HAZUS Results for the City of Burlington

Due to the Removal of the Burlington Levee

50 Year Flood Analysis

HAZUS 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 flood. These results can be improved by using enhanced inventory data and flood hazard information.

Figure 1. Flood Depth generated from a 50 year flood and the removal of the Burlington Levee (shown in pink). Flood Depth is shown in square pixels due to size of the raster image. Much of the City of Burlington is inundated in this scenario with the Gages Slough having the deepest flood waters.

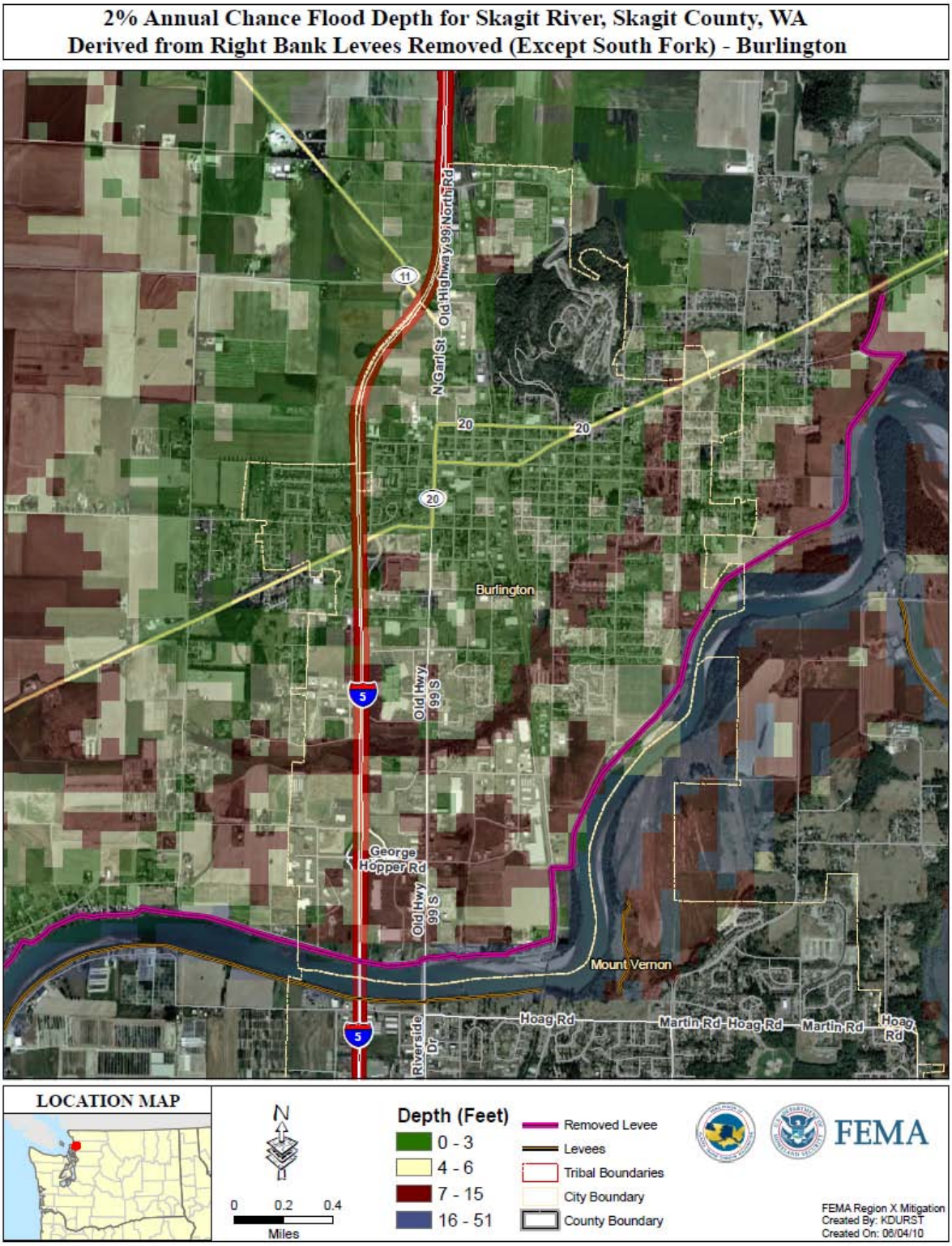


Figure 2. Close up for the City of Burlington and total economic loss. Total economic loss is shown by census block. Census blocks shown in red have $10-18 million dollars of economic loss, which comprise mostly commercial and residential areas. The total amount of economic loss for the City of Burlington is $179 million.

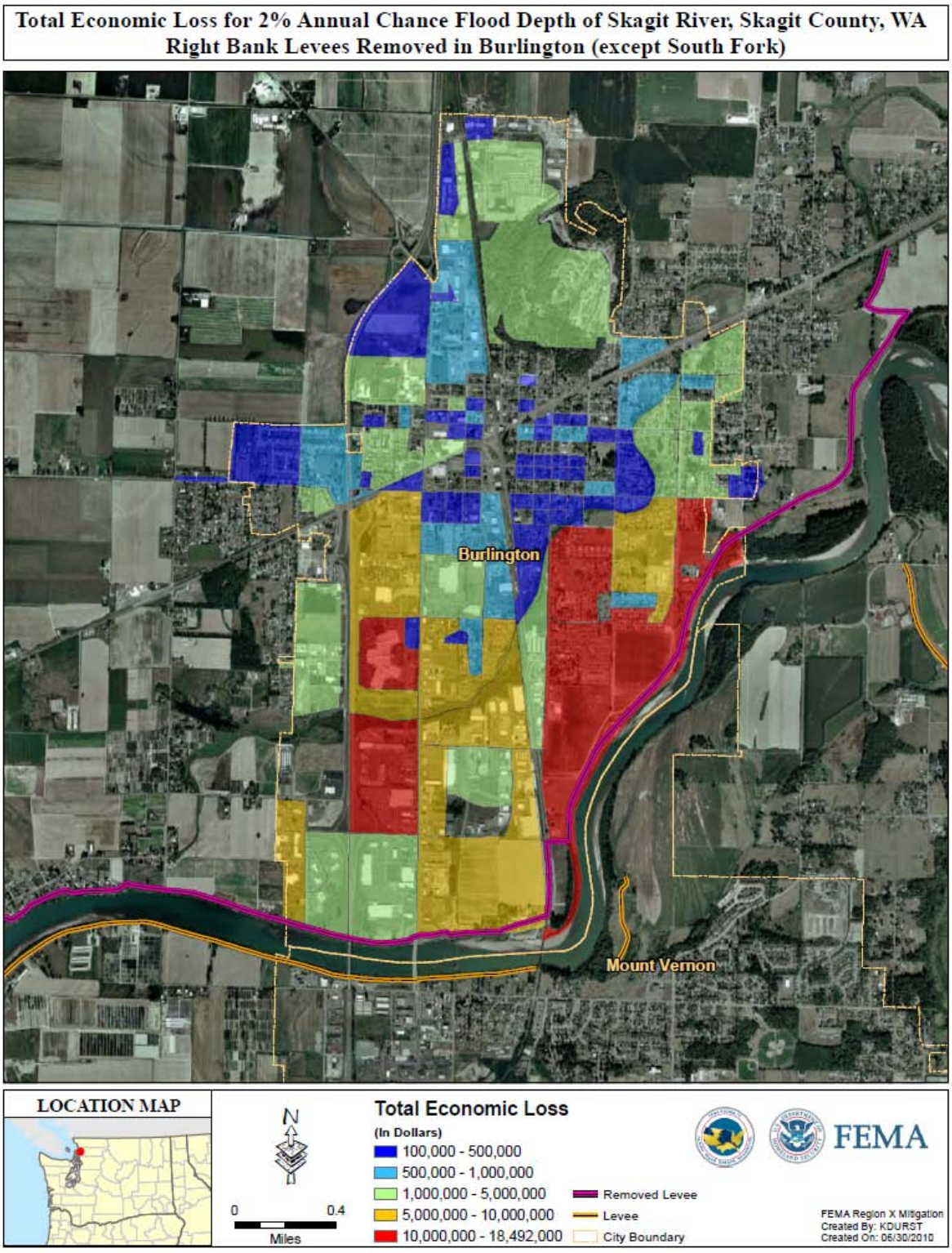


Table 1. Total Economic Loss for Each Building Category, for a 50 Year Flood with the Burlington Levee Removed. Results are for the City of Burlington only.

Loss Category	Residential	Commercial	Industrial	Others	TOTAL
Building Loss					
Building	$39.6M	$22.1M	$1.3M	$3.6M	$66.6M
Content	$25.8M	$66.6M	$6.7M	$7.0M	$106.1M
Inventory	$0	$3.0M	$1.1M	$200K	$4.3M
Subtotal	**$65.4M**	**$91.7M**	**$9.1M**	**$10.8M**	**$177.0M**
Business Interruption					
Income	$30K	$461K	$3K	$56K	$550K
Relocation	$148K	$209K	$2K	$1K	$360K
Rental Income	$108K	$137K	$0	$0K	$245K
Wage	$73K	$539K	$2K	$986K	$1.6M
Subtotal	**$359K**	**$1.4M**	**$7K**	**$1.0M**	**$2.8M**
TOTAL	**$65.8M**	**$93.1M**	**$9.1M**	**$11.8M**	**$179.8M**

*The above totals are estimates generated from HAZUS. A real event may produce different results than presented here.

Figure 3. Close up of the City of Burlington and damaged residential substantial buildings. For the City of Burlington HAZUS estimates approximately 30 substantially damaged residential buildings and approximately 670 residential buildings with at least minor damage.

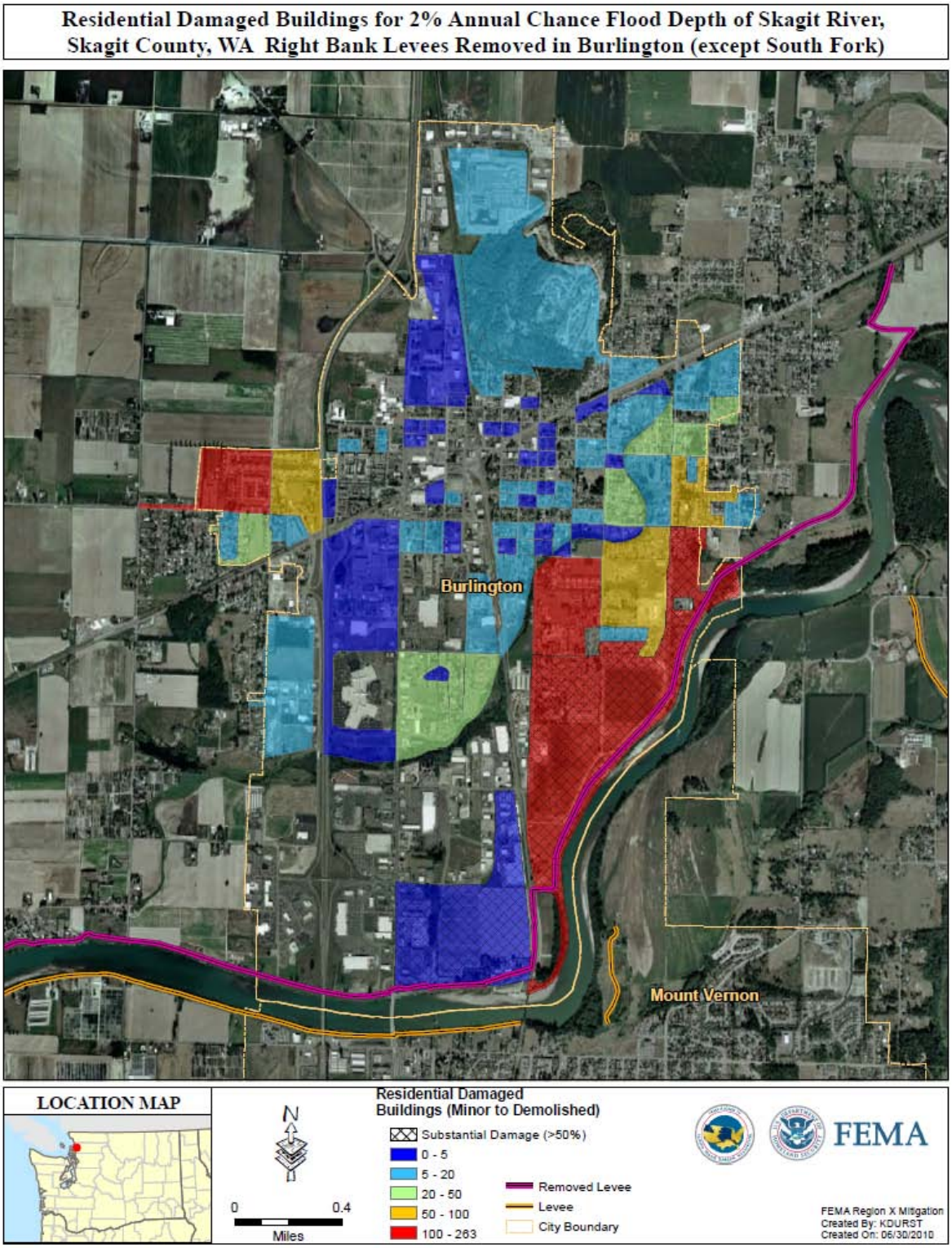


Table 2. Number of Buildings Damaged by Percent of Damage to that Building. Results are for the City of Burlington only

Building Type	None	1-10%	11-20%	21-30%	31-40%	41-50%	Substantial	Total
Education	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0
Industrial	2	0	0	0	0	0	0	2
Commercial	8	2	7	0	0	0	0	17
Residential	764	0	51	299	142	148	32	1436
Total	**828**	**2**	**58**	**288**	**130**	**148**	**32**	**1486**

Figure 4. Close up of the City of Burlington. Census blocks are mapped based on the number of displaced individuals. For the City of Burlington, HAZUS estimates 6,300 people will be displaced and of those, 5,600 would need short term shelter.

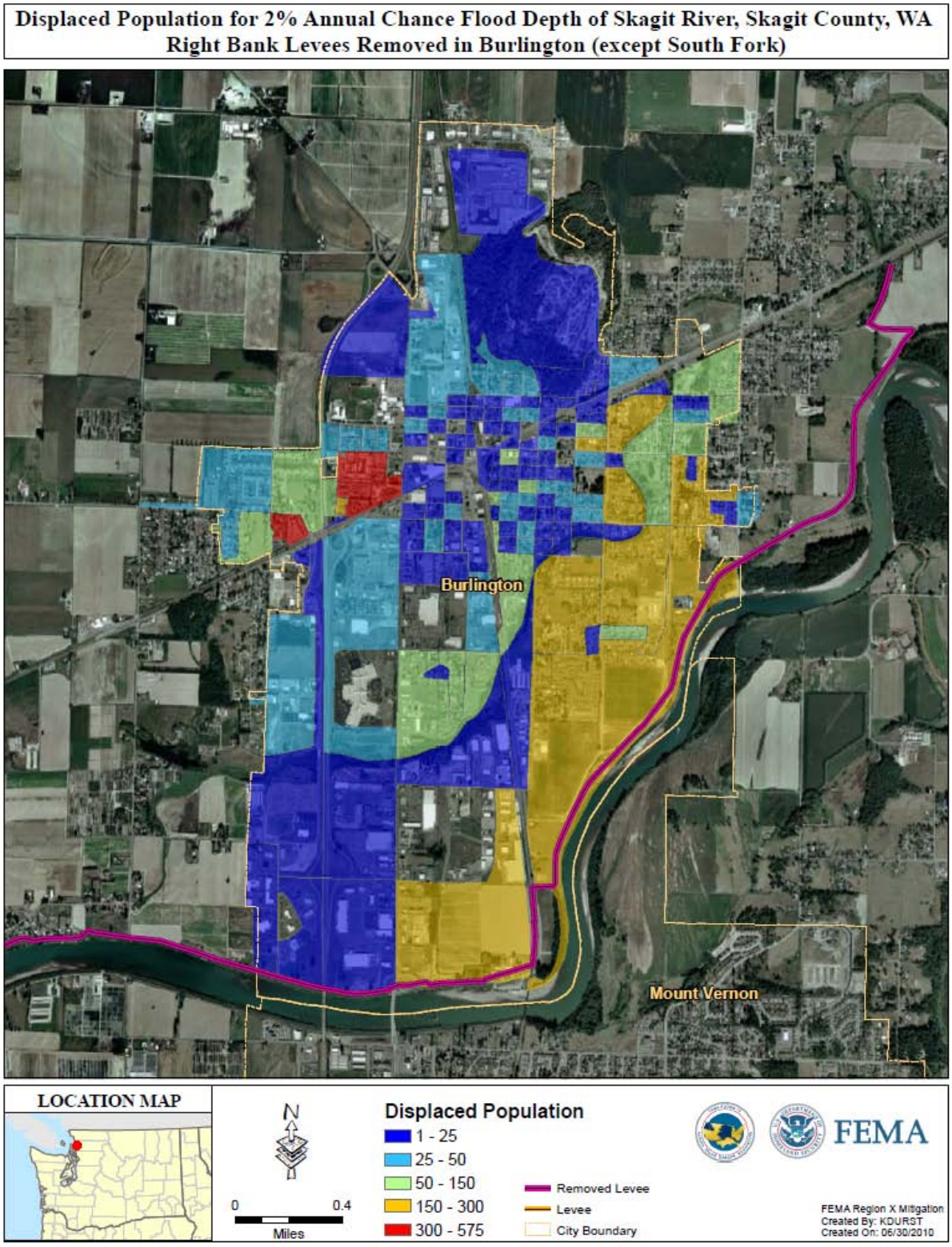
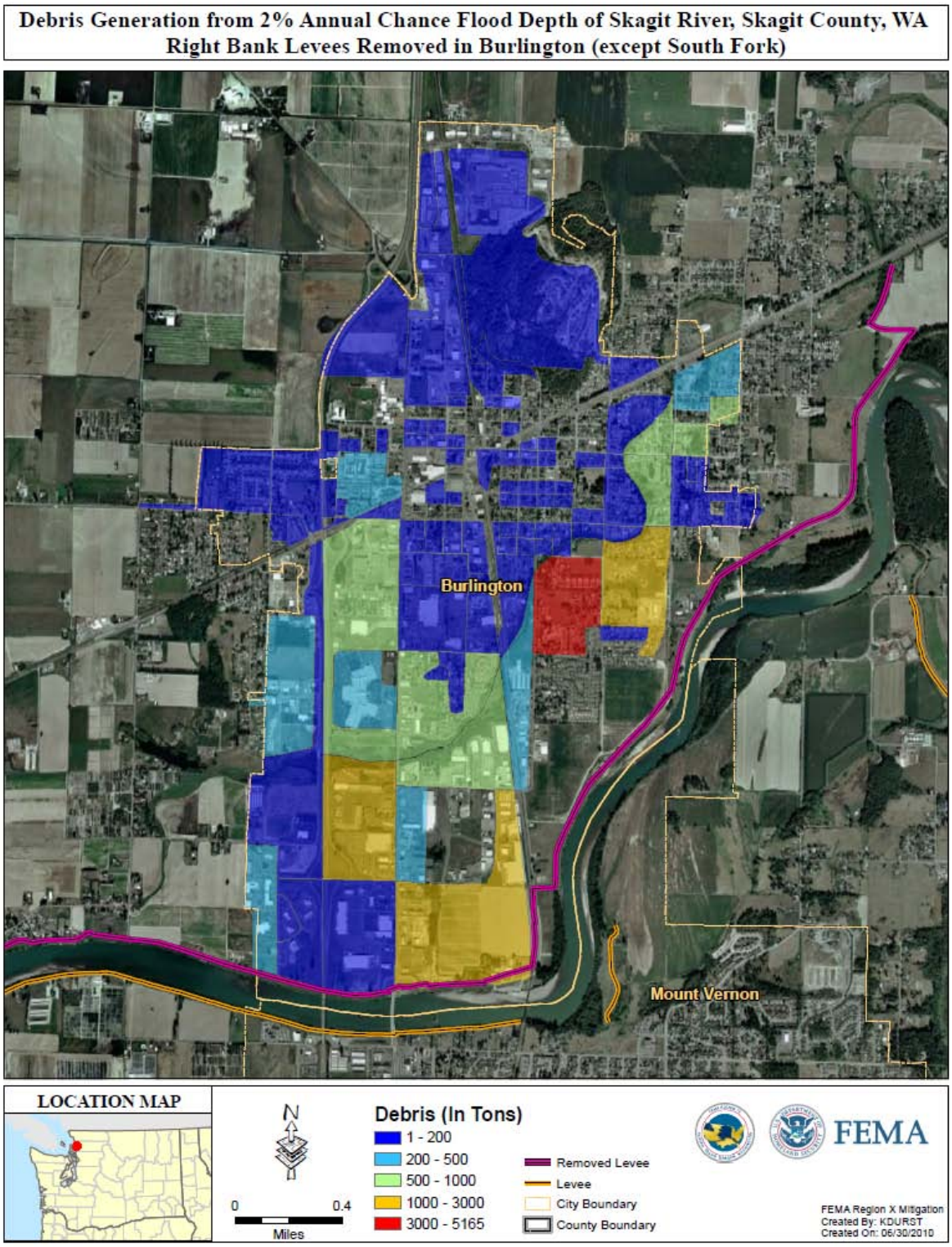


Figure 5. Close up of the City of Burlington and debris, shown in tons per census block. HAZUS calculates the estimated total debris generated for the City of Burlington is 24,900 tons. Debris is generated from building and content debris, not from damage due to roads or utilities.



HAZUS Results for the Skagit Valley
Due to the Removal of the Burlington Levee
50 Year Analysis

Figure 6. Flood Depth generated from a 50 year flood and the removal of the Burlington Levee (shown in pink). Right bank levees on the mainstem and North Fork Skagit River are removed with all other levees intact. Much of the area has depths from 0-15 feet. The city of Burlington is inundated in this scenario.

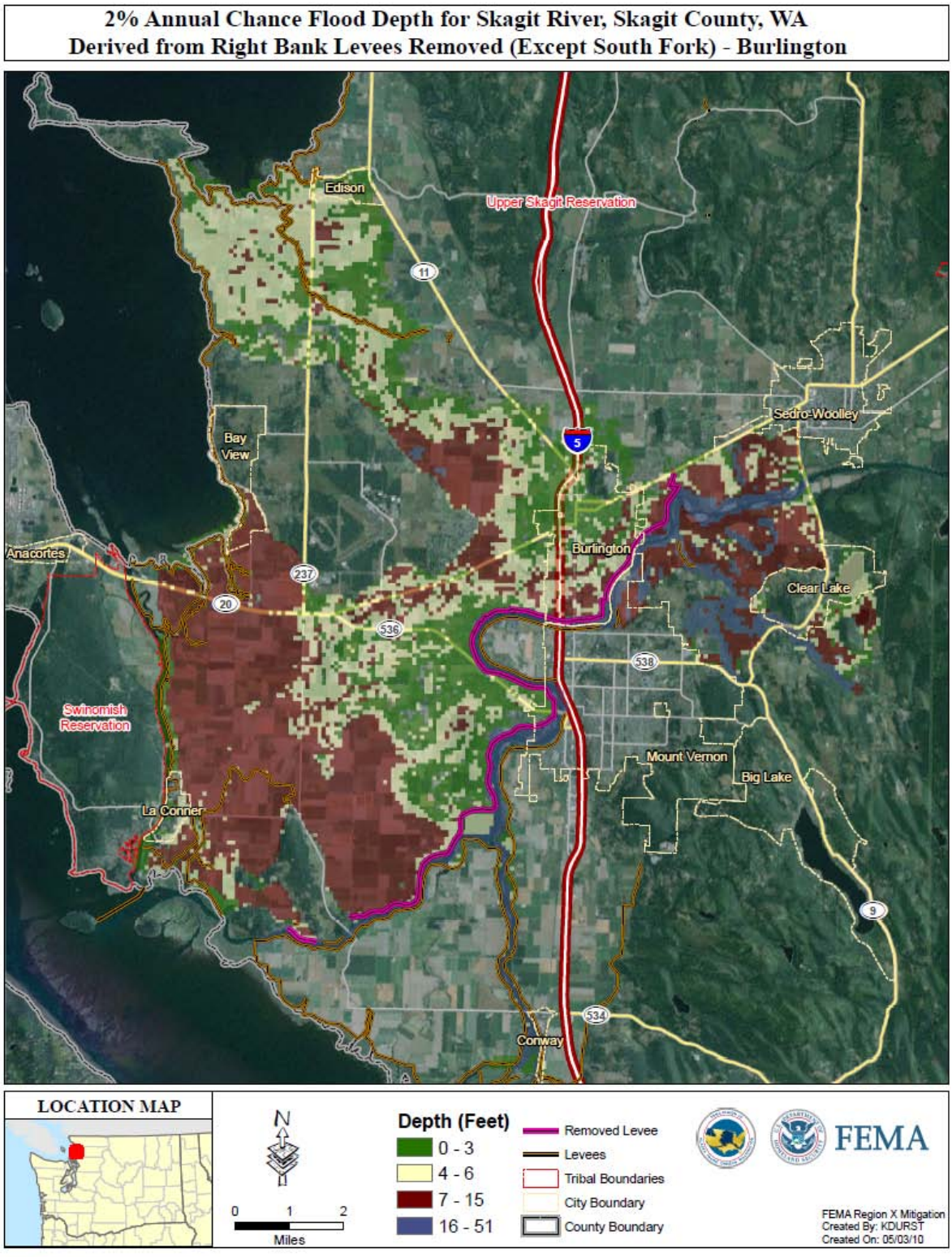


Figure 7. Using the Flood Depths and the local data, HAZUS calculates a total economic loss which includes structural damage including building cost, contents cost, and inventory cost. Additional non-structural costs are calculated including business interruption, relocation etc. Total economic loss for the entire area shown is $411 million. Red areas indicate $10-28 million of economic loss for each census block.

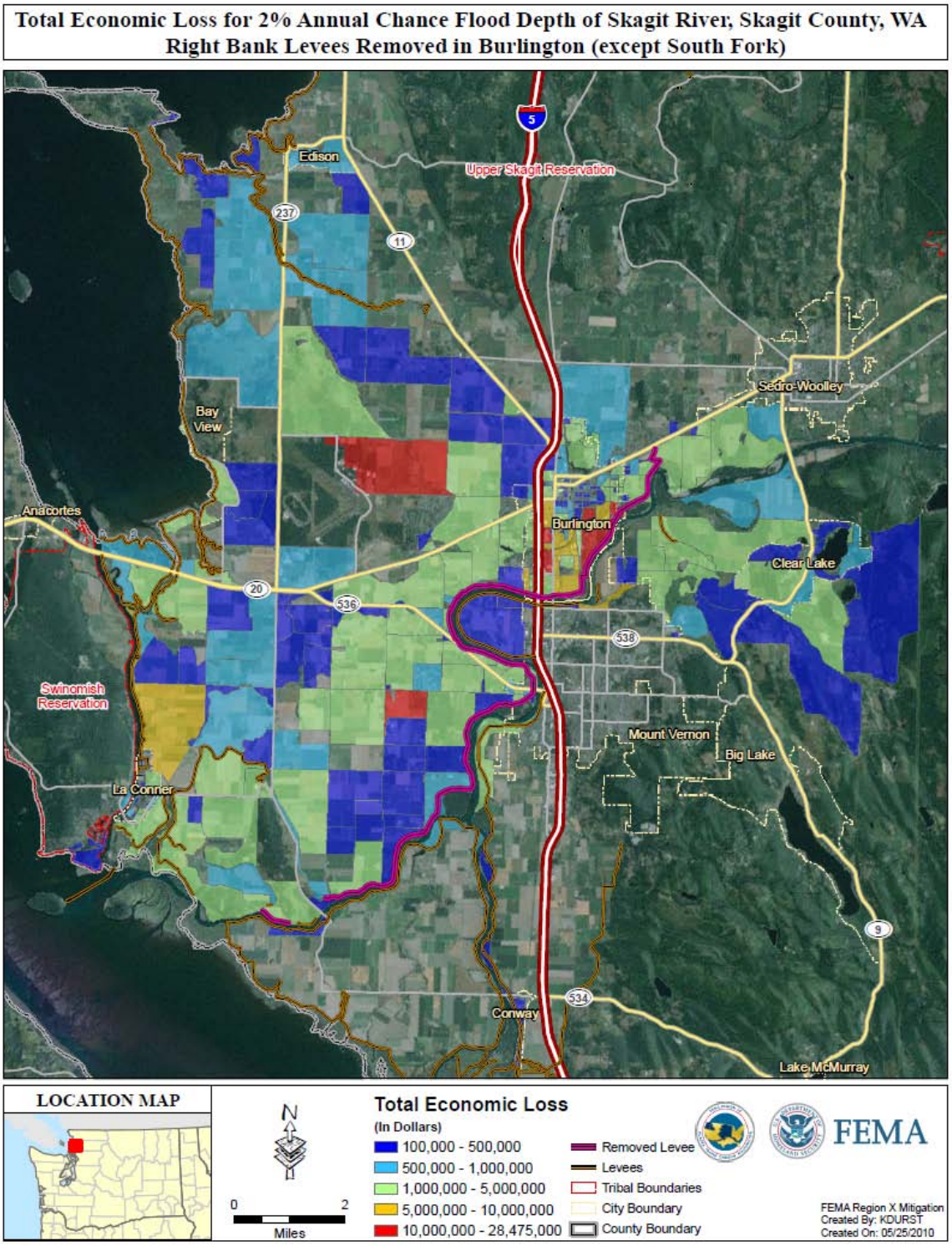


Table 3. Total Economic Loss for Each Building Category, for a 50 Year Flood with the Burlington Levee Removed. Results are for the entire area as shown in Figure 7.

Loss Category	Residential	Commercial	Industrial	Others	TOTAL
Building Loss					
Building	$110.0M	$35.5M	$10.8M	$12.1M	$168.4M
Content	$69.4M	$95.2M	$22.3M	$38.1M	$224.9M
Inventory	$0	$4.1M	$4.3M	$4.7M	$13.1M
Subtotal	**$179.4M**	**$134.8M**	**$37.4M**	**$54.9M**	**$406.5M**
Business Interruption					
Income	$4K	$66K	$0K	$38K	$1.1M
Relocation	$37K	$27K	$0K	$0	$64K
Rental Income	$17K	$18K	$0	$0	$34K
Wage	$10K	$82K	$0K	$2.1M	$3.0M
Subtotal	**$67K**	**$1.9M**	**$10K**	**$2.5M**	**$5.1M**
TOTAL	**$180.1M**	**$136.7M**	**$37.4M**	**$57.4M**	**$411.5M**

*The above totals are estimates generated from HAZUS. A real event may produce different results than presented here.

Figure 8. Number of residential buildings damaged for the Burlington Scenario. The results estimate approximately 140 substantially damaged (cross-hatched pattern) residential buildings and approximately 1400 residential buildings with at least minor damage.

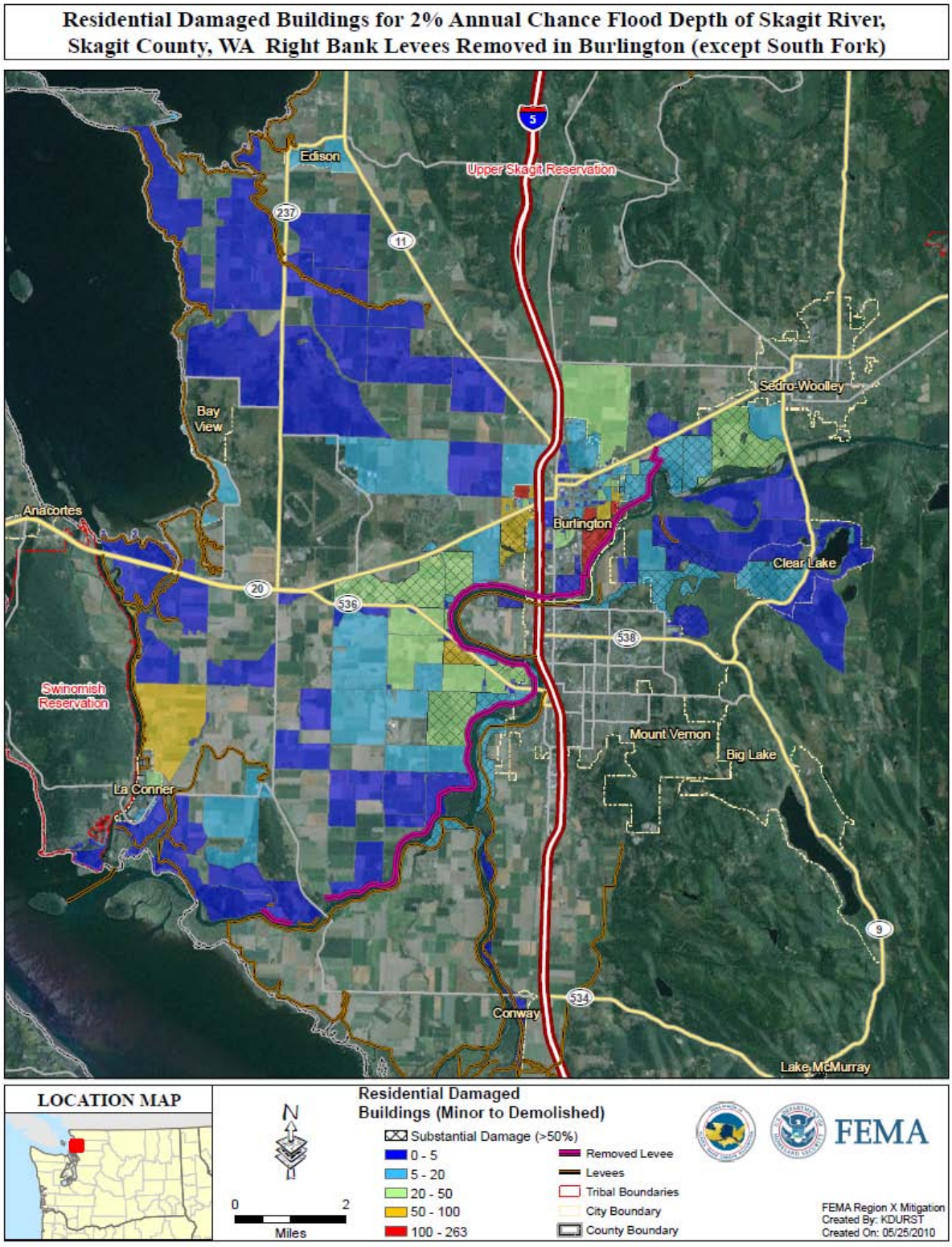


Table 4. Number of Buildings Damaged by Percent of Damage to that Building. The results are for the area shown in Figure 8.

Building Type	None	1-10%	11-20%	21-30%	31-40%	41-50%	Substantial	Total
Education	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0
Agriculture	13	1	5	2	0	0	0	21
Industrial	2	0	0	0	0	0	0	2
Commercial	8	2	7	0	0	0	2	19
Residential	1457	0	107	583	261	319	144	2848
Total	**1196**	**1**	**129**	**665**	**272**	**415**	**170**	**2848**

*The above totals are estimates generated from HAZUS. A real event may produce different results than presented here.

Figure 9. Displaced individuals and short term shelter needs for the Burlington Scenario. Census blocks are mapped based on the number of displaced individuals. HAZUS estimated 14,000 people will be displaced and of those, 11,000 would need short term shelter.

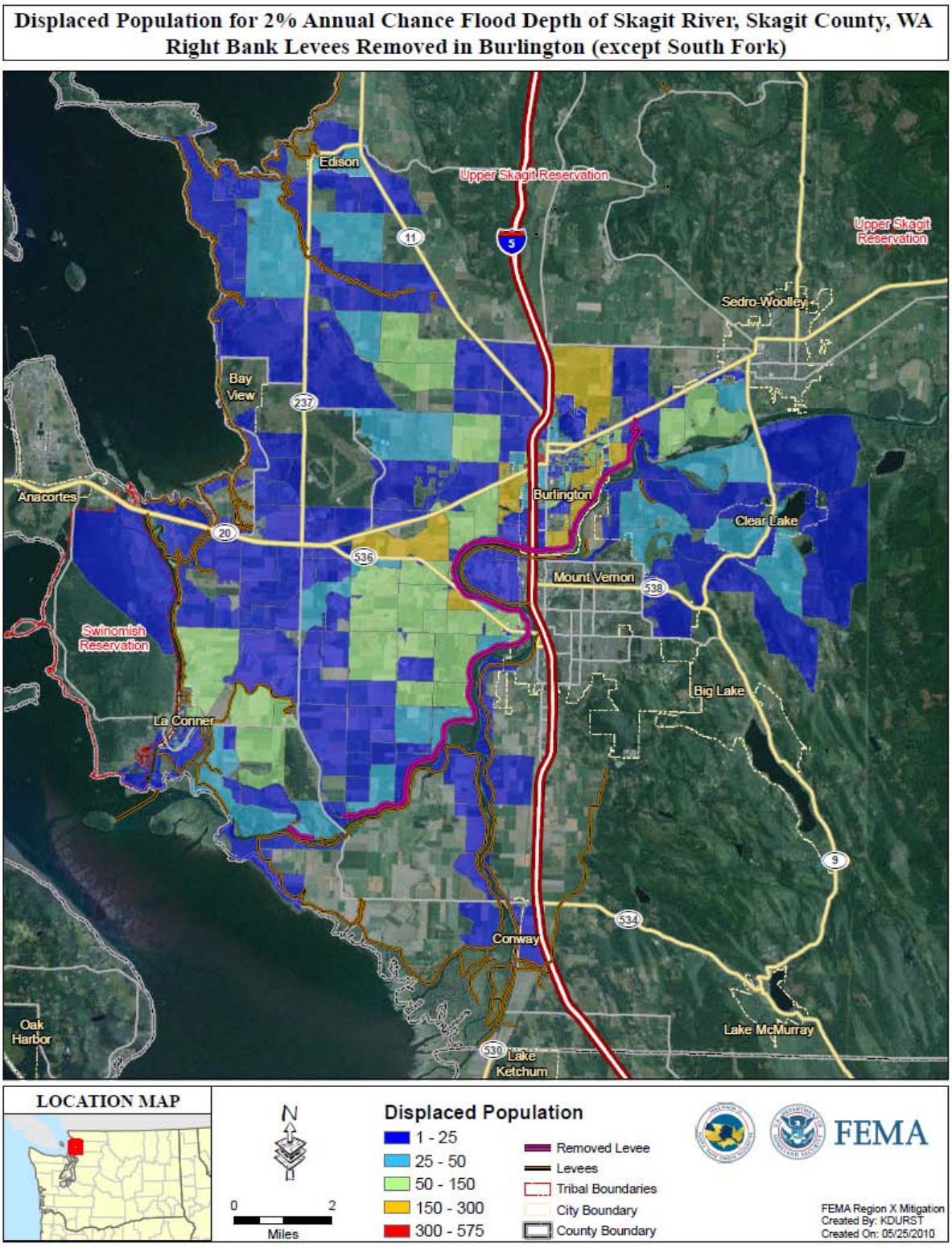


Figure 10. Debris Estimation for the Burlington Scenario. Debris in tons is shown per census block. HAZUS calculates the estimated total debris generated to be approximately 96,600 tons. Debris is generated from building and content debris, not from damage due to roads or utilities.