APPENDIX D

HAZUS-MH OUTPUT

Hazus-MH: Flood Event Report

Region Name: Bozrah - Riverine - 100

Flood Scenario: Bozrah - Riverine - 100

Print Date: Thursday, April 12, 2012

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

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

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Flood Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Flood Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building-Related Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). 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 flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

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

The geographical size of the region is 20 square miles and contains 101 census blocks. The region contains over 1 thousand households and has a total population of 2,357 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 1,221 buildings in the region with a total building replacement value (excluding contents) of 287 million dollars (2006 dollars). Approximately 87.47% of the buildings (and 53.73% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 1,221 buildings in the region which have an aggregate total replacement value of 287 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	154,279	53.7%
Commercial	30,669	10.7%
Industrial	12,845	4.5%
Agricultural	82,000	28.6%
Religion	2,848	1.0%
Government	563	0.2%
Education	3,930	1.4%
Total	**287,134**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	62,918	71.9%
Commercial	12,656	14.5%
Industrial	8,996	10.3%
Agricultural	0	0.0%
Religion	664	0.8%
Government	563	0.6%
Education	1,656	1.9%
Total	**87,453**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.
There are 1 school, 1 fire station, no police stations and no emergency operation centers.

Flood Scenario Parameters

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

Study Region Name:	Bozrah - Riverine - 100
Scenario Name:	Bozrah - Riverine - 100
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 9 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 2 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	4	44.44	3	33.33	2	22.22
Total	**0**		**0**		**0**		**4**		**3**		**2**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	4	44.44	3	33.33	2	22.22

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	1	0	0	0
Hospitals	0	0	0	0
Police Stations	0	0	0	0
Schools	1	1	0	1

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). 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 440 tons of debris will be generated. Of the total amount, Finishes comprises 64% of the total, Structure comprises 21% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 18 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 44 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 70 people (out of a total population of 2,357) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 7.49 million dollars, which represents 8.57 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building 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 flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 7.47 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 52.18% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	2.37	0.64	0.16	0.03	3.21
	Content	1.54	2.07	0.34	0.18	4.13
	Inventory	0.00	0.07	0.06	0.00	0.13
	Subtotal	**3.91**	**2.79**	**0.57**	**0.21**	**7.47**
Business Interruption						
	Income	0.00	0.01	0.00	0.00	0.01
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.01	0.00	0.00	0.01
	Subtotal	**0.00**	**0.01**	**0.00**	**0.00**	**0.02**
ALL	**Total**	**3.91**	**2.80**	**0.57**	**0.21**	**7.49**

Appendix A: County Listing for the Region

Connecticut

- New London

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
New London	2,357	154,279	132,855	287,134
Total	**2,357**	**154,279**	**132,855**	**287,134**
Total Study Region	**2,357**	**154,279**	**132,855**	**287,134**

Hazus-MH: Flood Event Report

Region Name: Colchester - Riverine - 100

Flood Scenario: Colchester - Riverine - 100

Print Date: Thursday, April 12, 2012

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

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

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Flood Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Flood Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building-Related Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). 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 flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

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

The geographical size of the region is 49 square miles and contains 212 census blocks. The region contains over 5 thousand households and has a total population of 14,551 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 5,339 buildings in the region with a total building replacement value (excluding contents) of 1,175 million dollars (2006 dollars). Approximately 91.68% of the buildings (and 81.34% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 5,339 buildings in the region which have an aggregate total replacement value of 1,175 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	955,827	81.3%
Commercial	158,629	13.5%
Industrial	31,332	2.7%
Agricultural	3,279	0.3%
Religion	10,811	0.9%
Government	5,832	0.5%
Education	9,413	0.8%
Total	**1,175,123**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	113,998	86.4%
Commercial	14,073	10.7%
Industrial	2,055	1.6%
Agricultural	333	0.3%
Religion	0	0.0%
Government	1,460	1.1%
Education	0	0.0%
Total	**131,919**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.
There are 5 schools, no fire stations, 2 police stations and 1 emergency operation center.

Flood Scenario Parameters

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

Study Region Name:	Colchester - Riverine - 100
Scenario Name:	Colchester - Riverine - 100
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

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 scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**0**		**0**		**0**		**0**		**0**		**0**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	0	0	0	0
Hospitals	0	0	0	0
Police Stations	2	0	0	0
Schools	5	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). 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 144 tons of debris will be generated. Of the total amount, Finishes comprises 99% of the total, Structure comprises 1% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 6 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 31 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 70 people (out of a total population of 14,551) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 3.09 million dollars, which represents 2.34 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building 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 flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 3.08 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 83.52% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	0.87	0.08	0.02	0.00	0.97
	Content	1.71	0.34	0.03	0.02	2.10
	Inventory	0.00	0.01	0.00	0.00	0.02
	Subtotal	**2.58**	**0.44**	**0.06**	**0.02**	**3.08**
Business Interruption						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	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**
ALL	**Total**	**2.58**	**0.44**	**0.06**	**0.02**	**3.09**

Appendix A: County Listing for the Region

Connecticut

- New London

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
New London	14,551	955,827	219,296	1,175,123
Total	**14,551**	**955,827**	**219,296**	**1,175,123**
Total Study Region	**14,551**	**955,827**	**219,296**	**1,175,123**

Hazus-MH: Flood Event Report

Region Name: East Lyme - Riverine - 100

Flood Scenario: East Lyme - Riverine & Coastal - 100

Print Date: Monday, May 07, 2012

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

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

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Flood Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Flood Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building-Related Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). 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 flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

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

The geographical size of the region is 34 square miles and contains 394 census blocks. The region contains over 6 thousand households and has a total population of 18,118 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 8,287 buildings in the region with a total building replacement value (excluding contents) of 1,656 million dollars (2006 dollars). Approximately 93.54% of the buildings (and 81.99% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 8,287 buildings in the region which have an aggregate total replacement value of 1,656 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,357,485	82.0%
Commercial	204,753	12.4%
Industrial	56,900	3.4%
Agricultural	3,650	0.2%
Religion	10,158	0.6%
Government	13,975	0.8%
Education	8,705	0.5%
Total	**1,655,626**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	711,829	78.4%
Commercial	136,976	15.1%
Industrial	42,325	4.7%
Agricultural	1,670	0.2%
Religion	6,152	0.7%
Government	2,106	0.2%
Education	7,049	0.8%
Total	**908,107**	**100.00%**

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, no fire stations, 2 police stations and 2 emergency operation center.

Flood Scenario Parameters

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

Study Region Name:	East Lyme - Riverine - 100
Scenario Name:	East Lyme - Riverine & Coastal - 100
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 255 buildings will be at least moderately damaged. This is over 15% of the total number of buildings in the scenario. There are an estimated 30 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	3	1.18	46	18.04	69	27.06	107	41.96	30	11.76
Total	**0**		**3**		**46**		**69**		**107**		**30**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	1	33.33	2	66.67	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	3	1.19	46	18.25	68	26.98	105	41.67	30	11.90

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	0	0	0	0
Hospitals	0	0	0	0
Police Stations	2	0	0	0
Schools	7	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). 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 16,312 tons of debris will be generated. Of the total amount, Finishes comprises 29% of the total, Structure comprises 42% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 652 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 360 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 587 people (out of a total population of 18,118) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 75.18 million dollars, which represents 8.28 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building 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 flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 75.03 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 68.95% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	31.40	5.25	1.24	0.31	38.20
	Content	20.39	11.93	2.64	1.34	36.29
	Inventory	0.00	0.10	0.42	0.01	0.54
	Subtotal	**51.79**	**17.28**	**4.29**	**1.66**	**75.03**
Business Interruption						
	Income	0.00	0.05	0.00	0.00	0.06
	Relocation	0.03	0.01	0.00	0.00	0.04
	Rental Income	0.01	0.00	0.00	0.00	0.01
	Wage	0.01	0.04	0.00	0.01	0.06
	Subtotal	**0.05**	**0.10**	**0.00**	**0.01**	**0.16**
ALL	**Total**	**51.84**	**17.39**	**4.29**	**1.67**	**75.18**

Appendix A: County Listing for the Region

Connecticut

- New London

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New London	18,118	1,357,485	298,141	1,655,626
Total	**18,118**	**1,357,485**	**298,141**	**1,655,626**
Total Study Region	**18,118**	**1,357,485**	**298,141**	**1,655,626**

Hazus-MH: Flood Event Report

Region Name: Franklin - Riverine - 100

Flood Scenario: Susquetonscut Brook & Yantic River

Print Date: Thursday, April 12, 2012

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

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

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Flood Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Flood Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building-Related Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). 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 flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

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

The geographical size of the region is 20 square miles and contains 64 census blocks. The region contains over 1 thousand households and has a total population of 1,835 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 881 buildings in the region with a total building replacement value (excluding contents) of 209 million dollars (2006 dollars). Approximately 86.04% of the buildings (and 57.96% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 881 buildings in the region which have an aggregate total replacement value of 209 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	121,117	58.0%
Commercial	35,470	17.0%
Industrial	13,980	6.7%
Agricultural	34,802	16.7%
Religion	2,095	1.0%
Government	391	0.2%
Education	1,112	0.5%
Total	**208,967**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	8,358	65.0%
Commercial	4,157	32.3%
Industrial	352	2.7%
Agricultural	0	0.0%
Religion	0	0.0%
Government	0	0.0%
Education	0	0.0%
Total	**12,867**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.
There are 1 school, 1 fire station, no police stations and no emergency operation centers.

Flood Scenario Parameters

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

Study Region Name:	Franklin - Riverine - 100
Scenario Name:	Susquetonscut Brook & Yantic River
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

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 scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**0**		**0**		**0**		**0**		**0**		**0**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	1	0	0	0
Hospitals	0	0	0	0
Police Stations	0	0	0	0
Schools	1	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). 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 21 tons of debris will be generated. Of the total amount, Finishes comprises 39% of the total, Structure comprises 36% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 1 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 3 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 1 people (out of a total population of 1,835) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 0.37 million dollars, which represents 2.84 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building 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 flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 0.37 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 16.39% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	0.04	0.07	0.01	0.00	0.12
	Content	0.02	0.20	0.01	0.00	0.24
	Inventory	0.00	0.01	0.00	0.00	0.01
	Subtotal	**0.06**	**0.28**	**0.03**	**0.00**	**0.37**
Business Interruption						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	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**
ALL	**Total**	**0.06**	**0.28**	**0.03**	**0.00**	**0.37**

Appendix A: County Listing for the Region

Connecticut

- New London

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
New London	1,835	121,117	87,850	208,967
Total	**1,835**	**121,117**	**87,850**	**208,967**
Total Study Region	**1,835**	**121,117**	**87,850**	**208,967**

Hazus-MH: Flood Event Report

Region Name: Griswold - Riverine - 100

Flood Scenario: Griswold - Riverine - 100

Print Date: Friday, April 13, 2012

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

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

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Flood Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Flood Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building-Related Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). 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 flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

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

The geographical size of the region is 35 square miles and contains 283 census blocks. The region contains over 4 thousand households and has a total population of 10,807 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 4,329 buildings in the region with a total building replacement value (excluding contents) of 853 million dollars (2006 dollars). Approximately 91.75% of the buildings (and 77.77% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 4,329 buildings in the region which have an aggregate total replacement value of 853 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	663,264	77.8%
Commercial	104,060	12.2%
Industrial	64,314	7.5%
Agricultural	2,274	0.3%
Religion	6,547	0.8%
Government	4,327	0.5%
Education	8,082	0.9%
Total	**852,868**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	221,390	76.2%
Commercial	23,190	8.0%
Industrial	38,559	13.3%
Agricultural	413	0.1%
Religion	2,654	0.9%
Government	3,292	1.1%
Education	1,050	0.4%
Total	**290,548**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.
There are 4 schools, 2 fire stations, 2 police stations and 1 emergency operation center.

Flood Scenario Parameters

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

Study Region Name:	Griswold - Riverine - 100
Scenario Name:	Griswold - Riverine - 100
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 10 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 4 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	1	100.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	3	33.33	2	22.22	4	44.44
Total	**0**		**0**		**0**		**3**		**3**		**4**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	1	50.00	1	50.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	1	100.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	3	37.50	2	25.00	3	37.50

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	2	0	0	0
Hospitals	0	0	0	0
Police Stations	2	1	0	1
Schools	4	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). 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 1,607 tons of debris will be generated. Of the total amount, Finishes comprises 29% of the total, Structure comprises 40% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 64 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 110 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 166 people (out of a total population of 10,807) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 28.12 million dollars, which represents 9.68 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building 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 flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 28.08 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 22.64% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	4.14	0.52	5.92	0.09	10.67
	Content	2.22	1.42	12.12	0.55	16.31
	Inventory	0.00	0.03	1.07	0.00	1.10
	Subtotal	**6.36**	**1.97**	**19.11**	**0.64**	**28.08**
Business Interruption						
	Income	0.00	0.00	0.01	0.00	0.01
	Relocation	0.00	0.00	0.01	0.00	0.01
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.01	0.01	0.02
	Subtotal	**0.00**	**0.01**	**0.02**	**0.01**	**0.04**
ALL	**Total**	**6.37**	**1.97**	**19.14**	**0.65**	**28.12**

Appendix A: County Listing for the Region

Connecticut

- New London

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
New London	10,807	663,264	189,604	852,868
Total	**10,807**	**663,264**	**189,604**	**852,868**
Total Study Region	**10,807**	**663,264**	**189,604**	**852,868**

Hazus-MH: Flood Event Report

Region Name: City of Groton 2 (Riverine)

Flood Scenario: City of Groton - Birch Plain Creek Rive

Print Date: Tuesday, April 10, 2012

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

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

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Flood Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Flood Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building-Related Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). 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 flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

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

The geographical size of the region is 3 square miles and contains 124 census blocks. The region contains over 4 thousand households and has a total population of 10,010 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 2,980 buildings in the region with a total building replacement value (excluding contents) of 871 million dollars (2006 dollars). Approximately 91.71% of the buildings (and 77.81% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 2,980 buildings in the region which have an aggregate total replacement value of 871 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	678,094	77.8%
Commercial	105,752	12.1%
Industrial	64,509	7.4%
Agricultural	399	0.0%
Religion	10,989	1.3%
Government	5,452	0.6%
Education	6,244	0.7%
Total	**871,439**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	73,327	82.3%
Commercial	15,039	16.9%
Industrial	0	0.0%
Agricultural	0	0.0%
Religion	475	0.5%
Government	0	0.0%
Education	206	0.2%
Total	**89,047**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.
There are 5 schools, 2 fire stations, 2 police stations and no emergency operation centers.

Flood Scenario Parameters

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

Study Region Name:	City of Groton 2 (Riverine)
Scenario Name:	City of Groton - Birch Plain Creek Rive
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 12 buildings will be at least moderately damaged. This is over 10% of the total number of buildings in the scenario. There are an estimated 1 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	1	8.33	2	16.67	4	33.33	4	33.33	1	8.33
Total	**0**		**1**		**2**		**4**		**4**		**1**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	1	8.33	2	16.67	4	33.33	4	33.33	1	8.33

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	2	0	0	0
Hospitals	0	0	0	0
Police Stations	2	0	0	0
Schools	5	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). 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 364 tons of debris will be generated. Of the total amount, Finishes comprises 100% of the total, Structure comprises 0% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 15 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 109 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 314 people (out of a total population of 10,010) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 6.75 million dollars, which represents 7.58 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building 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 flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 6.73 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 68.64% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	2.94	0.78	0.00	0.01	3.73
	Content	1.69	1.20	0.00	0.10	2.99
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	**4.63**	**1.98**	**0.00**	**0.11**	**6.73**
Business Interruption						
	Income	0.00	0.01	0.00	0.00	0.01
	Relocation	0.00	0.00	0.00	0.00	0.01
	Rental Income	0.00	0.00	0.00	0.00	0.01
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.01**	**0.02**	**0.00**	**0.00**	**0.03**
ALL	**Total**	**4.64**	**2.00**	**0.00**	**0.11**	**6.75**

Appendix A: County Listing for the Region

Connecticut

- New London

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New London	10,010	678,094	193,345	871,439
Total	**10,010**	**678,094**	**193,345**	**871,439**
Total Study Region	**10,010**	**678,094**	**193,345**	**871,439**

Hazus-MH: Flood Event Report

Region Name: Town of Groton - 100

Flood Scenario: Town of Groton - Riverine & Coastal - 1

Print Date: Tuesday, May 15, 2012

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

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

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Flood Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Flood Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building-Related Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). 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 flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

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

The geographical size of the region is 32 square miles and contains 512 census blocks. The region contains over 15 thousand households and has a total population of 39,958 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 14,075 buildings in the region with a total building replacement value (excluding contents) of 3,435 million dollars (2006 dollars). Approximately 92.50% of the buildings (and 79.32% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 14,075 buildings in the region which have an aggregate total replacement value of 3,435 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	2,724,840	79.3%
Commercial	441,503	12.9%
Industrial	118,416	3.4%
Agricultural	3,928	0.1%
Religion	43,924	1.3%
Government	75,198	2.2%
Education	27,541	0.8%
Total	**3,435,350**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	959,303	76.2%
Commercial	165,692	13.2%
Industrial	73,114	5.8%
Agricultural	1,265	0.1%
Religion	20,495	1.6%
Government	24,871	2.0%
Education	13,992	1.1%
Total	**1,258,732**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.
There are 17 schools, 9 fire stations, 4 police stations and 1 emergency operation center.

Flood Scenario Parameters

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

Study Region Name:	Town of Groton - 100
Scenario Name:	Town of Groton - Riverine & Coastal - 1
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 674 buildings will be at least moderately damaged. This is over 19% of the total number of buildings in the scenario. There are an estimated 84 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	1	50.00	1	50.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	1	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	1	50.00	1	50.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	9	1.35	139	20.78	199	29.75	238	35.58	84	12.56
Total	**0**		**10**		**140**		**201**		**239**		**84**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	4	100.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	4	100.00
Masonry	0	0.00	0	0.00	1	10.00	5	50.00	2	20.00	2	20.00
Steel	0	0.00	1	14.29	1	14.29	4	57.14	1	14.29	0	0.00
Wood	0	0.00	8	1.23	137	21.14	189	29.17	236	36.42	78	12.04

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	9	2	0	2
Hospitals	0	0	0	0
Police Stations	4	1	0	1
Schools	17	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). 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 73,372 tons of debris will be generated. Of the total amount, Finishes comprises 21% of the total, Structure comprises 54% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 2,935 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 903 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 1,922 people (out of a total population of 39,958) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 305.36 million dollars, which represents 24.26 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building 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 flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 304.47 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 59.69% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	99.91	17.11	12.57	2.91	132.50
	Content	82.14	32.94	37.07	13.94	166.09
	Inventory	0.00	0.51	5.35	0.01	5.88
	Subtotal	**182.05**	**50.57**	**54.99**	**16.86**	**304.47**
Business Interruption						
	Income	0.02	0.19	0.01	0.02	0.24
	Relocation	0.09	0.03	0.01	0.01	0.15
	Rental Income	0.05	0.02	0.00	0.00	0.08
	Wage	0.04	0.12	0.02	0.26	0.43
	Subtotal	**0.21**	**0.35**	**0.04**	**0.30**	**0.90**
ALL	**Total**	**182.26**	**50.92**	**55.03**	**17.15**	**305.36**

Appendix A: County Listing for the Region

Connecticut

- New London

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
New London	39,958	2,724,840	710,510	3,435,350
Total	**39,958**	**2,724,840**	**710,510**	**3,435,350**
Total Study Region	**39,958**	**2,724,840**	**710,510**	**3,435,350**

Hazus-MH: Flood Event Report

Region Name: Ledyard - Riverine & Coastal - 100

Flood Scenario: Ledyard - Riverine & Coastal - 100

Print Date: Thursday, May 03, 2012

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

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

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Flood Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Flood Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building-Related Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). 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 flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

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

The geographical size of the region is 38 square miles and contains 273 census blocks. The region contains over 5 thousand households and has a total population of 14,636 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 5,871 buildings in the region with a total building replacement value (excluding contents) of 1,128 million dollars (2006 dollars). Approximately 93.70% of the buildings (and 85.13% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 5,871 buildings in the region which have an aggregate total replacement value of 1,128 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	960,151	85.1%
Commercial	109,402	9.7%
Industrial	17,066	1.5%
Agricultural	4,610	0.4%
Religion	16,980	1.5%
Government	5,797	0.5%
Education	13,864	1.2%
Total	**1,127,870**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	160,480	84.2%
Commercial	18,488	9.7%
Industrial	4,018	2.1%
Agricultural	1,545	0.8%
Religion	1,555	0.8%
Government	1,661	0.9%
Education	2,941	1.5%
Total	**190,688**	**100.00%**

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, 3 fire stations, 1 police station and no emergency operation centers.

Flood Scenario Parameters

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

Study Region Name:	Ledyard - Riverine & Coastal - 100
Scenario Name:	Ledyard - Riverine & Coastal - 100
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 19 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 13 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	3	15.79	3	15.79	13	68.42
Total	**0**		**0**		**0**		**3**		**3**		**13**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	3	15.79	3	15.79	13	68.42

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	3	0	0	0
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	7	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). 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 1,302 tons of debris will be generated. Of the total amount, Finishes comprises 32% of the total, Structure comprises 41% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 52 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 71 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 120 people (out of a total population of 14,636) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 9.19 million dollars, which represents 4.82 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building 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 flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 9.16 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 70.26% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	4.27	0.28	0.13	0.25	4.93
	Content	2.19	0.64	0.19	1.16	4.19
	Inventory	0.00	0.00	0.03	0.00	0.04
	Subtotal	**6.46**	**0.92**	**0.36**	**1.42**	**9.16**
Business Interruption						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.03	0.03
	Subtotal	**0.00**	**0.00**	**0.00**	**0.03**	**0.04**
ALL	**Total**	**6.46**	**0.93**	**0.36**	**1.45**	**9.19**

Appendix A: County Listing for the Region

Connecticut

- New London

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
New London	14,636	960,151	167,719	1,127,870
Total	**14,636**	**960,151**	**167,719**	**1,127,870**
Total Study Region	**14,636**	**960,151**	**167,719**	**1,127,870**

Hazus-MH: Flood Event Report

Region Name: Lisbon - Riverine - 100

Flood Scenario: Lisbon - Riverine - 100

Print Date: Monday, April 16, 2012

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

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

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Flood Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Flood Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building-Related Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). 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 flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

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

The geographical size of the region is 16 square miles and contains 83 census blocks. The region contains over 2 thousand households and has a total population of 4,069 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 1,750 buildings in the region with a total building replacement value (excluding contents) of 306 million dollars (2006 dollars). Approximately 92.57% of the buildings (and 74.46% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 1,750 buildings in the region which have an aggregate total replacement value of 306 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	228,092	74.5%
Commercial	43,719	14.3%
Industrial	26,587	8.7%
Agricultural	1,118	0.4%
Religion	461	0.2%
Government	2,235	0.7%
Education	4,096	1.3%
Total	**306,308**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	44,300	92.7%
Commercial	2,096	4.4%
Industrial	1,206	2.5%
Agricultural	187	0.4%
Religion	0	0.0%
Government	0	0.0%
Education	0	0.0%
Total	**47,789**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.
There are 1 school, 1 fire station, 1 police station and 1 emergency operation center.

Flood Scenario Parameters

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

Study Region Name:	Lisbon - Riverine - 100
Scenario Name:	Lisbon - Riverine - 100
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 4 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 3 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	0	0.00	1	25.00	3	75.00
Total	**0**		**0**		**0**		**0**		**1**		**3**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	100.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	0	0.00	1	33.33	2	66.67

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	1	0	0	0
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	1	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). 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 163 tons of debris will be generated. Of the total amount, Finishes comprises 39% of the total, Structure comprises 31% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 7 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 16 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 29 people (out of a total population of 4,069) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 0.95 million dollars, which represents 1.98 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building 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 flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 0.95 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 87.13% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	0.55	0.03	0.00	0.00	0.57
	Content	0.28	0.09	0.00	0.00	0.37
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.83**	**0.12**	**0.00**	**0.00**	**0.95**
Business Interruption						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	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**
ALL	**Total**	**0.83**	**0.12**	**0.00**	**0.00**	**0.95**

Appendix A: County Listing for the Region

Connecticut

- New London

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
New London	4,069	228,092	78,216	306,308
Total	**4,069**	**228,092**	**78,216**	**306,308**
Total Study Region	**4,069**	**228,092**	**78,216**	**306,308**

Hazus-MH: Flood Event Report

Region Name: Montville - Riverine - 100

Flood Scenario: Montville - Riverine & Coastal - 100

Print Date: Wednesday, May 02, 2012

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

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

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Flood Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Flood Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building-Related Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). 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 flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

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

The geographical size of the region is 42 square miles and contains 350 census blocks. The region contains over 6 thousand households and has a total population of 18,546 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 7,151 buildings in the region with a total building replacement value (excluding contents) of 1,345 million dollars (2006 dollars). Approximately 93.46% of the buildings (and 80.01% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 7,151 buildings in the region which have an aggregate total replacement value of 1,345 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,075,756	80.0%
Commercial	152,814	11.4%
Industrial	47,719	3.5%
Agricultural	2,989	0.2%
Religion	14,556	1.1%
Government	35,950	2.7%
Education	14,774	1.1%
Total	**1,344,558**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	240,685	68.3%
Commercial	60,942	17.3%
Industrial	33,251	9.4%
Agricultural	1,097	0.3%
Religion	5,629	1.6%
Government	6,908	2.0%
Education	4,054	1.1%
Total	**352,566**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.
There are 9 schools, 6 fire stations, 2 police stations and 1 emergency operation center.

Flood Scenario Parameters

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

Study Region Name:	Montville - Riverine - 100
Scenario Name:	Montville - Riverine & Coastal - 100
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 17 buildings will be at least moderately damaged. This is over 3% of the total number of buildings in the scenario. There are an estimated 9 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	1	5.88	5	29.41	2	11.76	9	52.94
Total	**0**		**0**		**1**		**5**		**2**		**9**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	1	5.88	5	29.41	2	11.76	9	52.94

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	6	0	0	0
Hospitals	0	0	0	0
Police Stations	2	0	0	0
Schools	9	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). 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 1,241 tons of debris will be generated. Of the total amount, Finishes comprises 43% of the total, Structure comprises 34% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 50 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 79 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 95 people (out of a total population of 18,546) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 15.61 million dollars, which represents 4.43 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building 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 flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 15.56 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 42.24% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	4.23	1.46	0.68	0.14	6.51
	Content	2.36	4.38	1.28	0.74	8.75
	Inventory	0.00	0.10	0.18	0.02	0.30
	Subtotal	**6.59**	**5.94**	**2.13**	**0.90**	**15.56**
Business Interruption						
	Income	0.00	0.01	0.00	0.00	0.01
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.01	0.00	0.02	0.03
	Subtotal	**0.00**	**0.02**	**0.00**	**0.02**	**0.05**
ALL	**Total**	**6.59**	**5.97**	**2.13**	**0.92**	**15.61**

Appendix A: County Listing for the Region

Connecticut

- New London

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
New London	18,546	1,075,756	268,802	1,344,558
Total	**18,546**	**1,075,756**	**268,802**	**1,344,558**
Total Study Region	**18,546**	**1,075,756**	**268,802**	**1,344,558**

Hazus-MH: Flood Event Report

Region Name: New London - 100

Flood Scenario: New Haven - Coastal - 100

Print Date: Wednesday, May 09, 2012

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

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

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Flood Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Flood Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building-Related Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). 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 flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

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

The geographical size of the region is 6 square miles and contains 389 census blocks. The region contains over 10 thousand households and has a total population of 25,671 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 7,721 buildings in the region with a total building replacement value (excluding contents) of 2,620 million dollars (2006 dollars). Approximately 87.18% of the buildings (and 60.87% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 7,721 buildings in the region which have an aggregate total replacement value of 2,620 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,594,543	60.9%
Commercial	619,500	23.6%
Industrial	57,200	2.2%
Agricultural	2,530	0.1%
Religion	56,501	2.2%
Government	15,961	0.6%
Education	273,413	10.4%
Total	**2,619,648**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	178,754	60.3%
Commercial	79,538	26.8%
Industrial	17,279	5.8%
Agricultural	260	0.1%
Religion	10,744	3.6%
Government	5,435	1.8%
Education	4,574	1.5%
Total	**296,584**	**100.00%**

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 235 beds.
There are 16 schools, 1 fire station, 2 police stations and no emergency operation centers.

Flood Scenario Parameters

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

Study Region Name:	New London - 100
Scenario Name:	New Haven - Coastal - 100
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

General Building Stock Damage

Hazus estimates that about 56 buildings will be at least moderately damaged. This is over 25% of the total number of buildings in the scenario. There are an estimated 5 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	3	5.36	16	28.57	11	19.64	21	37.50	5	8.93
Total	**0**		**3**		**16**		**11**		**21**		**5**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	3	5.36	16	28.57	11	19.64	21	37.50	5	8.93

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 235 hospital beds available for use. On the day of the scenario flood event, the model estimates that 235 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	1	1	0	1
Hospitals	1	0	0	0
Police Stations	2	0	0	0
Schools	16	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). 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 4,947 tons of debris will be generated. Of the total amount, Finishes comprises 35% of the total, Structure comprises 41% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 198 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 145 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 283 people (out of a total population of 25,671) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 44.58 million dollars, which represents 15.03 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building 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 flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 44.33 million dollars. 1% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 35.08% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	9.32	5.27	1.66	0.60	16.85
	Content	6.31	13.96	3.21	3.30	26.79
	Inventory	0.00	0.16	0.53	0.01	0.70
	Subtotal	**15.63**	**19.39**	**5.40**	**3.91**	**44.33**
Business Interruption						
	Income	0.00	0.07	0.00	0.00	0.08
	Relocation	0.01	0.01	0.00	0.00	0.02
	Rental Income	0.00	0.01	0.00	0.00	0.01
	Wage	0.00	0.06	0.00	0.08	0.15
	Subtotal	**0.01**	**0.16**	**0.00**	**0.09**	**0.26**
ALL	**Total**	**15.64**	**19.55**	**5.40**	**4.00**	**44.58**

Appendix A: County Listing for the Region

Connecticut

- New London

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New London	25,671	1,594,543	1,025,105	2,619,648
Total	**25,671**	**1,594,543**	**1,025,105**	**2,619,648**
Total Study Region	**25,671**	**1,594,543**	**1,025,105**	**2,619,648**

Hazus-MH: Flood Event Report

Region Name: North Stonington - Riverine - 100

Flood Scenario: North Stonington - Riverine - 100

Print Date: Tuesday, April 17, 2012

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

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

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Flood Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Flood Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building-Related Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). 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 flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

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

The geographical size of the region is 54 square miles and contains 173 census blocks. The region contains over 2 thousand households and has a total population of 4,991 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 2,482 buildings in the region with a total building replacement value (excluding contents) of 448 million dollars (2006 dollars). Approximately 91.38% of the buildings (and 74.92% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 2,482 buildings in the region which have an aggregate total replacement value of 448 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	335,950	74.9%
Commercial	54,145	12.1%
Industrial	37,541	8.4%
Agricultural	3,740	0.8%
Religion	9,994	2.2%
Government	1,111	0.2%
Education	5,929	1.3%
Total	**448,410**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	45,543	51.0%
Commercial	14,079	15.8%
Industrial	25,696	28.8%
Agricultural	350	0.4%
Religion	654	0.7%
Government	1,007	1.1%
Education	2,039	2.3%
Total	**89,368**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.
There are 4 schools, no fire stations, no police stations and 1 emergency operation center.

Flood Scenario Parameters

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

Study Region Name:	North Stonington - Riverine - 100
Scenario Name:	North Stonington - Riverine - 100
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

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 scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**0**		**0**		**0**		**0**		**0**		**0**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	0	0	0	0
Hospitals	0	0	0	0
Police Stations	0	0	0	0
Schools	4	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). 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 17 tons of debris will be generated. Of the total amount, Finishes comprises 92% of the total, Structure comprises 3% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 1 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 10 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 2 people (out of a total population of 4,991) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 0.96 million dollars, which represents 1.07 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building 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 flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 0.96 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 16.72% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	0.11	0.06	0.09	0.01	0.27
	Content	0.05	0.26	0.26	0.06	0.64
	Inventory	0.00	0.00	0.05	0.00	0.05
	Subtotal	**0.16**	**0.32**	**0.40**	**0.07**	**0.96**
Business Interruption						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	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**
ALL	**Total**	**0.16**	**0.32**	**0.40**	**0.07**	**0.96**

Appendix A: County Listing for the Region

Connecticut

- New London

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
New London	4,991	335,950	112,460	448,410
Total	**4,991**	**335,950**	**112,460**	**448,410**
Total Study Region	**4,991**	**335,950**	**112,460**	**448,410**

Hazus-MH: Flood Event Report

Region Name: Norwich - 100

Flood Scenario: Norwich - Riverine & Coastal -100

Print Date: Monday, May 14, 2012

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

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

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Flood Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Flood Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building-Related Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). 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 flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

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

The geographical size of the region is 28 square miles and contains 619 census blocks. The region contains over 15 thousand households and has a total population of 36,117 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 12,748 buildings in the region with a total building replacement value (excluding contents) of 3,185 million dollars (2006 dollars). Approximately 89.68% of the buildings (and 67.59% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 12,748 buildings in the region which have an aggregate total replacement value of 3,185 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	2,152,909	67.6%
Commercial	690,615	21.7%
Industrial	160,592	5.0%
Agricultural	6,736	0.2%
Religion	58,269	1.8%
Government	40,591	1.3%
Education	75,313	2.4%
Total	**3,185,025**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	582,242	55.5%
Commercial	312,373	29.8%
Industrial	85,261	8.1%
Agricultural	2,260	0.2%
Religion	21,361	2.0%
Government	25,869	2.5%
Education	20,208	1.9%
Total	**1,049,574**	**100.00%**

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 184 beds.
There are 21 schools, 6 fire stations, 2 police stations and no emergency operation centers.

Flood Scenario Parameters

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

Study Region Name:	Norwich - 100
Scenario Name:	Norwich - Riverine & Coastal -100
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 92 buildings will be at least moderately damaged. This is over 7% of the total number of buildings in the scenario. There are an estimated 44 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	1	14.29	6	85.71	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	100.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	3	3.53	13	15.29	26	30.59	43	50.59
Total	**1**		**6**		**3**		**13**		**26**		**44**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	100.00
Masonry	0	0.00	1	20.00	0	0.00	0	0.00	2	40.00	2	40.00
Steel	1	20.00	3	60.00	0	0.00	0	0.00	0	0.00	1	20.00
Wood	0	0.00	0	0.00	3	3.75	13	16.25	24	30.00	40	50.00

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 184 hospital beds available for use. On the day of the scenario flood event, the model estimates that 184 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	6	1	0	1
Hospitals	1	0	0	0
Police Stations	2	0	0	0
Schools	21	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). 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 15,322 tons of debris will be generated. Of the total amount, Finishes comprises 24% of the total, Structure comprises 43% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 613 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 442 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 854 people (out of a total population of 36,117) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 151.40 million dollars, which represents 14.42 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building 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 flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 150.40 million dollars. 1% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 29.01% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	28.53	17.52	7.19	1.99	55.22
	Content	15.37	50.95	15.37	9.27	90.97
	Inventory	0.00	1.56	2.61	0.04	4.21
	Subtotal	**43.90**	**70.04**	**25.17**	**11.30**	**150.40**
Business Interruption						
	Income	0.00	0.16	0.00	0.01	0.18
	Relocation	0.01	0.04	0.00	0.01	0.06
	Rental Income	0.01	0.02	0.00	0.00	0.03
	Wage	0.00	0.25	0.00	0.48	0.74
	Subtotal	**0.02**	**0.48**	**0.00**	**0.50**	**1.00**
ALL	**Total**	**43.92**	**70.52**	**25.17**	**11.79**	**151.40**

Appendix A: County Listing for the Region

Connecticut

- New London

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New London	36,117	2,152,909	1,032,116	3,185,025
Total	**36,117**	**2,152,909**	**1,032,116**	**3,185,025**
Total Study Region	**36,117**	**2,152,909**	**1,032,116**	**3,185,025**

Hazus-MH: Flood Event Report

Region Name: Preston - 100

Flood Scenario: Preston - Riverine - 100

Print Date: Tuesday, May 08, 2012

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

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

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Flood Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Flood Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building-Related Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). 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 flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

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

The geographical size of the region is 31 square miles and contains 157 census blocks. The region contains over 2 thousand households and has a total population of 4,688 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 2,199 buildings in the region with a total building replacement value (excluding contents) of 379 million dollars (2006 dollars). Approximately 91.41% of the buildings (and 81.62% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 2,199 buildings in the region which have an aggregate total replacement value of 379 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	309,012	81.6%
Commercial	39,109	10.3%
Industrial	10,313	2.7%
Agricultural	12,906	3.4%
Religion	5,303	1.4%
Government	620	0.2%
Education	1,335	0.4%
Total	**378,598**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	64,812	86.7%
Commercial	7,872	10.5%
Industrial	1,457	1.9%
Agricultural	601	0.8%
Religion	0	0.0%
Government	0	0.0%
Education	0	0.0%
Total	**74,742**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.
There are 2 schools, 2 fire stations, 1 police station and no emergency operation centers.

Flood Scenario Parameters

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

Study Region Name:	Preston - 100
Scenario Name:	Preston - Riverine - 100
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 23 buildings will be at least moderately damaged. This is over 4% of the total number of buildings in the scenario. There are an estimated 14 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	1	4.35	4	17.39	4	17.39	14	60.87
Total	**0**		**0**		**1**		**4**		**4**		**14**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	1	4.35	4	17.39	4	17.39	14	60.87

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	2	0	0	0
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	2	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). 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 1,152 tons of debris will be generated. Of the total amount, Finishes comprises 33% of the total, Structure comprises 41% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 46 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 41 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 81 people (out of a total population of 4,688) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 7.32 million dollars, which represents 9.79 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building 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 flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 7.31 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 81.03% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	3.90	0.39	0.05	0.01	4.34
	Content	2.03	0.82	0.08	0.01	2.94
	Inventory	0.00	0.01	0.01	0.00	0.02
	Subtotal	**5.93**	**1.22**	**0.14**	**0.02**	**7.31**
Business Interruption						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	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**	**0.01**
ALL	**Total**	**5.93**	**1.22**	**0.14**	**0.02**	**7.32**

Appendix A: County Listing for the Region

Connecticut

- New London

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
New London	4,688	309,012	69,586	378,598
Total	**4,688**	**309,012**	**69,586**	**378,598**
Total Study Region	**4,688**	**309,012**	**69,586**	**378,598**

Hazus-MH: Flood Event Report

Region Name: Salem - Riverine - 100

Flood Scenario: Salem - Riverine - 100

Print Date: Monday, April 16, 2012

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

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

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Flood Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Flood Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building-Related Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). 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 flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

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

The geographical size of the region is 29 square miles and contains 76 census blocks. The region contains over 1 thousand households and has a total population of 3,858 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 1,631 buildings in the region with a total building replacement value (excluding contents) of 330 million dollars (2006 dollars). Approximately 91.54% of the buildings (and 84.64% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 1,631 buildings in the region which have an aggregate total replacement value of 330 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	278,906	84.6%
Commercial	33,044	10.0%
Industrial	7,664	2.3%
Agricultural	2,779	0.8%
Religion	2,703	0.8%
Government	3,812	1.2%
Education	626	0.2%
Total	**329,534**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	48,974	71.1%
Commercial	14,242	20.7%
Industrial	1,398	2.0%
Agricultural	520	0.8%
Religion	1,901	2.8%
Government	1,363	2.0%
Education	507	0.7%
Total	**68,905**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.
There are 1 school, 2 fire stations, 1 police station and no emergency operation centers.

Flood Scenario Parameters

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

Study Region Name:	Salem - Riverine - 100
Scenario Name:	Salem - Riverine - 100
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

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 scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**0**		**0**		**0**		**0**		**0**		**0**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	2	0	0	0
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	1	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). 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 6 tons of debris will be generated. Of the total amount, Finishes comprises 100% of the total, Structure comprises 0% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 6 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 0 people (out of a total population of 3,858) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 0.39 million dollars, which represents 0.56 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building 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 flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 0.39 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 23.00% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	0.06	0.05	0.01	0.00	0.12
	Content	0.03	0.21	0.01	0.01	0.26
	Inventory	0.00	0.01	0.00	0.00	0.01
	Subtotal	**0.09**	**0.27**	**0.02**	**0.01**	**0.39**
Business Interruption						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	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**
ALL	**Total**	**0.09**	**0.27**	**0.02**	**0.01**	**0.39**

Appendix A: County Listing for the Region

Connecticut

- New London

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
New London	3,858	278,906	50,628	329,534
Total	**3,858**	**278,906**	**50,628**	**329,534**
Total Study Region	**3,858**	**278,906**	**50,628**	**329,534**

Hazus-MH: Flood Event Report

Region Name: Sprague - Riverine - 100

Flood Scenario: Sprague - Riverine -100

Print Date: Friday, May 04, 2012

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

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

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Flood Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Flood Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building-Related Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). 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 flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

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

The geographical size of the region is 13 square miles and contains 76 census blocks. The region contains over 1 thousand households and has a total population of 2,971 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 1,186 buildings in the region with a total building replacement value (excluding contents) of 194 million dollars (2006 dollars). Approximately 92.66% of the buildings (and 83.65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 1,186 buildings in the region which have an aggregate total replacement value of 194 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	162,353	83.7%
Commercial	11,846	6.1%
Industrial	6,598	3.4%
Agricultural	1,262	0.7%
Religion	6,119	3.2%
Government	515	0.3%
Education	5,393	2.8%
Total	**194,086**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	76,716	81.6%
Commercial	5,298	5.6%
Industrial	5,308	5.6%
Agricultural	757	0.8%
Religion	4,351	4.6%
Government	446	0.5%
Education	1,168	1.2%
Total	**94,044**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.
There are 3 schools, 1 fire station, 1 police station and no emergency operation centers.

Flood Scenario Parameters

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

Study Region Name:	Sprague - Riverine - 100
Scenario Name:	Sprague - Riverine -100
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

General Building Stock Damage

Hazus estimates that about 15 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 5 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	4	26.67	6	40.00	5	33.33
Total	**0**		**0**		**0**		**4**		**6**		**5**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	4	26.67	6	40.00	5	33.33

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	1	0	0	0
Hospitals	0	0	0	0
Police Stations	1	1	0	1
Schools	3	1	0	1

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). 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 817 tons of debris will be generated. Of the total amount, Finishes comprises 65% of the total, Structure comprises 21% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 33 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 111 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 220 people (out of a total population of 2,971) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 10.05 million dollars, which represents 10.69 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building 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 flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 10.03 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 64.76% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	3.97	0.23	0.32	0.19	4.70
	Content	2.54	0.80	0.65	1.24	5.23
	Inventory	0.00	0.03	0.07	0.00	0.10
	Subtotal	**6.51**	**1.06**	**1.04**	**1.43**	**10.03**
Business Interruption						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.01	0.01
	Subtotal	**0.00**	**0.00**	**0.00**	**0.01**	**0.02**
ALL	**Total**	**6.51**	**1.06**	**1.04**	**1.44**	**10.05**

Appendix A: County Listing for the Region

Connecticut

- New London

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
New London	2,971	162,353	31,733	194,086
Total	**2,971**	**162,353**	**31,733**	**194,086**
Total Study Region	**2,971**	**162,353**	**31,733**	**194,086**

Hazus-MH: Flood Event Report

Region Name: Stonington Borough - 100

Flood Scenario: Stonington Borough - Coastal - 100

Print Date: Thursday, May 10, 2012

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

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

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Flood Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Flood Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building-Related Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). 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 flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

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

The geographical size of the region is 9 square miles and contains 143 census blocks. The region contains over 2 thousand households and has a total population of 3,533 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 2,282 buildings in the region with a total building replacement value (excluding contents) of 467 million dollars (2006 dollars). Approximately 88.87% of the buildings (and 72.85% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 2,282 buildings in the region which have an aggregate total replacement value of 467 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	340,380	72.8%
Commercial	73,956	15.8%
Industrial	29,261	6.3%
Agricultural	2,307	0.5%
Religion	6,932	1.5%
Government	5,057	1.1%
Education	9,372	2.0%
Total	**467,265**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	110,554	73.7%
Commercial	29,448	19.6%
Industrial	2,764	1.8%
Agricultural	554	0.4%
Religion	3,852	2.6%
Government	2,027	1.4%
Education	873	0.6%
Total	**150,072**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.
There are 2 schools, 1 fire station, no police stations and no emergency operation centers.

Flood Scenario Parameters

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

Study Region Name:	Stonington Borough - 100
Scenario Name:	Stonington Borough - Coastal - 100
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 172 buildings will be at least moderately damaged. This is over 26% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	8	4.65	47	27.33	40	23.26	77	44.77	0	0.00
Total	**0**		**8**		**47**		**40**		**77**		**0**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	7	100.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	8	4.88	47	28.66	40	24.39	69	42.07	0	0.00

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	1	0	0	0
Hospitals	0	0	0	0
Police Stations	0	0	0	0
Schools	2	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). 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 13,156 tons of debris will be generated. Of the total amount, Finishes comprises 29% of the total, Structure comprises 45% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 526 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 222 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 516 people (out of a total population of 3,533) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 53.65 million dollars, which represents 35.75 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building 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 flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 53.45 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 61.14% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	19.36	5.51	0.44	0.53	25.83
	Content	13.40	10.37	0.88	2.52	27.17
	Inventory	0.00	0.27	0.14	0.04	0.45
	Subtotal	**32.76**	**16.16**	**1.45**	**3.08**	**53.45**
Business Interruption						
	Income	0.00	0.06	0.00	0.01	0.07
	Relocation	0.02	0.01	0.00	0.00	0.03
	Rental Income	0.01	0.01	0.00	0.00	0.02
	Wage	0.01	0.04	0.00	0.04	0.09
	Subtotal	**0.05**	**0.11**	**0.00**	**0.05**	**0.20**
ALL	**Total**	**32.81**	**16.27**	**1.45**	**3.13**	**53.65**

Appendix A: County Listing for the Region

Connecticut

- New London

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
New London	3,533	340,380	126,885	467,265
Total	**3,533**	**340,380**	**126,885**	**467,265**
Total Study Region	**3,533**	**340,380**	**126,885**	**467,265**

Hazus-MH: Flood Event Report

Region Name: Stonington - 100

Flood Scenario: Stonington - Riverine & Coastal - 100

Print Date: Wednesday, May 09, 2012

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

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

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Flood Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Flood Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building-Related Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). 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 flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

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

The geographical size of the region is 39 square miles and contains 417 census blocks. The region contains over 8 thousand households and has a total population of 17,906 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 8,856 buildings in the region with a total building replacement value (excluding contents) of 1,904 million dollars (2006 dollars). Approximately 90.07% of the buildings (and 71.88% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 8,856 buildings in the region which have an aggregate total replacement value of 1,904 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,368,415	71.9%
Commercial	350,102	18.4%
Industrial	113,121	5.9%
Agricultural	10,230	0.5%
Religion	29,137	1.5%
Government	14,238	0.7%
Education	18,600	1.0%
Total	**1,903,843**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	949,304	69.5%
Commercial	273,856	20.1%
Industrial	83,781	6.1%
Agricultural	8,383	0.6%
Religion	23,014	1.7%
Government	13,629	1.0%
Education	13,880	1.0%
Total	**1,365,847**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.
There are 10 schools, 4 fire stations, 1 police station and no emergency operation centers.

Flood Scenario Parameters

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

Study Region Name:	Stonington - 100
Scenario Name:	Stonington - Riverine & Coastal - 100
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

General Building Stock Damage

Hazus estimates that about 863 buildings will be at least moderately damaged. This is over 13% of the total number of buildings in the scenario. There are an estimated 189 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	2	66.67	0	0.00	0	0.00	1	33.33	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	1	100.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	12	1.40	116	13.50	186	21.65	356	41.44	189	22.00
Total	**0**		**14**		**116**		**187**		**357**		**189**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	100.00
Masonry	0	0.00	0	0.00	1	7.69	2	15.38	10	76.92	0	0.00
Steel	0	0.00	1	50.00	0	0.00	1	50.00	0	0.00	0	0.00
Wood	0	0.00	12	1.42	115	13.63	184	21.80	345	40.88	188	22.27

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	4	2	0	2
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	10	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). 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 48,881 tons of debris will be generated. Of the total amount, Finishes comprises 35% of the total, Structure comprises 39% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 1,955 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 1,216 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 2,616 people (out of a total population of 17,906) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 372.76 million dollars, which represents 27.29 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building 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 flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 371.08 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 51.90% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	118.77	37.48	9.59	3.79	169.63
	Content	74.47	80.43	21.82	19.29	196.01
	Inventory	0.00	1.40	3.83	0.22	5.45
	Subtotal	**193.24**	**119.31**	**35.23**	**23.31**	**371.08**
Business Interruption						
	Income	0.02	0.38	0.00	0.02	0.43
	Relocation	0.09	0.06	0.00	0.02	0.17
	Rental Income	0.04	0.04	0.00	0.00	0.08
	Wage	0.07	0.29	0.00	0.65	1.00
	Subtotal	**0.22**	**0.77**	**0.00**	**0.69**	**1.68**
ALL	**Total**	**193.46**	**120.08**	**35.23**	**23.99**	**372.76**

Appendix A: County Listing for the Region

Connecticut

- New London

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New London	17,906	1,368,415	535,428	1,903,843
Total	**17,906**	**1,368,415**	**535,428**	**1,903,843**
Total Study Region	**17,906**	**1,368,415**	**535,428**	**1,903,843**

Hazus-MH: Flood Event Report

Region Name: Voluntown

Flood Scenario: Voluntown

Print Date: Wednesday, March 28, 2012

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

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

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Flood Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Flood Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building-Related Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). 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 flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

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

The geographical size of the region is 39 square miles and contains 117 census blocks. The region contains over 1 thousand households and has a total population of 2,528 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 1,361 buildings in the region with a total building replacement value (excluding contents) of 205 million dollars (2006 dollars). Approximately 93.24% of the buildings (and 86.93% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 1,361 buildings in the region which have an aggregate total replacement value of 205 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	178,037	86.9%
Commercial	13,723	6.7%
Industrial	4,711	2.3%
Agricultural	2,400	1.2%
Religion	4,412	2.2%
Government	957	0.5%
Education	568	0.3%
Total	**204,808**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	86,598	83.3%
Commercial	9,448	9.1%
Industrial	3,390	3.3%
Agricultural	1,441	1.4%
Religion	1,767	1.7%
Government	714	0.7%
Education	568	0.5%
Total	**103,926**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.
There are 1 school, 1 fire station, no police stations and no emergency operation centers.

Flood Scenario Parameters

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

Study Region Name:	Voluntown
Scenario Name:	Voluntown
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 4 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 2 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	1	25.00	1	25.00	2	50.00
Total	**0**		**0**		**0**		**1**		**1**		**2**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	1	25.00	1	25.00	2	50.00

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	1	0	0	0
Hospitals	0	0	0	0
Police Stations	0	0	0	0
Schools	1	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). 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 244 tons of debris will be generated. Of the total amount, Finishes comprises 36% of the total, Structure comprises 37% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 10 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 23 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 16 people (out of a total population of 2,528) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 2.46 million dollars, which represents 2.37 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building 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 flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 2.46 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 63.11% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	1.04	0.09	0.03	0.10	1.25
	Content	0.52	0.23	0.03	0.43	1.20
	Inventory	0.00	0.00	0.00	0.00	0.01
	Subtotal	**1.55**	**0.31**	**0.06**	**0.53**	**2.46**
Business Interruption						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.01	0.01
	Subtotal	**0.00**	**0.00**	**0.00**	**0.01**	**0.01**
ALL	**Total**	**1.56**	**0.31**	**0.06**	**0.54**	**2.46**

Appendix A: County Listing for the Region

Connecticut

- New London

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
New London	2,528	178,037	26,771	204,808
Total	**2,528**	**178,037**	**26,771**	**204,808**
Total Study Region	**2,528**	**178,037**	**26,771**	**204,808**

Hazus-MH: Flood Event Report

Region Name: Waterford - Riverine - 100

Flood Scenario: Waterford - Riverine & Coastal - 100

Print Date: Wednesday, May 02, 2012

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

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

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Flood Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Flood Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building-Related Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). 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 flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

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

The geographical size of the region is 33 square miles and contains 365 census blocks. The region contains over 8 thousand households and has a total population of 19,152 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 8,732 buildings in the region with a total building replacement value (excluding contents) of 1,808 million dollars (2006 dollars). Approximately 92.64% of the buildings (and 77.52% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 8,732 buildings in the region which have an aggregate total replacement value of 1,808 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,401,141	77.5%
Commercial	296,936	16.4%
Industrial	46,084	2.5%
Agricultural	4,424	0.2%
Religion	29,484	1.6%
Government	7,890	0.4%
Education	21,556	1.2%
Total	**1,807,515**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	597,101	79.5%
Commercial	102,886	13.7%
Industrial	16,994	2.3%
Agricultural	1,465	0.2%
Religion	12,685	1.7%
Government	6,968	0.9%
Education	12,863	1.7%
Total	**750,962**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.
There are 10 schools, 6 fire stations, 1 police station and 1 emergency operation center.

Flood Scenario Parameters

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

Study Region Name:	Waterford - Riverine - 100
Scenario Name:	Waterford - Riverine & Coastal - 100
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 139 buildings will be at least moderately damaged. This is over 9% of the total number of buildings in the scenario. There are an estimated 44 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	4	2.88	13	9.35	52	37.41	26	18.71	44	31.65
Total	**0**		**4**		**13**		**52**		**26**		**44**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	1	50.00	0	0.00	1	50.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	4	2.92	13	9.49	51	37.23	26	18.98	43	31.39

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	6	0	0	0
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	10	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). 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 6,015 tons of debris will be generated. Of the total amount, Finishes comprises 41% of the total, Structure comprises 36% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 241 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 295 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 436 people (out of a total population of 19,152) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 40.97 million dollars, which represents 5.46 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building 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 flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 40.89 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 75.87% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	19.27	2.36	0.37	0.13	22.13
	Content	11.79	5.32	0.63	0.86	18.60
	Inventory	0.00	0.08	0.07	0.00	0.15
	Subtotal	**31.06**	**7.76**	**1.08**	**0.99**	**40.89**
Business Interruption						
	Income	0.00	0.02	0.00	0.00	0.02
	Relocation	0.02	0.00	0.00	0.00	0.02
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.02	0.00	0.02	0.04
	Subtotal	**0.02**	**0.04**	**0.00**	**0.02**	**0.09**
ALL	**Total**	**31.09**	**7.80**	**1.08**	**1.01**	**40.97**

Appendix A: County Listing for the Region

Connecticut

- New London

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New London	19,152	1,401,141	406,374	1,807,515
Total	**19,152**	**1,401,141**	**406,374**	**1,807,515**
Total Study Region	**19,152**	**1,401,141**	**406,374**	**1,807,515**

Hazus-MH: Hurricane Event Report

Region Name: SCCOG

Hurricane Scenario: Probabilistic 10-year Return Period

Print Date: Monday, May 21, 2012

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

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.

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Hurricane Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Hurricane Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

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):

- Connecticut

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

The geographical size of the region is 574.47 square miles and contains 58 census tracts. There are over 93 thousand households in the region and has a total population of 242,759 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 95 thousand buildings in the region with a total building replacement value (excluding contents) of 21,465 million dollars (2006 dollars). Approximately 91% of the buildings (and 75% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 95,820 buildings in the region which have an aggregate total replacement value of 21,465 million (2006 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 Tot
Residential	16,022,077	74.6%
Commercial	3,390,039	15.8%
Industrial	832,983	3.9%
Agricultural	185,657	0.9%
Religious	310,302	1.4%
Government	229,963	1.1%
Education	494,250	2.3%
Total	**21,465,271**	**100.0%**

Essential Facility Inventory

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 419 beds. There are 120 schools, 46 fire stations, 23 police stations and 9 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 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	396	99.88	0	0.12	0	0.00	0	0.00	0	0.00
Commercial	5,207	99.81	10	0.19	0	0.00	0	0.00	0	0.00
Education	219	99.78	0	0.22	0	0.00	0	0.00	0	0.00
Government	243	99.78	1	0.22	0	0.00	0	0.00	0	0.00
Industrial	1,700	99.79	4	0.21	0	0.00	0	0.00	0	0.00
Religion	402	99.83	1	0.17	0	0.00	0	0.00	0	0.00
Residential	87,588	99.94	47	0.05	2	0.00	0	0.00	0	0.00
Total	**95,755**		**63**		**2**		**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	1,500	99.72	4	0.28	0	0.00	0	0.00	0	0.00
Masonry	10,135	99.73	27	0.27	1	0.01	0	0.00	0	0.00
MH	2,801	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	4,198	99.77	10	0.23	0	0.00	0	0.00	0	0.00
Wood	77,114	99.98	11	0.01	2	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had 419 hospital beds available for use. On the day of the hurricane, the model estimates that 419 hospital beds (only 100.00%) are available for use. After one week, 100.00% of the beds will be in service. By 30 days, 100.00% 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**
EOCs	9	0	0	9
Fire Stations	46	0	0	46
Hospitals	2	0	0	2
Police Stations	23	0	0	23
Schools	120	0	0	120

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. 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 1,270 tons of debris will be generated. Of the total amount, 1,194 tons (94%) is Other Tree Debris. Of the remaining 76 tons, Brick/Wood comprises 0% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible 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 building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 76 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

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 242,759) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.3 million dollars, which represents 0.00 % 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 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	145.06	0.00	0.00	0.00	145.06
	Content	182.99	0.00	0.00	0.00	182.99
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	**328.06**	**0.00**	**0.00**	**0.00**	**328.06**
Business Interruption Loss						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	3.41	0.00	0.00	0.00	3.41
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**3.41**	**0.00**	**0.00**	**0.00**	**3.41**
Total						
	Total	**331.46**	**0.00**	**0.00**	**0.00**	**331.46**

Appendix A: County Listing for the Region

Connecticut
- New London

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
New London	242,759	16,022,077	5,443,194	21,465,271
Total	**242,759**	**16,022,077**	**5,443,194**	**21,465,271**
Study Region Total	**242,759**	**16,022,077**	**5,443,194**	**21,465,271**

Hazus-MH: Hurricane Event Report

Region Name: SCCOG

Hurricane Scenario: Probabilistic 20-year Return Period

Print Date: Monday, May 21, 2012

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

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.

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Hurricane Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Hurricane Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

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):

- Connecticut

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

The geographical size of the region is 574.47 square miles and contains 58 census tracts. There are over 93 thousand households in the region and has a total population of 242,759 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 95 thousand buildings in the region with a total building replacement value (excluding contents) of 21,465 million dollars (2006 dollars). Approximately 91% of the buildings (and 75% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 95,820 buildings in the region which have an aggregate total replacement value of 21,465 million (2006 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 Tot
Residential	16,022,077	74.6%
Commercial	3,390,039	15.8%
Industrial	832,983	3.9%
Agricultural	185,657	0.9%
Religious	310,302	1.4%
Government	229,963	1.1%
Education	494,250	2.3%
Total	**21,465,271**	**100.0%**

Essential Facility Inventory

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 419 beds. There are 120 schools, 46 fire stations, 23 police stations and 9 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 15 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	394	99.58	2	0.40	0	0.01	0	0.00	0	0.00
Commercial	5,191	99.50	26	0.49	1	0.01	0	0.00	0	0.00
Education	218	99.50	1	0.49	0	0.00	0	0.00	0	0.00
Government	243	99.49	1	0.51	0	0.00	0	0.00	0	0.00
Industrial	1,695	99.45	9	0.54	0	0.01	0	0.00	0	0.00
Religion	401	99.59	2	0.40	0	0.01	0	0.00	0	0.00
Residential	87,377	99.70	246	0.28	14	0.02	1	0.00	0	0.00
Total	**95,519**		**286**		**14**		**1**		**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	1,493	99.30	11	0.70	0	0.00	0	0.00	0	0.00
Masonry	10,074	99.12	83	0.81	6	0.06	0	0.00	0	0.00
MH	2,801	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	4,184	99.44	23	0.56	0	0.01	0	0.00	0	0.00
Wood	76,987	99.82	134	0.17	5	0.01	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had 419 hospital beds available for use. On the day of the hurricane, the model estimates that 419 hospital beds (only 100.00%) are available for use. After one week, 100.00% of the beds will be in service. By 30 days, 100.00% 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**
EOCs	9	0	0	9
Fire Stations	46	0	0	46
Hospitals	2	2	0	2
Police Stations	23	0	0	23
Schools	120	0	0	120

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. 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 13,279 tons of debris will be generated. Of the total amount, 9,336 tons (70%) is Other Tree Debris. Of the remaining 3,943 tons, Brick/Wood comprises 35% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 55 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 2,564 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

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 242,759) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 16.2 million dollars, which represents 0.08 % 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 16 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	12,622.44	433.35	95.43	117.80	13,269.01
	Content	2,674.14	0.00	0.00	0.00	2,674.14
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	**15,296.58**	**433.35**	**95.43**	**117.80**	**15,943.15**
Business Interruption Loss						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	98.21	2.38	0.08	0.32	100.99
	Rental	141.03	0.00	0.00	0.00	141.03
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**239.23**	**2.38**	**0.08**	**0.32**	**242.01**
Total						
	Total	**15,535.82**	**435.73**	**95.50**	**118.12**	**16,185.17**

Appendix A: County Listing for the Region

Connecticut
- New London

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
New London	242,759	16,022,077	5,443,194	21,465,271
Total	**242,759**	**16,022,077**	**5,443,194**	**21,465,271**
Study Region Total	**242,759**	**16,022,077**	**5,443,194**	**21,465,271**

Hazus-MH: Hurricane Event Report

Region Name: SCCOG

Hurricane Scenario: Probabilistic 50-year Return Period

Print Date: Monday, May 21, 2012

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

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.

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Hurricane Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Hurricane Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

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):

- Connecticut

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

The geographical size of the region is 574.47 square miles and contains 58 census tracts. There are over 93 thousand households in the region and has a total population of 242,759 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 95 thousand buildings in the region with a total building replacement value (excluding contents) of 21,465 million dollars (2006 dollars). Approximately 91% of the buildings (and 75% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 95,820 buildings in the region which have an aggregate total replacement value of 21,465 million (2006 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 Tot
Residential	16,022,077	74.6%
Commercial	3,390,039	15.8%
Industrial	832,983	3.9%
Agricultural	185,657	0.9%
Religious	310,302	1.4%
Government	229,963	1.1%
Education	494,250	2.3%
Total	**21,465,271**	**100.0%**

Essential Facility Inventory

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 419 beds. There are 120 schools, 46 fire stations, 23 police stations and 9 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 631 buildings will be at least moderately damaged. This is over 1% 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 : 50 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	376	94.93	16	4.11	3	0.68	1	0.27	0	0.01
Commercial	4,966	95.18	218	4.19	30	0.58	3	0.05	0	0.00
Education	209	95.43	9	4.24	1	0.32	0	0.00	0	0.00
Government	233	95.65	10	4.05	1	0.29	0	0.00	0	0.00
Industrial	1,627	95.50	67	3.92	8	0.47	2	0.11	0	0.00
Religion	384	95.27	18	4.43	1	0.29	0	0.01	0	0.00
Residential	82,055	93.63	5,000	5.71	563	0.64	15	0.02	3	0.00
Total	**89,851**		**5,339**		**607**		**21**		**3**	

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

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	1,415	94.06	81	5.38	8	0.56	0	0.00	0	0.00
Masonry	9,319	91.70	624	6.14	210	2.06	10	0.10	0	0.00
MH	2,795	99.78	5	0.17	1	0.04	0	0.00	0	0.00
Steel	4,012	95.34	170	4.03	24	0.57	2	0.06	0	0.00
Wood	72,609	94.14	4,257	5.52	246	0.32	11	0.01	3	0.00

Essential Facility Damage

Before the hurricane, the region had 419 hospital beds available for use. On the day of the hurricane, the model estimates that 419 hospital beds (only 100.00%) are available for use. After one week, 100.00% of the beds will be in service. By 30 days, 100.00% 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**
EOCs	9	0	0	9
Fire Stations	46	0	0	46
Hospitals	2	2	0	2
Police Stations	23	0	0	23
Schools	120	0	0	118

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. 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 187,368 tons of debris will be generated. Of the total amount, 137,089 tons (73%) is Other Tree Debris. Of the remaining 50,279 tons, Brick/Wood comprises 37% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 735 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 31,906 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

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 126 households to be displaced due to the hurricane. Of these, 31 people (out of a total population of 242,759) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 144.1 million dollars, which represents 0.67 % 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 144 million dollars. 2% 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 92% 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	107,063.70	5,102.94	1,096.98	1,476.62	114,740.24
	Content	17,121.62	742.55	367.81	200.14	18,432.11
	Inventory	0.00	15.54	70.20	8.62	94.37
	Subtotal	**124,185.31**	**5,861.03**	**1,534.99**	**1,685.39**	**133,266.72**
Business Interruption Loss						
	Income	0.00	521.40	10.69	130.42	662.51
	Relocation	4,128.28	587.74	45.43	124.28	4,885.73
	Rental	4,062.80	318.10	9.20	10.90	4,400.99
	Wage	0.00	488.32	15.97	370.04	874.32
	Subtotal	**8,191.08**	**1,915.56**	**81.28**	**635.63**	**10,823.55**
Total						
	Total	**132,376.39**	**7,776.59**	**1,616.27**	**2,321.02**	**144,090.27**

Appendix A: County Listing for the Region

Connecticut
- New London

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
New London	242,759	16,022,077	5,443,194	21,465,271
Total	**242,759**	**16,022,077**	**5,443,194**	**21,465,271**
Study Region Total	**242,759**	**16,022,077**	**5,443,194**	**21,465,271**

Hazus-MH: Hurricane Event Report

Region Name: SCCOG

Hurricane Scenario: Probabilistic 100-year Return Period

Print Date: Monday, May 21, 2012

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

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.

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Hurricane Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Hurricane Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

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):

- Connecticut

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

The geographical size of the region is 574.47 square miles and contains 58 census tracts. There are over 93 thousand households in the region and has a total population of 242,759 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 95 thousand buildings in the region with a total building replacement value (excluding contents) of 21,465 million dollars (2006 dollars). Approximately 91% of the buildings (and 75% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 95,820 buildings in the region which have an aggregate total replacement value of 21,465 million (2006 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 Tot
Residential	16,022,077	74.6%
Commercial	3,390,039	15.8%
Industrial	832,983	3.9%
Agricultural	185,657	0.9%
Religious	310,302	1.4%
Government	229,963	1.1%
Education	494,250	2.3%
Total	**21,465,271**	**100.0%**

Essential Facility Inventory

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 419 beds. There are 120 schools, 46 fire stations, 23 police stations and 9 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 3,444 buildings will be at least moderately damaged. This is over 4% of the total number of buildings in the region. There are an estimated 88 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	325	81.97	51	12.82	13	3.40	6	1.62	1	0.18
Commercial	4,319	82.78	663	12.71	206	3.95	29	0.56	0	0.00
Education	183	83.61	28	12.67	8	3.44	1	0.28	0	0.00
Government	205	84.05	30	12.32	8	3.35	1	0.27	0	0.00
Industrial	1,428	83.77	197	11.55	63	3.68	16	0.92	1	0.08
Religion	333	82.65	57	14.10	12	3.01	1	0.24	0	0.00
Residential	69,985	79.86	14,573	16.63	2,847	3.25	146	0.17	86	0.10
Total	**76,777**		**15,599**		**3,157**		**199**		**88**	

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

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	1,205	80.13	216	14.38	79	5.25	4	0.24	0	0.00
Masonry	7,847	77.21	1,481	14.58	765	7.53	63	0.62	6	0.06
MH	2,749	98.14	35	1.26	14	0.49	0	0.01	3	0.09
Steel	3,507	83.33	493	11.71	181	4.30	28	0.66	0	0.00
Wood	62,105	80.52	13,093	16.98	1,729	2.24	120	0.16	79	0.10

Essential Facility Damage

Before the hurricane, the region had 419 hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (only 0.00%) are available for use. After one week, 44.00% of the beds will be in service. By 30 days, 100.00% 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**
EOCs	9	0	0	9
Fire Stations	46	0	0	46
Hospitals	2	2	0	0
Police Stations	23	0	0	23
Schools	120	0	0	11

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. 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 358,931 tons of debris will be generated. Of the total amount, 245,138 tons (68%) is Other Tree Debris. Of the remaining 113,793 tons, Brick/Wood comprises 47% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 2159 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 59,823 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

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 625 households to be displaced due to the hurricane. Of these, 156 people (out of a total population of 242,759) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 443.7 million dollars, which represents 2.07 % 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 444 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 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	284,046.15	21,392.41	6,107.68	6,851.22	318,397.46
	Content	63,137.49	6,207.00	3,682.04	2,214.24	75,240.77
	Inventory	0.00	126.54	658.16	68.38	853.08
	Subtotal	**347,183.65**	**27,725.95**	**10,447.88**	**9,133.84**	**394,491.31**
Business Interruption Loss						
	Income	0.00	3,087.00	93.34	821.68	4,002.02
	Relocation	16,736.55	4,123.05	435.15	1,382.89	22,677.65
	Rental	12,241.86	2,269.68	77.94	142.50	14,731.97
	Wage	0.00	3,127.72	147.32	4,553.86	7,828.91
	Subtotal	**28,978.41**	**12,607.45**	**753.76**	**6,900.93**	**49,240.55**
Total						
	Total	**376,162.06**	**40,333.40**	**11,201.63**	**16,034.77**	**443,731.86**

Appendix A: County Listing for the Region

Connecticut
- New London

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
New London	242,759	16,022,077	5,443,194	21,465,271
Total	**242,759**	**16,022,077**	**5,443,194**	**21,465,271**
Study Region Total	**242,759**	**16,022,077**	**5,443,194**	**21,465,271**

Hazus-MH: Hurricane Event Report

Region Name: SCCOG

Hurricane Scenario: Probabilistic 200-year Return Period

Print Date: Monday, May 21, 2012

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

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.

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Hurricane Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Hurricane Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

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):

- Connecticut

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

The geographical size of the region is 574.47 square miles and contains 58 census tracts. There are over 93 thousand households in the region and has a total population of 242,759 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 95 thousand buildings in the region with a total building replacement value (excluding contents) of 21,465 million dollars (2006 dollars). Approximately 91% of the buildings (and 75% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 95,820 buildings in the region which have an aggregate total replacement value of 21,465 million (2006 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 Tot
Residential	16,022,077	74.6%
Commercial	3,390,039	15.8%
Industrial	832,983	3.9%
Agricultural	185,657	0.9%
Religious	310,302	1.4%
Government	229,963	1.1%
Education	494,250	2.3%
Total	**21,465,271**	**100.0%**

Essential Facility Inventory

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 419 beds. There are 120 schools, 46 fire stations, 23 police stations and 9 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 9,618 buildings will be at least moderately damaged. This is over 10% of the total number of buildings in the region. There are an estimated 442 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	252	63.64	92	23.11	33	8.45	16	4.16	3	0.65
Commercial	3,385	64.89	1,131	21.67	575	11.01	126	2.41	1	0.02
Education	144	65.58	47	21.56	24	10.89	4	1.97	0	0.00
Government	162	66.32	51	21.09	26	10.72	5	1.87	0	0.00
Industrial	1,132	66.45	339	19.90	177	10.40	51	2.99	4	0.25
Religion	261	64.70	98	24.35	38	9.44	6	1.51	0	0.00
Residential	54,435	62.11	24,673	28.15	7,381	8.42	714	0.81	434	0.49
Total	**59,771**		**26,431**		**8,255**		**922**		**442**	

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

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	914	60.78	332	22.08	233	15.47	25	1.66	0	0.00
Masonry	6,007	59.11	2,270	22.34	1,651	16.25	208	2.05	26	0.26
MH	2,640	94.24	92	3.29	54	1.93	3	0.10	12	0.44
Steel	2,757	65.53	818	19.45	512	12.16	120	2.84	1	0.02
Wood	48,344	62.68	22,745	29.49	5,040	6.54	596	0.77	401	0.52

Essential Facility Damage

Before the hurricane, the region had 419 hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (only 0.00%) are available for use. After one week, 0.00% of the beds will be in service. By 30 days, 100.00% 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**
EOCs	9	0	0	9
Fire Stations	46	0	0	46
Hospitals	2	2	0	0
Police Stations	23	0	0	23
Schools	120	1	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 four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. 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 753,191 tons of debris will be generated. Of the total amount, 518,021 tons (69%) is Other Tree Debris. Of the remaining 235,170 tons, Brick/Wood comprises 49% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 4605 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 120,051 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

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 1,755 households to be displaced due to the hurricane. Of these, 428 people (out of a total population of 242,759) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 1068.4 million dollars, which represents 4.98 % 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 1,068 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 82% 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	616,047.28	61,103.99	16,837.92	21,384.76	715,373.94
	Content	175,593.00	24,788.62	11,482.18	9,729.73	221,593.53
	Inventory	0.00	504.34	1,944.48	264.78	2,713.61
	Subtotal	**791,640.28**	**86,396.95**	**30,264.58**	**31,379.27**	**939,681.07**
Business Interruption Loss						
	Income	29.63	4,548.39	226.53	1,177.21	5,981.76
	Relocation	54,637.14	12,247.78	1,302.86	4,751.58	72,939.37
	Rental	29,677.77	6,571.35	210.77	498.97	36,958.86
	Wage	69.85	4,879.82	360.24	7,556.65	12,866.55
	Subtotal	**84,414.39**	**28,247.34**	**2,100.41**	**13,984.40**	**128,746.55**
Total						
	Total	**876,054.67**	**114,644.29**	**32,364.99**	**45,363.67**	**1,068,427.62**

Appendix A: County Listing for the Region

Connecticut
- New London

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
New London	242,759	16,022,077	5,443,194	21,465,271
Total	**242,759**	**16,022,077**	**5,443,194**	**21,465,271**
Study Region Total	**242,759**	**16,022,077**	**5,443,194**	**21,465,271**

Hazus-MH: Hurricane Event Report

Region Name: SCCOG

Hurricane Scenario: Probabilistic 500-year Return Period

Print Date: Monday, May 21, 2012

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

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.

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Hurricane Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Hurricane Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

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):

- Connecticut

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

The geographical size of the region is 574.47 square miles and contains 58 census tracts. There are over 93 thousand households in the region and has a total population of 242,759 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 95 thousand buildings in the region with a total building replacement value (excluding contents) of 21,465 million dollars (2006 dollars). Approximately 91% of the buildings (and 75% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 95,820 buildings in the region which have an aggregate total replacement value of 21,465 million (2006 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 Tot
Residential	16,022,077	74.6%
Commercial	3,390,039	15.8%
Industrial	832,983	3.9%
Agricultural	185,657	0.9%
Religious	310,302	1.4%
Government	229,963	1.1%
Education	494,250	2.3%
Total	**21,465,271**	**100.0%**

Essential Facility Inventory

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 419 beds. There are 120 schools, 46 fire stations, 23 police stations and 9 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 23,391 buildings will be at least moderately damaged. This is over 24% of the total number of buildings in the region. There are an estimated 2,298 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	166	41.94	119	29.97	66	16.70	37	9.27	8	2.12
Commercial	2,204	42.25	1,336	25.61	1,154	22.11	517	9.92	6	0.11
Education	96	43.94	55	25.25	47	21.60	20	9.21	0	0.00
Government	107	44.00	61	24.81	54	22.03	22	9.17	0	0.00
Industrial	747	43.84	397	23.27	359	21.09	185	10.87	16	0.92
Religion	166	41.27	122	30.27	83	20.62	32	7.83	0	0.02
Residential	36,057	41.14	30,796	35.14	15,178	17.32	3,338	3.81	2,268	2.59
Total	**39,544**		**32,885**		**16,941**		**4,152**		**2,298**	

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

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	574	38.18	341	22.65	450	29.90	139	9.27	0	0.00
Masonry	3,911	38.48	2,572	25.31	2,820	27.75	749	7.37	111	1.09
MH	2,416	86.25	161	5.74	149	5.34	18	0.63	57	2.05
Steel	1,804	42.87	910	21.63	1,000	23.77	489	11.62	5	0.11
Wood	31,845	41.29	28,961	37.55	11,451	14.85	2,769	3.59	2,101	2.72

Essential Facility Damage

Before the hurricane, the region had 419 hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (only 0.00%) are available for use. After one week, 0.00% of the beds will be in service. By 30 days, 0.00% 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**
EOCs	9	0	0	9
Fire Stations	46	2	0	46
Hospitals	2	2	2	0
Police Stations	23	1	0	23
Schools	120	67	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 four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. 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 1,381,049 tons of debris will be generated. Of the total amount, 904,809 tons (66%) is Other Tree Debris. Of the remaining 476,240 tons, Brick/Wood comprises 56% of the total, Reinforced Concrete/Steel comprises of 1% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 10761 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 207,224 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

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 6,149 households to be displaced due to the hurricane. Of these, 1,433 people (out of a total population of 242,759) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 2908.7 million dollars, which represents 13.55 % 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 2,909 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 80% 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	1,518,695.98	179,298.56	50,496.77	56,089.20	1,804,580.52
	Content	558,387.22	94,451.59	39,588.33	30,807.92	723,235.07
	Inventory	0.00	1,710.87	6,543.07	588.46	8,842.40
	Subtotal	**2,077,083.20**	**275,461.03**	**96,628.18**	**87,485.59**	**2,536,658.00**
Business Interruption Loss						
	Income	1,031.87	26,513.62	832.79	1,377.46	29,755.74
	Relocation	159,144.44	33,813.10	3,550.78	12,009.28	208,517.60
	Rental	73,269.95	19,308.46	617.24	1,386.83	94,582.48
	Wage	2,430.97	27,076.70	1,344.85	8,353.23	39,205.75
	Subtotal	**235,877.23**	**106,711.89**	**6,345.66**	**23,126.79**	**372,061.58**
Total						
	Total	**2,312,960.44**	**382,172.92**	**102,973.84**	**110,612.38**	**2,908,719.58**

Appendix A: County Listing for the Region

Connecticut
- New London

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
New London	242,759	16,022,077	5,443,194	21,465,271
Total	**242,759**	**16,022,077**	**5,443,194**	**21,465,271**
Study Region Total	**242,759**	**16,022,077**	**5,443,194**	**21,465,271**

Hazus-MH: Hurricane Event Report

Region Name: SCCOG

Hurricane Scenario: Probabilistic 1000-year Return Period

Print Date: Monday, May 21, 2012

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

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.

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Hurricane Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Hurricane Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

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):

- Connecticut

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

The geographical size of the region is 574.47 square miles and contains 58 census tracts. There are over 93 thousand households in the region and has a total population of 242,759 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 95 thousand buildings in the region with a total building replacement value (excluding contents) of 21,465 million dollars (2006 dollars). Approximately 91% of the buildings (and 75% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 95,820 buildings in the region which have an aggregate total replacement value of 21,465 million (2006 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 Tot
Residential	16,022,077	74.6%
Commercial	3,390,039	15.8%
Industrial	832,983	3.9%
Agricultural	185,657	0.9%
Religious	310,302	1.4%
Government	229,963	1.1%
Education	494,250	2.3%
Total	**21,465,271**	**100.0%**

Essential Facility Inventory

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 419 beds. There are 120 schools, 46 fire stations, 23 police stations and 9 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 37,768 buildings will be at least moderately damaged. This is over 39% of the total number of buildings in the region. There are an estimated 5,055 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	99	25.09	128	32.21	95	23.94	59	14.77	16	3.99
Commercial	1,331	25.52	1,292	24.77	1,561	29.92	1,016	19.48	16	0.31
Education	56	25.51	52	23.76	66	29.99	45	20.71	0	0.03
Government	64	26.39	56	23.12	73	30.02	50	20.45	0	0.02
Industrial	459	26.96	382	22.41	487	28.56	348	20.45	28	1.62
Religion	98	24.37	121	29.94	118	29.16	66	16.43	0	0.10
Residential	22,282	25.43	31,630	36.09	21,735	24.80	6,994	7.98	4,996	5.70
Total	**24,391**		**33,661**		**24,133**		**8,579**		**5,055**	

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

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	339	22.51	292	19.44	578	38.43	295	19.62	0	0.00
Masonry	2,406	23.68	2,462	24.22	3,602	35.44	1,470	14.47	223	2.19
MH	2,147	76.66	197	7.04	264	9.41	49	1.74	144	5.15
Steel	1,100	26.15	831	19.74	1,307	31.07	958	22.76	12	0.28
Wood	19,483	25.26	30,092	39.02	17,203	22.31	5,743	7.45	4,605	5.97

Essential Facility Damage

Before the hurricane, the region had 419 hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (only 0.00%) are available for use. After one week, 0.00% of the beds will be in service. By 30 days, 0.00% 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**
EOCs	9	3	0	9
Fire Stations	46	10	0	46
Hospitals	2	2	2	0
Police Stations	23	13	0	22
Schools	120	116	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 four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. 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 2,066,435 tons of debris will be generated. Of the total amount, 1,301,109 tons (63%) is Other Tree Debris. Of the remaining 765,326 tons, Brick/Wood comprises 60% of the total, Reinforced Concrete/Steel comprises of 1% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 18758 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 296,382 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

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 13,669 households to be displaced due to the hurricane. Of these, 3,191 people (out of a total population of 242,759) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 5343.2 million dollars, which represents 24.89 % 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 5,343 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 78% 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	2,668,904.42	342,132.12	90,920.05	117,195.63	3,219,152.22
	Content	1,071,798.09	199,397.05	74,392.66	73,887.05	1,419,474.85
	Inventory	0.00	3,718.86	11,798.75	1,099.28	16,616.88
	Subtotal	**3,740,702.51**	**545,248.03**	**177,111.46**	**192,181.96**	**4,655,243.95**
Business Interruption Loss						
	Income	3,086.84	64,534.99	1,525.62	1,521.24	70,668.68
	Relocation	276,177.23	61,122.85	5,946.17	24,380.69	367,626.94
	Rental	124,108.15	36,270.93	1,073.63	2,983.75	164,436.46
	Wage	7,271.07	67,331.97	2,452.61	8,211.20	85,266.85
	Subtotal	**410,643.29**	**229,260.73**	**10,998.02**	**37,096.88**	**687,998.93**
Total						
	Total	**4,151,345.81**	**774,508.76**	**188,109.48**	**229,278.84**	**5,343,242.88**

Appendix A: County Listing for the Region

Connecticut
- New London

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
New London	242,759	16,022,077	5,443,194	21,465,271
Total	**242,759**	**16,022,077**	**5,443,194**	**21,465,271**
Study Region Total	**242,759**	**16,022,077**	**5,443,194**	**21,465,271**

Hazus-MH: Hurricane Event Report

Region Name: SCCOG

Hurricane Scenario: UN-NAMED-1938-4

Print Date: Monday, May 21, 2012

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

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.

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Hurricane Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Hurricane Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

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):

- Connecticut

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

The geographical size of the region is 574.47 square miles and contains 58 census tracts. There are over 93 thousand households in the region and has a total population of 242,759 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 95 thousand buildings in the region with a total building replacement value (excluding contents) of 21,465 million dollars (2006 dollars). Approximately 91% of the buildings (and 75% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 95,820 buildings in the region which have an aggregate total replacement value of 21,465 million (2006 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 Tot
Residential	16,022,077	74.6%
Commercial	3,390,039	15.8%
Industrial	832,983	3.9%
Agricultural	185,657	0.9%
Religious	310,302	1.4%
Government	229,963	1.1%
Education	494,250	2.3%
Total	**21,465,271**	**100.0%**

Essential Facility Inventory

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 419 beds. There are 120 schools, 46 fire stations, 23 police stations and 9 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:	UN-NAMED-1938-4
Type:	Historic
Max Peak Gust in Study Region:	125 mph

Building Damage

General Building Stock Damage

Hazus estimates that about 17,836 buildings will be at least moderately damaged. This is over 19% of the total number of buildings in the region. There are an estimated 1,327 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	194	48.91	115	28.93	54	13.72	28	7.05	6	1.39
Commercial	2,556	49.00	1,341	25.70	978	18.75	338	6.48	3	0.06
Education	108	49.33	56	25.40	42	18.98	14	6.29	0	0.00
Government	121	49.77	61	24.87	47	19.15	15	6.21	0	0.00
Industrial	870	51.04	401	23.54	303	17.77	121	7.09	10	0.56
Religion	197	48.77	119	29.55	68	16.81	20	4.86	0	0.00
Residential	41,973	47.89	29,873	34.09	12,429	14.18	2,054	2.34	1,308	1.49
Total	**46,019**		**31,965**		**13,920**		**2,589**		**1,327**	

Table 3: Expected Building Damage by Building Type

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	672	44.69	357	23.77	389	25.88	85	5.66	0	0.00
Masonry	4,545	44.72	2,571	25.30	2,477	24.37	502	4.94	67	0.66
MH	2,504	89.38	142	5.06	111	3.96	10	0.36	35	1.24
Steel	2,089	49.65	936	22.24	860	20.44	320	7.60	3	0.07
Wood	37,184	48.21	27,976	36.27	9,056	11.74	1,699	2.20	1,211	1.57

Essential Facility Damage

Before the hurricane, the region had 419 hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (only 0.00%) are available for use. After one week, 0.00% of the beds will be in service. By 30 days, 0.00% 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**
EOCs	9	0	0	9
Fire Stations	46	0	0	46
Hospitals	2	2	2	0
Police Stations	23	1	0	23
Schools	120	33	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 four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. 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 1,178,669 tons of debris will be generated. Of the total amount, 792,831 tons (67%) is Other Tree Debris. Of the remaining 385,838 tons, Brick/Wood comprises 52% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 8058 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 184,391 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

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 3,976 households to be displaced due to the hurricane. Of these, 956 people (out of a total population of 242,759) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 2083.1 million dollars, which represents 9.70 % 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 2,083 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 80% 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	1,117,899.66	128,536.23	34,014.11	44,801.60	1,325,251.60
	Content	380,124.65	62,368.03	25,102.90	23,741.59	491,337.18
	Inventory	0.00	1,221.90	4,108.76	519.74	5,850.39
	Subtotal	**1,498,024.30**	**192,126.16**	**63,225.78**	**69,062.94**	**1,822,439.17**
Business Interruption Loss						
	Income	325.81	12,291.80	478.39	1,369.40	14,465.40
	Relocation	115,235.86	25,128.98	2,567.07	9,927.43	152,859.34
	Rental	55,310.40	13,863.65	415.95	1,116.40	70,706.41
	Wage	767.66	12,985.34	768.54	8,070.24	22,591.79
	Subtotal	**171,639.74**	**64,269.77**	**4,229.95**	**20,483.48**	**260,622.93**
Total						
	Total	**1,669,664.04**	**256,395.93**	**67,455.72**	**89,546.41**	**2,083,062.11**

Appendix A: County Listing for the Region

Connecticut
- New London

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
New London	242,759	16,022,077	5,443,194	21,465,271
Total	**242,759**	**16,022,077**	**5,443,194**	**21,465,271**
Study Region Total	**242,759**	**16,022,077**	**5,443,194**	**21,465,271**

Hazus-MH: Hurricane Event Report

Region Name: SCCOG

Hurricane Scenario: CAROL

Print Date: Monday, May 21, 2012

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

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.

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Hurricane Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Hurricane Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

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):

- Connecticut

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

The geographical size of the region is 574.47 square miles and contains 58 census tracts. There are over 93 thousand households in the region and has a total population of 242,759 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 95 thousand buildings in the region with a total building replacement value (excluding contents) of 21,465 million dollars (2006 dollars). Approximately 91% of the buildings (and 75% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 95,820 buildings in the region which have an aggregate total replacement value of 21,465 million (2006 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 Tot
Residential	16,022,077	74.6%
Commercial	3,390,039	15.8%
Industrial	832,983	3.9%
Agricultural	185,657	0.9%
Religious	310,302	1.4%
Government	229,963	1.1%
Education	494,250	2.3%
Total	**21,465,271**	**100.0%**

Essential Facility Inventory

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 419 beds. There are 120 schools, 46 fire stations, 23 police stations and 9 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:	CAROL
Type:	Historic
Max Peak Gust in Study Region:	99 mph

Building Damage

General Building Stock Damage

Hazus estimates that about 761 buildings will be at least moderately damaged. This is over 1% of the total number of buildings in the region. There are an estimated 6 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	372	93.84	19	4.88	4	0.89	1	0.37	0	0.02
Commercial	4,926	94.42	249	4.77	39	0.74	3	0.07	0	0.00
Education	208	94.94	10	4.62	1	0.43	0	0.01	0	0.00
Government	232	95.09	11	4.50	1	0.40	0	0.01	0	0.00
Industrial	1,611	94.57	78	4.55	12	0.69	3	0.18	0	0.01
Religion	381	94.58	20	5.00	2	0.40	0	0.02	0	0.00
Residential	81,313	92.78	5,629	6.42	669	0.76	19	0.02	6	0.01
Total	**89,043**		**6,016**		**727**		**27**		**6**	

Table 3: Expected Building Damage by Building Type

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	1,404	93.33	89	5.91	11	0.75	0	0.01	0	0.00
Masonry	9,237	90.89	678	6.67	234	2.30	13	0.13	1	0.01
MH	2,793	99.73	6	0.22	1	0.05	0	0.00	0	0.01
Steel	3,981	94.60	192	4.57	32	0.75	3	0.08	0	0.00
Wood	71,942	93.28	4,842	6.28	323	0.42	14	0.02	6	0.01

Essential Facility Damage

Before the hurricane, the region had 419 hospital beds available for use. On the day of the hurricane, the model estimates that 419 hospital beds (only 100.00%) are available for use. After one week, 100.00% of the beds will be in service. By 30 days, 100.00% 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**
EOCs	9	0	0	9
Fire Stations	46	0	0	46
Hospitals	2	2	0	2
Police Stations	23	0	0	23
Schools	120	0	0	112

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. 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 207,319 tons of debris will be generated. Of the total amount, 152,309 tons (73%) is Other Tree Debris. Of the remaining 55,010 tons, Brick/Wood comprises 37% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 806 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 34,866 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

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 151 households to be displaced due to the hurricane. Of these, 37 people (out of a total population of 242,759) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 161.8 million dollars, which represents 0.75 % 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 162 million dollars. 2% 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 91% 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	117,318.00	5,738.86	1,474.37	1,648.44	126,179.68
	Content	20,607.05	929.32	622.55	259.64	22,418.56
	Inventory	0.00	18.91	118.38	11.04	148.33
	Subtotal	**137,925.05**	**6,687.09**	**2,215.30**	**1,919.12**	**148,746.57**
Business Interruption Loss						
	Income	0.00	801.98	15.95	184.27	1,002.20
	Relocation	4,624.49	815.96	71.21	181.86	5,693.53
	Rental	4,399.87	456.39	14.51	15.20	4,885.97
	Wage	0.00	750.73	26.60	728.87	1,506.20
	Subtotal	**9,024.36**	**2,825.06**	**128.28**	**1,110.20**	**13,087.90**
Total						
	Total	**146,949.41**	**9,512.15**	**2,343.59**	**3,029.32**	**161,834.47**

Appendix A: County Listing for the Region

Connecticut
- New London

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
New London	242,759	16,022,077	5,443,194	21,465,271
Total	**242,759**	**16,022,077**	**5,443,194**	**21,465,271**
Study Region Total	**242,759**	**16,022,077**	**5,443,194**	**21,465,271**

Hazus-MH: Hurricane Event Report

Region Name: SCCOG

Hurricane Scenario: GLORIA

Print Date: Monday, May 21, 2012

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

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.

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Hurricane Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Hurricane Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

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):

- Connecticut

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

The geographical size of the region is 574.47 square miles and contains 58 census tracts. There are over 93 thousand households in the region and has a total population of 242,759 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 95 thousand buildings in the region with a total building replacement value (excluding contents) of 21,465 million dollars (2006 dollars). Approximately 91% of the buildings (and 75% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 95,820 buildings in the region which have an aggregate total replacement value of 21,465 million (2006 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 Tot
Residential	16,022,077	74.6%
Commercial	3,390,039	15.8%
Industrial	832,983	3.9%
Agricultural	185,657	0.9%
Religious	310,302	1.4%
Government	229,963	1.1%
Education	494,250	2.3%
Total	**21,465,271**	**100.0%**

Essential Facility Inventory

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 419 beds. There are 120 schools, 46 fire stations, 23 police stations and 9 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:	GLORIA
Type:	Historic
Max Peak Gust in Study Region:	92 mph

Building Damage

General Building Stock Damage

Hazus estimates that about 290 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 1 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	384	96.96	10	2.57	1	0.35	0	0.12	0	0.00
Commercial	5,077	97.31	126	2.42	13	0.25	1	0.02	0	0.00
Education	214	97.56	5	2.36	0	0.08	0	0.00	0	0.00
Government	238	97.61	6	2.32	0	0.07	0	0.00	0	0.00
Industrial	1,659	97.36	41	2.42	3	0.18	1	0.04	0	0.00
Religion	393	97.62	9	2.29	0	0.09	0	0.01	0	0.00
Residential	84,520	96.44	2,847	3.25	263	0.30	7	0.01	0	0.00
Total	**92,485**		**3,045**		**281**		**9**		**1**	

Table 3: Expected Building Damage by Building Type

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	1,454	96.65	48	3.19	2	0.15	0	0.00	0	0.00
Masonry	9,641	94.87	406	4.00	111	1.09	5	0.05	0	0.00
MH	2,800	99.95	1	0.04	0	0.01	0	0.00	0	0.00
Steel	4,096	97.33	102	2.41	10	0.23	1	0.02	0	0.00
Wood	74,690	96.84	2,331	3.02	100	0.13	4	0.01	0	0.00

Essential Facility Damage

Before the hurricane, the region had 419 hospital beds available for use. On the day of the hurricane, the model estimates that 419 hospital beds (only 100.00%) are available for use. After one week, 100.00% of the beds will be in service. By 30 days, 100.00% 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**
EOCs	9	0	0	9
Fire Stations	46	0	0	46
Hospitals	2	2	0	2
Police Stations	23	0	0	23
Schools	120	0	0	119

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. 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 141,987 tons of debris will be generated. Of the total amount, 105,958 tons (75%) is Other Tree Debris. Of the remaining 36,029 tons, Brick/Wood comprises 31% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 442 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 24,969 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

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 46 households to be displaced due to the hurricane. Of these, 12 people (out of a total population of 242,759) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 92.6 million dollars, which represents 0.43 % 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 93 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 94% 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	71,481.10	2,855.67	536.82	852.61	75,726.19
	Content	10,553.37	303.51	109.98	83.80	11,050.66
	Inventory	0.00	6.91	22.49	8.06	37.45
	Subtotal	**82,034.47**	**3,166.09**	**669.28**	**944.46**	**86,814.30**
Business Interruption Loss						
	Income	0.00	205.66	1.36	18.10	225.11
	Relocation	2,715.44	193.51	9.21	25.06	2,943.23
	Rental	2,393.96	100.26	1.36	1.11	2,496.69
	Wage	0.00	88.30	2.24	42.55	133.09
	Subtotal	**5,109.39**	**587.73**	**14.17**	**86.82**	**5,798.12**
Total						
	Total	**87,143.86**	**3,753.83**	**683.46**	**1,031.27**	**92,612.42**

Appendix A: County Listing for the Region

Connecticut
- New London

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
New London	242,759	16,022,077	5,443,194	21,465,271
Total	**242,759**	**16,022,077**	**5,443,194**	**21,465,271**
Study Region Total	**242,759**	**16,022,077**	**5,443,194**	**21,465,271**

Hazus-MH: Earthquake Event Report

Region Name: SCCOG

Earthquake Scenario: East Haddam 6.4

Print Date: May 21, 2012

Totals only reflect data for those census tracts/blocks included in the user's study region.

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 earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

Table of Contents

Section	Page #
General Description of the Region	3
Building and Lifeline Inventory	4
Building Inventory	
Critical Facility Inventory	
Transportation and Utility Lifeline Inventory	
Earthquake Scenario Parameters	6
Direct Earthquake Damage	7
Buildings Damage	
Critical Facilities Damage	
Transportation and Utility Lifeline Damage	
Induced Earthquake Damage	11
Fire Following Earthquake	
Debris Generation	
Social Impact	12
Shelter Requirements	
Casualties	
Economic Loss	13
Building Losses	
Transportation and Utility Lifeline Losses	
Long-term Indirect Economic Impacts	
Appendix A: County Listing for the Region	
Appendix B: Regional Population and Building Value Data	

General Description of the Region

Hazus is a regional earthquake 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 earthquake 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 earthquakes and to prepare for emergency response and recovery.

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

Connecticut

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

The geographical size of the region is 574.32 square miles and contains 58 census tracts. There are over 93 thousand households in the region which has a total population of 242,759 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 95 thousand buildings in the region with a total building replacement value (excluding contents) of 21,465 (millions of dollars). Approximately 91.00 % of the buildings (and 75.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 10,338 and 1,349 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 95 thousand buildings in the region which have an aggregate total replacement value of 21,465 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 80% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 419 beds. There are 120 schools, 46 fire stations, 23 police stations and 9 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 82 dams identified within the region. Of these, 12 of the dams are classified as 'high hazard'. The inventory also includes 61 hazardous material sites, 0 military installations and 1 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 11,687.00 (millions of dollars). This inventory includes over 593 kilometers of highways, 319 bridges, 7,663 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	319	6,306.30
	Segments	255	3,544.90
	Tunnels	0	0.00
		Subtotal	**9,851.20**
Railways	Bridges	5	0.30
	Facilities	3	8.00
	Segments	68	211.50
	Tunnels	0	0.00
		Subtotal	**219.90**
Light Rail	Bridges	0	0.00
	Facilities	1	2.70
	Segments	5	111.40
	Tunnels	0	0.00
		Subtotal	**114.00**
Bus	Facilities	3	3.80
		Subtotal	**3.80**
Ferry	Facilities	2	2.70
		Subtotal	**2.70**
Port	Facilities	30	59.90
		Subtotal	**59.90**
Airport	Facilities	1	10.70
	Runways	2	75.90
		Subtotal	**86.60**
		Total	**10,338.00**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	76.60
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**76.60**
Waste Water	Distribution Lines	NA	46.00
	Facilities	11	842.50
	Pipelines	0	0.00
		Subtotal	**888.50**
Natural Gas	Distribution Lines	NA	30.70
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**30.70**
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**0.00**
Electrical Power	Facilities	4	506.00
		Subtotal	**506.00**
Communication	Facilities	12	1.40
		Subtotal	**1.40**
		Total	**1,503.10**

Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	East Haddam 6.4
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-72.40
Latitude of Epicenter	41.50
Earthquake Magnitude	6.40
Depth (Km)	10.00
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	Central & East US (CEUS 2008)

Building Damage

Hazus estimates that about 24,226 buildings will be at least moderately damaged. This is over 25.00 % of the buildings in the region. There are an estimated 2,698 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	89	0.19	75	0.31	108	0.68	70	1.22	54	1.99
Commercial	1,129	2.41	899	3.64	1,431	9.07	1,033	17.98	725	26.88
Education	45	0.10	36	0.15	62	0.39	46	0.81	29	1.07
Government	44	0.09	36	0.15	69	0.44	57	0.98	37	1.39
Industrial	325	0.69	247	1.00	456	2.89	379	6.60	297	11.01
Other Residential	8,379	17.87	4,622	18.72	3,791	24.02	1,881	32.74	956	35.42
Religion	160	0.34	88	0.36	84	0.53	47	0.81	24	0.88
Single Family	36,726	78.31	18,693	75.69	9,781	61.97	2,232	38.85	576	21.36
Total	**46,898**		**24,695**		**15,784**		**5,745**		**2,698**	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	42,034	89.63	21385	86.60	10,959	69.43	2,303	40.09	439	16.28
Steel	541	1.15	482	1.95	1,211	7.67	1,129	19.65	857	31.76
Concrete	192	0.41	150	0.61	359	2.28	313	5.45	208	7.71
Precast	63	0.13	35	0.14	72	0.46	69	1.20	41	1.52
RM	695	1.48	281	1.14	541	3.43	447	7.78	212	7.85
URM	2,738	5.84	1793	7.26	1,858	11.77	950	16.54	652	24.16
MH	634	1.35	570	2.31	783	4.96	535	9.30	289	10.71
Total	**46,898**		**24,695**		**15,784**		**5,745**		**2,698**	

*Note:
RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 419 hospital beds available for use. On the day of the earthquake, the model estimates that only 103 hospital beds (25.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 47.00% of the beds will be back in service. By 30 days, 75.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	2	1	0	0
Schools	120	65	7	6
EOCs	9	5	1	0
PoliceStations	23	10	3	1
FireStations	46	20	4	2

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component		Number of Locations			
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	255	0	0	255	255
	Bridges	319	100	14	224	261
	Tunnels	0	0	0	0	0
Railways	Segments	68	0	0	68	68
	Bridges	5	0	0	5	5
	Tunnels	0	0	0	0	0
	Facilities	3	0	0	3	3
Light Rail	Segments	5	0	0	5	5
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	1	0	0	1	1
Bus	Facilities	3	1	0	2	2
Ferry	Facilities	2	0	0	2	2
Port	Facilities	30	0	0	30	30
Airport	Facilities	1	0	0	1	1
	Runways	2	0	0	2	2

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	11	2	0	2	11
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	4	2	0	0	4
Communication	12	5	0	12	12

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	3,832	1393	348
Waste Water	2,299	700	175
Natural Gas	1,533	240	60
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	93,577	39,374	32,329	16,405	0	0
Electric Power		24,389	14,644	6,111	1,386	32

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. 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 1.24 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 33.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 49,720 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 3,630 households to be displaced due to the earthquake. Of these, 2,262 people (out of a total population of 242,759) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	16	4	1	1
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	40	11	2	3
	Industrial	22	6	1	2
	Other-Residential	495	134	20	40
	Single Family	294	58	6	11
	Total	**868**	**213**	**30**	**57**
2 PM	Commercial	1,002	273	40	78
	Commuting	2	2	4	1
	Educational	365	106	17	33
	Hotels	8	2	0	1
	Industrial	166	46	7	13
	Other-Residential	91	25	4	7
	Single Family	49	10	1	2
	Total	**1,683**	**463**	**72**	**134**
5 PM	Commercial	838	230	34	65
	Commuting	38	52	86	17
	Educational	42	12	2	4
	Hotels	12	3	0	1
	Industrial	104	29	4	8
	Other-Residential	193	52	8	15
	Single Family	117	24	3	5
	Total	**1,343**	**402**	**138**	**115**

Economic Loss

The total economic loss estimated for the earthquake is 4,761.89 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building 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 earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 3,810.75 (millions of dollars); 22 % 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 45 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	41.11	167.58	6.45	18.60	233.74
	Capital-Related	0.00	17.10	145.96	3.88	4.11	171.05
	Rental	17.86	60.29	71.79	1.89	7.71	159.54
	Relocation	66.37	33.49	114.61	9.29	55.08	278.85
	Subtotal	**84.23**	**151.99**	**499.94**	**21.52**	**85.50**	**843.18**
Capital Stock Losses							
	Structural	124.61	103.97	183.05	38.12	67.80	517.54
	Non_Structural	537.22	428.94	518.00	121.62	171.29	1,777.07
	Content	178.31	94.39	225.17	72.23	79.76	649.86
	Inventory	0.00	0.00	6.19	14.51	2.39	23.10
	Subtotal	**840.14**	**627.30**	**932.41**	**246.48**	**321.25**	**2,967.57**
	Total	**924.37**	**779.29**	**1,432.34**	**268.00**	**406.75**	**3,810.75**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	3,544.94	$0.00	0.00
	Bridges	6,306.29	$763.64	12.11
	Tunnels	0.00	$0.00	0.00
	Subtotal	**9851.20**	**763.60**	
Railways	Segments	211.52	$0.00	0.00
	Bridges	0.35	$0.00	0.93
	Tunnels	0.00	$0.00	0.00
	Facilities	7.99	$1.64	20.48
	Subtotal	**219.90**	**1.60**	
Light Rail	Segments	111.38	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	2.66	$0.55	20.67
	Subtotal	**114.00**	**0.60**	
Bus	Facilities	3.76	$1.34	35.73
	Subtotal	**3.80**	**1.30**	
Ferry	Facilities	2.66	$0.55	20.75
	Subtotal	**2.70**	**0.60**	
Port	Facilities	59.91	$12.63	21.09
	Subtotal	**59.90**	**12.60**	
Airport	Facilities	10.65	$1.81	17.01
	Runways	75.93	$0.00	0.00
	Subtotal	**86.60**	**1.80**	
	Total	**10338.00**	**782.20**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	76.60	$6.27	8.18
	Subtotal	**76.63**	**$6.27**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	842.50	$85.56	10.16
	Distribution Lines	46.00	$3.15	6.85
	Subtotal	**888.47**	**$88.71**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	30.70	$1.08	3.52
	Subtotal	**30.65**	**$1.08**	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Electrical Power	Facilities	506.00	$72.70	14.37
	Subtotal	**506.00**	**$72.70**	
Communication	Facilities	1.40	$0.22	16.00
	Subtotal	**1.38**	**$0.22**	
	Total	**1,503.14**	**$168.97**	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of $)

LOSS		Total	%

Appendix A: County Listing for the Region

New London,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut					
	New London	242,759	16,022	5,443	21,465
Total State		**242,759**	**16,022**	**5,443**	**21,465**
Total Region		**242,759**	**16,022**	**5,443**	**21,465**

Hazus-MH: Earthquake Event Report

Region Name: SCCOG

Earthquake Scenario: Haddam 5.7

Print Date: May 21, 2012

Totals only reflect data for those census tracts/blocks included in the user's study region.

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 earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

Table of Contents

Section	Page #
General Description of the Region	3
Building and Lifeline Inventory	4
Building Inventory	
Critical Facility Inventory	
Transportation and Utility Lifeline Inventory	
Earthquake Scenario Parameters	6
Direct Earthquake Damage	7
Buildings Damage	
Critical Facilities Damage	
Transportation and Utility Lifeline Damage	
Induced Earthquake Damage	11
Fire Following Earthquake	
Debris Generation	
Social Impact	12
Shelter Requirements	
Casualties	
Economic Loss	13
Building Losses	
Transportation and Utility Lifeline Losses	
Long-term Indirect Economic Impacts	
Appendix A: County Listing for the Region	
Appendix B: Regional Population and Building Value Data	

General Description of the Region

Hazus is a regional earthquake 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 earthquake 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 earthquakes and to prepare for emergency response and recovery.

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

Connecticut

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

The geographical size of the region is 574.32 square miles and contains 58 census tracts. There are over 93 thousand households in the region which has a total population of 242,759 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 95 thousand buildings in the region with a total building replacement value (excluding contents) of 21,465 (millions of dollars). Approximately 91.00 % of the buildings (and 75.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 10,338 and 1,349 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 95 thousand buildings in the region which have an aggregate total replacement value of 21,465 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 80% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 419 beds. There are 120 schools, 46 fire stations, 23 police stations and 9 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 82 dams identified within the region. Of these, 12 of the dams are classified as 'high hazard'. The inventory also includes 61 hazardous material sites, 0 military installations and 1 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 11,687.00 (millions of dollars). This inventory includes over 593 kilometers of highways, 319 bridges, 7,663 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	319	6,306.30
	Segments	255	3,544.90
	Tunnels	0	0.00
		Subtotal	**9,851.20**
Railways	Bridges	5	0.30
	Facilities	3	8.00
	Segments	68	211.50
	Tunnels	0	0.00
		Subtotal	**219.90**
Light Rail	Bridges	0	0.00
	Facilities	1	2.70
	Segments	5	111.40
	Tunnels	0	0.00
		Subtotal	**114.00**
Bus	Facilities	3	3.80
		Subtotal	**3.80**
Ferry	Facilities	2	2.70
		Subtotal	**2.70**
Port	Facilities	30	59.90
		Subtotal	**59.90**
Airport	Facilities	1	10.70
	Runways	2	75.90
		Subtotal	**86.60**
		Total	**10,338.00**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	76.60
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**76.60**
Waste Water	Distribution Lines	NA	46.00
	Facilities	11	842.50
	Pipelines	0	0.00
		Subtotal	**888.50**
Natural Gas	Distribution Lines	NA	30.70
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**30.70**
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**0.00**
Electrical Power	Facilities	4	506.00
		Subtotal	**506.00**
Communication	Facilities	12	1.40
		Subtotal	**1.40**
		Total	**1,503.10**

Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	Haddam 5.7
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-72.55
Latitude of Epicenter	41.47
Earthquake Magnitude	5.70
Depth (Km)	10.00
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	Central & East US (CEUS 2008)

Building Damage

Hazus estimates that about 4,014 buildings will be at least moderately damaged. This is over 4.00 % of the buildings in the region. There are an estimated 71 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	310	0.38	51	0.48	27	0.80	7	1.33	1	1.92
Commercial	4,054	4.99	645	6.16	400	11.69	98	18.88	19	26.76
Education	173	0.21	26	0.25	16	0.46	3	0.62	1	0.87
Government	191	0.23	30	0.28	19	0.56	4	0.77	1	1.08
Industrial	1,299	1.60	205	1.96	149	4.35	41	7.93	10	13.40
Other Residential	16,219	19.94	2,219	21.17	993	29.00	175	33.65	23	32.11
Religion	332	0.41	45	0.42	22	0.63	4	0.83	1	0.82
Single Family	58,747	72.24	7,260	69.27	1,797	52.51	187	35.98	17	23.03
Total	**81,325**		**10,481**		**3,422**		**520**		**72**	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	67,033	82.43	8093	77.21	1,838	53.70	150	28.79	8	10.78
Steel	3,204	3.94	502	4.79	388	11.33	101	19.41	25	34.15
Concrete	959	1.18	138	1.32	101	2.96	19	3.73	4	5.89
Precast	218	0.27	27	0.26	26	0.75	9	1.69	1	0.88
RM	1,833	2.25	165	1.58	140	4.08	36	6.91	1	1.93
URM	6,009	7.39	1142	10.90	652	19.06	160	30.77	27	37.98
MH	2,069	2.54	413	3.94	278	8.12	45	8.71	6	8.40
Total	**81,325**		**10,481**		**3,422**		**520**		**72**	

*Note:
RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 419 hospital beds available for use. On the day of the earthquake, the model estimates that only 282 hospital beds (68.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 85.00% of the beds will be back in service. By 30 days, 96.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	2	0	0	2
Schools	120	0	0	114
EOCs	9	0	0	8
PoliceStations	23	0	0	20
FireStations	46	0	0	44

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component		Number of Locations			
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	255	0	0	255	255
	Bridges	319	1	0	318	318
	Tunnels	0	0	0	0	0
Railways	Segments	68	0	0	68	68
	Bridges	5	0	0	5	5
	Tunnels	0	0	0	0	0
	Facilities	3	0	0	3	3
Light Rail	Segments	5	0	0	5	5
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	1	0	0	1	1
Bus	Facilities	3	0	0	3	3
Ferry	Facilities	2	0	0	2	2
Port	Facilities	30	0	0	30	30
Airport	Facilities	1	0	0	1	1
	Runways	2	0	0	2	2

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	11	0	0	11	11
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	4	0	0	4	4
Communication	12	0	0	12	12

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	3,832	138	34
Waste Water	2,299	69	17
Natural Gas	1,533	24	6
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	93,577	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. 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 0.10 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 54.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 4,080 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 241 households to be displaced due to the earthquake. Of these, 149 people (out of a total population of 242,759) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	1	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	2	0	0	0
	Industrial	1	0	0	0
	Other-Residential	32	5	1	1
	Single Family	31	3	0	0
	Total	**67**	**9**	**1**	**2**
2 PM	Commercial	50	9	1	2
	Commuting	0	0	0	0
	Educational	20	4	1	1
	Hotels	0	0	0	0
	Industrial	8	1	0	0
	Other-Residential	6	1	0	0
	Single Family	5	1	0	0
	Total	**89**	**16**	**2**	**3**
5 PM	Commercial	43	8	1	2
	Commuting	2	2	4	1
	Educational	2	0	0	0
	Hotels	1	0	0	0
	Industrial	5	1	0	0
	Other-Residential	12	2	0	0
	Single Family	12	1	0	0
	Total	**77**	**15**	**6**	**3**

Economic Loss

The total economic loss estimated for the earthquake is 506.24 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building 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 earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 402.58 (millions of dollars); 21 % 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 55 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	2.56	15.77	0.55	1.64	20.53
	Capital-Related	0.00	1.07	13.63	0.33	0.30	15.32
	Rental	2.37	6.12	7.83	0.18	0.59	17.09
	Relocation	8.69	4.17	11.68	1.09	4.34	29.98
	Subtotal	**11.06**	**13.92**	**48.91**	**2.15**	**6.87**	**82.91**
Capital Stock Losses							
	Structural	17.77	9.90	14.79	3.02	4.81	50.30
	Non_Structural	82.55	45.22	42.47	9.77	13.28	193.29
	Content	28.88	11.35	20.64	6.01	7.26	74.14
	Inventory	0.00	0.00	0.54	1.21	0.19	1.94
	Subtotal	**129.20**	**66.47**	**78.43**	**20.01**	**25.54**	**319.66**
	Total	**140.27**	**80.39**	**127.35**	**22.17**	**32.41**	**402.58**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	3,544.94	$0.00	0.00
	Bridges	6,306.29	$67.59	1.07
	Tunnels	0.00	$0.00	0.00
	Subtotal	**9851.20**	**67.60**	
Railways	Segments	211.52	$0.00	0.00
	Bridges	0.35	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	7.99	$0.54	6.73
	Subtotal	**219.90**	**0.50**	
Light Rail	Segments	111.38	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	2.66	$0.20	7.63
	Subtotal	**114.00**	**0.20**	
Bus	Facilities	3.76	$0.43	11.38
	Subtotal	**3.80**	**0.40**	
Ferry	Facilities	2.66	$0.20	7.63
	Subtotal	**2.70**	**0.20**	
Port	Facilities	59.91	$4.59	7.66
	Subtotal	**59.90**	**4.60**	
Airport	Facilities	10.65	$0.64	6.05
	Runways	75.93	$0.00	0.00
	Subtotal	**86.60**	**0.60**	
	Total	**10338.00**	**74.20**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	76.60	$0.62	0.81
	Subtotal	**76.63**	**$0.62**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	842.50	$14.48	1.72
	Distribution Lines	46.00	$0.31	0.68
	Subtotal	**888.47**	**$14.79**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	30.70	$0.11	0.35
	Subtotal	**30.65**	**$0.11**	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Electrical Power	Facilities	506.00	$13.90	2.75
	Subtotal	**506.00**	**$13.90**	
Communication	Facilities	1.40	$0.04	3.01
	Subtotal	**1.38**	**$0.04**	
	Total	**1,503.14**	**$29.46**	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of $)

LOSS	Total	%

Appendix A: County Listing for the Region

New London,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut					
	New London	242,759	16,022	5,443	21,465
Total State		**242,759**	**16,022**	**5,443**	**21,465**
Total Region		**242,759**	**16,022**	**5,443**	**21,465**

Hazus-MH: Earthquake Event Report

Region Name: SCCOG

Earthquake Scenario: Portland 5.7

Print Date: May 21, 2012

Totals only reflect data for those census tracts/blocks included in the user's study region.

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 earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

Table of Contents

Section	Page #
General Description of the Region	3
Building and Lifeline Inventory	4
Building Inventory	
Critical Facility Inventory	
Transportation and Utility Lifeline Inventory	
Earthquake Scenario Parameters	6
Direct Earthquake Damage	7
Buildings Damage	
Critical Facilities Damage	
Transportation and Utility Lifeline Damage	
Induced Earthquake Damage	11
Fire Following Earthquake	
Debris Generation	
Social Impact	12
Shelter Requirements	
Casualties	
Economic Loss	13
Building Losses	
Transportation and Utility Lifeline Losses	
Long-term Indirect Economic Impacts	
Appendix A: County Listing for the Region	
Appendix B: Regional Population and Building Value Data	

General Description of the Region

Hazus is a regional earthquake 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 earthquake 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 earthquakes and to prepare for emergency response and recovery.

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

Connecticut

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

The geographical size of the region is 574.32 square miles and contains 58 census tracts. There are over 93 thousand households in the region which has a total population of 242,759 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 95 thousand buildings in the region with a total building replacement value (excluding contents) of 21,465 (millions of dollars). Approximately 91.00 % of the buildings (and 75.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 10,338 and 1,349 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 95 thousand buildings in the region which have an aggregate total replacement value of 21,465 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 80% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 419 beds. There are 120 schools, 46 fire stations, 23 police stations and 9 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 82 dams identified within the region. Of these, 12 of the dams are classified as 'high hazard'. The inventory also includes 61 hazardous material sites, 0 military installations and 1 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 11,687.00 (millions of dollars). This inventory includes over 593 kilometers of highways, 319 bridges, 7,663 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	319	6,306.30
	Segments	255	3,544.90
	Tunnels	0	0.00
		Subtotal	**9,851.20**
Railways	Bridges	5	0.30
	Facilities	3	8.00
	Segments	68	211.50
	Tunnels	0	0.00
		Subtotal	**219.90**
Light Rail	Bridges	0	0.00
	Facilities	1	2.70
	Segments	5	111.40
	Tunnels	0	0.00
		Subtotal	**114.00**
Bus	Facilities	3	3.80
		Subtotal	**3.80**
Ferry	Facilities	2	2.70
		Subtotal	**2.70**
Port	Facilities	30	59.90
		Subtotal	**59.90**
Airport	Facilities	1	10.70
	Runways	2	75.90
		Subtotal	**86.60**
		Total	**10,338.00**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	76.60
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**76.60**
Waste Water	Distribution Lines	NA	46.00
	Facilities	11	842.50
	Pipelines	0	0.00
		Subtotal	**888.50**
Natural Gas	Distribution Lines	NA	30.70
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**30.70**
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**0.00**
Electrical Power	Facilities	4	506.00
		Subtotal	**506.00**
Communication	Facilities	12	1.40
		Subtotal	**1.40**
		Total	**1,503.10**

Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	Portland 5.7
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-72.60
Latitude of Epicenter	41.60
Earthquake Magnitude	5.70
Depth (Km)	10.00
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	Central & East US (CEUS 2008)

Building Damage

Hazus estimates that about 2,689 buildings will be at least moderately damaged. This is over 3.00 % of the buildings in the region. There are an estimated 42 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	333	0.39	39	0.50	19	0.81	4	1.31	1	1.83
Commercial	4,400	5.16	484	6.17	263	11.32	60	18.22	11	26.29
Education	187	0.22	19	0.25	10	0.43	2	0.58	0	0.83
Government	208	0.24	21	0.27	12	0.50	2	0.67	0	0.97
Industrial	1,413	1.66	158	2.02	101	4.35	26	7.93	6	13.60
Other Residential	17,093	20.04	1,712	21.84	698	30.11	112	34.28	14	33.07
Religion	351	0.41	34	0.43	15	0.64	3	0.83	0	0.80
Single Family	61,309	71.88	5,368	68.51	1,202	51.84	118	36.18	10	22.62
Total	**85,295**		**7,836**		**2,319**		**327**		**42**	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	69,884	81.93	5938	75.77	1,204	51.90	91	27.85	4	9.18
Steel	3,536	4.15	368	4.70	242	10.43	59	18.00	14	33.33
Concrete	1,047	1.23	101	1.28	62	2.65	11	3.34	2	5.67
Precast	234	0.27	21	0.27	18	0.79	6	1.75	0	0.88
RM	1,927	2.26	128	1.64	97	4.19	22	6.74	1	1.48
URM	6,441	7.55	935	11.93	489	21.08	109	33.33	17	40.25
MH	2,224	2.61	346	4.41	208	8.95	29	9.01	4	9.22
Total	**85,295**		**7,836**		**2,319**		**327**		**42**	

*Note:
RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 419 hospital beds available for use. On the day of the earthquake, the model estimates that only 307 hospital beds (73.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 88.00% of the beds will be back in service. By 30 days, 97.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	2	0	0	2
Schools	120	0	0	115
EOCs	9	0	0	8
PoliceStations	23	0	0	21
FireStations	46	0	0	46

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component		Number of Locations			
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	255	0	0	255	255
	Bridges	319	3	0	316	318
	Tunnels	0	0	0	0	0
Railways	Segments	68	0	0	68	68
	Bridges	5	0	0	5	5
	Tunnels	0	0	0	0	0
	Facilities	3	0	0	3	3
Light Rail	Segments	5	0	0	5	5
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	1	0	0	1	1
Bus	Facilities	3	0	0	3	3
Ferry	Facilities	2	0	0	2	2
Port	Facilities	30	0	0	30	30
Airport	Facilities	1	0	0	1	1
	Runways	2	0	0	2	2

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	11	0	0	11	11
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	4	0	0	4	4
Communication	12	0	0	12	12

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	3,832	98	24
Waste Water	2,299	49	12
Natural Gas	1,533	17	4
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	93,577	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. 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 0.07 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 57.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 2,680 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 156 households to be displaced due to the earthquake. Of these, 95 people (out of a total population of 242,759) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	1	0	0	0
	Industrial	1	0	0	0
	Other-Residential	21	3	0	1
	Single Family	21	2	0	0
	Total	**44**	**6**	**0**	**1**
2 PM	Commercial	30	5	1	1
	Commuting	0	0	0	0
	Educational	12	2	0	1
	Hotels	0	0	0	0
	Industrial	5	1	0	0
	Other-Residential	4	1	0	0
	Single Family	4	0	0	0
	Total	**55**	**9**	**1**	**2**
5 PM	Commercial	27	5	1	1
	Commuting	1	1	3	1
	Educational	1	0	0	0
	Hotels	0	0	0	0
	Industrial	3	1	0	0
	Other-Residential	8	1	0	0
	Single Family	8	1	0	0
	Total	**49**	**9**	**3**	**2**

Economic Loss

The total economic loss estimated for the earthquake is 324.22 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building 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 earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 257.01 (millions of dollars); 20 % 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 55 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	1.40	9.88	0.35	0.98	12.62
	Capital-Related	0.00	0.58	8.50	0.21	0.18	9.47
	Rental	1.58	3.96	5.03	0.12	0.33	11.03
	Relocation	5.74	2.80	7.31	0.70	2.50	19.05
	Subtotal	**7.32**	**8.75**	**30.73**	**1.37**	**3.99**	**52.16**
Capital Stock Losses							
	Structural	12.16	6.39	9.34	1.91	3.07	32.87
	Non_Structural	54.54	28.45	26.96	6.36	8.04	124.35
	Content	18.15	6.86	13.06	3.90	4.39	46.36
	Inventory	0.00	0.00	0.35	0.78	0.14	1.27
	Subtotal	**84.85**	**41.70**	**49.71**	**12.94**	**15.64**	**204.84**
	Total	**92.17**	**50.45**	**80.45**	**14.31**	**19.62**	**257.01**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	3,544.94	$0.00	0.00
	Bridges	6,306.29	$45.85	0.73
	Tunnels	0.00	$0.00	0.00
	Subtotal	**9851.20**	**45.90**	
Railways	Segments	211.52	$0.00	0.00
	Bridges	0.35	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	7.99	$0.37	4.66
	Subtotal	**219.90**	**0.40**	
Light Rail	Segments	111.38	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	2.66	$0.12	4.58
	Subtotal	**114.00**	**0.10**	
Bus	Facilities	3.76	$0.39	10.48
	Subtotal	**3.80**	**0.40**	
Ferry	Facilities	2.66	$0.12	4.59
	Subtotal	**2.70**	**0.10**	
Port	Facilities	59.91	$2.81	4.69
	Subtotal	**59.90**	**2.80**	
Airport	Facilities	10.65	$0.39	3.67
	Runways	75.93	$0.00	0.00
	Subtotal	**86.60**	**0.40**	
	Total	**10338.00**	**50.10**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	76.60	$0.44	0.57
	Subtotal	**76.63**	**$0.44**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	842.50	$8.26	0.98
	Distribution Lines	46.00	$0.22	0.48
	Subtotal	**888.47**	**$8.48**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	30.70	$0.08	0.25
	Subtotal	**30.65**	**$0.08**	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Electrical Power	Facilities	506.00	$8.13	1.61
	Subtotal	**506.00**	**$8.13**	
Communication	Facilities	1.40	$0.02	1.77
	Subtotal	**1.38**	**$0.02**	
	Total	**1,503.14**	**$17.15**	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of $)

LOSS		Total	%

Appendix A: County Listing for the Region

New London,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut					
	New London	242,759	16,022	5,443	21,465
Total State		**242,759**	**16,022**	**5,443**	**21,465**
Total Region		**242,759**	**16,022**	**5,443**	**21,465**

Hazus-MH: Earthquake Event Report

Region Name: SCCOG

Earthquake Scenario: Stamford 5.7

Print Date: May 21, 2012

Totals only reflect data for those census tracts/blocks included in the user's study region.

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 earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

Table of Contents

Section	Page #
General Description of the Region	3
Building and Lifeline Inventory	4
Building Inventory	
Critical Facility Inventory	
Transportation and Utility Lifeline Inventory	
Earthquake Scenario Parameters	6
Direct Earthquake Damage	7
Buildings Damage	
Critical Facilities Damage	
Transportation and Utility Lifeline Damage	
Induced Earthquake Damage	11
Fire Following Earthquake	
Debris Generation	
Social Impact	12
Shelter Requirements	
Casualties	
Economic Loss	13
Building Losses	
Transportation and Utility Lifeline Losses	
Long-term Indirect Economic Impacts	
Appendix A: County Listing for the Region	
Appendix B: Regional Population and Building Value Data	

General Description of the Region

Hazus is a regional earthquake 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 earthquake 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 earthquakes and to prepare for emergency response and recovery.

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

Connecticut

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

The geographical size of the region is 574.32 square miles and contains 58 census tracts. There are over 93 thousand households in the region which has a total population of 242,759 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 95 thousand buildings in the region with a total building replacement value (excluding contents) of 21,465 (millions of dollars). Approximately 91.00 % of the buildings (and 75.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 10,338 and 1,349 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 95 thousand buildings in the region which have an aggregate total replacement value of 21,465 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 80% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 419 beds. There are 120 schools, 46 fire stations, 23 police stations and 9 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 82 dams identified within the region. Of these, 12 of the dams are classified as 'high hazard'. The inventory also includes 61 hazardous material sites, 0 military installations and 1 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 11,687.00 (millions of dollars). This inventory includes over 593 kilometers of highways, 319 bridges, 7,663 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	319	6,306.30
	Segments	255	3,544.90
	Tunnels	0	0.00
		Subtotal	**9,851.20**
Railways	Bridges	5	0.30
	Facilities	3	8.00
	Segments	68	211.50
	Tunnels	0	0.00
		Subtotal	**219.90**
Light Rail	Bridges	0	0.00
	Facilities	1	2.70
	Segments	5	111.40
	Tunnels	0	0.00
		Subtotal	**114.00**
Bus	Facilities	3	3.80
		Subtotal	**3.80**
Ferry	Facilities	2	2.70
		Subtotal	**2.70**
Port	Facilities	30	59.90
		Subtotal	**59.90**
Airport	Facilities	1	10.70
	Runways	2	75.90
		Subtotal	**86.60**
		Total	**10,338.00**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	76.60
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**76.60**
Waste Water	Distribution Lines	NA	46.00
	Facilities	11	842.50
	Pipelines	0	0.00
		Subtotal	**888.50**
Natural Gas	Distribution Lines	NA	30.70
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**30.70**
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**0.00**
Electrical Power	Facilities	4	506.00
		Subtotal	**506.00**
Communication	Facilities	12	1.40
		Subtotal	**1.40**
		Total	**1,503.10**

Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	Stamford 5.7
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-73.60
Latitude of Epicenter	41.15
Earthquake Magnitude	5.70
Depth (Km)	10.00
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	Central & East US (CEUS 2008)

Building Damage

Hazus estimates that about 340 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 1 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	385	0.41	8	0.51	2	0.69	0	0.92	0	0.63
Commercial	5,058	5.39	120	7.20	35	11.27	4	15.63	0	14.63
Education	213	0.23	5	0.29	1	0.43	0	0.56	0	0.65
Government	237	0.25	5	0.31	1	0.45	0	0.55	0	0.51
Industrial	1,656	1.76	37	2.19	11	3.40	1	4.26	0	3.45
Other Residential	19,051	20.31	444	26.69	123	39.06	10	41.23	1	44.71
Religion	390	0.42	9	0.57	3	0.91	0	1.35	0	1.71
Single Family	66,825	71.23	1,037	62.25	138	43.79	9	35.52	0	33.70
Total	**93,815**		**1,665**		**314**		**25**		**1**	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	75,902	80.91	1099	65.98	116	36.93	4	17.07	0	0.00
Steel	4,116	4.39	80	4.81	22	6.96	2	6.74	0	1.48
Concrete	1,197	1.28	21	1.25	5	1.50	0	0.58	0	0.00
Precast	269	0.29	7	0.39	4	1.16	1	2.34	0	0.00
RM	2,118	2.26	38	2.27	17	5.56	2	7.33	0	0.00
URM	7,549	8.05	314	18.84	112	35.57	15	60.36	1	98.52
MH	2,663	2.84	107	6.46	39	12.31	1	5.58	0	0.00
Total	**93,815**		**1,665**		**314**		**25**		**1**	

*Note:
RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 419 hospital beds available for use. On the day of the earthquake, the model estimates that only 376 hospital beds (90.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 96.00% of the beds will be back in service. By 30 days, 99.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	2	0	0	2
Schools	120	0	0	120
EOCs	9	0	0	9
PoliceStations	23	0	0	23
FireStations	46	0	0	46

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component		Number of Locations			
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	255	0	0	255	255
	Bridges	319	0	0	319	319
	Tunnels	0	0	0	0	0
Railways	Segments	68	0	0	68	68
	Bridges	5	0	0	5	5
	Tunnels	0	0	0	0	0
	Facilities	3	0	0	3	3
Light Rail	Segments	5	0	0	5	5
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	1	0	0	1	1
Bus	Facilities	3	0	0	3	3
Ferry	Facilities	2	0	0	2	2
Port	Facilities	30	0	0	30	30
Airport	Facilities	1	0	0	1	1
	Runways	2	0	0	2	2

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	11	0	0	11	11
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	4	0	0	4	4
Communication	12	0	0	12	12

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	3,832	18	4
Waste Water	2,299	9	2
Natural Gas	1,533	3	1
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	93,577	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. 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 0.01 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 75.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 360 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 15 households to be displaced due to the earthquake. Of these, 10 people (out of a total population of 242,759) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	3	0	0	0
	Single Family	3	0	0	0
	Total	**6**	**1**	**0**	**0**
2 PM	Commercial	3	0	0	0
	Commuting	0	0	0	0
	Educational	1	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	1	0	0	0
	Single Family	0	0	0	0
	Total	**6**	**1**	**0**	**0**
5 PM	Commercial	3	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	1	0	0	0
	Single Family	1	0	0	0
	Total	**5**	**1**	**0**	**0**

Economic Loss

The total economic loss estimated for the earthquake is 26.75 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building 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 earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 23.50 (millions of dollars); 26 % 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 58 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.18	1.03	0.03	0.15	1.39
	Capital-Related	0.00	0.08	0.88	0.02	0.03	1.00
	Rental	0.18	0.63	0.61	0.01	0.04	1.48
	Relocation	0.59	0.43	0.78	0.07	0.32	2.19
	Subtotal	**0.77**	**1.31**	**3.31**	**0.14**	**0.54**	**6.07**
Capital Stock Losses							
	Structural	1.57	1.02	0.99	0.19	0.36	4.13
	Non_Structural	4.87	2.99	2.09	0.39	0.78	11.10
	Content	0.65	0.37	0.66	0.21	0.25	2.14
	Inventory	0.00	0.00	0.02	0.04	0.01	0.06
	Subtotal	**7.08**	**4.38**	**3.75**	**0.83**	**1.39**	**17.43**
	Total	**7.85**	**5.69**	**7.06**	**0.96**	**1.94**	**23.50**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	3,544.94	$0.00	0.00
	Bridges	6,306.29	$2.39	0.04
	Tunnels	0.00	$0.00	0.00
	Subtotal	**9851.20**	**2.40**	
Railways	Segments	211.52	$0.00	0.00
	Bridges	0.35	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	7.99	$0.04	0.46
	Subtotal	**219.90**	**0.00**	
Light Rail	Segments	111.38	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	2.66	$0.01	0.54
	Subtotal	**114.00**	**0.00**	
Bus	Facilities	3.76	$0.02	0.52
	Subtotal	**3.80**	**0.00**	
Ferry	Facilities	2.66	$0.01	0.54
	Subtotal	**2.70**	**0.00**	
Port	Facilities	59.91	$0.32	0.54
	Subtotal	**59.90**	**0.30**	
Airport	Facilities	10.65	$0.05	0.49
	Runways	75.93	$0.00	0.00
	Subtotal	**86.60**	**0.10**	
	Total	**10338.00**	**2.80**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	76.60	$0.08	0.11
	Subtotal	**76.63**	**$0.08**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	842.50	$0.16	0.02
	Distribution Lines	46.00	$0.04	0.09
	Subtotal	**888.47**	**$0.20**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	30.70	$0.01	0.05
	Subtotal	**30.65**	**$0.01**	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Electrical Power	Facilities	506.00	$0.11	0.02
	Subtotal	**506.00**	**$0.11**	
Communication	Facilities	1.40	$0.00	0.02
	Subtotal	**1.38**	**$0.00**	
	Total	**1,503.14**	**$0.41**	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of $)

LOSS		Total	%

Appendix A: County Listing for the Region

New London,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut					
	New London	242,759	16,022	5,443	21,465
Total State		**242,759**	**16,022**	**5,443**	**21,465**
Total Region		**242,759**	**16,022**	**5,443**	**21,465**