areas of minimal slope, and areas set back from the tops of slopes. Conversely, areas that are commonly considered to be more prone to landslides tend to be areas where a landslide has occurred in the past, bases of steep slopes or drainage channels, and developed hillsides where leach field septic systems are used.

The potential for landslides exists across the whole of New York State, although according to USGS and NYGS the vast majority of the state (80%) has a low susceptibility to landslide hazard. Landslide hazard mapping has been completed for New York State. In general the highest potential for landslides can be found along major river and lake valleys that were formerly occupied by glacial lakes resulting in glacial lake deposits (glacial lake clays) and usually associated with steeper slopes, such as the Hudson River valley. USGS landslide susceptibility mapping uses three basic classifications to communicate the risk, in conjunction with three further classifications to communicate the combinations of susceptibility and incidence:

- High incidence (Greater than 15 % of the area involved)
- Moderate incidence (1.5% - 15% of the area involved)
- Low incidence (Less than 1.5% of the area involved)
- High susceptibility/moderate incidence
- High susceptibility/low incidence
- Moderate susceptibility/low incidence

The USGS provides the following supporting narrative for the landslide hazard classifications:

> *"Susceptibility not indicated where same or lower than incidence. Susceptibility to land sliding was defined as the probably degree of response of [the areal] rocks and soils to natural or artificial cutting or loading of slopes, or to anomalously high precipitation. High, moderate, and low susceptibility are delimited by the same percentages used in classifying the incidence of land sliding. Some generalization was necessary at this scale, and several small areas of high incidence and susceptibility were slightly exaggerated."*

USGS landslide susceptibility mapping for Ulster County is presented in Figure 3a.20, which shows that the areas with the highest susceptibility to landslides are located in a narrow band adjacent to the Hudson River (high susceptibility), and in the northern part of the County (high susceptibility/low incidence). Of the six categories of incidence and susceptibility listed above, only four have been identified in Ulster County.

The severity of a landslide depends in large part on the degree of development in the area in which it occurs and the geographic area of slide itself. Generally speaking, landslides often result in devastating consequences, but in very localized areas. A landslide occurring in an undeveloped are would be less severe because lives and property would not be affected; the only impacts would be to land, vegetation, and possibly some wildlife. On the contrary, a landslide occurring in a developed area could have devastating affects, ranging from structure and infrastructure damage to injury and/or loss of life. Structures or infrastructure built on susceptible land would likely collapse as their footings slide downhill, while those below the land failure would likely be crushed. Landslides in the area of roadways could have the potential to fall and damage or destroy vehicles, and force other drivers to have accidents.

The GIS data used to generate Figure 3a.22 was used to estimate the extent of land areas vulnerable to landslides and the value of improved property within those areas in each municipality, as presented in Tables 3a.30 and 3a.31.

Figure 3a.22: Landslide Susceptibility in Ulster County

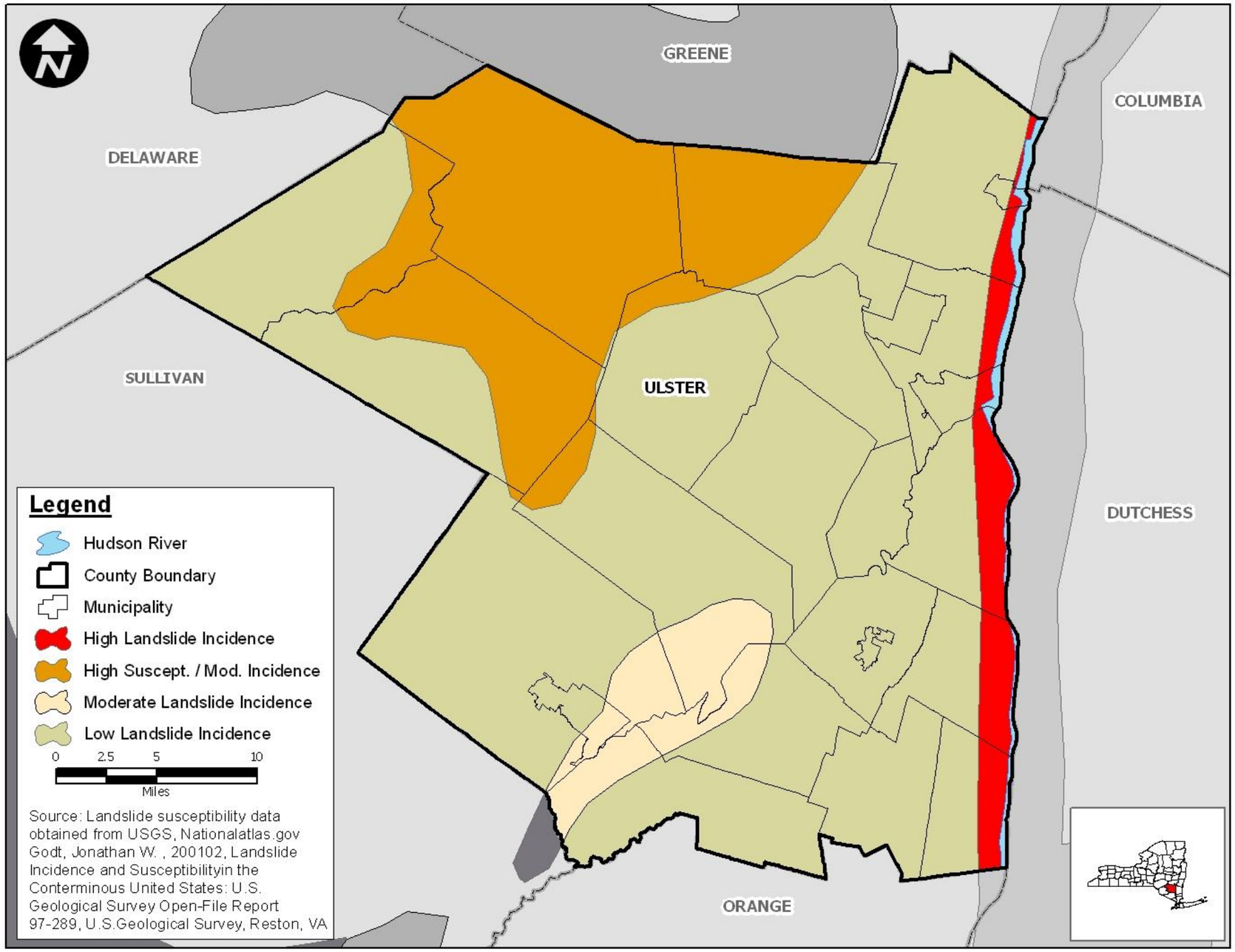


Table 3a.30
Areas of Landslide Susceptibility by Municipality

Municipality	Total Acres	High Susceptibility		High Susceptibility – Moderate Incidence		Moderate Susceptibility		Low Susceptibility	
		Acres	%	Acres	%	Acres	%	Acres	%
Denning	64,658	0	0.0%	36,584	56.6%	0	0.0%	28,075	43.4%
Ellenville Village	5,350	0	0.0%	0	0.0%	2,047	38.3%	3,303	61.7%
Esopus	23,524	7,246	30.8%	0	0.0%	0	0.0%	16,278	69.2%
Gardiner	27,495	0	0.0%	0	0.0%	6,865	25.0%	20,630	75.0%
Hardenburgh	51,004	0	0.0%	10,412	20.4%	0	0.0%	40,592	79.6%
Hurley	21,993	0	0.0%	0	0.0%	0	0.0%	21,993	100.0%
Kingston City	4,681	0	0.0%	0	0.0%	0	0.0%	4,681	100.0%
Kingston Town	4,285	887	20.7%	0	0.0%	0	0.0%	3,397	79.3%
Lloyd	19,694	6,215	31.6%	0	0.0%	0	0.0%	13,479	68.4%
Marbletown	34,814	0	0.0%	0	0.0%	0	0.0%	34,814	100.0%
Marlborough	15,472	4,695	30.3%	0	0.0%	0	0.0%	10,777	69.7%
New Paltz	19,741	0	0.0%	0	0.0%	0	0.0%	19,741	100.0%
New Paltz Village	1,002	0	0.0%	0	0.0%	0	0.0%	1,002	100.0%
Olive	41,492	0	0.0%	3,903	9.4%	0	0.0%	37,590	90.6%
Plattekill	22,039	0	0.0%	0	0.0%	0	0.0%	22,039	100.0%
Rochester	56,085	0	0.0%	4,429	7.9%	11,625	20.7%	40,032	71.4%
Rosendale	11,972	0	0.0%	0	0.0%	0	0.0%	11,972	100.0%
Saugerties	38,731	2,801	7.2%	0	0.0%	0	0.0%	35,930	92.8%
Saugerties Village	1,050	311	29.7%	0	0.0%	0	0.0%	739	70.3%
Shandaken	78,924	0	0.0%	78,700	99.7%	0	0.0%	225	0.3%
Shawangunk	35,306	0	0.0%	0	0.0%	7,263	20.6%	28,044	79.4%
Ulster	16,159	2,667	16.5%	0	0.0%	0	0.0%	13,493	83.5%
Wawarsing	79,654	0	0.0%	221	0.3%	8,321	10.4%	71,111	89.3%
Woodstock	42,809	0	0.0%	29,164	68.1%	0	0.0%	13,646	31.9%
County Totals	**717,936**	**24,823**	**3.5%**	**163,411**	22.8%	**36,122**	5.0%	**493,581**	**68.7%**

*Note: no areas of High susceptibility/low incidence or Moderate susceptibility/low incidence have been identified in Ulster County.

In terms of the land area covered by high landslide susceptibility zones, Table 3a.LS1 shows clearly that the municipalities most at risk from landslides are the Towns of Lloyd, Marlborough and Esopus, and the Village of Saugerties. The Town of Shandaken lies almost entirely within an area at of high landslide susceptibility but moderate incidence.

The GIS analysis indicates that the Towns of Lloyd, Esopus and Marlborough are most vulnerable to losses and damage resulting from landslides, since in all three cases more than 50% of the Townôs improved property values lie within the high landslide susceptibility area adjacent to the Hudson River.

Table 3a.31
Improved Property Values in Landslide Susceptibility Areas by Municipality

Municipality	Total Improved Value	High Susceptibility		High Susceptibility – Moderate Incidence		Moderate Susceptibility		Low Susceptibility	
		Value	%	Value	%	Value	%	Value	%
Denning	$51,126,978	$0	0.0%	$19,789,690	38.7%	$0	0.0%	$31,337,287	61.3%
Ellenville Village	$47,291,413	$0	0.0%	$0	0.0%	$0	0.0%	$47,291,413	100.0%
Esopus	$823,898,937	$472,141,638	57.3%	$0	0.0%	$0	0.0%	$351,757,298	42.7%
Gardiner	$612,092,899	$0	0.0%	$0	0.0%	$38,152,748	6.2%	$573,940,150	93.8%
Hardenburgh	$50,791,094	$0	0.0%	$2,226,571	4.4%	$0	0.0%	$48,564,522	95.6%
Hurley	$639,336,069	$0	0.0%	$0	0.0%	$0	0.0%	$639,336,069	100.0%
Kingston City	$1,922,939,212	$152,605,735	7.9%	$0	0.0%	$0	0.0%	$1,770,333,477	92.1%
Kingston Town	$57,541,463	$0	0.0%	$0	0.0%	$0	0.0%	$57,541,463	100.0%
Lloyd	$856,612,633	$553,045,623	64.6%	$0	0.0%	$0	0.0%	$303,567,010	35.4%
Marbletown	$993,766,725	$0	0.0%	$0	0.0%	$0	0.0%	$993,766,725	100.0%
Marlborough	$722,416,282	$378,987,157	52.5%	$0	0.0%	$0	0.0%	$343,429,125	47.5%
New Paltz	$578,833,042	$0	0.0%	$0	0.0%	$0	0.0%	$578,833,042	100.0%
New Paltz Village	$238,672,524	$0	0.0%	$0	0.0%	$0	0.0%	$238,672,524	100.0%
Olive	$377,496,142	$0	0.0%	$45,711,794	12.1%	$0	0.0%	$331,784,347	87.9%
Plattekill	$556,675,301	$0	0.0%	$0	0.0%	$0	0.0%	$556,675,301	100.0%
Rochester	$564,685,441	$0	0.0%	$2,361,565	0.4%	$63,170,533	11.2%	$499,153,343	88.4%
Rosendale	$469,479,238	$0	0.0%	$0	0.0%	$0	0.0%	$469,479,238	100.0%
Saugerties	$1,217,383,571	$213,776,905	17.6%	$0	0.0%	$0	0.0%	$1,003,606,665	82.4%
Saugerties Village	$275,716,843	$56,918,457	20.6%	$0	0.0%	$0	0.0%	$218,798,386	79.4%
Shandaken	$402,760,909	$0	0.0%	$402,544,791	99.9%	$0	0.0%	$216,118	0.1%
Shawangunk	$1,093,099,620	$0	0.0%	$0	0.0%	$138,115,217	12.6%	$954,984,403	87.4%
Ulster	$1,189,900,886	$82,893,085	7.0%	$0	0.0%	$0	0.0%	$1,107,007,800	93.0%
Wawarsing	$391,482,171	$0	0.0%	$291,430	0.1%	$9,522,897	2.4%	$381,667,845	97.5%
Woodstock	$1,250,466,647	$0	0.0%	$542,230,648	43.4%		0.0%	$708,235,999	56.6%
County Totals	*$15,384,466,039*	*$1,910,368,602*	*12.4%*	*$1,015,156,490*	*6.6%*	*$248,961,394*	*1.6%*	*$12,209,979,553*	*79.4%*

Previous Occurrences - Landslides

The New York State Geological Survey records a total of 329 significant landslide events that have occurred in New York State between 1837 and 2007. Only one of these events is recorded as having occurred in Ulster County: On December 16 1921 two workers were killed when a wall in a clay bank failed in the village of Glasco, within the Town of Saugerties. In addition to the NYGS information, local sources report a number of flood-related landslide incidents in the Town of Lloyd involving embankment failures adjacent to roads and streams between 2001 and 2007.

Probability of Occurrence – Landslides

While it is certainly possible for landslides to occur within Ulster County, available data regarding historic occurrences does not permit any estimation of the frequency of future occurrences. While the overall probability of future occurrence is assumed to be low for most of the County, there are significant portions (including developed areas) of the Towns of Saugerties, Ulster, Esopus, Lloyd and Marlborough, the Village of Saugerties, and the City of Kingston located within high landslide risk areas.

Wildfires

Description – Wildfires

A wildfire is an uncontrolled fire burning in an area of vegetative fuels such as grasslands, brush, or woodlands. Wildfires can occur in areas essentially void of development, or in areas where development intermingles with these natural areas (known as the ñurban-wildland interfaceò). Many wildfires occur in locations that abound in dense forests, grasslands and shrubs. Heavier fuels with high continuity, steep slopes, high temperatures, low humidity, low rainfall, and high winds all work to increase risk.

Wildfires can occur at any time of the year, but will usually occur during warmer and dryer months. Wildfires are most commonly caused by people (i.e., arson, debris burns, and carelessness). Lightning is the next most common cause of wildfires. As reported by the Wildland Fire Assessment System (WFAS) wildfires resulting from a lightning strike largely depend on the duration of the current and the kind of fuel the lightning hits. Spread of the wildfire after ignition usually depends primarily on fuel moisture.

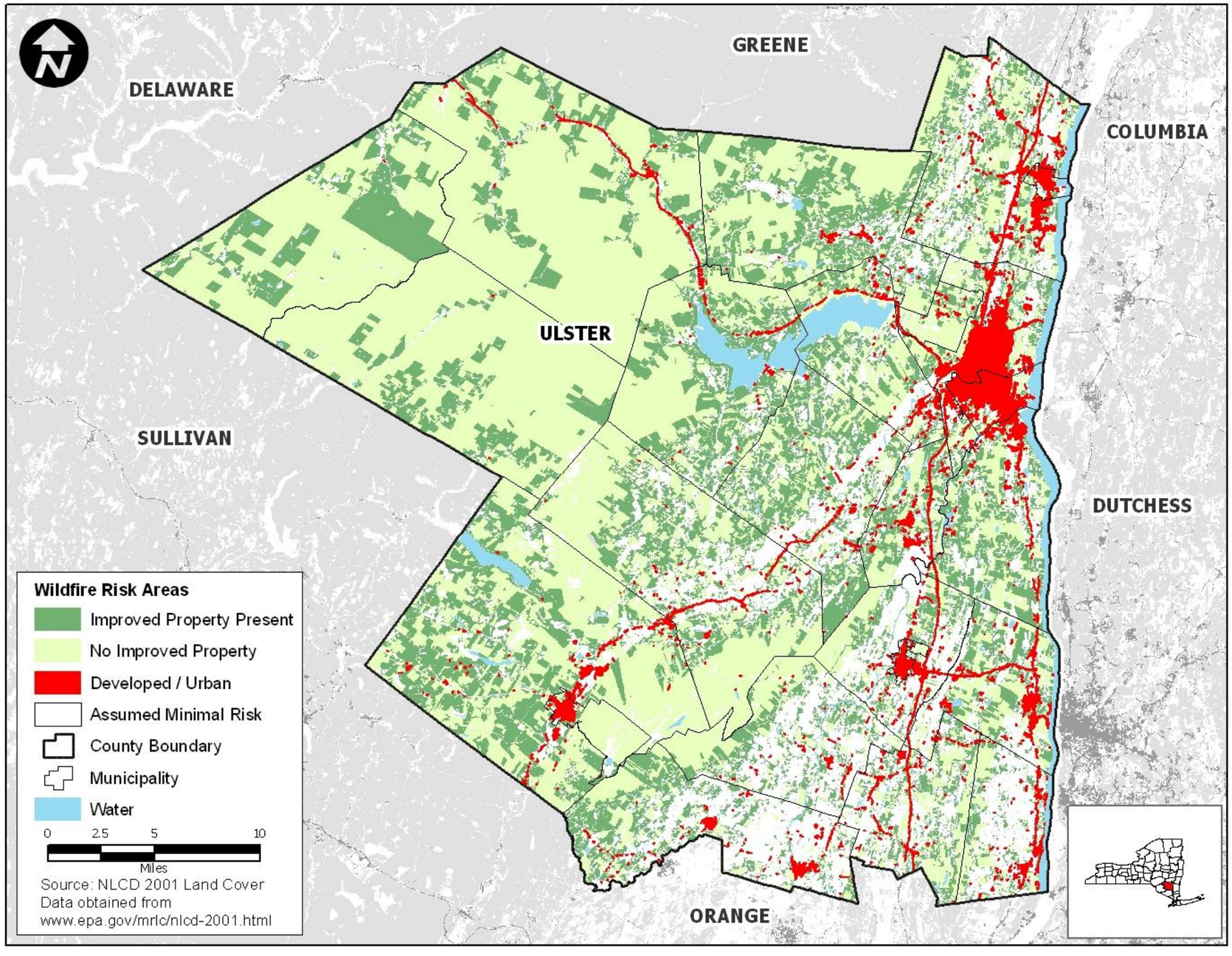
Location and Extent – Wildfires

Areas that are typically considered to be safe from wildfires include highly urbanized, developed areas that are not contiguous with vast areas of wild lands. Areas typically considered to be prone to wildfires include large tracts of wild lands containing heavier fuels with high continuity, at steeper slopes.

Wildfires are a significant hazard in Ulster County, particularly in the forested areas in the south and west of the County, where past wildfires have destroyed thousands of acres of forest with property loss running into the thousands of dollars. Many of the areas at from wildfires are also popular with hikers and campers. Several major transportation routes such as the New York State Thruway and Routes 44 and 28, leaving them vulnerable to closure during forest fire due to smoke conditions. Areas in Ulster County where the magnitude and severity of the hazard are the greatest tend to exhibit the lowest population densities in the County; as a result, exposure of people living and working in the highest hazard areas is often relatively low.

Figure 3a.23 shows the areas of Ulster County that are considered to be at risk from wildfire colored green and urban/developed areas colored red. At-risk areas include deciduous, evergreen, and mixed forest, shrub land, and grassland. It should be noted that the vast majority of the wildfire risk areas consist of deciduous woodland (approximately 50% of the County land area and 70% of the wildfire risk area) while shrub and grassland areas are not present in significant quantities (together they make up less than 1% of the wildfire risk area). Cultivated agricultural land and pastureland are not considered to be at significant risk from wildfire for the purposes of this plan and its component risk assessment.

Figure 3a.23: Wildfire Risk Areas in Ulster County



The wildfire risk areas in Figure 3a.23 have been color-coded as follows:

- Dark green: those areas in which the component parcels include some improved value; i.e. structures present.
- Light green: those areas for which no improved value and hence no structures are associated with the component parcels.

This allows a general determination to be made regarding those areas at risk from wildfire in which there is a higher likelihood that such fires could also pose a threat to lives and structures, in addition to developed areas (colored red) which have a direct interface with the wildfire risk areas.

The wildfire risk for the individual municipalities within Ulster County has been quantified by measuring the length of the urban-wildland interface and the total value of improved property located in hazard areas within the county, and these estimations are presented in Table 3a.32. The urban-wildland interface measurements were estimated incorporating a 200 ft buffer extending from the urban/developed areas into the wildfire risk areas, to account for the likelihood that structures in the urban area are at risk of combustion before a wildfire reaches the exact interface.

It should be noted that almost three quarters of the County lies within in a wildfire hazard zone. Although the Towns of Denning, Shandaken, and Hardenburgh are almost entirely inside wildfire hazard zones, the Towns of Saugerties, Ulster, Lloyd and Wawarsing have the greatest actual lengths of urban-wildland interface. The Towns of Denning, Hardenburgh and Woodstock have the highest percentages of total improved property within the hazard zone. The town of Woodstock has the greatest dollar value of improved property within wildfire hazard zones, followed at some distance by the Towns of Shandaken, Marbletown and Olive.

Previous Occurrences – Wildfires

On April 17, 2008 a fire began off Route 44/55 in the town of Rochester on lands managed by NYS Parks & Recreation. Before the fire was officially declared out on April 26 it had consumed 3,100 acres of land in both Rochester and Wawarsing. To extinguish this fire it took the combined resources of the NYS Department of Environmental Conservation, NYS Emergency Management Office, NYS Office of Fire Prevention & Control, NYS Parks & Recreation, NYS Division of Military & Naval Affairs, New York State Police, fire departments from Ulster, Sullivan, Orange, Dutchess, Putnam and Westchester counties and other entities too numerous to mention. In addition to ground crews, helicopters and bulldozers were instrumental in building the fireline and extinguishing the full canopy fire. An urban area interface in a portion of Wawarsing required extensive resources to protect. Homes were protected by literally placing a fire truck in every driveway. Ultimately there was only one serious injury to a first responder, and no homes were damaged. New York State officials consider it to be the largest forest fire in the State since 1995.

A fire in the Cherrytown area outside of the Town of Rochester in Ulster County which started on April 30, 2006 destroyed more than 900 acres of forest in the Catskill Park. The New York State Plan described it as the largest wildfire in the state since 2002.

Table 3a.32
Wildfire Risk in Ulster County

Municipality	Urban-Wildland Interface (feet)	Wildfire Risk Area – No Improved Property (Acres)	Wildfire Risk Area – With Improved Property (Acres)	Total Municipal Area (Acres)	Total Area Within Wildfire Risk Zones %	Total Value of Improvements in Municipal Areas	Improved Value Within Wildfire Risk Zones	Improved Value Within Wildfire Risk Zones %
Denning	4,800	53,207	10,192	64,652	98.1%	$51,126,978	$15,621,285	30.6%
Ellenville Village	43,000	3,561	387	5,351	73.8%	$47,291,413	$940,676	2.0%
Esopus	311,300	6,941	8,555	23,521	65.9%	$823,898,937	$40,207,994	4.9%
Gardiner	135,400	8,115	6,173	27,493	52.0%	$612,092,899	$23,288,223	3.8%
Hardenburgh	2,900	33,998	15,090	51,002	96.2%	$50,791,094	$10,775,824	21.2%
Hurley	265,700	7,041	5,458	21,985	56.9%	$639,336,069	$51,246,762	8.0%
Kingston City	72,800	484	200	4,284	16.0%	$1,922,939,212	$980,551	0.1%
Kingston Town	132,400	2,791	836	4,681	77.5%	$57,541,463	$4,803,190	8.3%
Lloyd	344,800	5,587	5,040	19,690	54.0%	$856,612,633	$25,348,546	3.0%
Marbletown	193,500	7,897	14,249	34,754	63.7%	$993,766,725	$68,381,675	6.9%
Marlborough	254,000	2,881	2,430	15,406	34.5%	$722,416,282	$7,663,749	1.1%
New Paltz	304,200	4,735	3,992	19,743	44.2%	$578,833,042	$15,753,363	2.7%
New Paltz Village	35,500	223	25	1,002	24.8%	$238,672,524	$203,340	0.1%
Olive	134,200	18,033	13,861	41,470	76.9%	$377,496,142	$65,328,453	17.3%
Plattekill	316,700	5,270	5,040	22,026	46.8%	$556,675,301	$20,677,391	3.7%
Rochester	237,200	27,115	13,889	56,085	73.1%	$564,685,441	$58,385,721	10.3%
Rosendale	259,000	3,800	3,684	11,972	62.5%	$469,479,238	$21,461,671	4.6%
Saugerties	563,300	11,625	9,972	38,716	55.8%	$1,217,383,571	$52,189,460	4.3%
Saugerties Village	46,200	132	102	1,040	22.5%	$275,716,843	$162,529	0.1%
Shandaken	241,000	62,782	13,233	78,947	96.3%	$402,760,909	$69,293,686	17.2%
Shawangunk	279,800	6,530	9,623	35,311	45.7%	$1,093,099,620	$42,732,568	3.9%
Ulster	401,900	4,354	2,660	16,165	43.4%	$1,189,900,886	$24,157,633	2.0%
Wawarsing	344,300	39,233	26,305	79,186	82.8%	$391,482,171	$39,685,869	10.1%
Woodstock	91,800	21,515	15,426	43,095	85.7%	$1,250,466,647	$250,585,937	20.0%
County Totals	*5,015,700*	*337,852*	*186,423*	*717,577*	*73.1%*	*$15,384,466,039*	*$909,876,094*	*5.9%*

Local sources also report that the area over and around Illinois Mountain in the Town of Lloyd is subject to periodic brush and forest fires. The New York State Plan records an additional 12 significant wildfire events in the state since 1903, notably in the Adirondacks Mountains.

Probability of Occurrence - Wildfires

Wildfire events will remain a frequent occurrence in Ulster County, and the probability of future occurrences in the County is certain. The likelihood of increased future development (particularly residential) can only result in an increase in the length of the urban-wildland interface, an increase in the improved value of property within wildfire hazard zones, and a greater risk of property damage and danger to the public in future years. However, most wildfire events in the County are typically contained and extinguished rather quickly and those events causing major property damage or life/safety threats are much less likely to occur.

A Distinction Between "Hazards" and "Events"

This section of the plan speaks to hurricanes and tropical storms, tornadoes, and winter storms/ice storms. These are severe weather events (not hazards themselves). Severe weather events have specific hazards associated with them. The unique hazards associated with the severe weather events discussed in this section are addressed specifically elsewhere in the plan; they are summarized briefly here. While HAZARDS are fully identified and profiled, with vulnerability assessments completed, EVENTS are merely summarized here for information only. EVENTS are not fully profiled and a vulnerability assessment has not been completed. The reader is, however, directed to the HAZARDS associated with these EVENTS (for profile/vulnerability assessment/etc.).

SECTION 3b - RISK ASSESSMENT: IDENTIFICATION AND CHARACTERIZATION OF ASSETS

Overview

An inventory of geo-referenced assets in Ulster County has been created in order to identify and characterize property and persons potentially at risk from the identified hazards. Understanding the type and number of hazards that exist in relation to known hazard areas is an important step in the process of formulating the risk assessment and quantifying the vulnerability of the municipalities that make up Ulster County. For this plan, six key categories of assets have been mapped and analyzed using GIS data provided by Ulster County, with some additional data drawn from other public sources:

1. Improved property: This category includes all developed properties according to parcel data provided by Ulster County Department of Information Services. Impacts to improved properties are presented as a percentage of each communityôs total assessed value of improvements that may be exposed to the identified hazards.
2. Emergency facilities: This category covers all facilities dedicated to the management and response of emergency or disaster situations, and includes emergency operations centers (EOCs), fire stations, police stations, ambulance stations, and hospitals. Impacts to these assets are presented by tabulating the number of each type of facility present in areas that may be exposed to the identified hazards.
3. Critical infrastructure and utilities: This category covers facilities and structures vital to the maintenance of basic living conditions in the county, and includes power generating stations, potable water treatment plants, wastewater treatment plants, significant public works buildings, airports, and ferry ports. Impacts to these assets are presented by tabulating the number of each type of facility present in areas that may be exposed to the identified hazards.
4. Other key facilities: This category covers facilities which may be capable of providing refuge and limited medical care and hence may be utilized as emergency shelters, and those which routinely house more vulnerable sectors of the county population, making them potentially especially vulnerable to identified hazards. Included in this category are schools and senior care facilities and impacts to these assets are presented by tabulating the number of each type of facility present in areas that may be exposed to the identified hazards.
5. Historic and cultural resources: This category includes those historic structures, landmarks and sites that are included in the New York State or National Register of Historic Places. Impacts to these assets are presented by tabulating the number of each type of facility present in areas exposed to each identified hazard. Any other structure, landmark or asset identified during the course of general research for this section that has been judged to be potentially of local historical or cultural significance has also been included in this category.
6. Population: This category covers the number of people residing in Ulster County as measured by the 2000 U.S. Census. Impacts to population are presented as a percentage of each municipalityôs total population exposed to the identified hazards, with the exposed population collated by census block.

There are no unincorporated areas within Ulster County; the 24 municipalities covered by this plan mentioned in this plan and all tables cover the entire county.

Improved Property

Improved property covers all development in the form of structures for residential, commercial, industrial, municipal, recreational, and utility uses. The total value of property improvements in the 24 Ulster County jurisdictions has been estimated at just over $16.5 billion, based on assessed values updated to 2007 using state equalization rates supplied for each jurisdiction by Ulster County Department of Planning Services. Table 3b.1 summarizes the improved properties in each jurisdiction, in terms of total parcels, percentage of improved parcels, and the total value of improvements in each, based on GIS data provided by the Ulster County Department of Information Services.

Table 3b.1
Improved Property by Jurisdiction

Jurisdiction	Total Number of Parcels	Number of Improved Parcels	Percentage of Improved Parcels	Total Value of Improvements*
Denning, Town of	1,188	503	42.34%	$51,126,978
Ellenville, Village of	1,527	1,287	84.28%	$47,291,413
Esopus, Town of	4,328	3,153	72.85%	$823,898,937
Gardiner, Town of	2,847	2,193	77.03%	$612,092,899
Hardenburgh, Town of	775	336	43.35%	$50,791,094
Hurley, Town of	3,551	2,831	79.72%	$639,336,069
Kingston, City of	8,490	7,196	84.76%	$1,922,939,212
Kingston, Town of	648	380	58.64%	$57,541,463
Lloyd, Town of	4,204	3,359	79.90%	$856,612,633
Marbletown, Town of	3,956	2,822	71.33%	$993,766,725
Marlborough, Town of	3,698	2,854	77.18%	$722,416,282
New Paltz, Town of	2,983	2,467	82.70%	$578,833,042
New Paltz, Village of	939	808	86.05%	$238,672,524
Olive, Town of	3,111	2,290	73.61%	$377,496,142
Plattekill, Town of	3,465	2,617	75.53%	$556,675,301
Rochester, Town of	4,799	3,068	63.93%	$564,685,441
Rosendale, Town of	2,828	2,246	79.42%	$469,479,238
Saugerties, Town of	7,976	5,868	73.57%	$1,217,383,571
Saugerties, Village of	1,557	1,254	80.54%	$275,716,843
Shandaken, Town of	3,575	2,262	63.27%	$402,760,909
Shawangunk, Town of	4,553	3,759	82.56%	$1,093,099,620
Ulster, Town of	5,374	4,214	78.41%	$1,189,900,886
Wawarsing, Town of	4,801	3,220	67.07%	$391,482,171
Woodstock, Town of	4,765	3,628	76.14%	$1,250,466,647
Ulster County Total	*85,938*	*64,615*	*73.09%*	*$15,384,466,039*

*Not including public buildings and other tax-exempt structures, and reservoirs.

Detailed tables presenting the number of parcels wholly or partially within delineated hazard areas (and their associated improved property values) broken down by land use and development type are included in Appendix A.

Emergency Facilities

Emergency facilities were included in the asset identification and characterization to determine jurisdictions with particularly high numbers of key facilities located in hazard areas, which may guide the focus of individual mitigation activities in the mitigation goals and strategy stage of the plan. Emergency facilities by jurisdiction are presented in Table 3b.2. According to County GIS records and databases embedded in HAZUS-MH, there are a total of 140 geo-referenced emergency facilities in Ulster County. The City of Kingston has more emergency facilities than any other jurisdiction (14), while the Towns of Esopus, Shandaken, and Ulster each contain nine such facilities. Of all the participating jurisdictions, only the Town of Hardenburgh does not contain any identified emergency facilities.

Table 3b.2
Emergency Facilities by Jurisdiction

Jurisdiction	Fire Stations	Police Stations	Ambulance Stations	Hospitals
Denning, Town of	1	0	0	0
Ellenville, Village of	3	1	1	1
Esopus, Town of	7	1	1	0
Gardiner, Town of	2	0	1	0
Hardenburgh, Town of	0	0	0	0
Hurley, Town of	4	0	3	0
Kingston, City of	9	2	1	2
Kingston, Town of	1	0	0	0
Lloyd, Town of	2	2	1	0
Marbletown, Town of	6	0	1	0
Marlborough, Town of	2	1	1	0
New Paltz, Town of	1	0	1	0
New Paltz, Village of	1	2	0	0
Olive, Town of	5	1	2	0
Plattekill, Town of	4	1	2	0
Rochester, Town of	3	1	1	0
Rosendale, Town of	5	1	1	0
Saugerties, Town of	8	0	0	0
Saugerties, Village of	2	2	1	0
Shandaken, Town of	5	2	2	0
Shawangunk, Town of	3	2	2	0
Ulster, Town of	6	2	1	0
Wawarsing, Town of	5	1	0	1
Woodstock, Town of	4	1	1	0
Total	*89*	*23*	*24*	*4*

Note that some facilities in Table 3b.2 may be located in shared structures: for example, the ambulance station in the Town of Gardiner is located in one of the listed fire stations. While these facilities have been listed separately in Table 3b.2, subsequent tables/appendices presenting critical facilities in hazard areas consider shared structures as a single facility.

Critical Infrastructure and Utilities

Critical infrastructure and utilities were included in the asset identification and characterization to determine jurisdictions with particularly high numbers of key facilities located in hazard areas, which may guide the focus of individual mitigation activities in the mitigation goals and strategy stage of the plan. Critical infrastructure and utilities by jurisdiction are presented in Table 3b.3. According to County GIS records, information from New York State Department of Environmental Conservation, and databases embedded in HAZUS-MH, there are a total of 151 identified critical infrastructure and utility facilities in Ulster County. According to the best readily available data, no power generating stations, ferry ports or passenger rail stations are located in Ulster County.

Table 3b.3
Critical Infrastructure and Utilities by Jurisdiction

Jurisdiction	Potable Water Treatment Facilities	Wastewater Treatment Facilities	Public Works Facilities	Airports	Waste Transfer Stations
Denning, Town of	3	0	1	0	0
Ellenville, Village of	1	1	0	0	0
Esopus, Town of	7	0	0	0	0
Gardiner, Town of	5	1	0	0	0
Hardenburgh, Town of	0	0	0	0	0
Hurley, Town of	9	0	1	0	0
Kingston, City of	1	1	1	0	0
Kingston, Town of	1	0	1	0	0
Lloyd, Town of	6	2	1	0	0
Marbletown, Town of	2	0	0	0	0
Marlborough, Town of	1	2	0	0	0
New Paltz, Town of	4	1	1	0	1
New Paltz, Village of	0	1	0	0	0
Olive, Town of	2	0	1	0	0
Plattekill, Town of	11	0	1	0	0
Rochester, Town of	7	0	1	0	0
Rosendale, Town of	7	1	1	0	0
Saugerties, Town of	1	2	1	0	0
Saugerties, Village of	8	1	0	0	0
Shandaken, Town of	3	2	1	0	0
Shawangunk, Town of	3	2	1	1	0
Ulster, Town of	11	2	1	1	1
Wawarsing, Town of	12	2	1	1	0
Woodstock, Town of	3	2	0	0	0
Total	*108*	*23*	*15*	*3*	*2*

Potable water treatment facilities include any community water supply facility serving 15 or more properties and identified by the County as a treatment plant or as some other supply facility which incorporates at least one treatment process. Many of the facilities listed in the table serve small communities or groups of properties. For example, 28 are specifically identified as serving trailer/mobile home parks.

Public works facilities include buildings for the storage and maintenance of vehicles and other equipment used to respond to emergency situations, apart from police, fire and ambulance stations, such as municipal highway departments.

ñAirportsò has been taken to mean substantial airfields with paved runways operating scheduled services or suitable for the operation of fixed-wing aircraft for the transporting of emergency response personnel and equipment.

The waste transfer stations listed in the table are the main facilities in Ulster County for the disposal of bulk (more than two cubic yards) solid waste by residents and commercial entities. In addition to these two principal facilities, there are 20 smaller municipal recycling centers in Ulster County.

Other Key Facilities

Other key facilities were included in the asset identification and characterization to determine jurisdictions with particularly high numbers of such facilities located in hazard areas, which may guide the focus of individual mitigation activities in the mitigation goals and strategy stage of the plan. Schools and senior care facilities by jurisdiction are presented in Table 3b.4.

Table 3b.4
Other Key Facilities by Jurisdiction

Jurisdiction	Schools	Senior Care Facilities
Denning, Town of	0	0
Ellenville, Village of	1	0
Esopus, Town of	6	0
Gardiner, Town of	0	0
Hardenburgh, Town of	0	0
Hurley, Town of	2	0
Kingston, City of	15	3
Kingston, Town of	0	0
Lloyd, Town of	5	4
Marbletown, Town of	3	1
Marlborough, Town of	5	0
New Paltz, Town of	3	1
New Paltz, Village of	4	0
Olive, Town of	2	0
Plattekill, Town of	1	0
Rochester, Town of	4	0
Rosendale, Town of	3	4
Saugerties, Town of	6	0
Saugerties, Village of	3	0
Shandaken, Town of	1	0
Shawangunk, Town of	5	0
Ulster, Town of	6	2
Wawarsing, Town of	4	1
Woodstock, Town of	3	0
Total	*82*	*16*

According to County GIS records and databases embedded in HAZUS-MH, there are a total of 98 other such geo-referenced key facilities in Ulster County.

The exposure of identified emergency services, critical facilities, and infrastructure assets to hazards with discrete delineable impact areas is presented in Appendix B.

Historical and Cultural Resources

Historical and cultural resources were included in the asset identification and characterization to determine jurisdictions with particularly high numbers of culturally or historically valuable assets located in hazard areas, which may influence the focus of individual mitigation activities in the mitigation goals and strategy stage of the plan. At the State and Federal levels, official listings of historic resources are established and maintained to foster the preservation of particular cultural resources. The State and National Registers of Historic Places are the official listings of buildings, structures, districts, objects, and sites significant in the history, architecture, archaeology, engineering, and culture of the State and the nation. Cultural and historic resources are defined as follows:

Cultural Resources: As defined by the National Park Service in its "Cultural Resources Management Guidelines," cultural resources are: ñ*Those tangible and intangible aspects of cultural systems, both living and dead, that are valued by or representative of a given culture or that contain information about a culture . . . and [they] include but are not limited to sites, structures, districts, objects and artifacts, and historic documents associated with or representative of peoples, cultures, and human activities and events, either in the present or in the past. Cultural resources also can include the primary written and verbal data for interpreting and understanding those tangible resources.*ò

Historic Resources: Historic resources are any cultural resource dating from the period between the onset of written records (which on Long Island is typically placed around the time of first European contact in the sixteenth century) and 50 years ago.

In the State of New York, the State Historic Preservation Office (SHPO) ï within the New York State Office of Parks, Recreation and Historic Preservation ï helps communities identify, evaluate, preserve, and revitalize their historic and cultural resources. New York SHPO maintains GIS databases of all historic and cultural assets listed on the State and National Registers. To identify the resources of this nature located in Ulster County, GIS files were downloaded from the New York SHPO website (http://www.nysparks.state.ny.us/shpo/resources/index.htm). This data includes only those cultural and historic properties and sites that are included in the New York State or National Registers of Historic Places, or that have been determined Eligible for inclusion through federal or state processes as administered by the New York SHPO. Inclusion in this data set does not preclude the existence of other historic properties or sites not within this category or as yet unidentified.

Historical and cultural assets located in Ulster County are presented in Table 3b.5. According to New York SHPO and National Register of Historic Places data there are more than 160 such assets

registered in Ulster County. According to the available records, State and Federally listed historical assets are located in all of the 23 municipalities covered by this hazard mitigation plan. In addition to assets identified via the State and Federal registers of historic places, Table 3b.5 also includes other significant cultural and historical assets such as museums of local history, which have been identified via general internet research. The exposure of identified historical and cultural resources to hazards with discrete delineable impact areas is presented in Appendix C.

Table 3b.5
Historic and Cultural Resources by Jurisdiction

Jurisdiction	Asset Name/Description	Location
Denning, Town of	Red Hill Fire Observation Tower	Red Hill
Ellenville	Hunt, George and John R., Memorial Building	2 Liberty St., corner of Liberty and Canal Streets
Esopus, Town of	Perrine's Bridge	Over Wallkill River, immediately east of I-87
Esopus, Town of	Klyne Esopus Reformed Dutch Church	764 US 9W
Esopus, Town of	Payne, Col. Oliver Hazard, Museum	US 9W
Esopus, Town of	Esopus Meadows Lighthouse	Spans Hudson River
Esopus, Town of	Poppletown Farmhouse	Jct. of Old Post Rd. and Swarte Kill Rd.
Esopus, Town of	Burroughs, John, Riverby Study	Between NY 9W and the Hudson River
Esopus, Town of	Burroughs, John, Cabin	W of West Park
Esopus, Town of	Holy Cross Monastery	US 9W, E side, West Park
Gardiner, Town of	Tuthilltown Gristmill	Albany Post Rd.
Gardiner, Town of	Trapps Mountain Hamlet Historic District	Trapps Road off NY 44/55
Gardiner, Town of	Jenkins-Du Bois Farm and Mill Site Historic district	Jenkinstown Road
Gardiner, Town of	LeFevre, Abraham and Maria, House	56 Forest Glen Road
Gardiner, Town of	Du Bois, Hendrikus, House	600 Albany Post Rd.
Gardiner, Town of	Guilford-Bower Farmhouse	Albany Post Road
Gardiner, Town of	Gardiner Schoolhouse	2340 US 44/NY 55
Gardiner, Town of	Locust Lawn Estate	NY 32, SE of Gardiner
Gardiner, Town of	Aldrich, Peter, Homestead	168 Decker Rd.
Gardiner, Town of	Bevier House	Bevier Rd.
Gardiner, Town of	Brykill	Bruynswick Rd.
Gardiner, Town of	Van Vleck House	Bruynswick Rd.
Gardiner, Town of	Decker, Johannes, Farm	SW of Gardiner on Red Mill Rd. and Shawangunk Kill
Hardenburgh, Town of	Beaverkill Valley Inn	Beaverkill Rd.
Hardenburgh, Town of	Balsam Lake Mountain Fire Observation Station	Balsam Lake Mountain
Hardenburgh, Town of	Grant Mills Covered Bridge	Mill Brook Road; North side; over Mill Brook
Hardenburgh, Town of	Coykendall, Samuel, Lodge	Alder Lake Road (CR 54)
Hurley, Town of	Maverick Concert Hall	Concert Road
Hurley, Town of	Hurley Historic District: Main St., Hurley Mountain Rd., and Schoonmaker Lane	Main St., Hurley Mountain Rd., and Schoonmaker Lane
Kingston, City of	Kingston-Port Ewen Suspension Bridge	U.S. 9W

Table 3b.5
Historic and Cultural Resources by Jurisdiction

Jurisdiction	Asset Name/Description	Location
Kingston, Town of	Old Dutch Church Parsonage	109 Pearl Street
Kingston, City of	Second Reformed Dutch Church of Kingston	213-223 Fair Street
Kingston, City of	Kenyon House	104 Fair Street
Kingston, City of	Boice House	110 Fair Street
Kingston, City of	Burger-Matthews House	105-107 Henry Street
Kingston, City of	Chichester House	116 Fair Street
Kingston, City of	Cordts Mansion	82-152 Lindsley Avenue
Kingston, City of	First Reformed Protestant Dutch Church	272 Wall Street
Kingston, City of	Smith, John, House	103 Albany Avenue
Kingston, City of	Albany Avenue, House at 322	322 Albany Avenue
Kingston, City of	Ten Broeck, Jacob, Stone House	169 Albany Avenue
Kingston, City of	Albany Avenue, House at 313	313 Albany Avenue
Kingston, City of	Albany Avenue, House at 184	184 Albany Avenue
Kingston, City of	Sharp Burial Ground	Albany Avenue
Kingston, City of	Kirkland Hotel	2 Main Street
Kingston, City of	K. Whittelsey Tugboat	3 North Street at Rondout Creek
Kingston, City of	Forsyth, James and Mary, House	31 Albany Avenue
Kingston, City of	Palen, Frank A., House	74-76 St. James Street
Kingston, City of	Ponckhockie Union Chapel	91 Abruyn St.
Kingston, City of	Kingston/Rondout Lighthouse	Hudson River and Rondout Creek
Kingston, City of	Kingston Stockade District	Area bounded by both sides of Clinton Ave., Main, Green, and Front Sts.
Kingston, City of	West Strand Historic District	West Strand and Broadway
Kingston, City of	Community Theatre	601 Broadway
Kingston, City of	Senate House	NW side of Clinton Ave. near jct. with N. Front St.
Kingston, City of	Rondout-West Strand Historic District	Roughly bounded by Broadway, Rondout Creek, Ravine, Hone and McEntee Sts.
Kingston, City of	Chestnut Street Historic District	Roughly bounded by W. Chestnut St., Broadway, E. Chestnut, Livingston & Stuyvesant Sts.
Kingston, City of	Kingston City Hall	408 Broadway
Kingston, City of	Kingston City Library (Carnegie Library)	399 Broadway
Kingston, City of	Catawissa Coastal Tugboat	Hudson River
Kingston, City of	Van Steenburgh, Tobias, House	93-103 Wall Street
Kingston, City of	Albany Avenue, House at 356	356 Albany Avenue
Kingston, City of	Clinton Avenue Historic District	Clinton Ave. and Fair St.
Kingston, City of	Smith, George J., House	109 Albany
Kingston, City of	Friends of Historic Kingston/Fred J. Johnston Museums	Corner, Main and Wall Streets
Kingston, City of	Hudson River Maritime Museum	50 Rondout Landing
Lloyd, Town of	Poughkeepsie Railroad Bridge	Spans Hudson River

Table 3b.5
Historic and Cultural Resources by Jurisdiction

Jurisdiction	Asset Name/Description	Location
Lloyd, Town of	Yelverton, Anthony, House	39 Maple Ave.
Marbletown, Town of	Delaware and Hudson Canal	High Falls
Marbletown, Town of	Main Street Historic District	US 209
Marbletown, Town of	Kripplebush Historic District	Kripplebush Road at intersections of Cooper and Pine Streets
Marbletown, Town of	Wyncoop, Cornelius, Stone House	Main Street (US 209)
Marbletown, Town of	High Falls Historic District	Not Provided
Marbletown, Town of	Lock Tender's House and Canal Store Ruin	40 Canal Road
Marbletown, Town of	Bevier Stone House	2687 US 209
Marbletown, Town of	Rest Plaus Historic District	Lucas Turnpike, Old Kings Road, Rest Place Road
Marbletown, Town of	Dubois-Sarles Octagon	17 South Street
Marlborough, Town of	Chapel Hill Bible Church	49 Bingham Road
Marlborough, Town of	Milton Railroad Station	41 Dock Road
New Paltz, Town of	Du Bois, Josiah, Farm	Libertyville Road
New Paltz, Town of	Lake Mohonk Mountain House Complex	NW of New Paltz, between Wallkill Valley on E and Rondout Valley on W
New Paltz, Town of	LaFevre, John A., House and School	NY 208, S of New Paltz
New Paltz, Village of	Elting Memorial Library	93 Main Street
New Paltz, Village of	Huguenot Street Historic District	Huguenot St.
New Paltz, Village of	Hasbrouck, Jean, House	Huguenot and N. Front Sts.
New Paltz, Town of	Locusts, The (Peter Eltinge House)	160 Plains Road
New Paltz, Village of	Hasbrouck, Major Jacob Jr., House	193 Huguenot Street
Olive, Town of	Ashokan-Turnwood Covered Bridge	Over Esopus Creek
Olive, Town of	Olive and Hurley Old School Baptist Church	NY 28 at Reservoir Road
Olive, Town of	Bruneul, Emile, Studio and Sculpture Garden	4008 NY 28
Plattekill, Town of	Cole--Hasbrouck Farm Historic District	NY 32, N of the jct. with US 44 and NY 55
Plattekill, Town of	Hait, Thaddeus, Farm	75 Allhusen Rd.
Plattekill, Town of	Shuart, Johannis, House	41 Alhusen Road
Rochester, Town of	Sahler, J., House	US 209
Rochester, Town of	Van Wagenen Stone House and Farm Complex	2732 Lucas Turnpike
Rochester, Town of	Winfield Corners Stone House	Winfield Road
Rochester, Town of	Sahler Stone House and Dutch Barn	Winfield Road
Rochester, Town of	Davis Stone House	Davis Stone House
Rochester, Town of	Sahler Stone House	CR 29A
Rochester, Town of	Stilwill Stone House	189 Old Kings Highway
Rochester, Town of	Stilwill-Westbrook Stone House	482 Old Kings Highway
Rochester, Town of	Jacobus Van Wagenen Stone House	2659 Lucas Turnpike
Rochester, Town of	Common School No. 10	North side of Upper Cherrytown Rd.
Rochester, Town of	Middaugh Stone House and Dutch Barn	476 Mill Road
Rochester, Town of	Westbrook, Dirck, Stone House	18 Old Whitfield Road

Table 3b.5
Historic and Cultural Resources by Jurisdiction

Jurisdiction	Asset Name/Description	Location
Rochester, Town of	Krom House	45 Upper Whitfield Road
Rochester, Town of	Krom Stone House and Dutch Barn	Airport Road
Rochester, Town of	Rider, Johannes, Stone House	7 Upper Whitfield Road
Rochester, Town of	Barley, Zachariah, Stone House	90 Upper Whitfield Road
Rochester, Town of	Hornbeck Stone House	149 Whitfield Road
Rochester, Town of	DuPuy, Ephraim, Stone House	193 Whitfield Road
Rochester, Town of	Krom, Lucas, Stone House	286 Whitfield Road
Rochester, Town of	Krom Stone House	31 Upper Whitfield Road
Rochester, Town of	Markle, Jacob F., Stone House	Not Provided
Rochester, Town of	Baker, Sebastian, Stone House	10 Doug Road
Rochester, Town of	Schoonmaker, C. K., Stone House	294 Queens Highway
Rochester, Town of	DuPuy, J, Stone House	Krum Road
Rochester, Town of	Terwilliger-Smith Farm	160 Cherrytown Road
Rochester, Town of	Schoonmaker Stone House	Samsonville Road
Rochester, Town of	Hoornbeck, Jacob, Stone House	Boice Mill Road
Rosendale, Town of	Binnewater Historic District	Sawdust Ave., Breezy Hill and Binnewater Rds.
Rosendale, Town of	All Saints' Chapel	Main St.
Rosendale, Town of	Snyder Estate Natural Cement Historic District	NY 213, 1/2 mi. W of Rosendale
Rosendale, Town of	Du Bois-Deyo House	437 Springtown Road
Saugerties, Town of	Saugerties Lighthouse	Hudson River at Esopus Creek
Saugerties, Town of	Wynkoop House	NY 32
Saugerties, Town of	Trumpbour Homestead Farm	1789 Old Kings Hwy.
Saugerties, Village of	Main-Partition Streets Historic District	Roughly bounded by Main, Partition, Market and Jane Sts.
Saugerties, Village of	Loerzel Beer Hall	213 Partition St.
Saugerties, Village of	Du Bois-Kierstede Stone House	119 Main Street
Saugerties, Village of	Trinity Episcopal Church Complex	Church Street
Saugerties, Village of	"Opus 40"	50 Fite Road
Saugerties, Town of	Savage, Augusta, House and Studio	189 Old NY 32
Shandaken, Town of	Ulster House Hotel	Main St. at Academy Rd.
Shandaken, Town of	Phoenicia Railroad Station	High Street
Shandaken, Town of	Camp Wapanachki / Zen Mountain Monastery	5312 CR 212
Shandaken, Town of	Mill Street Stone Arch Bridge	Mill Street over Alton Creek
Shandaken, Town of	Elm Street Stone Arch Bridge	Elm Street over Alton Creek
Shandaken, Town of	District School No. 14	Academy Street
Shandaken, Town of	Morton Memorial Library	Elm Street
Shandaken, Town of	Mount Tremper Fire Observation Tower	Mount Tremper
Shandaken, Town of	Town of Shandaken Historical Museum	26 Academy Street, Pine Hill
Shawangunk, Town of	Bruynswyck School No. 8	Bruynswyck Road
Shawangunk, Town of	Childs, Walstein, House	Sand Hill Rd., Wallkill Correctional Facility
Shawangunk, Town of	Reformed Dutch Church of New Hurley	N of Wallkill on NY 208
Shawangunk, Town of	Reformed Church of Shawangunk Complex	Hoagerburgh Rd.
Shawangunk, Town of	Crowell, J. B., and Son Brick Mould Mill	Lippencott Rd.

Table 3b.5 Historic and Cultural Resources by Jurisdiction		
Jurisdiction	**Asset Name/Description**	**Location**
	Complex	
Shawangunk, Town of	Du Bois, Andries, House	75 Wallkill Avenue
Shawangunk, Town of	Van Keuren, Benjamin, House Ruin	Off Bruyn Turnpike
Shawangunk, Town of	Decker, William, House	New Prospect Rd.
Shawangunk, Town of	Dill Farm	Off Goebel Rd.
Shawangunk, Town of	Jansen, Johannes, House and Dutch Barn	Decker Rd.
Shawangunk, Town of k	Jansen, Thomas, House	Jansen Rd.
Shawangunk, Town of	Miller's House at Red Mills	Red Mills Rd. and Wallkill Ave.
Shawangunk, Town of	Pearl Street Schoolhouse	Awosting and Decker Rds.
Shawangunk, Town of	Terwilliger House	Hoagerburgh Rd.
Ulster, Town of	Osterhoudt Stone House	1880 NY 32
Ulster, Town of	Ten Broeck, Benjamin, House	1019 Flatbush Road
Wawarsing, Town of	Cragsmoor Historic District	Roughly bounded by Henry, Cragsmoor and Sam's Point Roads
Wawarsing, Town of	Spring Glen Synagogue	Old US 209
Wawarsing, Town of	Ontario & Western Railroad Passenger Station	On grounds of NYS Eastern Correctional Facility
Wawarsing, Town of	Ulster Heights Synagogue	Ulster Heights Road and Beaver Dam Road
Wawarsing, Town of	O&W Railroad Station at Port Ben	Tow Path Road
Wawarsing, Town of	Hoornbeek Store Complex	Main St. between Clinton & Church Sts.
Wawarsing, Town of	Chetolah	S of Cragsmoor on Vista Maria Rd.
Woodstock, Town of	Church of the Holy Transfiguration of Christ-on-the-Mount	Meads Mountain Road
Woodstock, Town of	Vosburg Turning Mill Complex	52 Hutchin Hill Road
Woodstock, Town of	Byrdcliffe Historic District	W of Woodstock at Glasco Tpke. and Larks Nest Rd.
Woodstock, Town of	National Youth Administration Woodstock Resident Work Center	NY 212 N side, E of Woodstock

Population

According to the U.S. Census Bureau 2000 Census, the total population of Ulster County as covered by this plan was 173,619, in 65,959 households. When the 2000 population of the Village of Ellenville is included, the total population rises to 177,749. Current projections by the U.S. Census estimate that the 2006 population including *all* component municipalities is 182,742, an increase of approximately 3% over the 2000 Census. More information regarding likely future population trends can be found in the discussion of Land Use and Development Trends in a later section of the Plan report. Table 3b.6 presents the breakdown of the county population and household totals in 2000 by participating jurisdiction, while Table 3b.7 presents a summary of vulnerable sectors of the population by participating jurisdiction.

For the purposes of this plan, ñvulnerableò has been taken to mean residents of the county aged under five or over 65 years. Compared to the majority of the county population, people of these ages are assumed to require extra medical care and additional resources, particularly in the event of emergency evacuation. When viewed in combination with the data in Table 3b.4 and subsequent assessments of assets in individual hazard areas, this data may be used to highlight areas which may benefit from increased focus in the development of mitigation goals and strategies.

Table 3b.6
Population and Households by Jurisdiction (2000 Census)

Jurisdiction	Population		Households	
	Total	% of County	Total	% of County
Denning, Town of	516	0.30%	215	0.33%
Ellenville, Village of	4,130	2.32%	1,540	2.28%
Esopus, Town of	9,331	5.37%	3,439	5.21%
Gardiner, Town of	5,238	3.02%	1,997	3.03%
Hardenburgh, Town of	208	0.12%	95	0.14%
Hurley, Town of	6,564	3.78%	2,694	4.08%
Kingston, City of	23,456	13.51%	9,871	14.97%
Kingston, Town of	908	0.52%	356	0.54%
Lloyd, Town of	9,941	5.73%	3,626	5.50%
Marbletown, Town of	5,854	3.37%	2,386	3.62%
Marlborough, Town of	8,263	4.76%	3,020	4.58%
New Paltz, Town of	6,796	3.91%	2,557	3.88%
New Paltz, Village of	6,034	3.48%	1,898	2.88%
Olive, Town of	4,579	2.64%	1,869	2.83%
Plattekill, Town of	9,892	5.70%	3,649	5.53%
Rochester, Town of	7,018	4.04%	2,688	4.08%
Rosendale, Town of	6,352	3.66%	2,587	3.92%
Saugerties, Town of	14,913	8.59%	5,815	8.82%
Saugerties, Village of	4,955	2.85%	1,663	2.52%
Shandaken, Town of	3,235	1.86%	1,463	2.22%
Shawangunk, Town of	12,022	6.92%	3,433	5.20%
Ulster, Town of	12,544	7.23%	4,850	7.35%
Wawarsing, Town of	8,759	5.04%	2,842	4.31%
Woodstock, Town of	6,241	3.59%	2,946	4.47%
Total	*177,749*	*100.00%*	*67,499*	*100.00%*

Note: similar breakdown data for years later than 2000 is not yet available.

Table 3b.7
Vulnerable Sectors of the Population by Jurisdiction (2000 Census)

Jurisdiction	Total Population	Under 5 Years	% of Total	65 Years and over	% of Total	Total Vulnerable Population	% of Total
Denning, Town of	516	19	3.7%	90	17.4%	109	21.1%
Ellenville, Village of	4,130	309	7.5%	509	12.3%	818	19.8%
Esopus, Town of	9,331	582	6.2%	1,176	12.6%	1,758	18.8%
Gardiner, Town of	5,238	308	5.9%	502	9.6%	810	15.5%
Hardenburgh, Town of	208	4	1.9%	41	19.7%	45	21.6%
Hurley, Town of	6,564	294	4.5%	1,156	17.6%	1,450	22.1%
Kingston, City of	23,456	1,510	6.4%	4,003	17.1%	5,513	23.5%
Kingston, Town of	908	39	4.3%	105	11.6%	144	15.9%
Lloyd, Town of	9,941	554	5.6%	1,452	14.6%	2,006	20.2%
Marbletown, Town of	5,854	277	4.7%	770	13.2%	1,047	17.9%
Marlborough, Town of	8,263	517	6.3%	964	11.7%	1,481	17.9%
New Paltz, Town of	6,796	501	7.4%	1,164	17.1%	1,665	24.5%
New Paltz, Village of	6,034	97	1.6%	321	5.3%	418	6.9%
Olive, Town of	4,579	212	4.6%	621	13.6%	833	18.2%
Plattekill, Town of	9,892	654	6.6%	1,133	11.5%	1,787	18.1%
Rochester, Town of	7,018	416	5.9%	804	11.5%	1,220	17.4%
Rosendale, Town of	6,352	399	6.3%	718	11.3%	1,117	17.6%
Saugerties, Town of	14,913	1,094	7.3%	2,546	17.1%	3,640	24.4%
Saugerties, Village of	4,955	244	4.9%	609	12.3%	853	17.2%
Shandaken, Town of	3,235	160	4.9%	564	17.4%	724	22.4%
Shawangunk, Town of	12,022	610	5.1%	1,040	8.7%	1,650	13.7%
Ulster, Town of	12,544	714	5.7%	2,224	17.7%	2,938	23.4%
Wawarsing, Town of	8,759	689	7.9%	1,557	17.8%	2,246	25.6%
Woodstock, Town of	6,241	205	3.3%	1,081	17.3%	1,286	20.6%
Total	*177,749*	*10,408*	*6%*	*25,150*	*14%*	*35,558*	*20%*

Note: similar breakdown data for years later than 2000 is not yet available.

SECTION 3 - RISK ASSESSMENT
3.C - ESTIMATED DAMAGES IN HAZARD AREAS

44 CFR Part 201.6 (c)(2)(ii)(B) states, ñ[The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare this estimateé ò This section of the Plan is intended to satisfy this requirement.

Methodology

The team attempted to assess vulnerability to various hazards within the limitations of the available data, where generally accepted measures of vulnerability are established. Parcel data included assessed values for land and total assessed values; assessed values for improvements were calculated by subtracting the land value from the total value. Expanding upon the parcel data in the countyôs GIS to include such information as building square footage, year built, type, foundation type, and condition, would allow for a more accurate assessment of vulnerability. Therefore, the Planning Committee has considered actions in this regard. Please see further sections of this plan for additional information on actions considered and ultimately selected.

Estimated Damages – Extreme Temperatures

While all of Ulster County is exposed to extreme temperatures, existing buildings, infrastructure and critical facilities are not considered vulnerable to significant damage caused by extreme heat or cold events. Therefore any estimated property losses associated with these hazards are anticipated to be minimal across the area. Extreme temperatures do however present a significant life and safety threat to Ulster Countyôs population.

Heat casualties are usually caused by lack of adequate air conditioning or heat exhaustion. The most vulnerable population to heat casualties are the elderly or infirmed, who frequently live on low fixed incomes and cannot afford to run air-conditioning on a regular basis. This population is sometimes isolated, with no immediate family or friends to look out for their well being.

Casualties resulting from extreme cold may result from a lack of adequate heat, carbon monoxide poisoning from unsafe heat sources and frostbite. The most vulnerable populations to cold casualties are the elderly or infirmed as well as low income households, as they may not be able to afford to operate a heat source on a regular basis and may not have immediate family or friends to look out for their well being.

Given the lack of historical data and limited likelihood for structural losses resulting from extreme heat or cold occurrences in Ulster County, annualizing potential structural losses over a long period of time would most likely yield a negligible annual loss estimate for the entire county.

Estimated Damages – Extreme Winds

Sufficient data was not available at the time of the study to undertake a detailed formal assessment of damages due to extreme winds. At this time, vulnerability is being expressed as the value of improvements exposed to the hazard. Because it cannot be predicted where extreme winds (as defined in the *Hazard Profiles* section) may occur, all existing and future buildings, facilities and populations are considered to be exposed to this hazard and could potentially be impacted.

First, while FEMA methodologies do exist to estimate damages due to extreme wind, specific information is required for buildings in order to employ these methodologies, such as type of construction and details on any existing protective features. This data was not available as a part of the County GIS during this study.

Second, having even the year built data for each structure, one would be able to highlight structures built before codes and standards were adopted to make buildings more resistant to wind damage, thus being better candidates for mitigation. Without the year-built data, this can not be done.

For the purpose of estimating annual wind damages at this time, we have evaluated the NOAA NCDC database for wind events in the last ten years (1998-2008) and have determined that these events have caused approximately $6,834,000 in property damages (or $683,400 per year county-wide). The total value of all improvements in Ulster County is estimated to be $15,384,466,069. Thus, based on recent historical data roughly 0.0044% of Ulster Countyôs improved property has been damaged each year by extreme wind events. Applying this same percentage to each of the Countyôs municipalities (since the wind hazard is uniform across the county) yields the following estimated annual damages to improved property for extreme wind events.

Table 3c.1
Annual Loss Estimates – Extreme Wind

Jurisdiction	Total Value of Improvements	Annual Loss Estimate, Extreme Wind
Denning, Town of	$51,126,978	$2,271
Ellenville, Village of	$47,291,413	$2,100
Esopus, Town of	$823,898,937	$36,592
Gardiner, Town of	$612,092,899	$27,185
Hardenburgh, Town of	$50,791,094	$2,256
Hurley, Town of	$639,336,069	$28,395
Kingston, City of	$1,922,939,212	$85,403
Kingston, Town of	$57,541,463	$2,556
Lloyd, Town of	$856,612,633	$38,045
Marbletown, Town of	$993,766,725	$44,136
Marlborough, Town of	$722,416,282	$32,085
New Paltz, Town of	$578,833,042	$25,708
New Paltz, Village of	$238,672,524	$10,600
Olive, Town of	$377,496,142	$16,766
Plattekill, Town of	$556,675,301	$24,723
Rochester, Town of	$564,685,441	$25,079
Rosendale, Town of	$469,479,238	$20,851
Saugerties, Town of	$1,217,383,571	$54,067
Saugerties, Village of	$275,716,843	$12,245
Shandaken, Town of	$402,760,909	$17,888
Shawangunk, Town of	$1,093,099,620	$48,548
Ulster, Town of	$1,189,900,886	$52,847
Wawarsing, Town of	$391,482,171	$17,387
Woodstock, Town of	$1,250,466,647	$55,670
Total, County-wide:	*$15,384,466,039*	*$683,400*

Estimated Damages – Earthquakes

As stated previously in the plan in the Hazard Profile section, according to the Earthquake Hazard Map of Ulster County, there is a 10 percent chance over 50 years that an earthquake with a PGA of greater than 3 or 4%g will be centered within Ulster County and/or its participating jurisdictions. This earthquake, if it were to occur, would likely have associated with it light to moderate perceived shaking and little to no damage. PGAôs of between 8 and 10%g would most often be required to cause appreciable damage, say, to unreinforced masonry buildings. While it is true that earthquakes are possible in this part of New York, they are not particularly likely, or likely to be particularly intense. Therefore, a full earthquake loss estimation was not conducted at this time for individual jurisdictions. However, countywide data included in the State Plan has been evaluated and is presented later in this section.

Examples of the types of damages that could be observed include:

- ⇒ Felt indoors by many, outdoors by few during the day
- ⇒ At night, some awakened.
- ⇒ Dishes, windows, doors disturbed and possibly broken
- ⇒ Walls make cracking sounds
- ⇒ Unstable objects could be overturned
- ⇒ Sensation like heavy truck striking building
- ⇒ Standing automobiles rocked noticeably

For earthquakes, the hazard area encompasses the entire county and therefore all assets could be impacted.

FEMAôs How-To #2 suggests that for earthquake loss estimation, data regarding building type, type of foundation, building code design level, and date of construction, is required for a quality analysis. This is because certain structures are more susceptible to earthquake damage than others. In the State of New York, regulations accounting for earthquake risk exist for new construction. Older buildings, built before these standard building codes went into effect, are more susceptible to earthquake damage. Similarly, unreinforced masonry buildings are more likely to sustain earthquake damage. While extensive damage to even these structures is unlikely, based on the mapped hazard areas, identifying this subset of buildings is important, particularly with regard to critical facilities that may meet these criteria. This information was not readily available at the time of the study for Ulster County and its participating jurisdictions.

The New York State Hazard Mitigation Plan includes HAZUS-MH runs for earthquake losses in counties across New York State. The data prepared by the State estimates the following potential earthquake losses in Ulster County and includes; Total Exposure ï representing dollar value of all general building stock and calculated potential total losses (Capital Stock + Income Losses) for the four return periods of 2500, 1000, 500, & 250-years.

Table 3c.2
Total Earthquake Losses – Ulster County, NY
For the Four Return Periods of 2500, 1000, 500 and 250 years

2500-year	1000-year	500-year	250-year
$426,894,000	$122,588,000	$38,885,000	$9,971,000

The State Plan goes on to show an estimated annualized total earthquake losses in Ulster County of $495,000 which ranks 23rd as compared to all of New York Stateôs 62 counties. For comparison purposes, the highest annualized losses were calculated in Kings County at $10,093,000 and the lowest were calculated in Schuyler County at $19,000.

For the purpose of estimating annual earthquake damages at this time, we have compared the Stateôs estimated annual earthquake losses for Ulster County ($495,000) to the total value of all improvements in Ulster County ($15,384,466,069) and have determined that based on this, roughly 0.0032% of Ulster Countyôs improved property could be damaged in any given year by an earthquake. Applying this same percentage to each of the Countyôs municipalities (since the earthquake hazard is nearly uniform across the county) yields the following estimated annual damages to improved property for earthquakes. Note that these estimates do not incorporate any magnification of damages due to soil type.

Table 3c.3
Annual Loss Estimates – Earthquakes

Jurisdiction	Total Value of Improvements	Annual Loss Estimate, Earthquakes
Denning, Town of	$51,126,978	$1,645
Ellenville, Village of	$47,291,413	$1,521
Esopus, Town of	$823,898,937	$26,504
Gardiner, Town of	$612,092,899	$19,690
Hardenburgh, Town of	$50,791,094	$1,634
Hurley, Town of	$639,336,069	$20,567
Kingston, City of	$1,922,939,212	$61,859
Kingston, Town of	$57,541,463	$1,851
Lloyd, Town of	$856,612,633	$27,556
Marbletown, Town of	$993,766,725	$31,969
Marlborough, Town of	$722,416,282	$23,239
New Paltz, Town of	$578,833,042	$18,621
New Paltz, Village of	$238,672,524	$7,678
Olive, Town of	$377,496,142	$12,144
Plattekill, Town of	$556,675,301	$17,908
Rochester, Town of	$564,685,441	$18,165
Rosendale, Town of	$469,479,238	$15,103
Saugerties, Town of	$1,217,383,571	$39,162
Saugerties, Village of	$275,716,843	$8,870
Shandaken, Town of	$402,760,909	$12,956
Shawangunk, Town of	$1,093,099,620	$35,164
Ulster, Town of	$1,189,900,886	$38,278
Wawarsing, Town of	$391,482,171	$12,594
Woodstock, Town of	$1,250,466,647	$40,323
Total, County-wide:	*$15,384,466,039*	*$495,000*

Estimated Damages – Flood

Sufficient data was not available at the time of the study to estimate damages due to flooding. At this time, vulnerability is being expressed as the value of improvements in the current mapped flood hazard areas as presented in the ñIdentification and Characterization of Assetsò section of this plan. First, while FEMA methodologies do exist to estimate damages due to flooding, specific information is required for buildings in order to employ these methodologies, such as first floor elevation, type of construction, foundation type, and details on any existing protective features. This data was not available as a part of the County GIS during this study.

Second, having even the year built data for each structure, one would be able to highlight structures built before codes and standards were adopted to make buildings more resistant to flood damage, thus being better candidates for mitigation. Without the year-built data, this can not be done. If this information

should become available in the future, it could be incorporated into future updates of the plan. While one could make some blanket assumptions at this time to use various tools for loss estimation, this would likely yield erroneous data. Acting upon such rough estimates could result in an unwise use of limited resources.

For the purpose of estimating annual flood damages at this time, we have evaluated the NOAA NCDC database for flood events in the last ten years (1998-2008) and have determined that these events have caused approximately $13,260,000 in property damages (or $1,326,000 per year county-wide). Because the flood hazard is not uniform across the county, we applied this percentage to the subset of improved property in the flood hazard area in each municipality (Zones A, AE, and X500) to estimate annual flood losses presented in the table below. The total value of all improvements in flood hazard areas in Ulster County is estimated to be $2,214,288,580. Thus, based on recent historical data roughly 0.06% of Ulster Countyôs improved property in the floodplain has been damaged each year by flood events. (Note: NFIP losses were considered for use, but were not selected due to their limitations in not including: unpaid claims, damages to uninsured properties, crop losses, or damages to roads/bridges/etc.)

Table 3c.4
Annual Loss Estimates – Flood

Jurisdiction	Total Value of Improvements	Total Value of Improvements in the Flood Hazard Area	Annual Loss Estimates, Flood
Denning, Town of	$51,126,978	$21,617,425	$12,945
Ellenville, Village of	$47,291,413	$9,420,995	$5,642
Esopus, Town of	$823,898,937	$159,394,633	$95,452
Gardiner, Town of	$612,092,899	$73,924,289	$44,269
Hardenburgh, Town of	$50,791,094	$18,811,933	$11,265
Hurley, Town of	$639,336,069	$30,066,164	$18,005
Kingston, City of	$1,922,939,212	$144,378,016	$86,459
Kingston, Town of	$57,541,463	$13,269,195	$7,946
Lloyd, Town of	$856,612,633	$126,783,351	$75,923
Marbletown, Town of	$993,766,725	$284,190,349	$170,184
Marlborough, Town of	$722,416,282	$9,309,836	$5,575
New Paltz, Town of	$578,833,042	$48,533,621	$29,064
New Paltz, Village of	$238,672,524	$25,644,975	$15,357
Olive, Town of	$377,496,142	$47,284,614	$28,316
Plattekill, Town of	$556,675,301	$0	$0
Rochester, Town of	$564,685,441	$88,442,681	$52,963
Rosendale, Town of	$469,479,238	$63,705,975	$38,150
Saugerties, Town of	$1,217,383,571	$156,220,761	$93,551
Saugerties, Village of	$275,716,843	$30,698,423	$18,383
Shandaken, Town of	$402,760,909	$168,880,011	$101,132
Shawangunk, Town of	$1,093,099,620	$304,030,659	$182,065
Ulster, Town of	$1,189,900,886	$140,625,437	$84,212
Wawarsing, Town of	$391,482,171	$80,858,822	$48,421
Woodstock, Town of	$1,250,466,647	$168,196,414	$100,722
Total, County-wide:	*$15,384,466,039*	*$2,214,288,580*	*$1,326,000*

Estimated Damages – Ice Jams

Flooding caused by ice jams is similar to flash flooding. Ice jam formation causes a rapid rise of water at the jam and extending upstream. Failure or release of the jam causes sudden flooding downstream.

It is difficult to identify particular areas that are generally prone to ice jam flooding because the hazard can be very localized. The formation of ice jams depends on the weather and physical conditions in river channels. Unlike the typical violent flash flooding occurrences where steep terrain is present, ice jams are most likely to occur where the channel slope naturally decreases, where culverts freeze solid at headwaters of reservoirs, at natural channel restrictions such as bends and bridges, and along shallows where channels may freeze solid. Ice jams in Ulster County have historically occurred 28 times between 1925 and 2007. Most events have been either along the Wallkill River or Rondout Creek. Specifically:

- 12 events ï Rondout Creek (11at Rosendale and 1 at Kingston)
- 10 events ï Wallkill River (8 at Gardiner and 2 at New Paltz)
- 4 events ï Shawangunk Kill at Shawangunk
- 2 events ï Esopus Creek at Shandaken

Damage from ice jam flooding usually exceeds that caused by open water flooding. Flood elevations are usually higher than predicted for free-flow conditions and water levels may change rapidly. Additional physical damage is caused by the force of ice impacting buildings and other structures. Because of the sometimes unpredictable nature of ice jam floods, FEMAôs Flood Insurance Rate Maps often do not reflect ice jam flood threats.

Loss estimation methodologies are not currently available for estimating ice jam damages. Sufficient historical data regarding events and associated losses was not available to quantify here. For the purpose of this analysis, we have assumed that annual losses would be realized as an unquantifiable component within the flood damage estimate.

Table 3c.5
Annual Loss Estimates – Ice Jams

Jurisdiction	Total Value of Improvements	Total Value of Improvements in the Flood Hazard Area	Annual Loss Estimates, Ice Jams
Denning, Town of	$51,126,978	$21,617,425	unquantifiable
Ellenville, Village of	$47,291,413	$9,420,995	unquantifiable
Esopus, Town of	$823,898,937	$159,394,633	unquantifiable
Gardiner, Town of	$612,092,899	$73,924,289	unquantifiable - 8 historic events
Hardenburgh, Town of	$50,791,094	$18,811,933	unquantifiable
Hurley, Town of	$639,336,069	$30,066,164	unquantifiable
Kingston, City of	$1,922,939,212	$144,378,016	unquantifiable - 1 historic event
Kingston, Town of	$57,541,463	$13,269,195	unquantifiable
Lloyd, Town of	$856,612,633	$126,783,351	unquantifiable
Marbletown, Town of	$993,766,725	$284,190,349	unquantifiable
Marlborough, Town of	$722,416,282	$9,309,836	unquantifiable
New Paltz, Town of	$578,833,042	$48,533,621	unquantifiable - 2 historic events
New Paltz, Village of	$238,672,524	$25,644,975	unquantifiable
Olive, Town of	$377,496,142	$47,284,614	unquantifiable
Plattekill, Town of	$556,675,301	$0	unquantifiable

Table 3c.5 Annual Loss Estimates – Ice Jams			
Jurisdiction	**Total Value of Improvements**	**Total Value of Improvements in the Flood Hazard Area**	**Annual Loss Estimates, Ice Jams**
Rochester, Town of	$564,685,441	$88,442,681	unquantifiable
Rosendale, Town of	$469,479,238	$63,705,975	unquantifiable - 11 historic events
Saugerties, Town of	$1,217,383,571	$156,220,761	unquantifiable
Saugerties, Village of	$275,716,843	$30,698,423	unquantifiable
Shandaken, Town of	$402,760,909	$168,880,011	unquantifiable - 2 historic events
Shawangunk, Town of	$1,093,099,620	$304,030,659	unquantifiable - 4 historic events
Ulster, Town of	$1,189,900,886	$140,625,437	unquantifiable
Wawarsing, Town of	$391,482,171	$80,858,822	unquantifiable
Woodstock, Town of	$1,250,466,647	$168,196,414	unquantifiable
Total, County-wide:	*$15,384,466,039*	*$2,214,288,580*	unquantifiable

Estimated Damages – Dam Failure

Sufficient data was not available at the time of the study to estimate damages due to dam failure. At this time, vulnerability is being expressed as the value of improvements exposed to the hazard, as presented in Table 3a.13 in the ñHazard Profilesò section of this plan.

Given the lack of historical data for significant dam failure occurrences, and that it would be inappropriate to make assumptions regarding the effectiveness of future dam inspection and maintenance activities, it is assumed that major dam failures are a considerably rare event. Therefore, while one major event may result in significant losses, annualizing structural losses over a long period of time would most likely yield a negligible annual loss estimate for jurisdictions exposed to this hazard.

Table 3c.6 Annual Loss Estimates – Dam Failure		
Jurisdiction	**Total Value of Improvements**	**Annual Loss Estimate, Dam Failure**
Denning, Town of	$51,126,978	*negligible*
Ellenville, Village of	$47,291,413	*negligible*
Esopus, Town of	$823,898,937	*negligible*
Gardiner, Town of	$612,092,899	*negligible*
Hardenburgh, Town of	$50,791,094	*negligible*
Hurley, Town of	$639,336,069	*negligible*
Kingston, City of	$1,922,939,212	*negligible*
Kingston, Town of	$57,541,463	*negligible*
Lloyd, Town of	$856,612,633	*negligible*
Marbletown, Town of	$993,766,725	*negligible*
Marlborough, Town of	$722,416,282	*negligible*
New Paltz, Town of	$578,833,042	*negligible*
New Paltz, Village of	$238,672,524	*negligible*
Olive, Town of	$377,496,142	*negligible*
Plattekill, Town of	$556,675,301	*negligible*
Rochester, Town of	$564,685,441	*negligible*

Table 3c.6 Annual Loss Estimates – Dam Failure		
Jurisdiction	**Total Value of Improvements**	**Annual Loss Estimate, Dam Failure**
Rosendale, Town of	$469,479,238	*negligible*
Saugerties, Town of	$1,217,383,571	*negligible*
Saugerties, Village of	$275,716,843	*negligible*
Shandaken, Town of	$402,760,909	*negligible*
Shawangunk, Town of	$1,093,099,620	*negligible*
Ulster, Town of	$1,189,900,886	*negligible*
Wawarsing, Town of	$391,482,171	*negligible*
Woodstock, Town of	$1,250,466,647	*negligible*
Total, County-wide:	*$15,384,466,039*	***negligible***

Estimated Damages – Lightning

Sufficient data was not available at the time of the study to estimate damages due to lightning. At this time, vulnerability is being expressed as the value of improvements exposed to the hazard, as presented in the ñIdentification and Characterization of Assetsò section of this plan.

First, current loss estimation methodologies are not available for estimating lightning damages.

Second, having even the year built data for each structure, one would be able to highlight structures built before codes and standards were adopted to make buildings more resistant to lightning damage, thus being better candidates for mitigation. Without the year-built data, this can not be done.

If this information should become available in the future, it could be incorporated into future updates of the plan. While one could make some blanket assumptions at this time to use various tools for loss estimation, this would likely yield erroneous data given the high degree of variation in type and density of development in Ulster County. Acting upon such rough estimates could result in an unwise use of limited resources.

In general terms, estimated damages due to a single lightning event could be severe in any one location, however no one location or municipality in the county is any more vulnerable than another, and annual damages from lightning in Ulster County are estimated to be generally low.

For the purpose of estimating annual lightning damages at this time, we have evaluated the NOAA NCDC database for lightning events in the last ten years (1998-2008) and have determined that these events have caused approximately $30,800 in property damages (or $30,800 per year county-wide). The total value of all improvements in Ulster County is estimated to be $15,384,466,039. Thus, based on recent historical data roughly 0.0002% of Ulster Countyôs improved property has been damaged each year by lightning events. Applying this same percentage to each of the Countyôs municipalities (since the lightning hazard is uniform across the county) yields the following estimated annual damages to improved property for lightning events.

Table 3c.7 Annual Loss Estimates – Lightning		
Jurisdiction	**Total Value of Improvements**	**Annual Loss Estimate, Lightning**
Denning, Town of	$51,126,978	$102
Ellenville, Village of	$47,291,413	$95
Esopus, Town of	$823,898,937	$1,649
Gardiner, Town of	$612,092,899	$1,225
Hardenburgh, Town of	$50,791,094	$102
Hurley, Town of	$639,336,069	$1,280
Kingston, City of	$1,922,939,212	$3,849
Kingston, Town of	$57,541,463	$115
Lloyd, Town of	$856,612,633	$1,715
Marbletown, Town of	$993,766,725	$1,989
Marlborough, Town of	$722,416,282	$1,446
New Paltz, Town of	$578,833,042	$1,159
New Paltz, Village of	$238,672,524	$478
Olive, Town of	$377,496,142	$756
Plattekill, Town of	$556,675,301	$1,114
Rochester, Town of	$564,685,441	$1,130
Rosendale, Town of	$469,479,238	$940
Saugerties, Town of	$1,217,383,571	$2,437
Saugerties, Village of	$275,716,843	$552
Shandaken, Town of	$402,760,909	$806
Shawangunk, Town of	$1,093,099,620	$2,188
Ulster, Town of	$1,189,900,886	$2,382
Wawarsing, Town of	$391,482,171	$784
Woodstock, Town of	$1,250,466,647	$2,509
Total, County-wide:	*$15,384,466,039*	*$30,800*

Estimated Damages – Landslides

Sufficient data was not available at the time of the study to estimate damages due to landslides. At this time, vulnerability is being expressed as the value of improvements in the current mapped landslide hazard area (of high susceptibility, low incidence) presented in the ñIdentification and Characterization of Assetsò section of this plan.

First, according to FEMAôs How-To #2, current loss estimation methodologies are not available for estimating landslide damages. While the guide indicates that structures within a landslide hazard area could be assumed to be ñseverelyò damaged and those outside could be assumed to be ñundamagedò, applying this methodology would not be appropriate for Ulster County given the variations in susceptibility and incidence. Ulster County has within its boundaries four different zones of susceptibility; that is, areas of: high incidence, high susceptibility/moderate incidence, moderate incidence, and low incidence). Applying the How-To methodology would not account for different vulnerabilities associated with each zone. In addition, specific information would be required for buildings in order to employ these methodologies, such as type of construction, foundation type, and details on any existing protective features. This data was not available as a part of the County GIS during this study.

Second, having even the year built data for each structure, one would be able to highlight structures built before codes and standards (such as steep slope ordinances) were adopted to make buildings more

resistant to landslide damage, thus being better candidates for mitigation. Without the year-built data, this can not be done.

If this information should become available in the future, it could be incorporated into future updates of the plan. While one could make some blanket assumptions at this time to use various tools for loss estimation, this would likely yield erroneous data given the high degree of variation in type and density of development. Acting upon such rough estimates could result in an unwise use of limited resources.

In general terms, estimated damages due to a single landslide event could be severe in any one location, but are most likely only in areas of high incidence and/or high susceptibility/moderate incidence (isolated portions of the seven communities with mapped areas of high incidence; five communities with mapped areas of high susceptibility/moderate incidence). Additional details can be found throughout the ñAsset Identification and Characterizationò section of this plan.

Given the lack of historical data on significant landslide occurrences (USGS notes only one event in Ulster County), it is assumed that while one major event may result in significant losses, annualizing structural losses over a long period of time would most likely yield a negligible annual loss estimate for jurisdictions exposed to this hazard.

Table 3c.8
Annual Loss Estimates – Landslides

Jurisdiction	Total Value of Improvements	Annual Loss Estimate, Landslides
Denning, Town of	$51,126,978	*negligible*
Ellenville, Village of	$47,291,413	*negligible*
Esopus, Town of	$823,898,937	*negligible*
Gardiner, Town of	$612,092,899	*negligible*
Hardenburgh, Town of	$50,791,094	*negligible*
Hurley, Town of	$639,336,069	*negligible*
Kingston, City of	$1,922,939,212	*negligible*
Kingston, Town of	$57,541,463	*negligible*
Lloyd, Town of	$856,612,633	*negligible*
Marbletown, Town of	$993,766,725	*negligible*
Marlborough, Town of	$722,416,282	*negligible*
New Paltz, Town of	$578,833,042	*negligible*
New Paltz, Village of	$238,672,524	*negligible*
Olive, Town of	$377,496,142	*negligible*
Plattekill, Town of	$556,675,301	*negligible*
Rochester, Town of	$564,685,441	*negligible*
Rosendale, Town of	$469,479,238	*negligible*
Saugerties, Town of	$1,217,383,571	*negligible*
Saugerties, Village of	$275,716,843	*negligible*
Shandaken, Town of	$402,760,909	*negligible*
Shawangunk, Town of	$1,093,099,620	*negligible*
Ulster, Town of	$1,189,900,886	*negligible*
Wawarsing, Town of	$391,482,171	*negligible*
Woodstock, Town of	$1,250,466,647	*negligible*
Total, County-wide:	*$15,384,466,039*	*negligible*

Estimated Damages – Drought

Sufficient data was not available at the time of the study to estimate damages due to drought. According to FEMAôs How-To #2, current loss estimation methodologies are not available for estimating drought damages. If this information should become available in the future, it could be incorporated into future updates of the plan. While one could make some blanket assumptions at this time to use various tools for loss estimation, this would likely yield erroneous data given the high degree of variation in type and density of development. Acting upon such rough estimates could result in an unwise use of limited resources. At this time, vulnerability is being expressed in qualitative terms in terms of types of damages.

In general estimated damages due to future droughts in Ulster County could be high. Types of damages are discussed qualitatively below.

Because drought impacts large areas and crosses jurisdictional boundaries, all existing and future buildings, facilities and populations are considered to be exposed to this hazard and could potentially be impacted. However, drought impacts are mostly experienced in water shortages and crop losses on agricultural lands and have no impact on buildings.

Crop failure is one common affect of drought. According to the 2002 Agriculture Census, Ulster County has 532 farms totaling 83,418 acres. Farms in Ulster County are 47.18 percent cropland, 31.66 percent woodland, 11.33 percent pasture land, and 9.83 percent other uses. The market value of production on Ulster County farms in 2002 was $34.5 million, with $28.8 generated from crop sales and $5.7 million generated from livestock sales. By far the largest commodity group was fruits, tree nuts and berries accounting for approximately half of all sales in 2002 at $17 million, making Ulster County second in New York State in this category. Top crop items in terms of acreage: 17,581 acres forage (silage, haylage); 6,365 acres apples (number two in New York State); 3,381 acres harvested vegetables; 2,674 acres sweet corn; and 1,559 acres corn for grain. Agricultural losses, specifically losses to crops, in Ulster County could be significant during a drought. When drought begins, the agricultural sector is usually the first to be impacted because of its heavy reliance on stored soil water, which can rapidly be depleted during extended dry periods. When precipitation returns to normal, impacts on the agricultural sector are quick to diminish again due to the reliance on stored soil moisture.

Water supply shortages are a second affect of drought. Ulster Countyôs total withdrawal of fresh water for public supply is 439.54 million gallons per day, with one percent from groundwater sources and 99 percent from surface water sources. Groundwater is fairly resistant to drought conditions (one percent of public supply). However, the remaining 99 percent is sourced from surface water, which is more susceptible to the effects of drought. The expected likelihood of future losses associated with reductions in water supply from underground aquifers would be low. However, the expected likelihood of future losses associated with reductions in water supply from surface water sources would be much higher because surface water sources (such as reservoirs and rivers) are much less resistant to periods of drought and are more susceptible to being impacted.

A third common affect of drought is fish and wildlife mortality. Ulster County is largely rural has diverse populations of fish and wildlife and abundant creeks, estuaries, aquifers and reservoirs provide essential water resources. Five different threatened and endangered species reside in Ulster County. Because so much of the land area in Ulster County is undeveloped, fish and wildlife habitat is fairly high and therefore losses to fish and wildlife could likely be high.

A fourth common affect of drought is wildfires. Due to Ulster Countyôs largely undeveloped nature, fuel is plentiful for wildfires. In Ulster County, fuel tends to be most plentiful in areas where development

densities are lowest; this works to reduce possible property damages and loss of life; however, the wildland-urban interface would be particularly vulnerable as well as transportation routes. Wildfires are a unique hazard addressed separately in this plan.

For the purpose of estimating annual drought damages at this time, we have evaluated the NOAA NCDC database for drought events in the last ten years (1998-2008) and have determined that these events have caused approximately $50,000,000 in crop related damages (or $5,000,000 per year county-wide). Using this historical data for estimated annual damages county-wide, annual losses on a municipal level were estimated by distributed the annual county-wide losses using a weighted percentage of crop land/pasture land. This methodology does not take into account the degree of variation in value of various crops/livestock, or the degree of drought resistance and should be used for mitigation planning purposes only.

Table 3c.9
Annual Loss Estimates – Drought

Jurisdiction	Total Acres Cultivated Crop Land / Pasture	Percent of Total Cultivated Crop Land / Pasture = Estimated Percent of Total Annual Losses	Annual Loss Estimate, Drought
Denning, Town of	203	0.32%	$16,185
Ellenville, Village of	38	0.06%	$3,030
Esopus, Town of	1,940	3.09%	$154,678
Gardiner, Town of	7,296	11.63%	$581,716
Hardenburgh, Town of	997	1.59%	$79,492
Hurley, Town of	965	1.54%	$76,940
Kingston, City of	92	0.15%	$7,335
Kingston, Town of	203	0.32%	$16,185
Lloyd, Town of	2,810	4.48%	$224,044
Marbletown, Town of	5,108	8.15%	$407,265
Marlborough, Town of	6,838	10.90%	$545,199
New Paltz, Town of	3,616	5.77%	$288,307
New Paltz, Village of	92	0.15%	$7,335
Olive, Town of	915	1.46%	$72,954
Plattekill, Town of	4,026	6.42%	$320,996
Rochester, Town of	6,144	9.80%	$489,866
Rosendale, Town of	663	1.06%	$52,862
Saugerties, Town of	3,640	5.80%	$290,220
Saugerties, Village of	50	0.08%	$3,987
Shandaken, Town of	324	0.52%	$25,833
Shawangunk, Town of	10,790	17.21%	$860,296
Ulster, Town of	1873	2.99%	$149,336
Wawarsing, Town of	3,348	5.34%	$266,939
Woodstock, Town of	742	1.18%	$59,160
Total, County-wide:	***62,711***	***100.00%***	***$5,000,000***

Estimated Damages – Wildfires

Sufficient data was not available at the time of the study to estimate damages due to wildfires. At this time, vulnerability is being expressed as the value of improvements exposed to the hazard, as presented in the ñIdentification and Characterization of Assetsò section of this plan.

First, according to FEMAôs How-To #2, current loss estimation methodologies are not available for estimating wildfire damages. In addition, specific information would be required for buildings in order to develop alternate methodologies, such as type of construction, and details on any existing protective features. This data was not available as a part of the County GIS during this study.

Second, having even the year built data for each structure, one would be able to highlight structures built before codes and standards were adopted to make buildings more resistant to wildfire damage, thus being better candidates for mitigation. Without the year-built data, this can not be done.

If this information should become available in the future, it could be incorporated into future updates of the plan. While one could make some blanket assumptions at this time to use various tools for loss estimation, this would likely yield erroneous data given the high degree of variation in type and density of development. Acting upon such rough estimates could result in an unwise use of limited resources.

Loss estimation methodologies are not currently available for estimating wildfire damages. Sufficient historical data regarding events and associated losses was not available to quantify here. For the purpose of this analysis, we have determined that annual losses are unquantifiable at this time.

Table 3c.10
Annual Loss Estimates – Wildfires

Jurisdiction	Total Value of Improvements	Annual Loss Estimate, Wildfires
Denning, Town of	$51,126,978	unquantifiable
Ellenville, Village of	$47,291,413	unquantifiable
Esopus, Town of	$823,898,937	unquantifiable
Gardiner, Town of	$612,092,899	unquantifiable
Hardenburgh, Town of	$50,791,094	unquantifiable
Hurley, Town of	$639,336,069	unquantifiable
Kingston, City of	$1,922,939,212	unquantifiable
Kingston, Town of	$57,541,463	unquantifiable
Lloyd, Town of	$856,612,633	unquantifiable
Marbletown, Town of	$993,766,725	unquantifiable
Marlborough, Town of	$722,416,282	unquantifiable
New Paltz, Town of	$578,833,042	unquantifiable
New Paltz, Village of	$238,672,524	unquantifiable
Olive, Town of	$377,496,142	unquantifiable
Plattekill, Town of	$556,675,301	unquantifiable
Rochester, Town of	$564,685,441	unquantifiable
Rosendale, Town of	$469,479,238	unquantifiable
Saugerties, Town of	$1,217,383,571	unquantifiable
Saugerties, Village of	$275,716,843	unquantifiable
Shandaken, Town of	$402,760,909	unquantifiable

Table 3c.10 Annual Loss Estimates – Wildfires		
Jurisdiction	**Total Value of Improvements**	**Annual Loss Estimate, Wildfires**
Shawangunk, Town of	$1,093,099,620	unquantifiable
Ulster, Town of	$1,189,900,886	unquantifiable
Wawarsing, Town of	$391,482,171	unquantifiable
Woodstock, Town of	$1,250,466,647	unquantifiable
Total, County-wide:	*$15,384,466,039*	unquantifiable

Estimated Damages – Severe Weather Events: Hurricanes/Tropical Storms, Tornadoes, Winter Storms/Ice Storms and Nor'easters

Severe weather "events" have certain hazards associated with them, as discussed throughout the Hazard Profile section of this plan. Please see Estimated Damages for the specific hazards associated with a given event.

Summary

The following table is a useful tool to summarize vulnerability in terms of annual damages estimated for various hazards in communities across Ulster County. For mitigation planning purposes only, municipalities could use this information in their evaluation and prioritization of mitigation options, and development of a mitigation strategy, as municipalities may wish to stress mitigation of those hazards for which annual loss estimates are the highest. These estimated damages are not intended for use in any more formal benefit-cost analyses.

Table 3c.11
Annual Loss Estimates – Summary, All Natural Hazards

Jurisdiction	Total Value of Improvements	Extreme Temperatures	Extreme Wind	Earthquake	Flood	Ice Jams	Dam Failure	Lightning	Landslides	Drought	Wildfires
Denning, Town of	$51,126,978	*negligible*	$2,271	$1,645	$12,945	unquantifiable	*negligible*	$102	*negligible*	$16,185	unquantifiable
Ellenville, Village of	$47,291,413	*negligible*	$2,100	$1,521	$5,642	unquantifiable	*negligible*	$95	*negligible*	$3,030	unquantifiable
Esopus, Town of	$823,898,937	*negligible*	$36,592	$26,504	$95,452	unquantifiable	*negligible*	$1,649	*negligible*	$154,678	unquantifiable
Gardiner, Town of	$612,092,899	*negligible*	$27,185	$19,690	$44,269	unquantifiable - 8 historic events	*negligible*	$1,225	*negligible*	$581,716	unquantifiable
Hardenburgh, Town of	$50,791,094	*negligible*	$2,256	$1,634	$11,265	unquantifiable	*negligible*	$102	*negligible*	$79,492	unquantifiable
Hurley, Town of	$639,336,069	*negligible*	$28,395	$20,567	$18,005	unquantifiable	*negligible*	$1,280	*negligible*	$76,940	unquantifiable
Kingston, City of	$1,922,939,212	*negligible*	$85,403	$61,859	$86,459	unquantifiable - 1 historic event	*negligible*	$3,849	*negligible*	$7,335	unquantifiable
Kingston, Town of	$57,541,463	*negligible*	$2,556	$1,851	$7,946	unquantifiable	*negligible*	$115	*negligible*	$16,185	unquantifiable
Lloyd, Town of	$856,612,633	*negligible*	$38,045	$27,556	$75,923	unquantifiable	*negligible*	$1,715	*negligible*	$224,044	unquantifiable
Marbletown, Town of	$993,766,725	*negligible*	$44,136	$31,969	$170,184	unquantifiable	*negligible*	$1,989	*negligible*	$407,265	unquantifiable
Marlborough, Town of	$722,416,282	*negligible*	$32,085	$23,239	$5,575	unquantifiable	*negligible*	$1,446	*negligible*	$545,199	unquantifiable
New Paltz, Town of	$578,833,042	*negligible*	$25,708	$18,621	$29,064	unquantifiable - 2 historic events	*negligible*	$1,159	*negligible*	$288,307	unquantifiable
New Paltz, Village of	$238,672,524	*negligible*	$10,600	$7,678	$15,357	unquantifiable	*negligible*	$478	*negligible*	$7,335	unquantifiable
Olive, Town of	$377,496,142	*negligible*	$16,766	$12,144	$28,316	unquantifiable	*negligible*	$756	*negligible*	$72,954	unquantifiable
Plattekill, Town of	$556,675,301	*negligible*	$24,723	$17,908	$0	unquantifiable	*negligible*	$1,114	*negligible*	$320,996	unquantifiable
Rochester, Town of	$564,685,441	*negligible*	$25,079	$18,165	$52,963	unquantifiable	*negligible*	$1,130	*negligible*	$489,866	unquantifiable
Rosendale, Town of	$469,479,238	*negligible*	$20,851	$15,103	$38,150	unquantifiable - 11 historic events	*negligible*	$940	*negligible*	$52,862	unquantifiable
Saugerties, Town of	$1,217,383,571	*negligible*	$54,067	$39,162	$93,551	unquantifiable	*negligible*	$2,437	*negligible*	$290,220	unquantifiable
Saugerties, Village of	$275,716,843	*negligible*	$12,245	$8,870	$18,383	unquantifiable	*negligible*	$552	*negligible*	$3,987	unquantifiable
Shandaken, Town of	$402,760,909	*negligible*	$17,888	$12,956	$101,132	unquantifiable - 2 historic events	*negligible*	$806	*negligible*	$25,833	unquantifiable
Shawangunk, Town of	$1,093,099,620	*negligible*	$48,548	$35,164	$182,065	unquantifiable - 4 historic events	*negligible*	$2,188	*negligible*	$860,296	unquantifiable
Ulster, Town of	$1,189,900,886	*negligible*	$52,847	$38,278	$84,212	unquantifiable	*negligible*	$2,382	*negligible*	$149,336	unquantifiable
Wawarsing, Town of	$391,482,171	*negligible*	$17,387	$12,594	$48,421	unquantifiable	*negligible*	$784	*negligible*	$266,939	unquantifiable
Woodstock, Town of	$1,250,466,647	*negligible*	$55,670	$40,323	$100,722	unquantifiable	*negligible*	$2,509	*negligible*	$59,160	unquantifiable
Total, County-wide:	*$15,384,466,039*	***negligible***	***$683,400***	***$495,000***	***$1,326,000***	**unquantifiable**	***negligible***	*$30,800*	***negligible***	***$5,000,000***	**unquantifiable**

SECTION 3d - RISK ASSESSMENT: EXISTING LAND USES AND FUTURE DEVELOPMENT TRENDS IN HAZARD AREAS

Historic

The Ulster County economic development plan ñUlster Tomorrowò begins by describing the Countyôs rich history. It describes the Countyôs agrarian beginning and then goes on to discuss the Countyôs growth during the industrial revolution, the economic downturn of the 1990s, and its struggles to revitalize its manufacturing base, maintain its legacy in production agriculture, and continue to encourage its tourism-visitor industry without compromising its natural resources. This is not only a story of economic development in Ulster County, but also a story of how that development can be affected by the hazards which affect the County.

Existing Land Use

Ulster County is located in the Catskill Mountains in the Hudson River Valley of southeastern New York State approximately 70 miles north of New York City and 45 miles south of Albany. It is 1,126 square miles in area. There are 24 municipal jurisdictions in addition to the County, with the City of Kingston as the County seat. The Countywide population as determined by the 2000 Census was 177, 749 and NYSIS population projections estimate a 2020 population of 203,871. Figure 3.d.1 presents a graphical depiction of the land use/land cover in Ulster County, and the component data used to compile this figure is presented in Table 3d.1. The table and the figure show clearly that more than half the County land area is forested, with only a little under 7% of the County classified as developed. While cultivated land and other farmland accounts for less than 10% of the Countyôs land area, agriculture/farming is locally considered to be of paramount importance to the economy and the character of the County.

Major areas of designated open space include:

- Catskill Forest Preserve with 160,000 acres
- Minnewaska State Park with 12,000 acres
- Mohonk Preserve with more than 6,500 acres
- Two County parks (one with over 3,000 feet of Hudson River Frontage and one with 150 acres)

Figure 3d.1: Ulster County Land Use / Land Cover

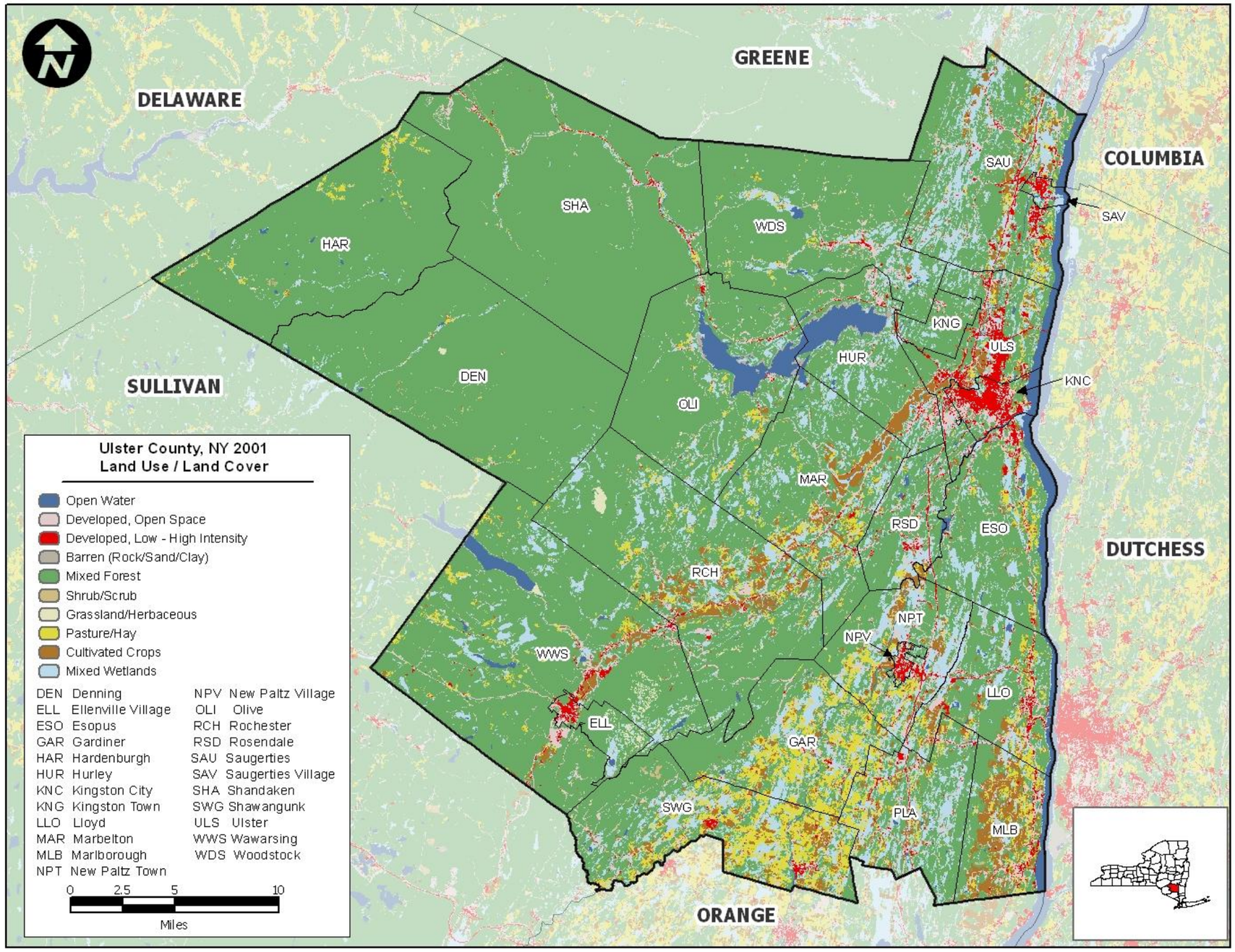


Table 3d.1 Ulster County Land Cover Estimates		
Description of Land Use	**Acres**	**Percent of Land Use**
Open Water	20,188.9	2.7
Developed, Open Space	35,467.4	4.8
Developed, Low Intensity	9,197.8	1.2
Developed, Medium Intensity	3,276.5	0.4
Developed, High Intensity	1,280.3	0.2
Barren Land (Rock/Sand/Clay)	1,374.8	0.2
Deciduous Forest	374,662.5	50.4
Evergreen Forest	38,447.9	5.2
Mixed Forest	118,234.8	15.9
Shrub/Scrub	1,479.8	0.2
Grassland/Herbaceous	2,938.3	0.4
Pasture/Hay	33,004.8	4.4
Cultivated Crops	30,609.3	4.1
Woody Wetlands	72,106.5	9.7
Emergent Herbaceous Wetlands	1,059.5	0.1
Ulster County Total	**743,329.3**	**100.0**

Land Use Planning

Land use planning in the State of New York is primarily a function of local communities, with Ulster County serving a coordination function for those elements that are best served on a regional level. The County has completed or is working on an economic development strategy, a housing strategy, an open space plan, a stormwater management program and a long range transportation plan. At the local level, seven of the nine participating communities who returned the Land Use and Development Trends Questionnaire have zoning statutes, while only five of the communities have subdivision statutes and six have comprehensive plans. However, all nine have either combined planning and zoning boards or separate planning boards and zoning boards of appeals. No information was available regarding land use regulations for the Town of Kingston.

Table 3d.2 Communities with Land Use Regulations (Source: Ulster County Planning Department and internet)			
Zoning Statutes	**Building Code**	**Subdivision Statutes**	**Comprehensive Plans**
Town of Gardiner	Town of Gardiner	Town of Gardiner	Town of Gardiner
Town of Hurley	Town of Hurley		Town of Hurley
City of Kingston	City of Kingston		
Town of Lloyd	Town of Lloyd	Town of Lloyd	Town of Lloyd
Town of Marlborough	Town of Marlborough	Town of Marlborough	Town of Marlborough
Town of Rosendale	Town of Rosendale		Town of Rosendale
Town of Shandaken	Town of Shandaken	Town of Shandaken	Town of Shandaken
Town of Ulster	Town of Ulster	Town of Ulster	Town of Ulster

Existing Land Use – Town of Gardner

The Town of Gardner had a population in 2000 of 5,283 people. The 2000 Census indicated that the Town of Gardnerôs average household size was 2.6 people per household resulting in the average number of housing units being 2032. The Town includes 5 hamlets which are developed along the highways of the town. Development in these hamlets is a mixture of residences and commercial activities. Recreational and open space uses cover much of the remainder of the Town. Approximately 5,200 acres, or 18%, of the townôs 28,600 acres are considered protected open-space. A large area of the town is also working agricultural land.

Existing Land Use – Town of Hurley

The Town of Hurley has very little open land (not forested) left for developing, and as such experiences single family home building on a moderate to low scale. Hurley has seen interest recently on developing a PRD, but this application was withdrawn. The Planning Board has approved a new subdivision recently which may result in a few new homes being built on Dug Hill Road.

Existing Land Use – City of Kingston

Development trends in the City of Kingston are focused on the Rondout Creek - Hudson River area of the city. These proposed developments are of mixed use and density. While primarily condominium and single family homes there is a light industrial and commercial component as well. These proposals if developed fully would add as many as 2000 units of housing with a commensurate increase in population. These developments primarily involve the reuse of industrial areas that have been abandoned for many years. The city has developed a waterfront redevelopment plan and has established zoning requirements for development within the Hudson River and Rondout Creek areas.

Existing Land Use – Town of Kingston

The Town of Kingston does not have any major construction going on at the present time. The building that is being done is scattered around the Town. There is a pre-existing seventy five lot subdivision located across the road from the Sawkill Creek. This neighborhood has the potential to flood. The developer removed six feet of soil before homes were built. Other areas of the Town of Kingston have steep slopes that front on Ulster County and New York State roads.

Existing Land Use – Town of Lloyd

The Town of Lloyd had a population in 2000 of 9,941 people and 3,818 housing units. Most of Lloyd is characterized by severe or very severe limitations for development. Large portions of the town are constrained by steep slopes with greater than 15% gradient and the town has the greatest concentration of wetlands in the County. Development patterns include small rural communities with intervening open space. Active agriculture is an important part of the Townôs economy. Finally, the Town includes large blocks of intact forests. The Town includes one hamlet that is located on the eastern side of the Town. The eastern side of the Town borders the Hudson River.

Existing Land Use – Town of Marlborough

The Town of Marlborough has the most agricultural/farmland of any municipality in the County, most of which is under cultivation. It had a population in 2000 of 8,263 in 3,020 households. Although there has been substantial encroachment by new residential development in recent years, and several multi-dwelling residential developments are proposed, the Town has recently resisted any further efforts to increase single-family residential development. Commercial or industrial development has not been significant in recent years and this is unlikely to change in the foreseeable future.

Existing Land Use – Town of Rosendale

The Town of Rosendale had a population in 2000 of 6,352 people and 2,851 housing units with 5% of the housing units being seasonal units. 72% of the units were single family detached. The Town includes 3 larger hamlets and several smaller ones. According to year 2000 data, the four leading local employment sectors in Rosendale were transportation, hospitality, retail, and health. The next three largest employers were manufacturing, construction, and education. Development constraints such as Federal and State regulated wetland, severe slopes and floodplains cover much of the Town.

Existing Land Use – Town of Shandaken

The Town of Shandaken had a population in 2000 of 3,235 people and 2,668 housing units with a majority (80%) of the units being single-family detached structures. Only 55% of the structures are owner occupied. Also, 55 % of the residents are full-time residents. The Town includes 12 hamlets which are developed along the highways of the town. Development in these hamlets is a mixture of residences, tourist-oriented businesses, real-estate offices and service businesses and small pockets of resource related businesses, such as saw mills and bluestone industries. Recreational and open space uses cover much of the remainder of the Town.

Shandaken is comprised of 79,200 acres and has only limited development potential. The general breakdown of land us is:

- 66% of this land is currently under public ownership and designated as public open space;
- 14% comprises of residential land uses;
- 9% of private open space;
- 7% vacant land;
- 4% miscellaneous.

The majority of the Townôs development is located in the valleys of Esopus Creek and its tributaries. As, such, there is a high potential for significant flood impacts. There is also a potential for similar impacts during snowstorms, ice storms or other major weather events.

Existing Land Use – Town of Ulster

The Town of Ulster had a population in 2000 of 12,544 people and 5,239 housing units with 61% of the units being single-family detached structures. 67.1% of the structures are owner occupied. 92.6 % of the residents are full-time residents. The Residential development in the Town is both Residential and rural.

Retail development has occurred along Ulster Avenue, US Route 9W, Washington Avenue and NYS Route 28. Farmlands tend to be concentrated within the floodplain of Esopus Creek. Development in the Town of Ulster is a mixture of residential, commercial, offices, warehouses, recreational, open space, institutional, government and manufacturing uses. Much of the developed areas lie between Interstate Highway 87 and Highway 9W.

The Town includes some areas with Slopes of 15% or greater that are subject to Landslides. The Town has developed a GIS based map that shows the location of these areas. Floodplains include land along the Hudson River and Esopus Creek. The Esopus Creek floodplain is generally along Interstate Highway 87.The majority of the Townôs development is located in the valleys of Esopus Creek and its tributaries. As, such, there is a high potential for significant flood impacts. There is also a potential for similar impacts during snowstorms, ice storms or other major weather events.

Future Development Trends – County Overview

Ulster County lies approximately 70 miles north of New York City and 45 Miles south of Albany. This unique location makes the County a place that residents from New York City can go to escape the costs, pressures and densities of life in a major metropolis. It also makes the County a place where businesses want to located that serve the State of New Yorkôs two most important cities. At the same time, Ulster Countyôs location between the Hudson River and the Catskill Mountains ensures that development can not get too intense, especially since the County, the State, the local jurisdictions and private organization have done an excellent job of ensuring that much of the County will remain in pubic open space.

Earlier in this chapter, eleven hazards were identified as having a significant impact on Ulster County and have been analyzed in detail in this plan. The

Future Development Trends – Extreme Wind

The wind hazard area encompasses the entire County and is essentially uniform from one jurisdiction to the next. Therefore, future development trends for the wind hazard area would be the same as those county-wide. While an increased number of structures could be exposed in the future, all communities have adopted the New York State Building Code in addition to any local changes that they may have made, so that they will be constructed with a certain degree of protection from the most frequent high wind events.

Future Development Trends – Hurricanes and Tropical Storms, Nor'easters, and, Tornadoes

Severe weather events such as hurricanes/tropical storms can occur anywhere in Ulster County. These events will not have the same affect on Ulster County as they would on a coastal county; however the rain and hurricane force winds can still have a major affect on the County. The hazards associated with them include:

- For hurricanes/tropical storms and norôeasters, see future development trends for flooding and extreme winds.
- For tornadoes, see future development trends for high winds.

Future Development Trends – Lightning

The lightning hazard area encompasses the entire County and is uniform from one jurisdiction to the next. Therefore, future development trends for the lightning hazard area would be the same county-wide. It is anticipated that while an increasing number of structures will be present in the County, they will be constructed at least in accordance with currently adopted building codes which include basic measures to protect against lightning strikes.

Future Development Trends – Dam Failure

The New York State Department of Environmental Conservation Dam Safety Program maintains an inventory of dams in the State and conducts safety inspections of dams, completes technical reviews of proposed dam construction or modification, monitoring of remedial work for dam safety compliance, and is involved in emergency preparedness activities. At the time of writing, research of readily available data sources did not reveal any dams proposed or under construction, in addition to those listed by the US Army Corps of Engineers National Inventory of Dams, or the Stanford University National Performance of Dams Program.

Future Development Trends – Drought

The drought hazard area encompasses the entire County and is uniform from one jurisdiction to the next, although the local impact depends on the prevalence of agricultural land in individual municipalities. While the individual jurisdictions would like to focus on the preservation of farmland and other open space, possible pressures on agricultural land in Ulster County to be zoned for residential and other development, may reduce the economic effects of drought on agriculture, while the impact on potable water supplies may increase.

Future Development Trends – Flood

Individuals and larger developers often look toward land along rivers, streams, canals, bays, and near the ocean for development because of the passive and active recreational opportunities that they offer. In turn, flood hazard areas (for flooding and storm surge) are often areas where development pressures are high due to the recreational value of these lands, particularly in communities where the amount of undeveloped land is small and the density of development is high.

Development within mapped flood hazard areas is currently regulated for communities participating in FEMAôs National Flood Insurance Program (NFIP). All municipalities in the County participate in FEMAôs National Flood Insurance Program, and thereby must have in place a floodplain management ordinance to regulate activities in the floodplain, as well as a designated floodplain manager/NFIP Coordinator to enforce the relevant ordinances. This will work to protect new development and substantial improvements in the Countyôs floodplains. In addition, the Towns of Rosendale and Shandaken have included a discussion of floodplains in their comprehensive plan. The Town of Lloyd doesnôt include floodplains, but does include a section on the restraints to development due to hydrologic considerations.

While an increased number of assets could be susceptible, it is assumed that they will be built to codes that will offer a certain degree of protection from the most frequent events.

Future Development Trends – Ice Jams

The ice jam hazard is similar to the flood hazard in that ice jams may cause rivers and streams to overflow their banks. If a structure is near the banks of the rivers or streams, it may also be subject to structural damage from the impact of ice striking the structure. The jurisdictionsô flood hazard ordinances are assumed to currently deal with the flooding aspect of the ice jam hazard, and future damages due to this hazard will depend on development within the floodplain and adherence to the relevant building codes.

Future Development Trends – Earthquake

For Ulster County, PGA values of between 3 and 4%g have a 10 percent chance of being exceeded over 50 years. The earthquake hazard area encompasses the entire County and is nearly uniform from one jurisdiction to the next, although the effects of an earthquake may vary from one jurisdiction and across jurisdictions as the soil type varies. Therefore, future development trends for the earthquake hazard area would be the same as other county-wide hazards. All communities have adopted the New York State Building Code in addition to any local changes that they may have made.

Future Development Trends – Landslides

Scattered areas of the County are susceptible to landslide activity as described in Section 3a. Although there are few recorded examples of significant landslide events in Ulster County, the future may bring an increased frequency of events if vacant parcels and wildland areas in the relevant areas continue to be built on. The Towns of Lloyd, Rosendale and Ulster have included mapping of potential landslide areas as part of their comprehensive plan. They had previously determined that those areas could be a risk and consider the areas a constraint to development.

Future Development Trends – Wildfires

Areas that are typically considered to be safe from wildfires include highly urbanized, developed areas that are not contiguous with vast areas of wild lands. Areas typically considered to be prone to wildfires include large tracts of wild lands containing heavier fuels with high continuity such as those forested areas in many parts of the County. Pressure to develop some forested areas, especially for residential use, will generally result in increases to the urban-wildlife interface and the value of improved property within these areas in most jurisdictions, and hence an increased risk of future property damage and public danger due to wildfires.

Conclusion

Ulster County is balancing the objectives of preserving natural, cultural and historic resources; facing the reality of an economy which is undergoing a big change as the nation moves into the post-industrial era; and, seeing development that is driven by agricultural and natural resources as well as the occurrences of the nations largest urban area only 70 miles away. The County is involved in economic development, housing, open space, Stormwater and transportation planning, while six of the eight participating jurisdiction in this planning effort have prepared comprehensive plans in the past four years. This is an indication that they are concerned with their communities and want to ensure that they are safe, thriving

and appealing places to live work and play. The following recent development trends are expected to continue in the future:

- The County and itôs jurisdictions will continue to focus on preserving open space throughout the area;
- Most new development will continue to occur in the Hudson River Valley, especially along Interstate Highway 87 corridor;
- Additional development will take place along transportation corridors in the County, particularly in and around existing hamlets that have developed throughout the County;
- Redevelopment will take place throughout the County, as sites that were vacated due to changes in the economy are reused, modified or replaced;
- Agriculture and natural resources will continue to be a focus of the Ulster County economy;
- Ulster County will continue to be both recreational destination and drive both the commercial and industrial development in the County;
- Ulster County will continue to be a location where individuals that seek to leave the bustle of the New York City urban area seek to locate.

As such the County and its jurisdictions will continue to focus on:

1. Preserving open space throughout the County;
2. Ensuring that development within the County will meet the minimum requirements of the National Flood Insurance Program as well as meeting the Countyôs minimum Stormwater Management requirements;
3. Enforcing minimum building codes meeting the requirements of New York State Building Code;
4. Ensuring that development is limited to areas that are not subject to high landslide potential.

Note: All data was taken from websites of Ulster County or the participating jurisdictions. Of special significance were plans from Ulster County and the Towns of Gardiner, Hurley, Lloyd, Rosendale, Shandaken and Ulster.

A full summary of all the completed Land Use and Development Questionnaires returned by individual jurisdictions is presented in Table 3.d.3.

Summary of Responses – Land Use and Development Trends Questionnaire

Table 3d.3
Summary of Responses
Land Uses and Development Trends Questionnaire
(Source: Core Planning Group Members)

Community	Land Uses and Development Trends in Hazard Areas	Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
Ulster, County of	The County is making extensive efforts to support agriculture while at the same time encouraging industrial development in defined areas. Simultaneously, several large housing projects have been proposed for the area. >Agriculture- Farming has a long rich history in Ulster County which is being threatened by residential development. Family farms that have for generations been the predominant land use within many communities are being replaced with housing developments. Ulster County is working to preserve several agriculture districts in the various fertile valleys of the County. >Industrial development- Several areas of the County have been identified as potential ñshovel-readyò candidates. The areas that are being touted as potential manufacturing/ industrial sites are the Tech City complex in the Town of Ulster, the Kingston Business Park in the City of Kingston and a few other (primarily existing) sites that have water, sewer and roadways that can support expanded business use. Since tourism has been identified as an extremely important industry in Ulster County, efforts are being made to protect open spaces, scenic vistas, historical areas and existing recreational/ tourist destinations. >Housing- Several large housing projects have been proposed in the vicinity of the City of Kingston ï primarily along the Hudson River. The Crossroads Ventures resorts project in Shandaken also will result in significant changes in density and the landscape of the western portion of the county. While these mega projects have been held up in the regulatory/ SEQRA process (in some cases for years already), other major housing projects have been pulled from consideration in large part due to community opposition. Mid size projects and the proliferation of ñMcMansionsò continues throughout the county, especially in southern areas.	Many of the land use regulations/ ordinances are implemented at the local level through Town Planning and Zoning Boards. In general, every municipality in the county does participate in the National Flood Insurance Protection Program, and every municipality honors the NYS Uniform Fire and Prevention & Building Code. Additionally, seven towns have adopted steep slope ordinances for slopes greater than 15-20%. The Ulster County Planning Board is responsible for the review of local site plans, special permits, variances, comprehensive plans and zoning amendments. However, a local town planning board may take action contrary to the recommendations made by the County Planning Board by a majority plus one vote.

Table 3d.3
Summary of Responses
Land Uses and Development Trends Questionnaire
(Source: Core Planning Group Members)

Community	Land Uses and Development Trends in Hazard Areas	Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
Gardiner, Town of	The predominant type of development occurring in the Town is single family residential units, mostly built on 2 acre lots. Over the past 5-8 years there has been some commercial and light industrial development. Several years ago, the town enacted a building moratorium (which expired in November 2007), after it revised its master plan. Currently, the Town is in the final stage of the process of adopting a revised zoning law, and therefore some development activity is "on hold" as land owners and developers await the completion of that process. In the environmentally fragile "Shawangunk Ridge" area, significant zoning restrictions have already been adopted by the town. The Town is also attempting, through the use of open space conservation development, to preserve as much open space as possible, while permitting developers to maintain the density required to make development economically feasible. Traditional development is permitted under both the existing and the proposed zoning law.	Flooding: Chapter 121 of the Town Code, "Flood Damage Protection" addresses the issues of development on the floodplain, and is based on the FEMA Flood Insurance Rate Map (Index No. 360856 0005-0050) dated 7/16/97, and a scientific and engineering report entitled "Flood Insurance Study, Town of Gardiner, NY, Ulster County" dated 7/16/97. The proposed zoning law incorporates these provisions in creating a Floodplain Overlay District, defined as the one-hundred-year floodplain, based on FEMA maps. Section 220-13 (C) of the proposed zoning law reads: "In addition to any restrictions, requirements, or permits imposed or required by Chapter 121, no new structure intended for residential use and no new septic tank, leach field, or other sanitary sewage system shall be located within the Floodplain Overlay District. This shall not prevent the replacement of existing facilities." Steep Slope Development: The current zoning law addresses this issue in Chapter 220, Article V, Section 13.1 (F) (4) (b). Wildfire Hazard Areas: The current zoning law addresses this issue in Chapter 220, Article V, Section 13.1 (E). (N.B. While not enacted specifically to address the wildfire issue, the restrictions on lot size, etc. in the SP sections of the zoning law have the effect of reducing that risk.)
Hurley, Town of	Hurley has very little open land (not forested) left for developing, and as such experiences single family home building on a moderate to low scale. Hurley has seen interest recently on developing a PRD, but this application was withdrawn. The Planning Board has approved a new subdivision recently which may result in a few new homes being built on Dug Hill Road.	At this time the town of Hurley enforces the regular regulations and building codes, with no ordinances concerning only the effects of natural hazards. That being said, the regular Codes have the function of protecting the *burden* and the surrounding area from chemical hazards. Recent *MS4* regulations are in place
Kingston, City of	Development trends in the City of Kingston are focused on the Rondout Creek Hudson River area of the city. These proposed developments are of mixed use and density. While primarily condominium and single family homes there is a light industrial and commercial component as well. These proposals if developed fully would add as many as 2000 units of housing with a commensurate increase in population. These developments primarily involve the reuse of industrial areas that have been abandoned for many years. The city has developed a waterfront redevelopment plan and has established zoning requirements for development within the Hudson River and Rondout Creek areas. There has been acquisition of properties along the Rondout Creek	The City of Kingston does enforce regulations/ codes and local ordinance that regulate new development with regard to natural hazards. Applicable New York State Building and Fire Codes address wind and snow load design criteria for new construction. The city through its land use and site plan approval process regulates storm water runoff and control. The city floodplain coordinator and city engineer are part of the approval process in the development of site plan approvals and the issuance of building permits.

Table 3d.3
Summary of Responses
Land Uses and Development Trends Questionnaire
(Source: Core Planning Group Members)

Community	Land Uses and Development Trends in Hazard Areas	Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
	however no firm development plans for this area has been submitted to the city. It is anticipated that this will be an area of significant development in the near future. This is an area previously used for industrial applications, oil storage and junk yards. Most of these parcels have been cleared and are ready for reuse. Additionally the city continues to pursue development of its industrial park. There are presently two tenants Alcoa operating 70000 square foot manufacturing facility and Armor Dynamics a new tenant in a 10000 square foot building with a proposed 70000 square foot addition. There are three additional development sites in the complex which would support light industrial development. There have been several other residential projects proposed for other areas of the city which have not been pursued.	
Kingston, Town of	The Town of Kingston does not have any major construction going on at the present time. The building that is being done is scattered around the Town. There is a pre-existing seventy five lot subdivision located across the road from the Sawkill Creek. This neighborhood has the potential to flood. The developer removed six feet of soil before homes were built. Other areas of the Town of Kingston have steep slopes that front on Ulster County and New York State roads.	The Town of Kingston enforces current New York State building code regulations for development in the floodplain. Other hazards such as wind and landslides, the Town follows the New York State building code.
Lloyd, Town of	The Town of Lloyd is experiencing strong growth on the Eastern side of Illinois Mountain, which in effect splits the Town in its center, in the Route 9W and Route 44/55 corridor. There is a mix of commercial development and medium density residential development and medium density residential development. The Twalfskill Creek, one of our identified flood prone basins, sits between these two corridors. A large commercial project is being reviewed by our Planning Board for the Route 9W and Route 299 corner, which will impact the unnamed water course which joins the Twalfskill in the Hamlet of Highland. Further, light residential and some light commercial development continues in the Black Creek Basin, another identified flood prone watercourse. Other proposed projects include residential developments in the Lower Twalfskill basin (single family dwellings), further light residential developments along the Route 44/55 corridor. The Western side of Illinois Mountain is light residential and agricultural, with scattered commercial sites.	The Town of Lloyd Code includes regulations for flood plains, stormwater management, and our code on Zoning has language that encourages the Planning Board to review with water management in mind. We are also working on a new chapter for the regulation of construction near watercourses in the town, which would restrict construction in and near boundaries of watercourses in the town. We also work with the DEC for enforcement of SWPP (Lloyd is an MS4 community) through a municipal code officer.

Table 3d.3
Summary of Responses
Land Uses and Development Trends Questionnaire
(Source: Core Planning Group Members)

Community	Land Uses and Development Trends in Hazard Areas	Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
Marlborough, Town of	The predominant land use in Marlborough remains agricultural. There has been a substantial loss to single-family residential development in the rural areas. There has been some multi-family development in the hamlet areas of Milton & Marlboro. There are two large multi-housing projects being proposed in Marlboro adjacent to Rt 9W. There has been little commercial or industrial growth. Most recently there has been a halt on single-family residential building.	The Town of Marlborough is in the process of updating the codes with the help of Behan Associates (Planning Consultants). Our existing code does have language to help guide development and protect for the effects of natural hazards: Chapter 8 ï Conservation Advisory Council Chapter 29 ï Exposure to Disease Control Plan Chapter 47 ï Building Construction Chapter 48 ï 911 Numbering of Buildings Chapter 75 ï Clearing & Grading Chapter 89 ï SEQRA Review Chapter 93 ï Explosives & Blasting Chapter 97 ï Flood Damage Protection Chapter 134 ï Subdivision of Land Chapter 135 Stormwater Management Chapter 155 ï Zoning (Steep Slope/Right to Farm)
Rosendale, Town of	Rosendale is an area with much land that is constrained either by slope, flood plain or wetland. By contrast, Rosendale has a topography that seems almost corrugated in character. This is particularly true in the glaciated areas in the northern part of Town, among Binnerwater lakes. Heading south, these steep slopes descend to Rondout Creek. The Shawangunk Ridge rises just south of the creek. The only extensive flat area in Town is in the vicinity of Tillson (an area once referred to as Rosendale Plains). However, much of the flatland is located in flood plain. Consequently, unlike neighboring towns, Rosendale has little land that is easily developed. This condition has influenced Rosendaleôs sloe to moderate growth. The planning board has seen in the past several years mainly small subdivisions, including lot line adjustments and minor subdivisions. The planning board also has experienced various side plan approvals. These side plans have been primarily on existing commercial structures where businesses have been revitalized, renovated, changed used, expanded or created. Most of these activities have taken place on RT 32 corridor and our main street business district. Along with site plan approvals for small business and light industry the only other development trend that could be considered is thereôs been four petitions for rezoning in the past three years. These rezoning	The Town of Rosendale currently enforces regulations, ordinances, and Local codes including NYS rules and regulations and Federal requirements. These regulatory requirements are applied when applicable to protect and promote public health, safety, morals, comfort, convenience, economy, Town aesthetics and the general welfare of the public. The Town has adopted local codes that enforce zoning, they are found in chapter 75. Chapter 75 Article V has regulation 75-27 that specifically addresses flood damage prevention. The Townôs Local Codes can be viewed at Town of Rosendaleôs Web site. These are some of the Codes and Regulations administered and enforced by the Town: (Town of Rosendale Local Town Codes, Rules and Regulations; Ulster County Health Department and Other County Rules and Regulations; NYS Environmental Quality Review 6NYCRR Part 617; NYS Town Law; NYS Municipal Law; NYS Residential Code; NYS Uniform Fire Prevention and Building Code; NYS Vehicle and Traffic Law; NYS Wetlands; NYS Storrnwater; NYS Parks, Recreation and Historic Preservation Law; Federal Wet Lands)

Table 3d.3
Summary of Responses
Land Uses and Development Trends Questionnaire
(Source: Core Planning Group Members)

Community	Land Uses and Development Trends in Hazard Areas	Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
	petitions have mostly included existing residential zoning that has been changed to business and light industrial zones. Two of which were on the RT 32 corridor and the other two were in the Binnerwater area. The Town is currently reviewing a petition for a zoning text change to permit the redevelopment of the Williams Lake Hotel site located in Binnerwater. The proposed project is located on a 779 site that has a long history of industrial and commercial use, most recently as an outdated 95 room hotel with amenities and an internal road and trail system. The concept plan anticipates a LEED Gold-certified 130-room hotel, 160 fro sale homes (101 attached townhouses and 59 detached single family homes), a spa a wellness center, and a welcoming/ arrival facility. Roughly 729 acres, or almost 95% or the project siteôs 779 acres will remain open.	These Codes, Laws, Rules, and regulations are administered, regulated and enforced by various departments within the Town. Some Departments and Boards within the Town only regulate and apply codes as a requirement, such as The Town Board, Planning Board and Zoning Board of Appeals. Whereas other departments such as the Building Department, Code Enforcement Officer, Fire Marshal and Police department apply administer and enforce the Regulations and Laws when needed.
Shandaken, Town of	Last year and this year, most of our developments are alterations and repairs to single family homes. We had four single family homes being built. We get a lot of sheds, garages, wood stove permits. 75 percent of our town is owned by the State. We do not have much land to develop.	The town of Shandaken has zoning codes and flood plain management ordinances for development near the Esopus Creek.
Ulster, Town of	The Town of Ulster is currently reviewing a twenty-five lot subdivision that fronts on the Esopus Creek. Six of the twenty-five lots are on the water front. A second one hundred-lot subdivision is proposed across the street from the Esopus Creek. Both projects are expected to be approved within the next six to twelve months.	The Town of Ulster enforces building code regulations for both new construction and renovation in the flood plain. Other hazards and wildfire buffer zones, the Town of Ulster defers to the currently New York State building code.