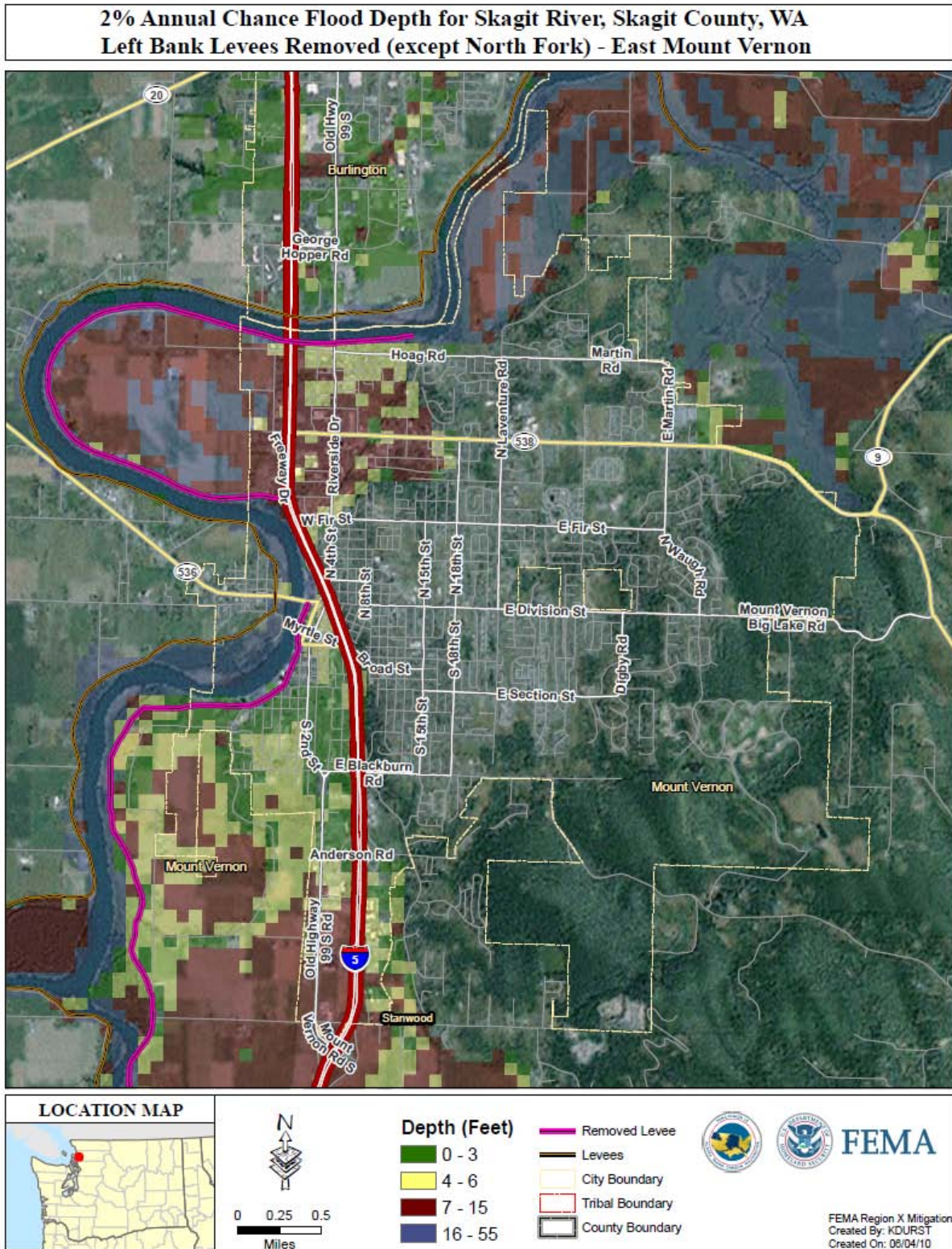


HAZUS Results for the City of Mount Vernon  
Due to the Removal of the Mount Vernon Levee  
50 Year Flood Analysis

**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.*

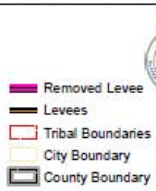
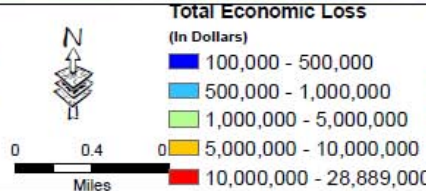
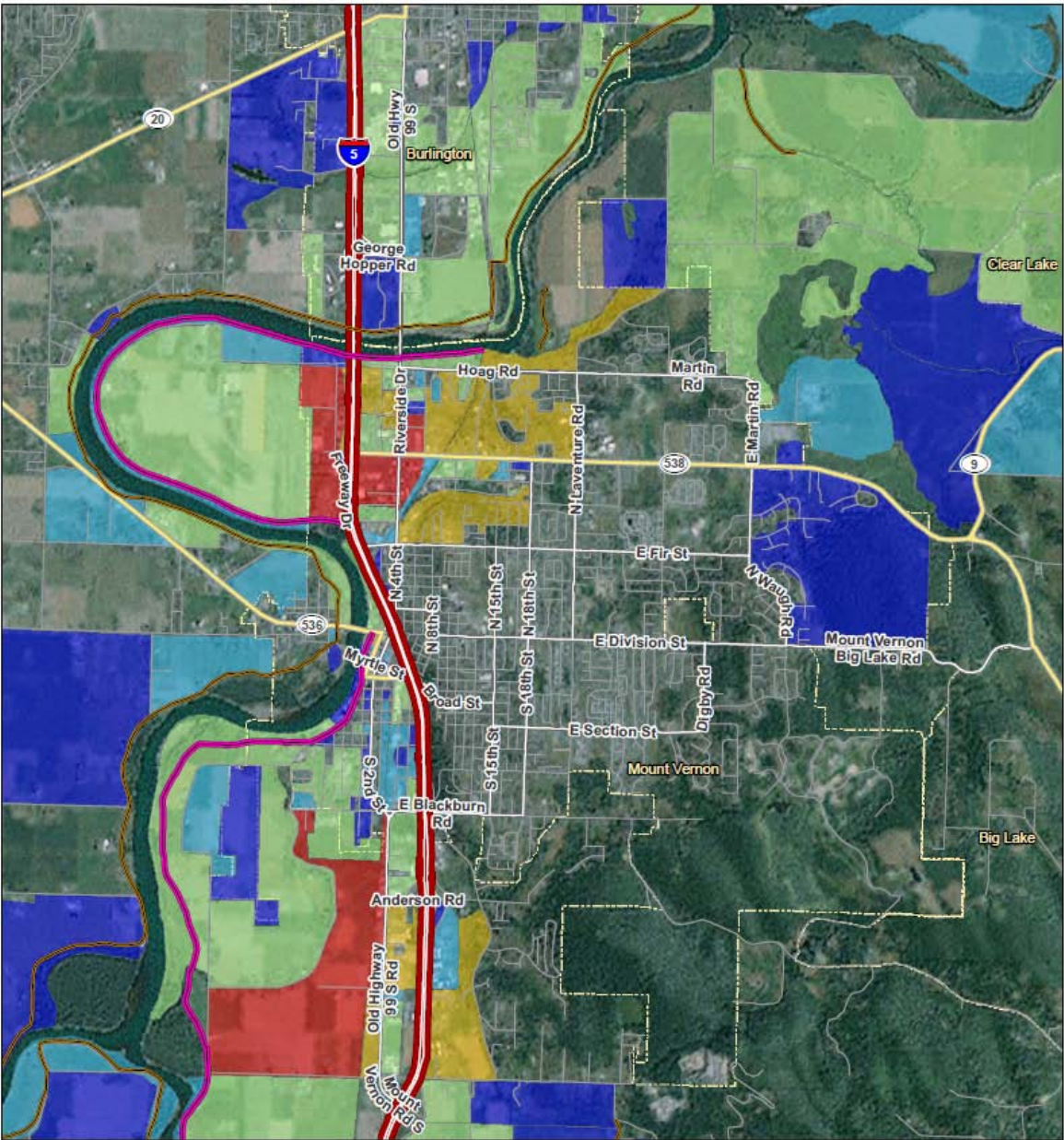
**Figure 1. Flood Depth generated from a 50 year flood and the removal of the Mount Vernon levee (shown in pink). Flood Depth is shown in square pixels due to size of the raster image. The area near the horseshoe bend levee have very high flood depths which impacts portions of Mount Vernon.**





**Figure 2. Close up for the City of Mount Vernon and total economic loss. Total economic loss is shown by census block. Census blocks shown in red have \$10-30 million dollars of economic loss, which comprise mostly commercial and residential areas. The total amount of economic loss for the City of Mount Vernon is \$229 million.**

**Total Economic Loss from 2% Annual Chance Flood Depth of Skagit River, Skagit County, WA  
Left Bank Levees Removed in East Mount Vernon (except North Fork)**



FEMA Region X Mitigation  
Created By: KDURST  
Created On: 06/04/10

**Table 1. 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 Fig. 2.**

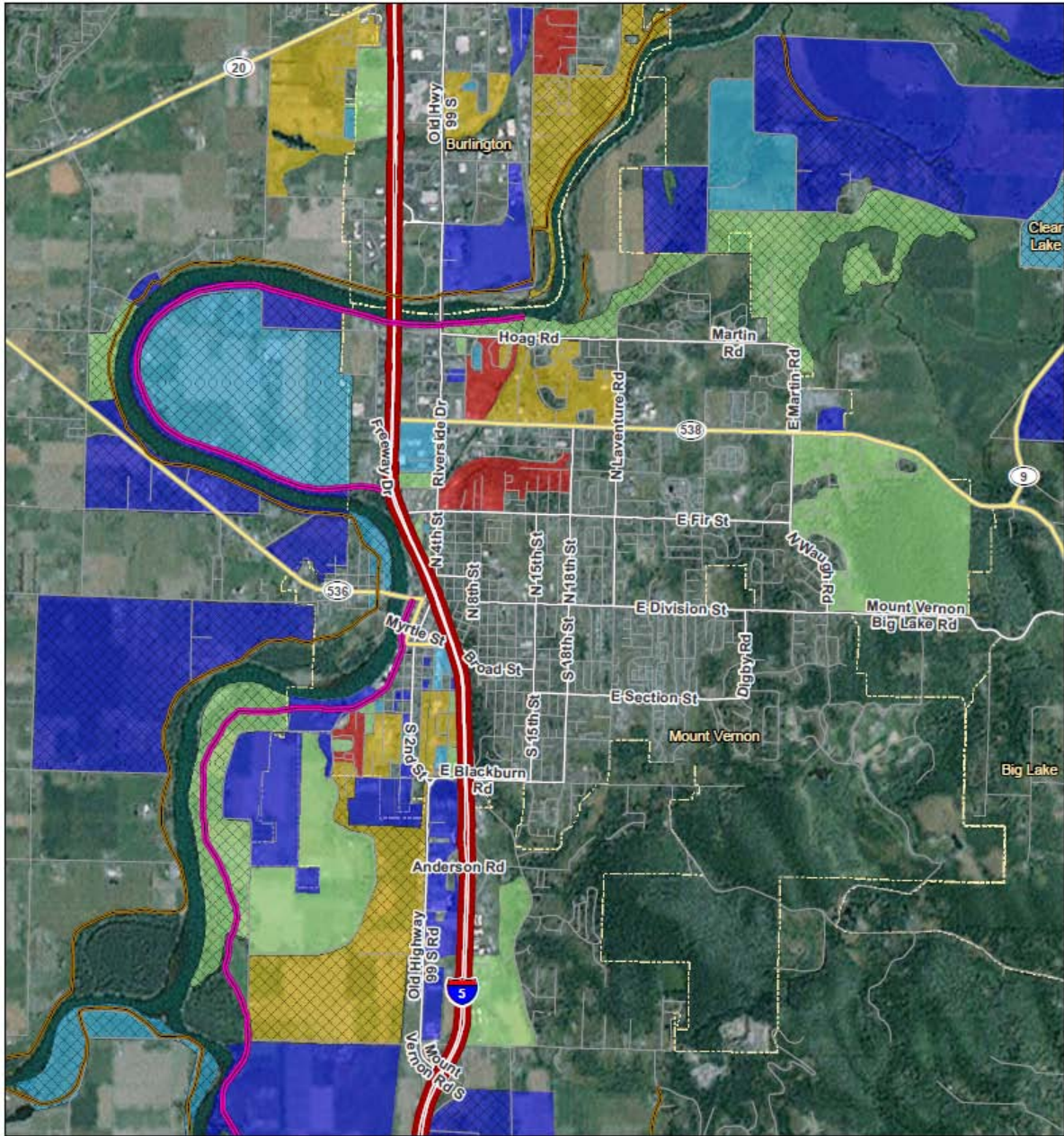
<b>Loss Category</b>	<b>Residential</b>	<b>Commercial</b>	<b>Industrial</b>	<b>Others</b>	<b>TOTAL</b>
<u>Building Loss</u>					
Building	\$28.2M	\$39.3M	\$5.6M	\$2.6M	\$75.7M
Content	\$18.8M	\$97.5M	\$14.7M	\$12.6M	\$143.6M
Inventory	\$0	\$2.8M	\$2.3M	\$200K	\$5.3M
<b>Subtotal</b>	<b>\$47.0M</b>	<b>\$139.6M</b>	<b>\$22.6M</b>	<b>\$15.4M</b>	<b>\$224.6M</b>
<u>Business Interruption</u>					
Income	\$34K	\$647K	\$3K	\$42K	\$726K
Relocation	\$77K	\$202K	\$4K	\$2	\$285K
Rental Income	\$94K	\$148K	\$1	\$1	\$244K
Wage	\$84K	\$652K	\$4K	\$1.7M	\$2.4M
<b>Subtotal</b>	<b>\$289K</b>	<b>\$1.6M</b>	<b>\$12K</b>	<b>\$1.7M</b>	<b>\$3.6M</b>
<b>TOTAL</b>	<b>\$47.3M</b>	<b>\$141.2M</b>	<b>\$22.6M</b>	<b>\$17.1M</b>	<b>\$228.2M</b>

\*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 Mount Vernon and damaged residential substantial buildings. For the City of Burlington HAZUS estimates approximately 26 substantially damaged residential buildings and approximately 405 residential buildings with at least minor damage.**

**Residential Damaged Buildings from 2% Annual Chance Flood Depth of Skagit River, Skagit County, WA Left Bank Leves Removed in East Mount Vernon (except North Fork)**



<p><b>LOCATION MAP</b></p>		<p><b>Residential Damaged Buildings (Minor to Demolished)</b></p> <ul style="list-style-type: none"> <li> Substantial Damage (&gt;50%)</li> <li> 1 - 5</li> <li> 6 - 10</li> <li> 11 - 20</li> <li> 21 - 50</li> <li> 51 - 87</li> <li> Removed Levee</li> <li> Levees</li> <li> Tribal Boundaries</li> <li> City Boundary</li> <li> County Boundary</li> </ul>	<p><b>FEMA</b></p> <p>FEMA Region X Mitigation Created By: KDURST Created On: 06/04/10</p>
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**Table 2. Number of Buildings Damaged by Percent of Damage to that Building. Results are for the City of Mount Vernon only.**

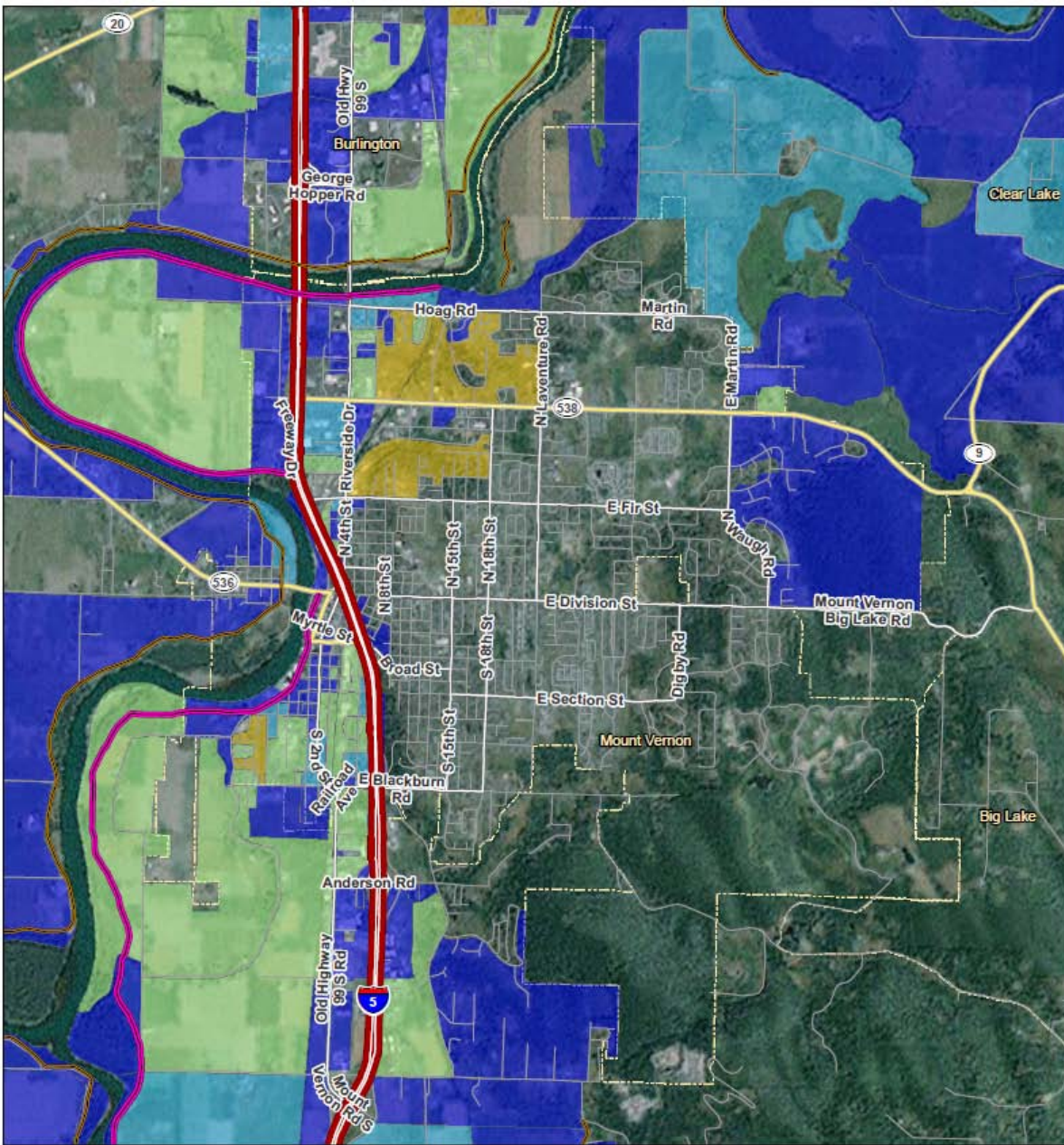
<b>Building Type</b>	<b>None</b>	<b>1-10%</b>	<b>11-20%</b>	<b>21-30%</b>	<b>31-40%</b>	<b>41-50%</b>	<b>Substantial</b>	<b>Total</b>
Education	0	0	1	0	0	0	0	1
Government	1	0	0	0	0	0	0	1
Religion	0	0	0	0	0	0	0	0
Agriculture	1	0	0	0	0	0	0	1
Industrial	0	0	0	0	0	0	0	0
Commercial	1	0	9	6	2	2	2	22
Residential	281	0	40	177	84	76	29	687
<b>Total</b>	<b>284</b>	<b>0</b>	<b>50</b>	<b>183</b>	<b>86</b>	<b>78</b>	<b>31</b>	<b>712</b>

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



Figure 4. Close up of the City of Mount Vernon. Census blocks are mapped based on the number of displaced individuals. For the City of Mount Vernon, HAZUS estimates 3,600 people will be displaced and of those, 3,200 would need short term shelter.

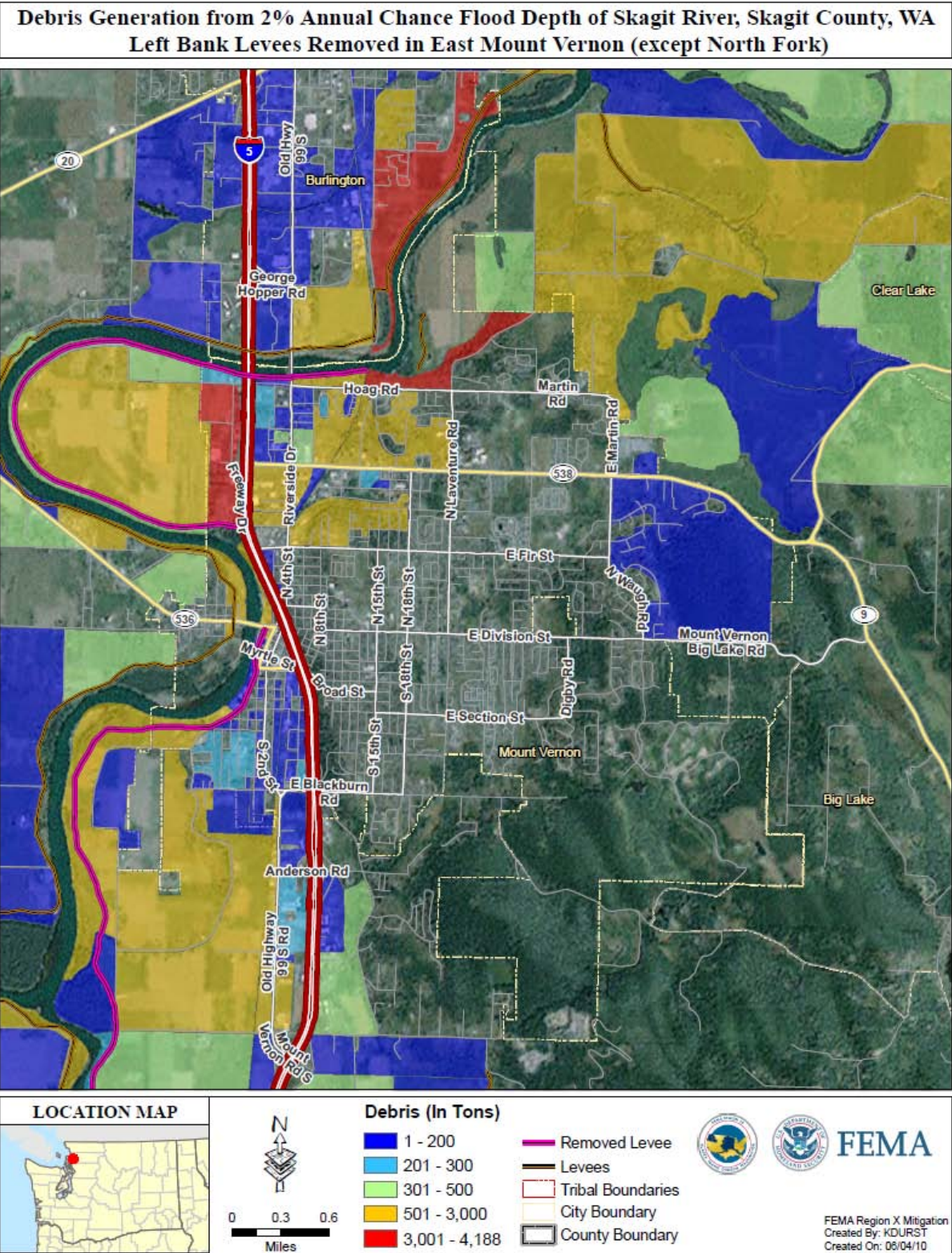
Displaced Population from 2% Annual Chance Flood Depth of Skagit River, Skagit County, WA  
Left Bank Levees Removed in East Mount Vernon (except North Fork)



<p><b>LOCATION MAP</b></p>	<p><b>Scale</b></p> <p>0 0.3 0.6 Miles</p>	<p><b>Displaced Population</b></p> <ul style="list-style-type: none"> <li>1 - 25</li> <li>25 - 50</li> <li>50 - 150</li> <li>150 - 300</li> <li>300 - 354</li> </ul>	<ul style="list-style-type: none"> <li>Removed Levee</li> <li>Levees</li> <li>Tribal Boundaries</li> <li>City Boundary</li> <li>County Boundary</li> </ul> <p>FEMA FEMA Region X Mitigation Created By: KOURST Created On: 08/04/10</p>
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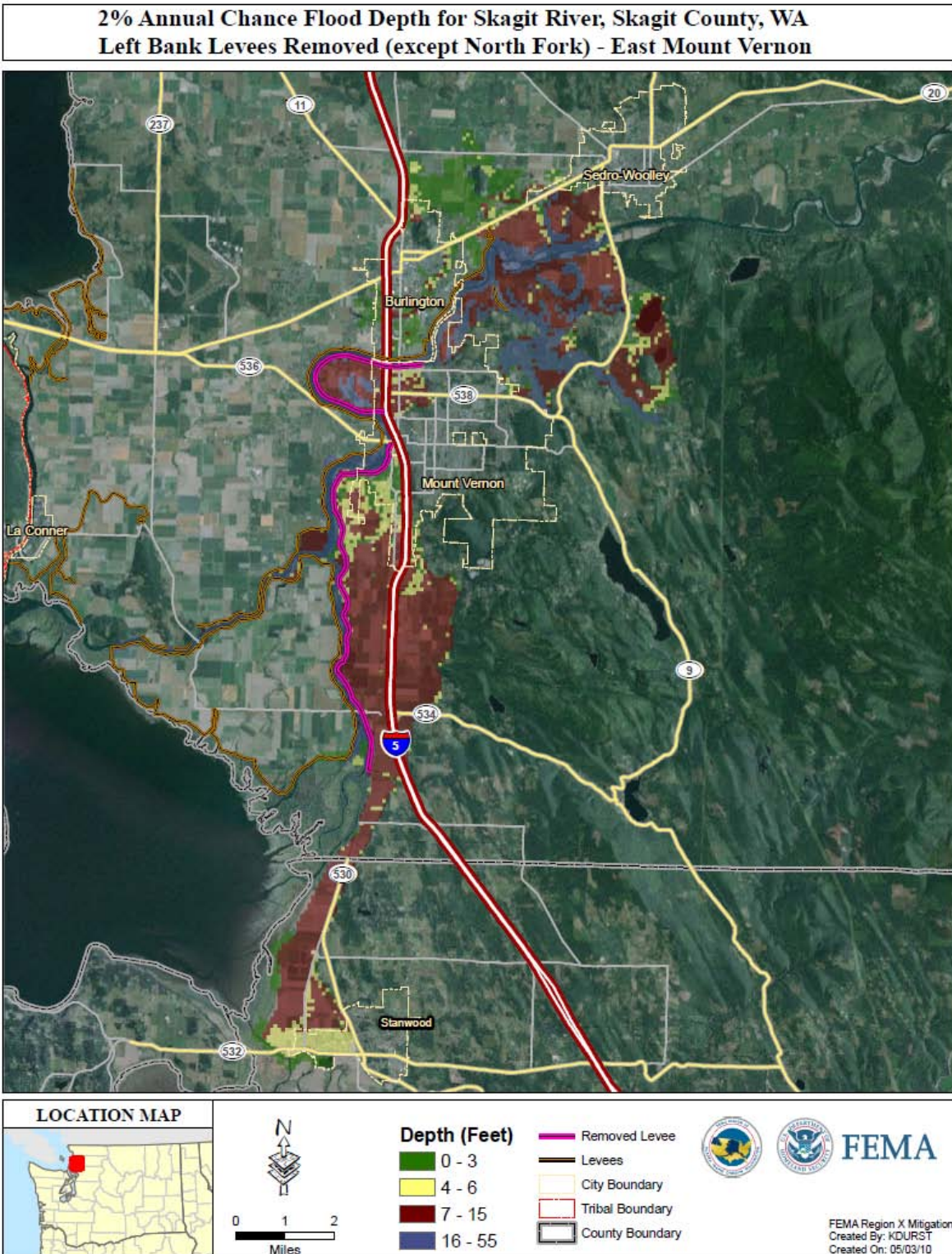
Figure 5. Close up of the City of Mount Vernon and debris shown in tons per census block. HAZUS calculates the estimated total debris generated for the City of Mount Vernon is 27,000 tons.





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

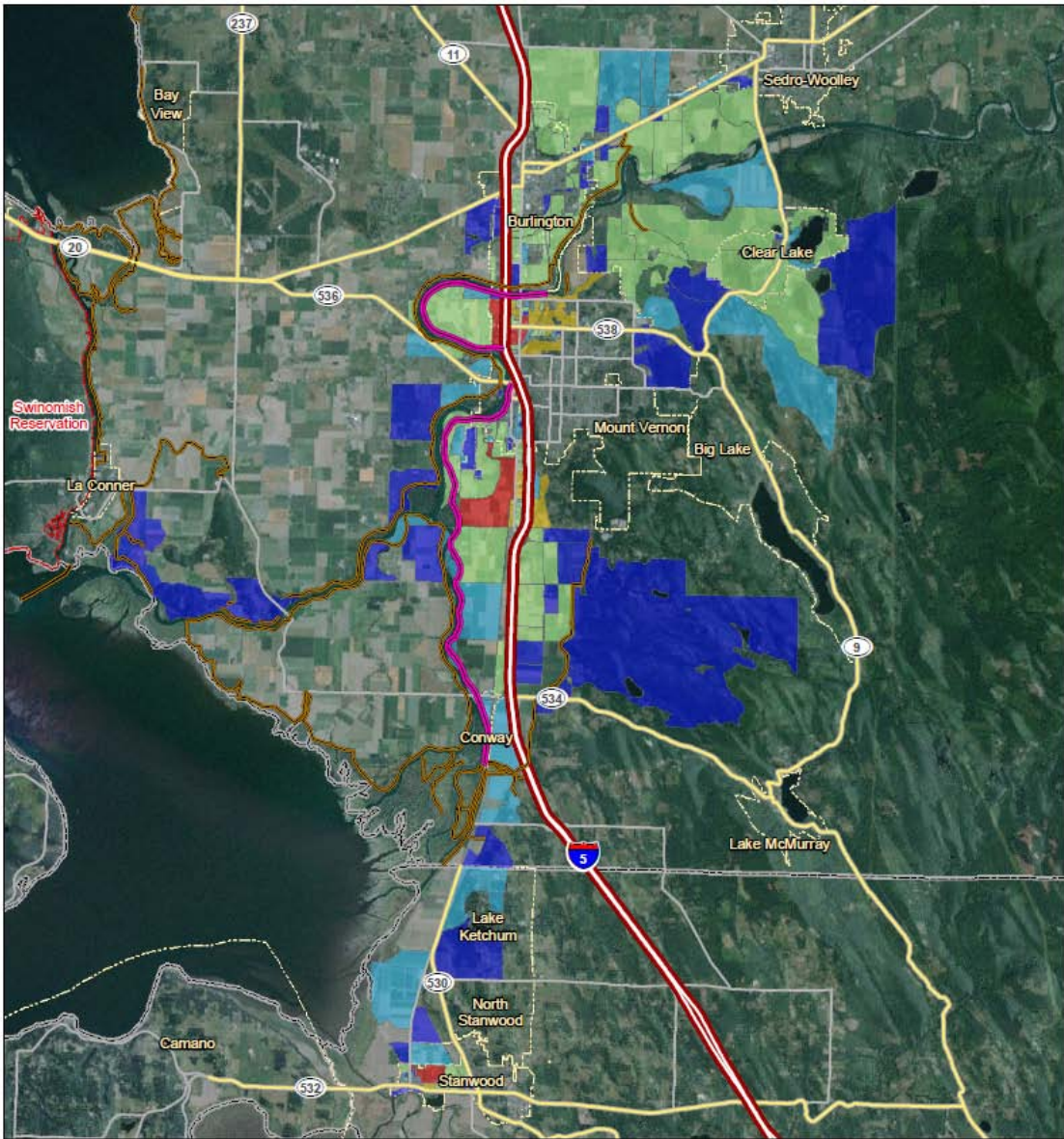
**Figure 6. Flood Depth generated from a 50 year flood and the removal of the Mount Vernon levee (shown in pink). All left bank levees were removed with right bank levees intact. Much of the area has depths from 0-15 feet. Portions of Mount Vernon near the large river bend could have depths of 7-20 feet.**





**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 \$644 million. Red areas indicate \$10-33 million of economic loss for each census block.**

**Total Economic Loss from 2% Annual Chance Flood Depth of Skagit River, Skagit County, WA  
Left Bank Levees Removed in East Mount Vernon (except North Fork)**



<p><b>LOCATION MAP</b></p>		<p><b>Total Economic Loss</b> (In Dollars)</p> <ul style="list-style-type: none"> <li><span style="color: blue;">■</span> 100,000 - 500,000</li> <li><span style="color: cyan;">■</span> 500,000 - 1,000,000</li> <li><span style="color: green;">■</span> 1,000,000 - 5,000,000</li> <li><span style="color: yellow;">■</span> 5,000,000 - 10,000,000</li> <li><span style="color: red;">■</span> 10,000,000 - 28,889,000</li> </ul>	<ul style="list-style-type: none"> <li><span style="color: magenta;">—</span> Removed Levee</li> <li><span style="color: black;">—</span> Levees</li> <li><span style="border: 1px dashed black; display: inline-block; width: 10px; height: 10px;"></span> Tribal Boundaries</li> <li><span style="border: 1px solid black; display: inline-block; width: 10px; height: 10px;"></span> City Boundary</li> <li><span style="border: 1px solid gray; display: inline-block; width: 10px; height: 10px;"></span> County Boundary</li> </ul> <div style="text-align: right;"> <p><b>FEMA</b></p> <p>FEMA Region X Mitigation Created By: KDURST Created On: 05/27/10</p> </div>
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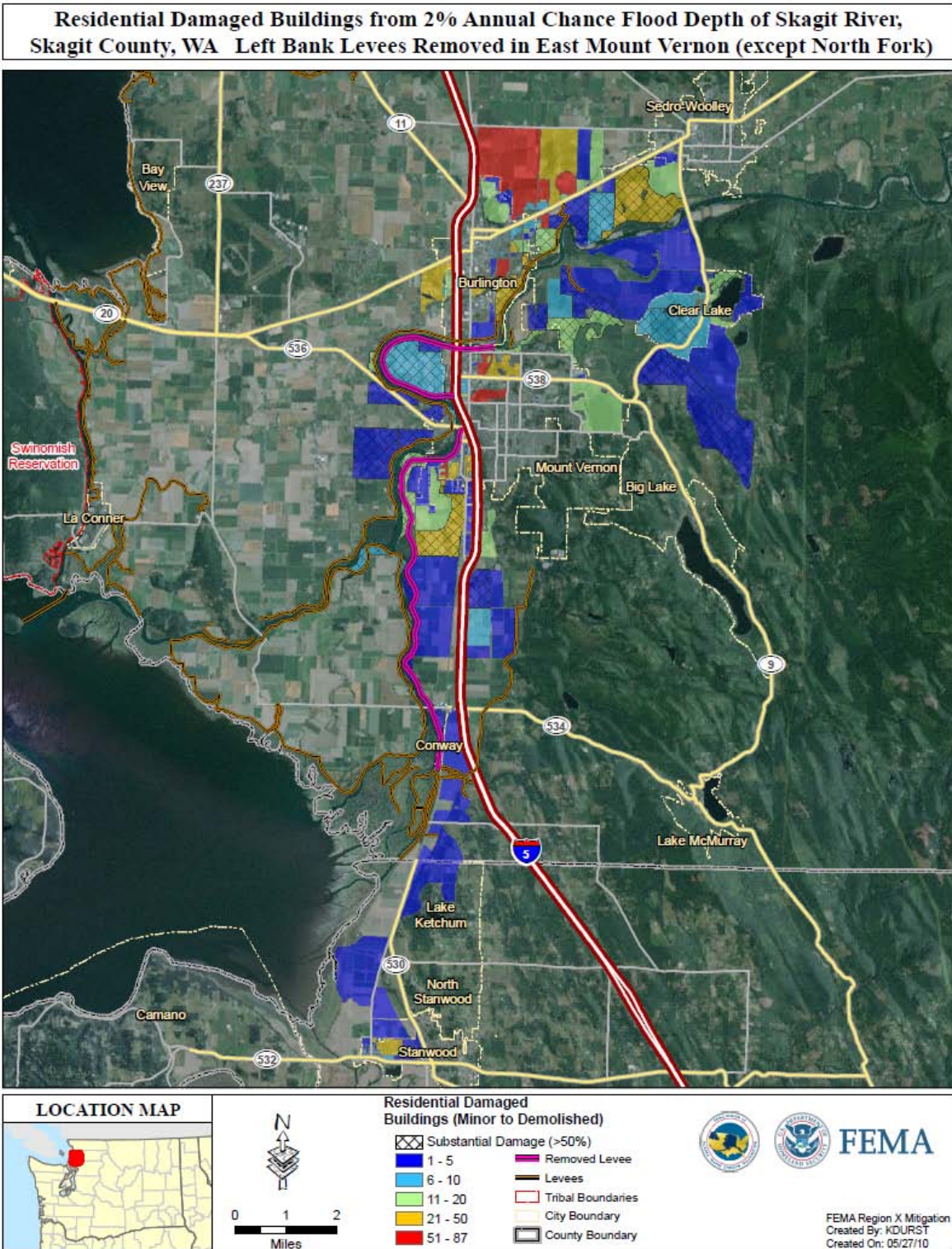
**Table 3. Total Economic Loss for Each Building Category, for a 50 Year Flood with the Burlington Levee Removed. Results are for the entire area as shown in Fig. 7.**

<b>Loss Category</b>	<b>Residential</b>	<b>Commercial</b>	<b>Industrial</b>	<b>Others</b>	<b>TOTAL</b>
<u>Building Loss</u>					
Building	\$93.0M	\$59.8M	\$13.9M	\$8.2M	\$174.9M
Content	\$70.1M	\$153.1M	\$31.4M	\$31.2M	\$285.9M
Inventory	\$0	\$4.8M	\$5.6M	\$92K	\$11.3M
<b>Subtotal</b>	<b>\$163.1M</b>	<b>\$217.7M</b>	<b>\$51.0M</b>	<b>\$40.4M</b>	<b>\$472.1M</b>
<u>Business Interruption</u>					
Income	\$90K	\$1.0M	\$10K	\$150K	\$1.3M
Relocation	\$27K	\$35K	\$10K	\$0	\$63K
Rental Income	\$18K	\$25K	\$0	\$0	\$43K
Wage	\$22K	\$1.1M	\$10K	\$3.2M	\$6.7M
<b>Subtotal</b>	<b>\$75K</b>	<b>\$2.8M</b>	<b>\$30K</b>	<b>\$3.2M</b>	<b>\$6.7M</b>
<b>TOTAL</b>	<b>\$163.9M</b>	<b>\$220.4M</b>	<b>\$51.0M</b>	<b>\$43.6M</b>	<b>\$478.8M</b>

\*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 Mount Vernon Scenario. The results estimate approximately 150 substantially damaged (cross-hatched pattern) residential buildings and approximately 1600 residential buildings with at least minor damage.**



**Table 4. Number of Buildings Damaged by Percent of Damage to that Building. Results are for the entire are shown in Figure 8.**

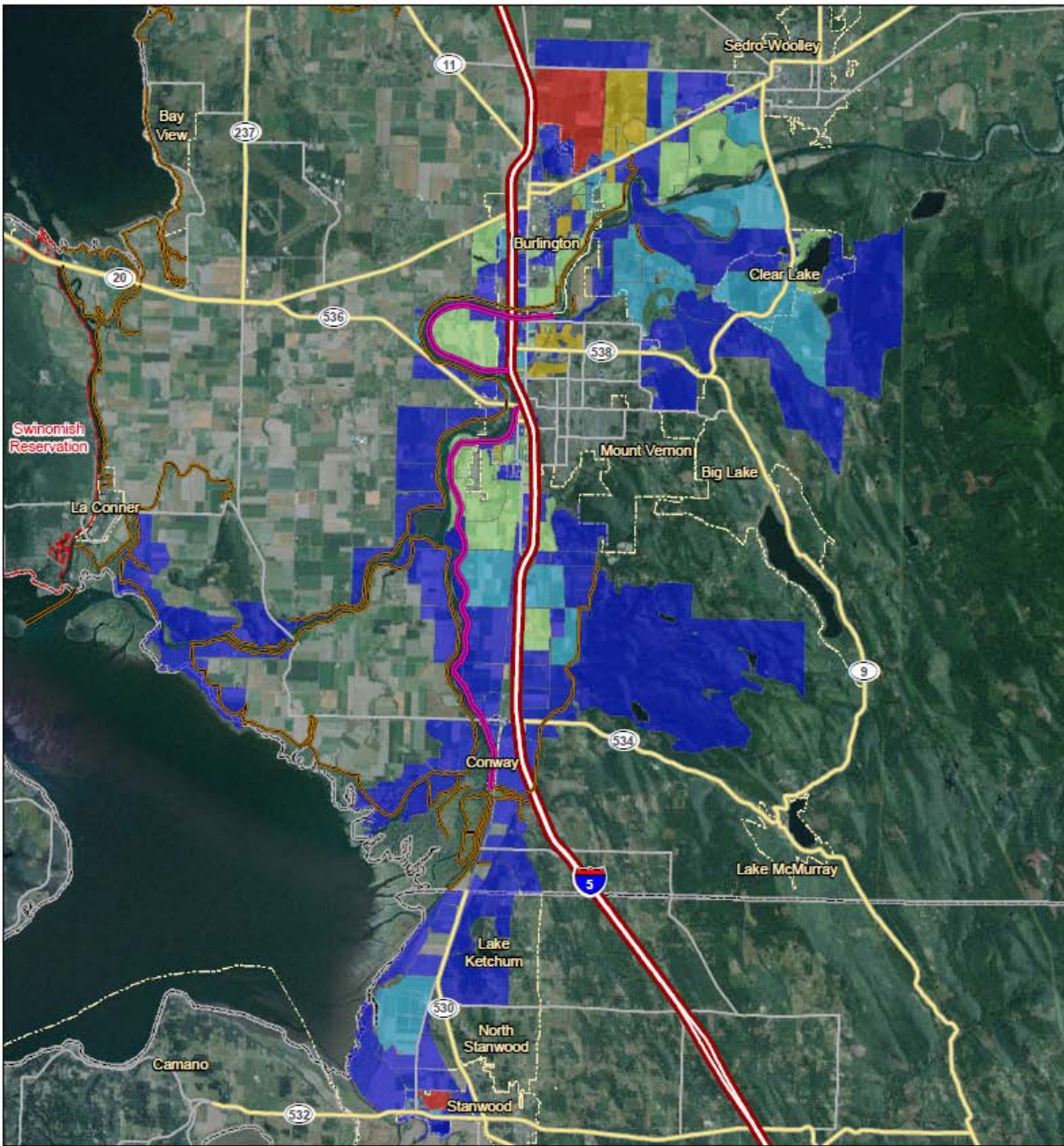
<b>Building Type</b>	<b>None</b>	<b>1-10%</b>	<b>11-20%</b>	<b>21-30%</b>	<b>31-40%</b>	<b>41-50%</b>	<b>Substantial</b>	<b>Total</b>
Education	0	0	1	0	0	0	0	1
Government	1	0	0	0	0	0	0	1
Religion	0	0	1	0	0	0	0	1
Agriculture	1	0	0	0	0	0	0	1
Industrial	1	0	0	0	0	0	1	2
Commercial	5	0	14	6	5	2	2	34
Residential	949	0	83	420	183	261	135	2031
<b>Total</b>	<b>957</b>	<b>0</b>	<b>99</b>	<b>426</b>	<b>188</b>	<b>263</b>	<b>138</b>	<b>2071</b>

\*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 Mount Vernon Scenario. Census blocks are mapped based on the number of displaced individuals. HAZUS estimated 14,000 people will be displaced and of those, 11,500 would need short term shelter.**

**Displaced Population from 2% Annual Chance Flood Depth of Skagit River, Skagit County, WA  
Left Bank Levees Removed in East Mount Vernon (except North Fork)**



<p><b>LOCATION MAP</b></p>		<p><b>Displaced Population</b></p> <ul style="list-style-type: none"> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: blue; margin-right: 5px;"></span> 1 - 25</li> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: lightblue; margin-right: 5px;"></span> 25 - 50</li> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: lightgreen; margin-right: 5px;"></span> 50 - 150</li> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: yellow; margin-right: 5px;"></span> 150 - 300</li> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: red; margin-right: 5px;"></span> 300 - 354</li> </ul>	<ul style="list-style-type: none"> <li><span style="display: inline-block; width: 15px; border-bottom: 2px solid magenta; margin-right: 5px;"></span> Removed Levee</li> <li><span style="display: inline-block; width: 15px; border-bottom: 2px solid black; margin-right: 5px;"></span> Levees</li> <li><span style="display: inline-block; width: 15px; border-bottom: 2px dashed gray; margin-right: 5px;"></span> Tribal Boundaries</li> <li><span style="display: inline-block; width: 15px; border-bottom: 2px solid gray; margin-right: 5px;"></span> City Boundary</li> <li><span style="display: inline-block; width: 15px; border-bottom: 2px solid gray; margin-right: 5px;"></span> County Boundary</li> </ul> <div style="text-align: right;"> <p><b>FEMA</b></p> <p>FEMA Region X Mitigation Created By: KDURST Created On: 05/28/10</p> </div>
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**Figure 10. Debris Estimation for the Mount Vernon Scenario. Debris in tons is shown per census block. HAZUS calculates the estimated total debris generated to be 78,000 tons. Debris is generated from building and content debris, not from damage due to roads or utilities.**

