HAZUS-MH: Flood Event Report

Region Name: NorthumberlandMR2

Flood Study Case: NorthumberlandMR2

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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):

- Pennsylvania

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

The geographical size of the region is 460 square miles and contains 4,373 census blocks. There are over 39 thousand households in the region and has a total population of 94,556 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 30,478 buildings in the region with a total building replacement value (excluding contents of 5,031 million dollars (2002 dollars). Approximately 98.95% of the buildings (and 84.63% of the building value) are associated with residential housing.

General Building Stock

HAZUS estimates that there are 30,478 buildings in the region which have an aggregate total replacement value of 5,031 million (2002 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Study Case 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	4,257,812	84.6%
Commercial	465,446	9.3%
Industrial	195,227	3.9%
Agricultural	28,734	0.6%
Religion	48,273	1.0%
Government	15,399	0.3%
Education	20,125	0.4%
Total	5,031,016	100.00%

Table 2
Building Exposure by Occupancy Type for the Study Case

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,373,813	77.5%
Commercial	284,432	16.0%
Industrial	63,492	3.6%
Agricultural	12,413	0.7%
Religion	19,389	1.1%
Government	13,282	0.7%
Education	6,876	0.4%
Total	1,773,697	100.00%

Essential Facility Inventory

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 166 beds. There are 38 schools, 24 fire stations, 15 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:	NorthumberlandMR2
Scenario Name:	NorthumberlandMR2
Return Period Analyzed:	200
Analysis Options Analyzed:	0

General Building Stock Damage

HAZUS estimates that about 1,585 buildings will be at least moderately damaged. This is over 25% of the total number of buildings in the study case. There are an estimated 733 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

Occupancy	1-10 Count	(%)	11-20 Count	(%)	21-30 Count	(%)	31-40 Count	(%)	41-50 Count	(%)	Substantially Count	(%)
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	2	16.67	0	0.00	0	0.00	1	8.33	0	0.00	9	75.00
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	1	100.00
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	639	28.87	351	15.86	225	10.17	106	4.79	169	7.64	723	32.67
Total	**641**		**351**		**225**		**107**		**169**		**733**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10 Count	(%)	11-20 Count	(%)	21-30 Count	(%)	31-40 Count	(%)	41-50 Count	(%)	Substantially Count	(%)
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	100.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	199	28.63	102	14.68	64	9.21	31	4.46	57	8.20	242	34.82
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	5	100.00
Wood	438	28.87	249	16.41	161	10.61	75	4.94	111	7.32	483	31.84

Essential Facility Damage

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

Table 5: Expected Damage to Essential Facilities

| Classification | Total | # Facilities | | |
		At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	24	0	0	0
Hospitals	2	0	0	0
Police Stations	15	0	0	0
Schools	38	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 217,267 tons of debris will be generated. Of the total amount, Finishes comprises 23% of the total, Structure comprises 44% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 8,691 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 3,633 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 7,988 people (out of a total population of 94,556) will seek temporary shelter in public shelters.

The total economic loss estimated for the flood is 803.27 million dollars, which represents 69.35 % of the total replacement value of the study case 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 510.86 million dollars. 36% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 48.01% 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	230.46	36.07	7.83	4.47	278.83
	Content	126.15	68.43	16.49	14.60	225.67
	Inventory	0.00	2.85	3.52	0.00	6.37
	Subtotal	**356.61**	**107.35**	**27.83**	**19.07**	**510.86**
Business Interruption						
	Income	1.06	37.71	0.47	5.36	44.59
	Relocation	15.78	10.79	0.40	2.84	29.80
	Rental Income	9.74	7.97	0.11	0.50	18.33
	Wage	2.49	46.75	0.52	149.95	199.70
	Subtotal	**29.06**	**103.22**	**1.49**	**158.65**	**292.42**
ALL	**Total**	**385.67**	**210.57**	**29.33**	**177.71**	**803.27**

Appendix A: County Listing for the Region

Pennsylvania
- Northumberland

Appendix B: Regional Population and Building Value Data

| | Population | Building Value (thousands of dollars) | | |
		Residential	Non-Residential	Total
Pennsylvania				
Northumberland	94,556	4,257,812	773,204	5,031,016
Total State	**94,556**	**4,257,812**	**773,204**	**5,031,016**
Total Study Region	**94,556**	**4,257,812**	**773,204**	**5,031,016**