Appendix 3.
HAZUS-MH: Hurricane Event Report

3.1 Scenario 01/ Historical Model

3.2 Probabilistic Model

(10 Year –1,000 Year Return Periods)

Quick Assessment Report

October 8, 2011

Study Region : MamaroneckNY-hurricane-1
Scenario : Scenario-1
Scenario Description : User Defined
Peak Gust Wind Speed (mph) : 141

Regional Statistics

Area (Square Miles)	3
Number of Census Tracts	4
Number of People in the Region	18,464

General Building Stock

Occupancy	*Building Count*	*Dollar Exposure ($ M)*
Residential	4,061	1,175
Commercial	83	202
Other	12	94
Total	4,156	1,474

Scenario Results

Number of Buildings Damaged

Damage State	*Residential*	*Commercial*	*Other*	*Total*
Minor	900	10	<10	900
Moderate	1,400	30	<10	1,400
Severe	800	40	<10	900
Destruction	600	<10	0	600
Total	3,800	80	<10	3,900

Shelter Requirements

Displaced Households (# Households)	3,300
Short Term Shelter (# People)	800

Economic Loss ($ Millions)

Capital Stock		782
Residential Property	650	
Commercial Property	87	
Other Property	45	
Business Interruption (Income)		92
Total Direct Economic Loss		874

Disclaimer:

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

HAZUS-MH: Hurricane Event Report

Region Name: MamaroneckNY-hurricane-1

Hurricane Scenario: Scenario-1

Print Date: Saturday, October 08, 2011

Disclaimer:
The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software wh is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

Table of Contents

General Description of the Region

HAZUS is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- New York

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 3.14 square miles and contains 4 census tracts. There are over 6 thousand households in the region and has a total population of 18,464 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 4 thousand buildings in the region with a total building replacement value (excluding contents) of 1,475 million dollars (2002 dollars). Approximately 98% of the buildings (and 80% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

HAZUS estimates that there are 4,156 buildings in the region which have an aggregate total replacement value of 1,475 million (2002 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,175,153	79.7%
Commercial	202,474	13.7%
Industrial	33,912	2.3%
Agricultural	3,161	0.2%
Religious	6,915	0.5%
Government	5,164	0.4%
Education	47,781	3.2%
Total	1,474,560	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 7 schools, 2 fire stations, 2 police stations and no emergency operation facilities.

Hurricane Scenario

HAZUS used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name: Scenario-1

Type: Deterministic

Maximum Peak Gust in Study Region: 141 mph

Storm Information: Deterministic scenario

User Defined Storm Track Input Data

Point	Latitude	Longitude	Time Step (hour)	Translation Speed (mph)	Radius To Max Winds (miles)	Max. Sustained Wind Speed (mph @ 10m)	Cental Pressure (mBar)	Profile Parameter	Radius to Hurricane Force Winds (miles)
1	31.45	-75.64	--	15.00	20.00	120.00	955.00	--	--
2	40.29	-73.91	--	15.00	20.00	120.00	955.00	--	--
3	41.50	-73.71	--	15.00	20.00	120.00	955.00	--	--
4	45.59	-72.80	--	15.00	20.00	120.00	955.00	--	--

Building Damage

General Building Stock Damage

HAZUS estimates that about 2,946 buildings will be at least moderately damaged. This is over 71% of the total number of buildings in the region. There are an estimated 616 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the HAZUS Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	6.48	0	21.46	0	32.38	0	28.63	0	11.05
Commercial	7	8.01	11	13.55	26	31.00	38	45.91	1	1.53
Education	0	7.21	0	10.98	1	28.20	2	52.95	0	0.66
Government	0	7.42	0	9.89	1	27.13	2	55.17	0	0.38
Industrial	0	9.34	0	12.69	1	30.19	1	46.07	0	1.70
Religion	0	7.81	0	18.54	0	34.93	0	37.88	0	0.84
Residential	263	6.47	927	22.82	1,411	34.74	847	20.85	614	15.12
Total	**270**		**939**		**1,440**		**891**		**616**	

Table 3: Expected Building Damage by Building Type

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	6	7.61	7	8.88	26	33.75	39	49.75	0	0.01
Masonry	56	7.67	125	17.06	281	38.44	212	28.99	57	7.85
MH	2	19.68	1	11.61	2	27.19	1	9.96	3	31.56
Steel	6	8.52	6	9.00	19	28.08	37	53.38	1	1.01
Wood	201	6.17	824	25.27	1,081	33.16	605	18.54	550	16.86

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	2	0	0
Police Stations	2	2	0	0
Schools	7	7	0	0

Induced Hurricane Damage

Debris Generation

HAZUS estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into three general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, and c) Trees. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 82,476 tons of debris will be generated. Of the total amount, Brick/Wood comprises 90% of the total, Reinforced Concrete/Steel comprises of 3% of the total, with the remainder being Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 3049 truckloads (@25 tons/truck) to remove the debris generated by the hurricane.

Social Impact

Shelter Requirement

HAZUS estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 3,267 households to be displaced due to the hurricane. Of these, 751 people (out of a total population of 18,464) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 874.1 million dollars, which represents 59.28 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 874 million dollars. 4% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 81% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	451,953.00	51,504.80	8,480.63	17,264.51	529,202.94
	Content	198,117.06	34,625.30	7,248.28	11,524.67	251,515.31
	Inventory	0.00	703.39	905.45	64.66	1,673.50
	Subtotal	**650,070.06**	**86,833.50**	**16,634.35**	**28,853.84**	**782,391.75**
Business Interruption Loss						
	Income	35.62	9,937.02	90.45	193.98	10,257.09
	Relocation	35,465.87	7,395.68	492.89	3,007.49	46,361.93
	Rental	18,771.32	4,870.33	83.14	218.73	23,943.52
	Wage	83.25	10,319.37	155.20	619.95	11,177.76
	Subtotal	**54,356.06**	**32,522.40**	**821.68**	**4,040.16**	**91,740.29**
Total	**Total**	**704,426.12**	**119,355.89**	**17,456.03**	**32,894.00**	**874,132.05**

Appendix A: County Listing for the Region

New York
- Westchester

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
New York				
Westchester	18,464	1,175,153	299,407	1,474,560
Total State	**18,464**	**1,175,153**	**299,407**	**1,474,560**
Total Study Region	**18,464**	**1,175,153**	**299,407**	**1,474,560**

Quick Assessment Report

October 7, 2011

Study Region : MamaroneckNY-hurricane-1

Scenario : Probabilistic

Regional Statistics

Area (Square Miles)	3
Number of Census Tracts	4
Number of People in the Region	18,464

General Building Stock

Occupancy	*Building Count*	*Dollar Exposure ($ M)*
Residential	4,061	1,175
Commercial	83	202
Other	12	94
Total	4,156	1,474

Scenario Results

Number of Residential Buildings Damaged

Return Period	*Minor*	*Moderate*	*Severe*	*Destruction*	*Total*
10	0	0	0	0	0
20	6	0	0	0	6
50	134	17	1	0	152
100	665	149	6	3	823
200	1,366	584	71	43	2,065
500	1,408	1,229	406	258	3,301
1000	979	1,412	800	573	3,764

Number of Buildings Damaged

Return Period	*Minor*	*Moderate*	*Severe*	*Destruction*	*Total*
10	0	0	0	0	0
20	6	0	0	0	6
50	136	18	1	0	154
100	678	153	7	3	841
200	1,390	602	77	43	2,112
500	1,429	1,259	432	258	3,378
1000	993	1,442	842	574	3,850

Shelter Requirements

Return Period	*Displaced Households (#Households)*	*Short Term Shelter (#People)*
10	0	0
20	0	0
50	7	1
100	67	15
200	302	69
500	1,459	335
1000	3,059	702

Economic Loss (x 1000)

	Property Damage (Capital Stock) Losses		*Business Interruption*
ReturnPeriod	*Residential*	*Total*	*(Income) Losses*
10	0	0	0
20	261	261	1
50	7,150	7,400	530
100	26,740	29,080	3,278
200	97,860	112,864	14,239
500	344,584	411,850	52,670
1000	616,405	740,142	87,287
Annualized	2,449	2,903	337

Disclaimer:

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

HAZUS-MH: Hurricane Event Report

Region Name: MamaroneckNY-hurricane-1

Hurricane Scenario: Scenario-1

Print Date: Saturday, October 08, 2011

Disclaimer:
The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software wh is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

Table of Contents

General Description of the Region

HAZUS is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- New York

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 3.14 square miles and contains 4 census tracts. There are over 6 thousand households in the region and has a total population of 18,464 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 4 thousand buildings in the region with a total building replacement value (excluding contents) of 1,475 million dollars (2002 dollars). Approximately 98% of the buildings (and 80% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

HAZUS estimates that there are 4,156 buildings in the region which have an aggregate total replacement value of 1,475 million (2002 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,175,153	79.7%
Commercial	202,474	13.7%
Industrial	33,912	2.3%
Agricultural	3,161	0.2%
Religious	6,915	0.5%
Government	5,164	0.4%
Education	47,781	3.2%
Total	1,474,560	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 7 schools, 2 fire stations, 2 police stations and no emergency operation facilities.

Hurricane Scenario

HAZUS used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name: Scenario-1

Type: Deterministic

Maximum Peak Gust in Study Region: 141 mph

Storm Information: Deterministic scenario

User Defined Storm Track Input Data

Point	Latitude	Longitude	Time Step (hour)	Translation Speed (mph)	Radius To Max Winds (miles)	Max. Sustained Wind Speed (mph @ 10m)	Cental Pressure (mBar)	Profile Parameter	Radius to Hurricane Force Winds (miles)
1	31.45	-75.64	--	15.00	20.00	120.00	955.00	--	--
2	40.29	-73.91	--	15.00	20.00	120.00	955.00	--	--
3	41.50	-73.71	--	15.00	20.00	120.00	955.00	--	--
4	45.59	-72.80	--	15.00	20.00	120.00	955.00	--	--

Building Damage

General Building Stock Damage

HAZUS estimates that about 2,946 buildings will be at least moderately damaged. This is over 71% of the total number of buildings in the region. There are an estimated 616 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the HAZUS Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	6.48	0	21.46	0	32.38	0	28.63	0	11.05
Commercial	7	8.01	11	13.55	26	31.00	38	45.91	1	1.53
Education	0	7.21	0	10.98	1	28.20	2	52.95	0	0.66
Government	0	7.42	0	9.89	1	27.13	2	55.17	0	0.38
Industrial	0	9.34	0	12.69	1	30.19	1	46.07	0	1.70
Religion	0	7.81	0	18.54	0	34.93	0	37.88	0	0.84
Residential	263	6.47	927	22.82	1,411	34.74	847	20.85	614	15.12
Total	**270**		**939**		**1,440**		**891**		**616**	

Table 3: Expected Building Damage by Building Type

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	6	7.61	7	8.88	26	33.75	39	49.75	0	0.01
Masonry	56	7.67	125	17.06	281	38.44	212	28.99	57	7.85
MH	2	19.68	1	11.61	2	27.19	1	9.96	3	31.56
Steel	6	8.52	6	9.00	19	28.08	37	53.38	1	1.01
Wood	201	6.17	824	25.27	1,081	33.16	605	18.54	550	16.86

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	2	0	0
Police Stations	2	2	0	0
Schools	7	7	0	0

Induced Hurricane Damage

Debris Generation

HAZUS estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into three general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, and c) Trees. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 82,476 tons of debris will be generated. Of the total amount, Brick/Wood comprises 90% of the total, Reinforced Concrete/Steel comprises of 3% of the total, with the remainder being Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 3049 truckloads (@25 tons/truck) to remove the debris generated by the hurricane.

Social Impact

Shelter Requirement

HAZUS estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 3,267 households to be displaced due to the hurricane. Of these, 751 people (out of a total population of 18,464) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 874.1 million dollars, which represents 59.28 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 874 million dollars. 4% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 81% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	451,953.00	51,504.80	8,480.63	17,264.51	529,202.94
	Content	198,117.06	34,625.30	7,248.28	11,524.67	251,515.31
	Inventory	0.00	703.39	905.45	64.66	1,673.50
	Subtotal	**650,070.06**	**86,833.50**	**16,634.35**	**28,853.84**	**782,391.75**
Business Interruption Loss						
	Income	35.62	9,937.02	90.45	193.98	10,257.09
	Relocation	35,465.87	7,395.68	492.89	3,007.49	46,361.93
	Rental	18,771.32	4,870.33	83.14	218.73	23,943.52
	Wage	83.25	10,319.37	155.20	619.95	11,177.76
	Subtotal	**54,356.06**	**32,522.40**	**821.68**	**4,040.16**	**91,740.29**
Total	**Total**	**704,426.12**	**119,355.89**	**17,456.03**	**32,894.00**	**874,132.05**

Appendix A: County Listing for the Region

New York
- Westchester

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
New York				
Westchester	18,464	1,175,153	299,407	1,474,560
Total State	**18,464**	**1,175,153**	**299,407**	**1,474,560**
Total Study Region	**18,464**	**1,175,153**	**299,407**	**1,474,560**

Quick Assessment Report

October 8, 2011

Study Region : MamaroneckNY-hurricane-1
Scenario : Scenario-1
Scenario Description : User Defined
Peak Gust Wind Speed (mph) : 141

Regional Statistics

Area (Square Miles)	3
Number of Census Tracts	4
Number of People in the Region	18,464

General Building Stock

Occupancy	*Building Count*	*Dollar Exposure ($ M)*
Residential	4,061	1,175
Commercial	83	202
Other	12	94
Total	4,156	1,474

Scenario Results

Number of Buildings Damaged

Damage State	*Residential*	*Commercial*	*Other*	*Total*
Minor	900	10	<10	900
Moderate	1,400	30	<10	1,400
Severe	800	40	<10	900
Destruction	600	<10	0	600
Total	3,800	80	<10	3,900

Shelter Requirements

Displaced Households (# Households)	3,300
Short Term Shelter (# People)	800

Economic Loss ($ Millions)

Capital Stock		782
Residential Property	650	
Commercial Property	87	
Other Property	45	
Business Interruption (Income)		92
Total Direct Economic Loss		874

Disclaimer:

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

Quick Assessment Report

October 7, 2011

Study Region : MamaroneckNY-hurricane-1

Scenario : Probabilistic

Regional Statistics

Area (Square Miles)	3
Number of Census Tracts	4
Number of People in the Region	18,464

General Building Stock

Occupancy	*Building Count*	*Dollar Exposure ($ M)*
Residential	4,061	1,175
Commercial	83	202
Other	12	94
Total	4,156	1,474

Scenario Results

Number of Residential Buildings Damaged

Return Period	*Minor*	*Moderate*	*Severe*	*Destruction*	*Total*
10	0	0	0	0	0
20	6	0	0	0	6
50	134	17	1	0	152
100	665	149	6	3	823
200	1,366	584	71	43	2,065
500	1,408	1,229	406	258	3,301
1000	979	1,412	800	573	3,764

Number of Buildings Damaged

Return Period	*Minor*	*Moderate*	*Severe*	*Destruction*	*Total*
10	0	0	0	0	0
20	6	0	0	0	6
50	136	18	1	0	154
100	678	153	7	3	841
200	1,390	602	77	43	2,112
500	1,429	1,259	432	258	3,378
1000	993	1,442	842	574	3,850

Shelter Requirements

Return Period	*Displaced Households (#Households)*	*Short Term Shelter (#People)*
10	0	0
20	0	0
50	7	1
100	67	15
200	302	69
500	1,459	335
1000	3,059	702

Economic Loss (x 1000)

	Property Damage (Capital Stock) Losses		*Business Interruption*
ReturnPeriod	*Residential*	*Total*	*(Income) Losses*
10	0	0	0
20	261	261	1
50	7,150	7,400	530
100	26,740	29,080	3,278
200	97,860	112,864	14,239
500	344,584	411,850	52,670
1000	616,405	740,142	87,287
Annualized	2,449	2,903	337

Disclaimer:

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

HAZUS-MH: Hurricane Event Report

Region Name: MamaroneckNY-hurricane-1

Hurricane Scenario: Probabilistic 10-year Return Period

Print Date: Friday, October 07, 2011

Disclaimer:

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software wh is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

Table of Contents

General Description of the Region

HAZUS is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- New York

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 3.14 square miles and contains 4 census tracts. There are over 6 thousand households in the region and has a total population of 18,464 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 4 thousand buildings in the region with a total building replacement value (excluding contents) of 1,475 million dollars (2002 dollars). Approximately 98% of the buildings (and 80% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

HAZUS estimates that there are 4,156 buildings in the region which have an aggregate total replacement value of 1,475 million (2002 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,175,153	79.7%
Commercial	202,474	13.7%
Industrial	33,912	2.3%
Agricultural	3,161	0.2%
Religious	6,915	0.5%
Government	5,164	0.4%
Education	47,781	3.2%
Total	1,474,560	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 7 schools, 2 fire stations, 2 police stations and no emergency operation facilities.

Hurricane Scenario

HAZUS used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

HAZUS estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the HAZUS Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 10 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	1	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	83	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	3	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	4	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	3	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	1	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	4,061	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**4,156**		**0**		**0**		**0**		**0**	

Table 3: Expected Building Damage by Building Type : 10 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	78	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	732	100.00	0	0.00	0	0.00	0	0.00	0	0.00
MH	9	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	69	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	3,261	100.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	2
Police Stations	2	0	0	2
Schools	7	0	0	7

Induced Hurricane Damage

Debris Generation

HAZUS estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into three general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, and c) Trees. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0 tons of debris will be generated. Of the total amount, Brick/Wood comprises 0% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the hurricane.

Social Impact

Shelter Requirement

HAZUS estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 18,464) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.0 million dollars, which represents 0.00 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 0 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Business Interruption Loss						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Total	**Total**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Appendix A: County Listing for the Region

New York
- Westchester

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
New York				
Westchester	18,464	1,175,153	299,407	1,474,560
Total State	**18,464**	**1,175,153**	**299,407**	**1,474,560**
Total Study Region	**18,464**	**1,175,153**	**299,407**	**1,474,560**

HAZUS-MH: Hurricane Event Report

Region Name: MamaroneckNY-hurricane-1

Hurricane Scenario: Probabilistic 20-year Return Period

Print Date: Friday, October 07, 2011

Disclaimer:

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software wh is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

Table of Contents

General Description of the Region

HAZUS is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- New York

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 3.14 square miles and contains 4 census tracts. There are over 6 thousand households in the region and has a total population of 18,464 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 4 thousand buildings in the region with a total building replacement value (excluding contents) of 1,475 million dollars (2002 dollars). Approximately 98% of the buildings (and 80% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

HAZUS estimates that there are 4,156 buildings in the region which have an aggregate total replacement value of 1,475 million (2002 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,175,153	79.7%
Commercial	202,474	13.7%
Industrial	33,912	2.3%
Agricultural	3,161	0.2%
Religious	6,915	0.5%
Government	5,164	0.4%
Education	47,781	3.2%
Total	1,474,560	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 7 schools, 2 fire stations, 2 police stations and no emergency operation facilities.

Hurricane Scenario

HAZUS used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

HAZUS estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the HAZUS Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 20 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	1	99.80	0	0.20	0	0.00	0	0.00	0	0.00
Commercial	83	99.72	0	0.28	0	0.00	0	0.00	0	0.00
Education	3	99.69	0	0.31	0	0.00	0	0.00	0	0.00
Government	4	99.67	0	0.33	0	0.00	0	0.00	0	0.00
Industrial	3	99.72	0	0.28	0	0.00	0	0.00	0	0.00
Religion	1	99.79	0	0.21	0	0.00	0	0.00	0	0.00
Residential	4,055	99.86	6	0.14	0	0.01	0	0.00	0	0.00
Total	**4,150**		**6**		**0**		**0**		**0**	

Table 3: Expected Building Damage by Building Type : 20 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	78	99.63	0	0.37	0	0.00	0	0.00	0	0.00
Masonry	729	99.62	3	0.37	0	0.01	0	0.00	0	0.00
MH	9	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	69	99.68	0	0.32	0	0.00	0	0.00	0	0.00
Wood	3,259	99.95	1	0.04	0	0.01	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	2
Police Stations	2	0	0	2
Schools	7	0	0	7

Induced Hurricane Damage

Debris Generation

HAZUS estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into three general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, and c) Trees. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 124 tons of debris will be generated. Of the total amount, Brick/Wood comprises 19% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 1 truckloads (@25 tons/truck) to remove the debris generated by the hurricane.

Social Impact

Shelter Requirement

HAZUS estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 18,464) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.3 million dollars, which represents 0.02 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 0 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 100% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	210.65	0.00	0.00	0.00	210.65
	Content	50.32	0.00	0.00	0.00	50.32
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	**260.97**	**0.00**	**0.00**	**0.00**	**260.97**
Business Interruption Loss						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.60	0.00	0.00	0.00	0.60
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.60**	**0.00**	**0.00**	**0.00**	**0.60**
Total	**Total**	**261.57**	**0.00**	**0.00**	**0.00**	**261.57**

Appendix A: County Listing for the Region

New York
- Westchester

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
New York				
Westchester	18,464	1,175,153	299,407	1,474,560
Total State	**18,464**	**1,175,153**	**299,407**	**1,474,560**
Total Study Region	**18,464**	**1,175,153**	**299,407**	**1,474,560**

HAZUS-MH: Hurricane Event Report

Region Name: MamaroneckNY-hurricane-1

Hurricane Scenario: Probabilistic 50-year Return Period

Print Date: Friday, October 07, 2011

Disclaimer:

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software wh is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

Table of Contents

General Description of the Region

HAZUS is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- New York

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 3.14 square miles and contains 4 census tracts. There are over 6 thousand households in the region and has a total population of 18,464 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 4 thousand buildings in the region with a total building replacement value (excluding contents) of 1,475 million dollars (2002 dollars). Approximately 98% of the buildings (and 80% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

HAZUS estimates that there are 4,156 buildings in the region which have an aggregate total replacement value of 1,475 million (2002 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,175,153	79.7%
Commercial	202,474	13.7%
Industrial	33,912	2.3%
Agricultural	3,161	0.2%
Religious	6,915	0.5%
Government	5,164	0.4%
Education	47,781	3.2%
Total	1,474,560	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 7 schools, 2 fire stations, 2 police stations and no emergency operation facilities.

Hurricane Scenario

HAZUS used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

HAZUS estimates that about 18 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the HAZUS Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 50 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	1	97.33	0	2.31	0	0.28	0	0.07	0	0.01
Commercial	81	97.11	2	2.62	0	0.26	0	0.01	0	0.00
Education	3	96.68	0	3.11	0	0.21	0	0.00	0	0.00
Government	4	96.66	0	3.13	0	0.21	0	0.00	0	0.00
Industrial	3	97.76	0	2.14	0	0.08	0	0.01	0	0.00
Religion	1	97.64	0	2.28	0	0.07	0	0.01	0	0.00
Residential	3,909	96.27	134	3.29	17	0.43	1	0.02	0	0.00
Total	**4,002**		**136**		**18**		**1**		**0**	

Table 3: Expected Building Damage by Building Type : 50 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	75	96.67	2	3.17	0	0.17	0	0.00	0	0.00
Masonry	693	94.65	31	4.21	8	1.12	0	0.03	0	0.00
MH	9	99.85	0	0.12	0	0.03	0	0.00	0	0.00
Steel	67	97.06	2	2.68	0	0.25	0	0.01	0	0.00
Wood	3,165	97.06	91	2.79	5	0.14	0	0.01	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	2
Police Stations	2	0	0	2
Schools	7	0	0	7

Induced Hurricane Damage

Debris Generation

HAZUS estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into three general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, and c) Trees. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 1,601 tons of debris will be generated. Of the total amount, Brick/Wood comprises 58% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 37 truckloads (@25 tons/truck) to remove the debris generated by the hurricane.

Social Impact

Shelter Requirement

HAZUS estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 7 households to be displaced due to the hurricane. Of these, 1 people (out of a total population of 18,464) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 7.9 million dollars, which represents 0.54 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 8 million dollars. 1% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 96% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	5,910.20	158.94	17.24	45.12	6,131.50
	Content	1,239.48	23.30	3.31	1.46	1,267.55
	Inventory	0.00	0.56	0.44	0.09	1.09
	Subtotal	**7,149.68**	**182.80**	**20.98**	**46.68**	**7,400.15**
Business Interruption Loss						
	Income	0.00	22.73	0.00	0.00	22.73
	Relocation	228.87	14.54	0.35	0.99	244.76
	Rental	245.51	8.57	0.00	0.00	254.08
	Wage	0.00	8.06	0.00	0.00	8.06
	Subtotal	**474.38**	**53.90**	**0.35**	**0.99**	**529.63**
Total	**Total**	**7,624.06**	**236.71**	**21.34**	**47.67**	**7,929.78**

Appendix A: County Listing for the Region

New York
- Westchester

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
New York				
Westchester	18,464	1,175,153	299,407	1,474,560
Total State	**18,464**	**1,175,153**	**299,407**	**1,474,560**
Total Study Region	**18,464**	**1,175,153**	**299,407**	**1,474,560**

HAZUS-MH: Hurricane Event Report

Region Name: MamaroneckNY-hurricane-1

Hurricane Scenario: Probabilistic 100-year Return Period

Print Date: Friday, October 07, 2011

Disclaimer:

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software wh is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

Table of Contents

General Description of the Region

HAZUS is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- New York

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 3.14 square miles and contains 4 census tracts. There are over 6 thousand households in the region and has a total population of 18,464 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 4 thousand buildings in the region with a total building replacement value (excluding contents) of 1,475 million dollars (2002 dollars). Approximately 98% of the buildings (and 80% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

HAZUS estimates that there are 4,156 buildings in the region which have an aggregate total replacement value of 1,475 million (2002 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,175,153	79.7%
Commercial	202,474	13.7%
Industrial	33,912	2.3%
Agricultural	3,161	0.2%
Religious	6,915	0.5%
Government	5,164	0.4%
Education	47,781	3.2%
Total	1,474,560	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 7 schools, 2 fire stations, 2 police stations and no emergency operation facilities.

Hurricane Scenario

HAZUS used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

HAZUS estimates that about 163 buildings will be at least moderately damaged. This is over 4% of the total number of buildings in the region. There are an estimated 3 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the HAZUS Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 100 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	1	82.05	0	13.02	0	3.31	0	1.48	0	0.14
Commercial	68	81.95	11	13.39	3	4.15	0	0.50	0	0.00
Education	2	79.52	0	14.87	0	5.12	0	0.49	0	0.00
Government	3	79.50	1	14.65	0	5.32	0	0.52	0	0.00
Industrial	3	85.34	0	11.59	0	2.76	0	0.30	0	0.01
Religion	1	84.17	0	13.36	0	2.37	0	0.10	0	0.00
Residential	3,238	79.73	665	16.38	149	3.66	6	0.16	3	0.08
Total	**3,315**		**678**		**153**		**7**		**3**	

Table 3: Expected Building Damage by Building Type : 100 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	63	80.45	11	14.49	4	4.88	0	0.18	0	0.00
Masonry	561	76.68	113	15.37	56	7.61	2	0.30	0	0.04
MH	9	96.31	0	2.64	0	0.83	0	0.01	0	0.20
Steel	57	81.91	9	12.73	3	4.74	0	0.62	0	0.00
Wood	2,656	81.44	536	16.44	62	1.90	4	0.13	3	0.09

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	0
Police Stations	2	0	0	0
Schools	7	0	0	0

Induced Hurricane Damage

Debris Generation

HAZUS estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into three general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, and c) Trees. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 5,854 tons of debris will be generated. Of the total amount, Brick/Wood comprises 70% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 164 truckloads (@25 tons/truck) to remove the debris generated by the hurricane.

Social Impact

Shelter Requirement

HAZUS estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 67 households to be displaced due to the hurricane. Of these, 15 people (out of a total population of 18,464) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 32.4 million dollars, which represents 2.19 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 32 million dollars. 3% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 90% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	21,917.84	1,182.87	161.03	390.36	23,652.10
	Content	4,822.58	362.54	82.25	139.49	5,406.86
	Inventory	0.00	8.22	10.88	1.77	20.87
	Subtotal	**26,740.42**	**1,553.63**	**254.15**	**531.62**	**29,079.82**
Business Interruption Loss						
	Income	0.00	183.46	2.36	46.02	231.84
	Relocation	1,166.33	218.55	16.62	84.06	1,485.56
	Rental	1,068.16	116.60	1.80	4.90	1,191.46
	Wage	0.00	180.54	4.06	184.28	368.87
	Subtotal	**2,234.48**	**699.15**	**24.83**	**319.27**	**3,277.73**
Total	**Total**	**28,974.91**	**2,252.78**	**278.98**	**850.88**	**32,357.55**

Appendix A: County Listing for the Region

New York
- Westchester

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
New York				
Westchester	18,464	1,175,153	299,407	1,474,560
Total State	**18,464**	**1,175,153**	**299,407**	**1,474,560**
Total Study Region	**18,464**	**1,175,153**	**299,407**	**1,474,560**

HAZUS-MH: Hurricane Event Report

Region Name: MamaroneckNY-hurricane-1

Hurricane Scenario: Probabilistic 200-year Return Period

Print Date: Friday, October 07, 2011

Disclaimer:

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software wh is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

Table of Contents

General Description of the Region

HAZUS is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- New York

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 3.14 square miles and contains 4 census tracts. There are over 6 thousand households in the region and has a total population of 18,464 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 4 thousand buildings in the region with a total building replacement value (excluding contents) of 1,475 million dollars (2002 dollars). Approximately 98% of the buildings (and 80% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

HAZUS estimates that there are 4,156 buildings in the region which have an aggregate total replacement value of 1,475 million (2002 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,175,153	79.7%
Commercial	202,474	13.7%
Industrial	33,912	2.3%
Agricultural	3,161	0.2%
Religious	6,915	0.5%
Government	5,164	0.4%
Education	47,781	3.2%
Total	1,474,560	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 7 schools, 2 fire stations, 2 police stations and no emergency operation facilities.

Hurricane Scenario

HAZUS used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

HAZUS estimates that about 721 buildings will be at least moderately damaged. This is over 17% of the total number of buildings in the region. There are an estimated 43 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the HAZUS Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 200 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	1	50.32	0	28.21	0	13.33	0	6.93	0	1.21
Commercial	42	50.76	21	25.20	15	18.40	5	5.60	0	0.05
Education	1	49.34	1	24.75	1	19.37	0	6.54	0	0.00
Government	2	49.31	1	23.80	1	19.97	0	6.92	0	0.00
Industrial	2	52.41	1	23.94	1	18.30	0	5.20	0	0.15
Religion	1	52.14	0	28.91	0	15.67	0	3.28	0	0.00
Residential	1,996	49.15	1,366	33.65	584	14.38	71	1.76	43	1.06
Total	**2,044**		**1,390**		**602**		**77**		**43**	

Table 3: Expected Building Damage by Building Type : 200 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	36	46.60	19	23.85	19	24.67	4	4.88	0	0.00
Masonry	342	46.68	198	27.02	168	22.94	21	2.80	4	0.56
MH	7	75.06	1	11.57	1	9.57	0	0.62	0	3.18
Steel	34	49.93	15	22.00	15	21.04	5	6.99	0	0.05
Wood	1,654	50.72	1,176	36.07	342	10.50	51	1.55	38	1.17

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	0
Police Stations	2	0	0	0
Schools	7	0	0	0

Induced Hurricane Damage

Debris Generation

HAZUS estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into three general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, and c) Trees. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 16,175 tons of debris will be generated. Of the total amount, Brick/Wood comprises 81% of the total, Reinforced Concrete/Steel comprises of 1% of the total, with the remainder being Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 530 truckloads (@25 tons/truck) to remove the debris generated by the hurricane.

Social Impact

Shelter Requirement

HAZUS estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 302 households to be displaced due to the hurricane. Of these, 69 people (out of a total population of 18,464) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 127.1 million dollars, which represents 8.62 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 127 million dollars. 3% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 85% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	74,603.37	6,515.83	1,079.73	2,161.65	84,360.57
	Content	23,256.97	3,202.52	755.88	1,110.76	28,326.14
	Inventory	0.00	70.64	97.12	9.87	177.63
	Subtotal	**97,860.34**	**9,788.99**	**1,932.73**	**3,282.28**	**112,864.34**
Business Interruption Loss						
	Income	0.73	414.73	8.13	63.78	487.38
	Relocation	6,691.53	1,220.61	108.52	471.47	8,492.12
	Rental	3,853.11	674.25	11.64	28.95	4,567.95
	Wage	1.72	427.20	13.80	248.65	691.36
	Subtotal	**10,547.09**	**2,736.78**	**142.09**	**812.85**	**14,238.81**
Total	**Total**	**108,407.43**	**12,525.77**	**2,074.82**	**4,095.13**	**127,103.15**

Appendix A: County Listing for the Region

New York
- Westchester

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
New York				
Westchester	18,464	1,175,153	299,407	1,474,560
Total State	**18,464**	**1,175,153**	**299,407**	**1,474,560**
Total Study Region	**18,464**	**1,175,153**	**299,407**	**1,474,560**

HAZUS-MH: Hurricane Event Report

Region Name: MamaroneckNY-hurricane-1

Hurricane Scenario: Probabilistic 500-year Return Period

Print Date: Friday, October 07, 2011

Disclaimer:

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software wh is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

Table of Contents

General Description of the Region

HAZUS is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- New York

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 3.14 square miles and contains 4 census tracts. There are over 6 thousand households in the region and has a total population of 18,464 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 4 thousand buildings in the region with a total building replacement value (excluding contents) of 1,475 million dollars (2002 dollars). Approximately 98% of the buildings (and 80% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

HAZUS estimates that there are 4,156 buildings in the region which have an aggregate total replacement value of 1,475 million (2002 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,175,153	79.7%
Commercial	202,474	13.7%
Industrial	33,912	2.3%
Agricultural	3,161	0.2%
Religious	6,915	0.5%
Government	5,164	0.4%
Education	47,781	3.2%
Total	1,474,560	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 7 schools, 2 fire stations, 2 police stations and no emergency operation facilities.

Hurricane Scenario

HAZUS used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

HAZUS estimates that about 1,949 buildings will be at least moderately damaged. This is over 47% of the total number of buildings in the region. There are an estimated 258 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the HAZUS Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 500 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	18.57	0	31.28	0	26.55	0	18.12	0	5.48
Commercial	16	19.02	19	22.40	26	31.53	22	26.61	0	0.44
Education	1	16.88	1	19.66	1	31.30	1	32.06	0	0.10
Government	1	17.03	1	18.08	1	31.11	1	33.72	0	0.06
Industrial	1	21.83	1	21.20	1	30.71	1	25.53	0	0.73
Religion	0	18.61	0	28.83	0	31.52	0	20.96	0	0.08
Residential	760	18.72	1,408	34.66	1,229	30.27	406	10.00	258	6.34
Total	**778**		**1,429**		**1,259**		**432**		**258**	

Table 3: Expected Building Damage by Building Type : 500 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	14	17.35	13	16.68	30	38.21	22	27.75	0	0.00
Masonry	138	18.91	187	25.51	276	37.64	107	14.62	24	3.31
MH	4	43.36	1	15.25	2	22.93	0	4.29	1	14.17
Steel	13	19.20	11	16.47	22	32.04	22	31.93	0	0.37
Wood	616	18.89	1,254	38.46	874	26.81	287	8.81	229	7.02

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	2	0	0
Police Stations	2	2	0	0
Schools	7	7	0	0

Induced Hurricane Damage

Debris Generation

HAZUS estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into three general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, and c) Trees. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 46,229 tons of debris will be generated. Of the total amount, Brick/Wood comprises 87% of the total, Reinforced Concrete/Steel comprises of 2% of the total, with the remainder being Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 1651 truckloads (@25 tons/truck) to remove the debris generated by the hurricane.

Social Impact

Shelter Requirement

HAZUS estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 1,459 households to be displaced due to the hurricane. Of these, 335 people (out of a total population of 18,464) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 464.5 million dollars, which represents 31.50 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 465 million dollars. 4% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 81% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	245,452.41	26,860.35	4,406.75	9,295.56	286,015.07
	Content	99,131.24	16,555.52	3,565.51	5,756.86	125,009.13
	Inventory	0.00	345.46	446.73	33.62	825.81
	Subtotal	**344,583.65**	**43,761.33**	**8,418.98**	**15,086.04**	**411,850.01**
Business Interruption Loss						
	Income	15.69	5,249.70	45.76	82.08	5,393.23
	Relocation	21,170.89	4,305.11	318.11	1,780.59	27,574.70
	Rental	11,034.13	2,684.11	45.81	124.12	13,888.16
	Wage	36.66	5,422.30	78.34	277.01	5,814.31
	Subtotal	**32,257.36**	**17,661.22**	**488.02**	**2,263.80**	**52,670.40**
Total	**Total**	**376,841.01**	**61,422.55**	**8,907.00**	**17,349.84**	**464,520.40**

Appendix A: County Listing for the Region

New York
- Westchester

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
New York				
Westchester	18,464	1,175,153	299,407	1,474,560
Total State	**18,464**	**1,175,153**	**299,407**	**1,474,560**
Total Study Region	**18,464**	**1,175,153**	**299,407**	**1,474,560**

HAZUS-MH: Hurricane Event Report

Region Name: MamaroneckNY-hurricane-1

Hurricane Scenario: Probabilistic 1000-year Return Period

Print Date: Friday, October 07, 2011

Disclaimer:

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software wh is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

Table of Contents

General Description of the Region

HAZUS is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- New York

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 3.14 square miles and contains 4 census tracts. There are over 6 thousand households in the region and has a total population of 18,464 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 4 thousand buildings in the region with a total building replacement value (excluding contents) of 1,475 million dollars (2002 dollars). Approximately 98% of the buildings (and 80% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

HAZUS estimates that there are 4,156 buildings in the region which have an aggregate total replacement value of 1,475 million (2002 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,175,153	79.7%
Commercial	202,474	13.7%
Industrial	33,912	2.3%
Agricultural	3,161	0.2%
Religious	6,915	0.5%
Government	5,164	0.4%
Education	47,781	3.2%
Total	1,474,560	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 7 schools, 2 fire stations, 2 police stations and no emergency operation facilities.

Hurricane Scenario

HAZUS used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

HAZUS estimates that about 2,857 buildings will be at least moderately damaged. This is over 69% of the total number of buildings in the region. There are an estimated 574 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the HAZUS Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 1000 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	7.43	0	22.68	0	32.06	0	27.46	0	10.37
Commercial	7	8.85	12	14.51	26	31.49	36	43.80	1	1.34
Education	0	8.05	0	11.99	1	29.12	2	50.31	0	0.53
Government	0	8.25	0	10.82	1	28.13	2	52.50	0	0.30
Industrial	0	10.25	0	13.54	1	30.55	1	44.07	0	1.58
Religion	0	8.25	0	19.12	0	34.89	0	36.96	0	0.78
Residential	297	7.32	979	24.12	1,412	34.77	800	19.69	573	14.10
Total	**306**		**993**		**1,442**		**842**		**574**	

Table 3: Expected Building Damage by Building Type : 1000 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	6	8.28	7	9.55	27	34.58	37	47.57	0	0.01
Masonry	62	8.47	131	17.94	284	38.84	201	27.42	54	7.34
MH	2	21.44	1	12.06	2	27.12	1	9.41	3	29.97
Steel	6	9.33	7	9.71	20	28.88	35	51.15	1	0.92
Wood	230	7.04	872	26.75	1,076	32.99	571	17.52	512	15.70

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	2	0	0
Police Stations	2	2	0	0
Schools	7	7	0	0

Induced Hurricane Damage

Debris Generation

HAZUS estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into three general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, and c) Trees. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 78,378 tons of debris will be generated. Of the total amount, Brick/Wood comprises 90% of the total, Reinforced Concrete/Steel comprises of 3% of the total, with the remainder being Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 2892 truckloads (@25 tons/truck) to remove the debris generated by the hurricane.

Social Impact

Shelter Requirement

HAZUS estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 3,059 households to be displaced due to the hurricane. Of these, 702 people (out of a total population of 18,464) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 827.4 million dollars, which represents 56.11 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 827 million dollars. 4% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 81% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	429,222.57	48,399.57	7,993.01	16,124.31	501,739.46
	Content	187,182.15	32,217.71	6,793.89	10,640.71	236,834.46
	Inventory	0.00	658.21	849.44	60.63	1,568.28
	Subtotal	**616,404.72**	**81,275.49**	**15,636.34**	**26,825.64**	**740,142.20**
Business Interruption Loss						
	Income	31.86	9,331.60	84.99	177.44	9,625.90
	Relocation	34,017.66	7,032.55	473.50	2,836.48	44,360.19
	Rental	17,916.46	4,607.23	78.53	205.56	22,807.78
	Wage	74.46	9,700.45	145.82	572.82	10,493.55
	Subtotal	**52,040.44**	**30,671.84**	**782.84**	**3,792.30**	**87,287.42**
Total	**Total**	**668,445.16**	**111,947.33**	**16,419.18**	**30,617.94**	**827,429.62**

Appendix A: County Listing for the Region

New York
- Westchester

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
New York				
Westchester	18,464	1,175,153	299,407	1,474,560
Total State	**18,464**	**1,175,153**	**299,407**	**1,474,560**
Total Study Region	**18,464**	**1,175,153**	**299,407**	**1,474,560**

HAZUS-MH: Hurricane Event Report

Region Name: MamaroneckNY-hurricane-1

Hurricane Scenario: Scenario-1

Print Date: Saturday, October 08, 2011

Disclaimer:
The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software wh is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

Table of Contents

General Description of the Region

HAZUS is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- New York

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 3.14 square miles and contains 4 census tracts. There are over 6 thousand households in the region and has a total population of 18,464 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 4 thousand buildings in the region with a total building replacement value (excluding contents) of 1,475 million dollars (2002 dollars). Approximately 98% of the buildings (and 80% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

HAZUS estimates that there are 4,156 buildings in the region which have an aggregate total replacement value of 1,475 million (2002 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,175,153	79.7%
Commercial	202,474	13.7%
Industrial	33,912	2.3%
Agricultural	3,161	0.2%
Religious	6,915	0.5%
Government	5,164	0.4%
Education	47,781	3.2%
Total	1,474,560	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 7 schools, 2 fire stations, 2 police stations and no emergency operation facilities.

Hurricane Scenario

HAZUS used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name: Scenario-1

Type: Deterministic

Maximum Peak Gust in Study Region: 141 mph

Storm Information: Deterministic scenario

User Defined Storm Track Input Data

Point	Latitude	Longitude	Time Step (hour)	Translation Speed (mph)	Radius To Max Winds (miles)	Max. Sustained Wind Speed (mph @ 10m)	Cental Pressure (mBar)	Profile Parameter	Radius to Hurricane Force Winds (miles)
1	31.45	-75.64	--	15.00	20.00	120.00	955.00	--	--
2	40.29	-73.91	--	15.00	20.00	120.00	955.00	--	--
3	41.50	-73.71	--	15.00	20.00	120.00	955.00	--	--
4	45.59	-72.80	--	15.00	20.00	120.00	955.00	--	--

Building Damage

General Building Stock Damage

HAZUS estimates that about 2,946 buildings will be at least moderately damaged. This is over 71% of the total number of buildings in the region. There are an estimated 616 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the HAZUS Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	6.48	0	21.46	0	32.38	0	28.63	0	11.05
Commercial	7	8.01	11	13.55	26	31.00	38	45.91	1	1.53
Education	0	7.21	0	10.98	1	28.20	2	52.95	0	0.66
Government	0	7.42	0	9.89	1	27.13	2	55.17	0	0.38
Industrial	0	9.34	0	12.69	1	30.19	1	46.07	0	1.70
Religion	0	7.81	0	18.54	0	34.93	0	37.88	0	0.84
Residential	263	6.47	927	22.82	1,411	34.74	847	20.85	614	15.12
Total	**270**		**939**		**1,440**		**891**		**616**	

Table 3: Expected Building Damage by Building Type

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	6	7.61	7	8.88	26	33.75	39	49.75	0	0.01
Masonry	56	7.67	125	17.06	281	38.44	212	28.99	57	7.85
MH	2	19.68	1	11.61	2	27.19	1	9.96	3	31.56
Steel	6	8.52	6	9.00	19	28.08	37	53.38	1	1.01
Wood	201	6.17	824	25.27	1,081	33.16	605	18.54	550	16.86

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	2	0	0
Police Stations	2	2	0	0
Schools	7	7	0	0

Induced Hurricane Damage

Debris Generation

HAZUS estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into three general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, and c) Trees. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 82,476 tons of debris will be generated. Of the total amount, Brick/Wood comprises 90% of the total, Reinforced Concrete/Steel comprises of 3% of the total, with the remainder being Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 3049 truckloads (@25 tons/truck) to remove the debris generated by the hurricane.

Social Impact

Shelter Requirement

HAZUS estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 3,267 households to be displaced due to the hurricane. Of these, 751 people (out of a total population of 18,464) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 874.1 million dollars, which represents 59.28 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 874 million dollars. 4% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 81% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	451,953.00	51,504.80	8,480.63	17,264.51	529,202.94
	Content	198,117.06	34,625.30	7,248.28	11,524.67	251,515.31
	Inventory	0.00	703.39	905.45	64.66	1,673.50
	Subtotal	**650,070.06**	**86,833.50**	**16,634.35**	**28,853.84**	**782,391.75**
Business Interruption Loss						
	Income	35.62	9,937.02	90.45	193.98	10,257.09
	Relocation	35,465.87	7,395.68	492.89	3,007.49	46,361.93
	Rental	18,771.32	4,870.33	83.14	218.73	23,943.52
	Wage	83.25	10,319.37	155.20	619.95	11,177.76
	Subtotal	**54,356.06**	**32,522.40**	**821.68**	**4,040.16**	**91,740.29**
Total	**Total**	**704,426.12**	**119,355.89**	**17,456.03**	**32,894.00**	**874,132.05**

Appendix A: County Listing for the Region

New York
- Westchester

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
New York				
Westchester	18,464	1,175,153	299,407	1,474,560
Total State	**18,464**	**1,175,153**	**299,407**	**1,474,560**
Total Study Region	**18,464**	**1,175,153**	**299,407**	**1,474,560**