### Earthquake and Flood Loss Estimates

The Hazards U.S. Multi-Hazard (Hazus-MH) tool is a nationally applicable standardized methodology. The Federal Emergency Management Agency (FEMA) developed Hazus-MH under contract with the National Institute of Building Sciences (NIBS). Hazus-MH uses state-of-the-art Geographic Information Systems (GIS) software to map and display hazard data and the results of damage and economic loss estimates for buildings and infrastructure. It also allows users to estimate the impacts of earthquakes, hurricane winds, and floods on populations. The following loss exposures have been developed using Hazus-MH (from available base data).

NOTE: Hazus-MH utilizes data at the census tracts/block level from diverse sources such as the U.S. Census. Due to the data compilation process, estimates based on city boundaries are difficult to generate. Consequently Hazus-MH data groups some areas and city specific figures should be considered approximate. Also, for security reasons some data (such as pipeline and potable water locations) are not included. Furthermore, the following disclaimer applies to Hazus-MH generated reports:

> ***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.*

#### *Hazus-MH Estimated Dollar Exposure*

Dollar Exposure represents the value of residential, commercial, and industrial properties in the area. Note: the sums provided are not equal to the total value of the area since some groups such as agriculture, government, and education are omitted.

| City Name | Total Exposure [$B] | Residential [$B] | Commercial [$B] | Industrial [$B] |
|---|---|---|---|---|
| Agoura Hills (including Agoura) Note: Hazus-MH aggregates portions of Agoura Hills under Westlake Village | 1.693 | 1.176 | 0.398 | 0.071 |
| Calabasas/Hidden Hills | 3.100 | 2.569 | 0.432 | 0.040 |
| Malibu | 3.190 | 2.098 | 0.989 | 0.041 |
| Westlake Village (includes portions of Agoura Hills and Los Angeles County) | 2.770 | 2.061 | 0.556 | 0.085 |
| **Totals** | **10.753** | **7.904** | **2.375** | **0.237** |

**Table 58: Hazus-MH Estimated $ Exposure**

| City Name | Total Depreciated Exposure [$B] | Depreciated Residential [$B] | Depreciated Commercial [$B] | Depreciated Industrial [$B] |
|---|---|---|---|---|
| Agoura Hills (including Agoura) Note: Hazus-MH aggregates portions of Agoura Hills under Westlake Village | 1.181 | 0.840 | 0.264 | 0.047 |
| Calabasas/Hidden Hills | 2.146 | 1.822 | 0.265 | 0.023 |
| Malibu | 2.039 | 1.379 | 0.603 | 0.023 |
| Westlake Village (includes portions of Agoura Hills and Los Angeles County) | 1.905 | 1.469 | 0.342 | 0.052 |
| **Totals** | **7.271** | **5.510** | **1.474** | **0.145** |

**Table 59: Hazus-MH Estimated Depreciated Exposure**

### *Hazus-MH Estimated Building Counts*

Estimated Building Counts represent the number of residential, commercial, and industrial properties in the area. Note: the sums provided are not equal to the total number of the area since some groups such as agriculture, government, and education are omitted.

| City Name | Total Number of Buildings | Residential Buildings | Commercial Buildings | Industrial Buildings |
|---|---|---|---|---|
| Agoura Hills (including Agoura) Note: Hazus-MH aggregates portions of Agoura Hills under Westlake Village | 4,723 | 4,168 | 395 | 107 |
| Calabasas/Hidden Hills | 10,252 | 9,468 | 547 | 145 |
| Malibu | 8,178 | 7,393 | 540 | 150 |
| Westlake Village (includes portions of Agoura Hills and Los Angeles County) | 9,059 | 8,254 | 583 | 146 |
| **Totals** | **32,212** | **29,283** | **2,065** | **548** |

**Table 60: Hazus-MH Estimated Building Count**

### *Hazus-MH Loss Scenarios*

The following Hazus-MH loss estimates were generated for two earthquake and two flood scenarios:

- Magnitude 7.0 Simi-Santa Rosa Fault Earthquake
- Magnitude 7.0 Malibu Coast Fault Earthquake
- 50-year Flood
- 100-year Food

In terms of earthquake, the Simi-Santa Rosa Fault and Malibu Coast Fault were selected based on their proximity to the study area and potential magnitude. For each earthquake scenario, a hypothetical epicenter was chosen to model the impact on the local area. Based on Hazus-MH projections, maps of Peak Ground Acceleration and potential losses were generated. For reference purposes, the USGS developed an Instrumental Intensity Scale that provides relative values for selected PGA ranges.

| Instrumental Intensity | Acceleration (g) | Perceived Shaking | Potential Damage |
|---|---|---|---|
| I | < 0.0017 | Not Felt | None |
| II-III | 0.0017 - 0.014 | Weak | None |
| IV | 0.014 - 0.039 | Light | None |
| V | 0.039 - 0.092 | Moderate | Very light |
| VI | 0.092 - 0.18 | Strong | Light |
| VII | 0.18 - 0.34 | Very Strong | Moderate |
| VIII | 0.34 - 0.65 | Severe | Moderate to Heavy |
| IX | 0.65 - 1.24 | Violent | Heavy |
| X+ | > 1.24 | Extreme | Very Heavy |

**Figure 56: USGA PGA Instrumental Intensity Scale**

Flood estimates used 50-year and 100-year scenarios. A 100-year flood is defined as an event having a one percent chance of being equaled or exceeded in any given year. This is the regulatory standard "base flood". The base flood is used by the NFIP and all Federal agencies for the purposes of requiring the purchase of flood insurance and regulating new development. Base Flood Elevations (BFEs) are typically shown on Flood Insurance Rate Maps (FIRMs). A 50-year flood has a 2% chance of being equaled or exceeded in any given year.

### *Magnitude 7.0 Simi-Santa Rosa Fault Earthquake Scenario*

Hazus-MH was used to estimate the impact of a magnitude 7.0 earthquake on the Simi-Santa Rosa Fault (epicenter "red circle" at Latitude 34.2902 Longitude -118.741 and a depth of 1 Km with a rupture length of 35.48 Km). The map below depicts the estimated Peak Ground Acceleration for the area.

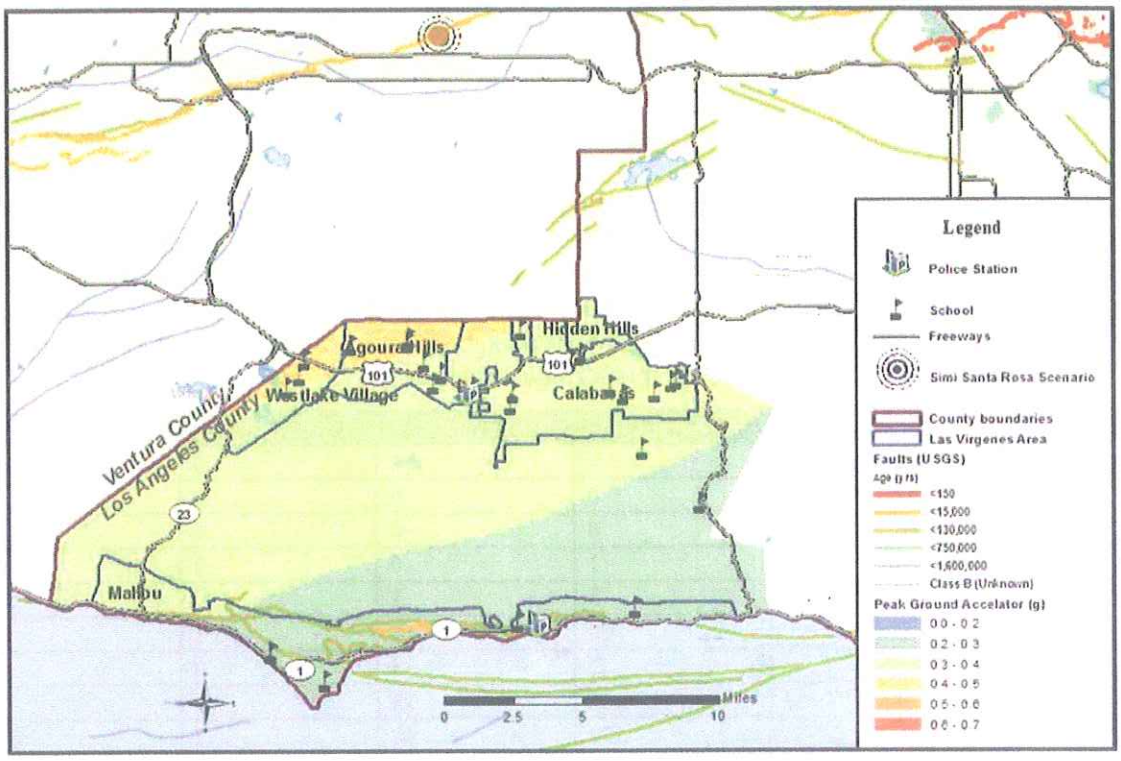



**Figure 57: Simi-Santa Rosa M7.0 EQ Peak Ground Acceleration Estimate**

Based on projected Peak Ground Acceleration, the greatest impact (and damage) will be in the Agoura Hills and Westlake Village areas (PGA 0.4 to 0.5). This corresponds to severe shaking and moderate to heavy damage. Though somewhat less intense, Calabasas and Hidden Hills (PGA 0.3 to 0.4) would also experience severe shaking and moderate to heavy damage while Malibu (PGA 0.2 to 0.3) would experience very strong shaking with moderate damage.

Additional projected impacts on the Las Virgenes-Malibu Council of Governments area are included in the following sections for:

- Casualties
- Shelter Requirements
- Fire
- Debris Generation
- Financial Impact to Infrastructure and Buildings
- Damage by Building and Facility Type
- Economic Loss

### Casualties

Hazus-MH 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. |

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 at maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are at maximum and 5:00 PM represents peak commute time. The table below provides a summary of the casualties estimated for this earthquake scenario.

| Time | Sector | Level 1 | Level 2 | Level 3 | Level 4 |
|---|---|---|---|---|---|
| **2 AM** | Commercial | 4 | 1 | 0 | 0 |
| | Commuting | 0 | 0 | 0 | 0 |
| | Educational | 0 | 0 | 0 | 0 |
| | Hotels | 1 | 0 | 0 | 0 |
| | Industrial | 5 | 1 | 0 | 0 |
| | Other-Residential | 28 | 6 | 1 | 1 |
| | Single Family | 47 | 5 | 0 | 0 |
| | **Total** | **85** | **13** | **1** | **1** |
| **2 PM** | Commercial | 190 | 48 | 7 | 14 |
| | Commuting | 0 | 0 | 0 | 0 |
| | Educational | 36 | 9 | 1 | 3 |
| | Hotels | 0 | 0 | 0 | 0 |
| | Industrial | 40 | 10 | 2 | 3 |
| | Other-Residential | 4 | 1 | 0 | 0 |
| | Single Family | 7 | 1 | 0 | 0 |
| | **Total** | **277** | **69** | **10** | **20** |
| **5 PM** | Commercial | 152 | 38 | 6 | 11 |
| | Commuting | 30 | 42 | 69 | 13 |
| | Educational | 5 | 1 | 0 | 0 |
| | Hotels | 0 | 0 | 0 | 0 |
| | Industrial | 25 | 6 | 1 | 2 |
| | Other-Residential | 10 | 2 | 0 | 0 |
| | Single Family | 18 | 2 | 0 | 0 |
| | **Total** | **240** | **91** | **76** | **26** |

**Table 61: Simi-Santa Rosa Fault M7.0 EQ Casualty Estimates**

### Shelter Requirement

Hazus-MH 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 195 households to be displaced due to the earthquake. Of these, 104 people will seek temporary shelter in public shelters.

### Fires

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-MH uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimated that there would be little or no impact of fires to the area.

### Debris Generation

Hazus-MH estimates the amount of debris that will be generated by the earthquake. The model classifies 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 0.22 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 31.00% 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 8,880 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

### Financial Impact to Infrastructure and Buildings

The following estimates were generated using Hazus-MH.

| System | Component | # Locations/ # Segments | Replacement Value (millions of dollars) |
|---|---|---|---|
| Highway | Bridges | 67 | 74.00 |
| | Segments | 28 | 832.50 |
| | Tunnels | 7 | 16.50 |
| | | **Total** | **923.00** |

**Table 62: Simi-Santa Rosa Fault M7.0 EQ Transportation System Lifeline Inventory Replacement Values**

| System | Component | # Locations / Segments | Replacement Value (millions of dollars) |
|---|---|---|---|
| Potable Water | Distribution Lines | Multiple | 26.40 |
| | Facilities | 0 | 0.00 |
| | | Subtotal | 26.40 |
| Waste Water | Distribution Lines | Multiple | 15.90 |
| | Facilities | 2 | 157.20 |
| | | Subtotal | 173.00 |
| Natural Gas | Distribution Lines | Multiple | 10.6 |
| | Facilities | 0 | 0 |
| | | Subtotal | 10.6 |
| | | **Total** | **210.10** |

**Table 63: Simi-Santa Rosa Fault M7.0 EQ Water Utility Lifeline Inventory Replacement Values**

Note: Electric Power, Communication, and Oil System data was not available.

| Occupancy Type | None | | Slight | | Moderate | | Extensive | | Complete | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Count | (%) | Count | (%) | Count | (%) | Count | (%) | Count | (%) |
| Agriculture | 45 | 0.28 | 28 | 0.26 | 20 | 0.47 | 8 | 0.9 | 3 | 1.18 |
| Commercial | 794 | 4.96 | 502 | 4.64 | 490 | 11.48 | 210 | 24.51 | 68 | 27.38 |
| Education | 30 | 0.19 | 16 | 0.15 | 11 | 0.26 | 4 | 0.46 | 1 | 0.44 |
| Government | 14 | 0.09 | 7 | 0.07 | 7 | 0.16 | 3 | 0.37 | 1 | 0.44 |
| Industrial | 194 | 1.21 | 129 | 1.19 | 139 | 3.24 | 64 | 7.42 | 23 | 9.05 |
| Other Residential | 1,504 | 9.39 | 1,066 | 9.86 | 799 | 18.7 | 383 | 44.63 | 105 | 42.4 |
| Religion | 49 | 0.31 | 30 | 0.27 | 24 | 0.56 | 11 | 1.24 | 4 | 1.46 |
| Single Family | 13,388 | 83.57 | 9,037 | 83.56 | 2,782 | 65.12 | 175 | 20.47 | 44 | 17.65 |
| **Total** | **16,018** | | **10,815** | | **4,272** | | **858** | | **249** | |

**Table 64: Simi-Santa Rosa Fault M7.0 EQ Expected Building Damage by Occupancy**

## Damage by Building and Facility Type

| Building Type | None | | Slight | | Moderate | | Extensive | | Complete | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Count | (%) | Count | (%) | Count | (%) | Count | (%) | Count | (%) |
| Wood | 14,552 | 90.84 | 9827 | 90.86 | 3,039 | 71.15 | 200 | 23.32 | 56 | 22.43 |
| Steel | 213 | 1.33 | 143 | 1.32 | 198 | 4.64 | 99 | 11.55 | 33 | 13.19 |
| Concrete | 255 | 1.59 | 161 | 1.49 | 129 | 3.02 | 64 | 7.46 | 24 | 9.59 |
| Precast | 191 | 1.19 | 123 | 1.14 | 145 | 3.39 | 60 | 6.94 | 17 | 6.68 |
| RM | 508 | 3.17 | 196 | 1.82 | 198 | 4.62 | 85 | 9.97 | 18 | 7.34 |
| URM | 64 | 0.4 | 50 | 0.46 | 51 | 1.21 | 23 | 2.69 | 10 | 4.17 |
| MH | 237 | 1.48 | 315 | 2.91 | 511 | 11.97 | 326 | 38.06 | 91 | 36.6 |
| Total | 16,020 | | 10,815 | | 4,271 | | 857 | | 249 | |

**Table 65: Simi-Santa Rosa Fault M7.0 EQ Expected Building Damage by Building Type**

Notes:
RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

| Classification | Total | Number of Facilities | | |
|---|---|---|---|---|
| | | At Least Moderate Damage > 50% | Complete Damage > 50% | With Functionality > 50% on day 1 |
| Schools | 32 | 0 | 0 | 14 |

**Table 66: Simi-Santa Rosa Fault M7.0 EQ Expected Damage to Essential Facilities - Schools**

| System | Component | Locations/ Segments | Number of Locations With at Least Mod. Damage | With Complete Damage | With Functionality > 50% After Day 1 | After Day 7 |
|---|---|---|---|---|---|---|
| Highway | Bridges | 67 | 4 | 0 | 62 | 67 |
| | Segments | 28 | 0 | 0 | 28 | 28 |
| | Tunnels | 7 | 0 | 0 | 7 | 7 |

**Table 67: Simi-Santa Rosa Fault M7.0 EQ Expected Damage to Transportation Systems**

| System | Total # | Number of Locations With at Least Mod. Damage | With Complete Damage | With Functionality > 50% After Day 1 | After Day 7 |
|---|---|---|---|---|---|
| Waste Water | 2 | 2 | 0 | 0 | 2 |

**Table 68: Simi-Santa Rosa Fault M7.0 EQ Expected Damage to Waste Water Utility Systems**

| System | Total Pipelines Length (kms) | Number of Leaks | Number of Breaks |
|---|---|---|---|
| Potable Water | 1,322 | 324 | 81 |
| Waste Water | 793 | 163 | 41 |
| Natural Gas | 529 | 529 | 14 |

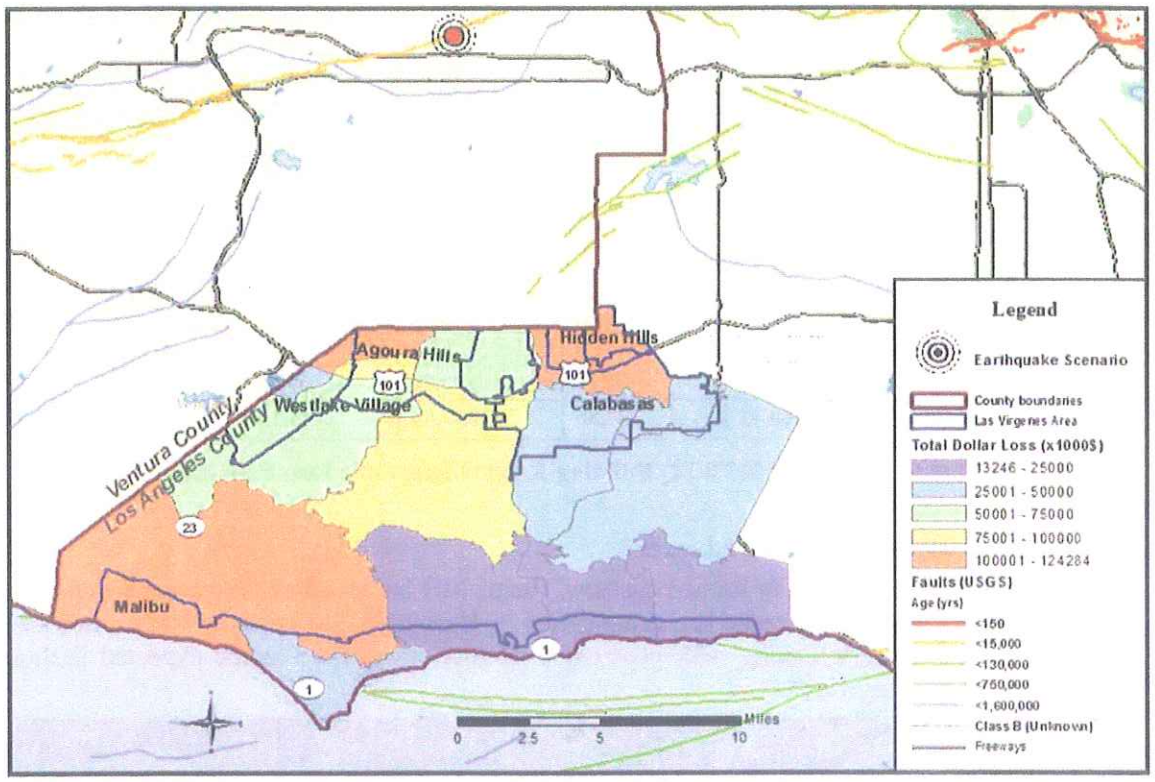
**Table 69: Simi-Santa Rosa Fault M7.0 EQ Expected Utility System Pipeline Damage**

| System | 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 | 29,844 | 4,665 | 7 | 0 | 0 | 0 |
| Electric | | 4,171 | 2,248 | 753 | 119 | 7 |

**Table 70: Simi-Santa Rosa Fault M7.0 EQ Expected Potable Water and Electric Power System Performance**

## Economic Loss

The total economic loss estimated for the earthquake is $1,284,000,000 which includes building and lifeline related losses based on the region's available inventory.




**Map 17: Simi-Santa Rosa M7.0 EQ Total $ Loss Estimate**

Losses are anticipated to be greatest in the northern areas of Agoura Hills, Hidden Hills, and Westlake Village as well as the western portion of Malibu. Additional details are provided in the following sections.

### *Building - Related Losses*

Building losses are segmented into two categories: direct building losses and business interruption losses. Direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. 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 estimated building-related losses are $1,215.64 million (19% 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.

The table below provides a summary of the losses associated with income and capital stock.

| Category | Area | Single Family $M | Other Residential $M | Commercial $M | Industrial $M | Others $M | Total $M |
|---|---|---|---|---|---|---|---|
| Income Losses | Wage | 0 | 0.9 | 33.88 | 0.77 | 1.1 | 36.64 |
| | Capital-Related | 0 | 0.39 | 37.71 | 0.45 | 0.29 | 38.84 |
| | Rental | 4.6 | 3.2 | 26.25 | 0.39 | 0.54 | 34.97 |
| | Relocation | 17.25 | 3.66 | 37.28 | 2.15 | 4.39 | 64.71 |
| | Subtotal | **21.85** | **8.15** | **135.12** | **3.76** | **6.32** | **175.16** |
| Capital Stock | Losses | | | | | | |
| | Structural | 38.95 | 6.46 | 51.03 | 5.44 | 5.06 | 106.93 |
| | Non-Structural | 220.9 | 34.69 | 166.55 | 19.37 | 15.5 | 457 |
| | Content | 79.02 | 8.56 | 78.83 | 12.74 | 7.78 | 186.92 |
| | Inventory | 0 | 0 | 1.33 | 1.88 | 0.13 | 3.34 |
| | Subtotal | **338.87** | **49.71** | **297.74** | **39.43** | **28.47** | **754.19** |
| | **Total** | **360.72** | **57.86** | **432.86** | **43.19** | **34.79** | **929.35** |

**Table 71: Simi-Santa Rosa Fault M7.0 EQ Building-Related Economic Loss Estimates**

### *Transportation and Utility Lifeline Losses*

For the transportation and utility lifeline systems, Hazus-MH computes the direct repair cost for each component only. There are no losses computed by Hazus-MH for business interruption due to lifeline outages. The following table provides a detailed breakdown in the expected lifeline losses for selected categories.

| System | Component | Inventory Value $M | Economic Loss $M | Loss Ratio (%) |
|---|---|---|---|---|
| Highway | Bridges | 74.00 | 5.77 | 7.79 |
| | Segments | 832.48 | 0.00 | 0.00 |
| | Tunnels | 16.53 | 0.54 | 3.28 |
| | **Total** | **923.00** | **8.00** | |

**Table 72: Simi-Santa Rosa Fault M7.0 EQ Transportation System Economic Losses**

| System | Component | Inventory Value $M | Economic Loss $M | Loss Ratio (%) |
|---|---|---|---|---|
| Potable Water | Distribution Lines | 26.40 | 1.46 | 5.53 |
| | Facilities | NA | - | - |
| | Subtotal | 26.40 | 1.46 | |
| Waste Water | Distribution Lines | 15.90 | 0.73 | 4.59 |
| | Facilities | 157.20 | 19.35 | 12.31 |
| | Subtotal | 173.04 | 20.08 | |
| Natural Gas | Distribution Lines | 10.60 | 0.25 | 2.36 |
| | Facilities | NA | - | - |
| | Subtotal | 10.58 | 0.44 | |
| | **Total** | **210.07** | **20.52** | |

**Table 73: Simi-Santa Rosa Fault M7.0 EQ Utility System Economic Losses**

Note: Electric Power, Communication, and Oil System data was not available (NA).

### *15 Year Projected Impact*

Hazus-MH 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.

| Year | Loss | Total | % |
|---|---|---|---|
| First Year | Employment Impact (# of people) | 0 | 0.00 |
| | Income Impact ($M) | <7> | -0.61 |
| Second Year | Employment Impact (# of people) | 0 | 0.00 |
| | Income Impact ($M) | <21> | -1.87 |
| Third Year | Employment Impact (# of people) | 0 | 0.00 |
| | Income Impact ($M) | <27> | -2.41 |
| Fourth Year | Employment Impact (# of people) | 0 | 0.00 |
| | Income Impact ($M) | <27> | -2.41 |
| Fifth Year | Employment Impact (# of people) | 0 | 0.00 |
| | Income Impact ($M) | <27> | -2.41 |
| Years 6 to 15 | Employment Impact (# of people) | 0 | 0.00 |
| | Income Impact ($M) | <27> | -2.41 |

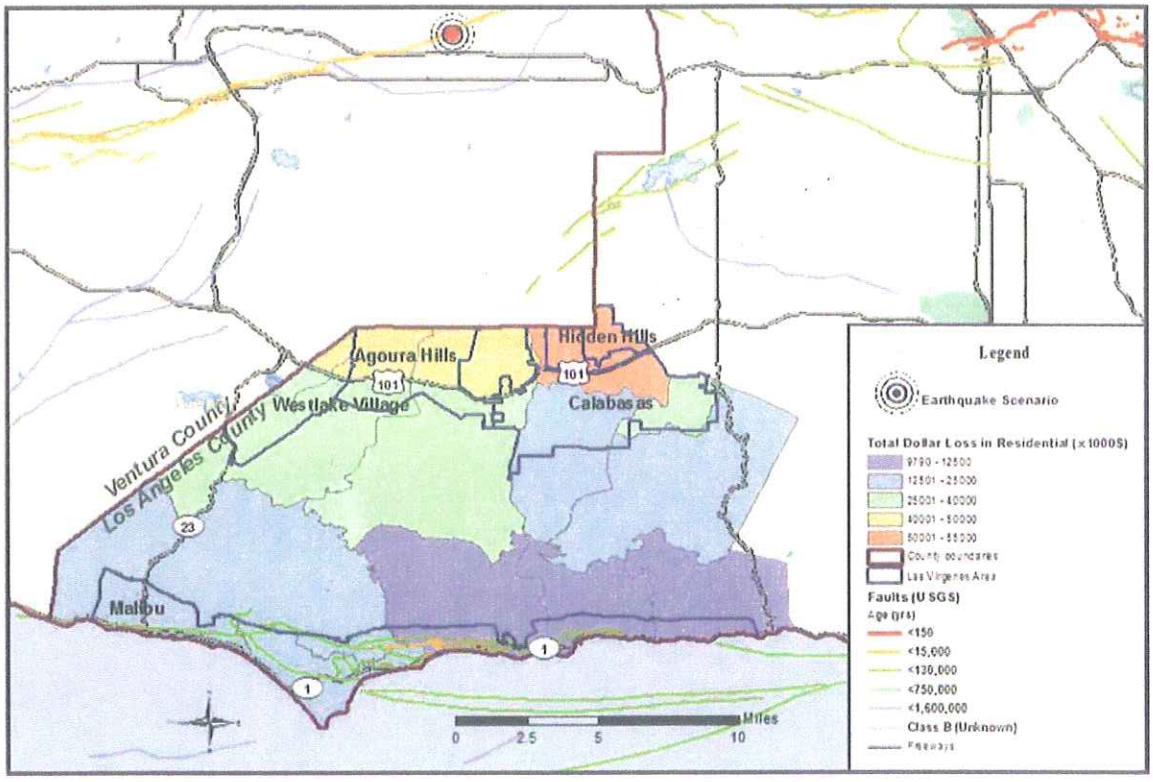
**Table 74: Simi-Santa Rosa Fault M7.0 EQ Indirect Economic Impact**

### Estimated Losses by City

The following dollar loss estimates for residential, commercial, and industrial facilities were generated utilizing Hazus-MH. Note: The total loss is not equal to the sum due to overlaps in structural and building losses.

| City Name | Residential Total Loss [$M] | Residential Structural Loss [$M] | Residential Non-Structural Loss [$M] | Residential Building Loss [$M] | Residential Content Loss [$M] |
|---|---|---|---|---|---|
| Agoura Hills (including Agoura) | 72.9 | 7.4 | 44.7 | 52.1 | 15.0 |
| Calabasas/Hidden Hills | 127.2 | 13.9 | 77.9 | 91.8 | 27.2 |
| Malibu | 70.9 | 7.9 | 43.9 | 51.8 | 14.3 |
| Westlake Village | 147.5 | 16.2 | 89.1 | 105.3 | 31.1 |
| **Totals** | 418.5 | 45.4 | 255.6 | 301.0 | 87.6 |

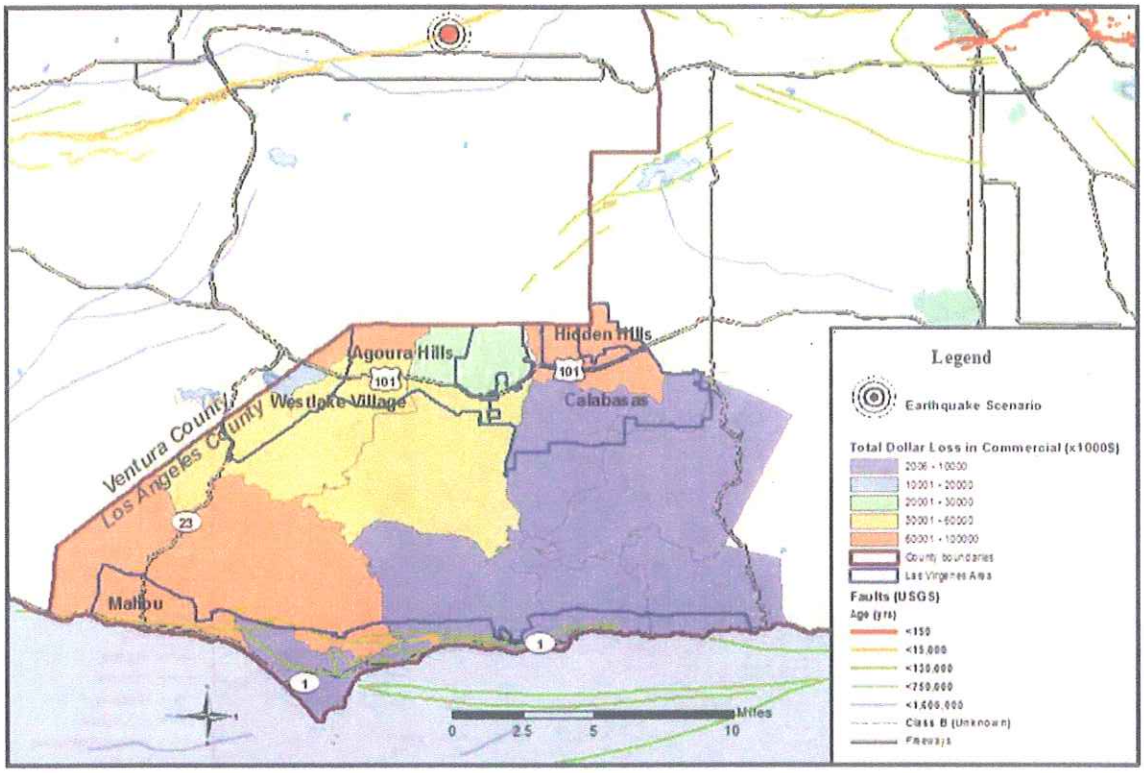
**Table 75: Simi-Santa Rosa Fault M7.0 EQ Residential Loss $ Exposure**




**Map 18: Simi-Santa Rosa Fault M7.0 EQ Residential $ Loss Estimate**

| City Name | Commercial Total Loss [$M] | Commercial Structural Loss [$M] | Commercial Non-Structural Loss [$M] | Commercial Building Loss [$M] | Commercial Content Loss [$M] |
|---|---|---|---|---|---|
| Agoura Hills (including Agoura) | 81.7 | 9.7 | 29.6 | 39.3 | 14.2 |
| Calabasas/Hidden Hills | 84.7 | 9.3 | 31.9 | 41.2 | 15.0 |
| Malibu | 121.6 | 14.2 | 49.8 | 64.0 | 23.5 |
| Westlake Village | 144.9 | 17.9 | 55.2 | 73.1 | 26.2 |
| **Totals** | 432.9 | 51.1 | 166.5 | 217.6 | 78.9 |

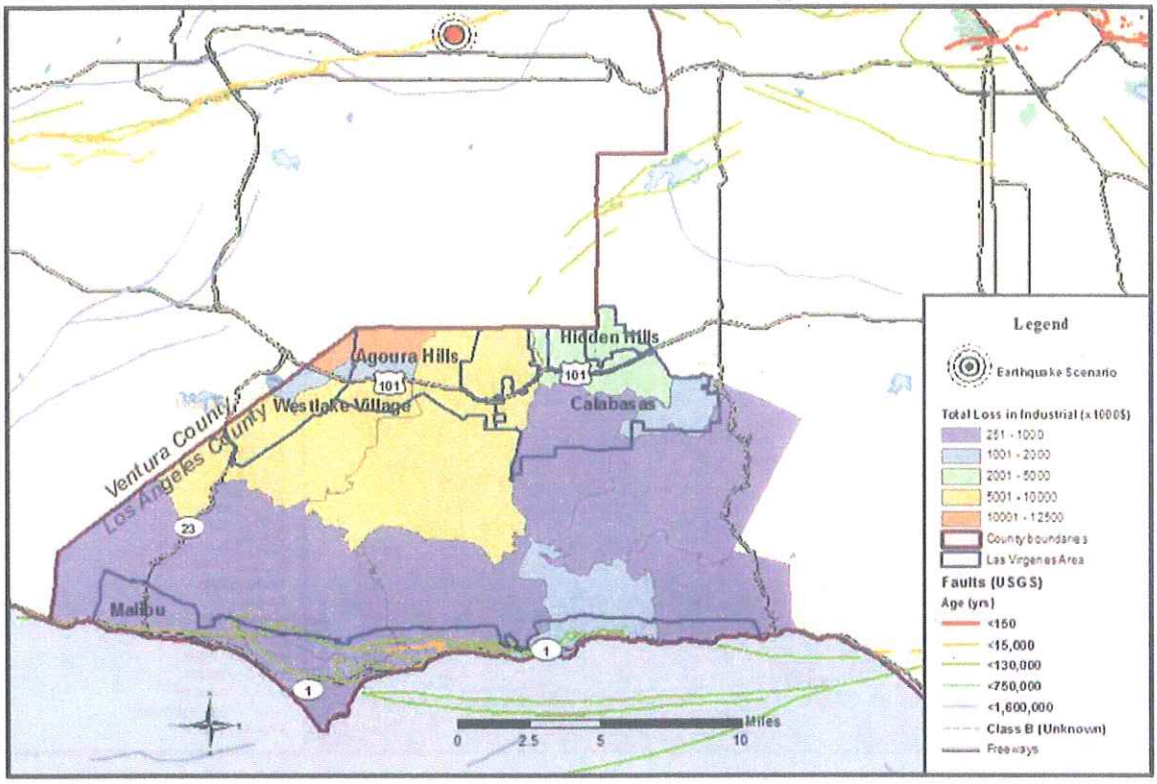
**Table 76: Simi-Santa Rosa Fault M7.0 EQ Commercial $ Loss**




**Map 19: Simi-Santa Rosa Fault M7.0 EQ Commercial $ Loss Estimate**

| City Name | Industrial Total Loss [$M] | Industrial Structural Loss [$M] | Industrial Non-Structural Loss [$M] | Industrial Building Loss [$M] | Industrial Content Loss [$M] |
|---|---|---|---|---|---|
| Agoura Hills (including Agoura) | 13.0 | 1.6 | 5.8 | 7.4 | 3.8 |
| Calabasas/Hidden Hills | 6.2 | 0.8 | 2.9 | 3.7 | 1.7 |
| Malibu | 3.7 | 0.5 | 1.6 | 2.1 | 1.1 |
| Westlake Village | 20.3 | 2.5 | 9.1 | 11.6 | 6.1 |
| **Totals** | 43.2 | 5.4 | 19.4 | 24.8 | 12.7 |

**Table 77: Simi-Santa Rosa Fault M7.0 EQ Industrial Loss $ Exposure**




**Map 20: Simi-Santa Rosa Fault M7.0 EQ Industrial $ Loss Estimate**

### *Magnitude 7.0 Malibu Coast Fault Earthquake Scenario*

Hazus-MH was used to estimate the impact of a magnitude 7.0 earthquake on the Malibu Coast Fault (epicenter "orange circle" at Latitude 33.9684 Longitude -118.729 and a depth of 1 Km). The map below provides a project of peak ground acceleration for the area.

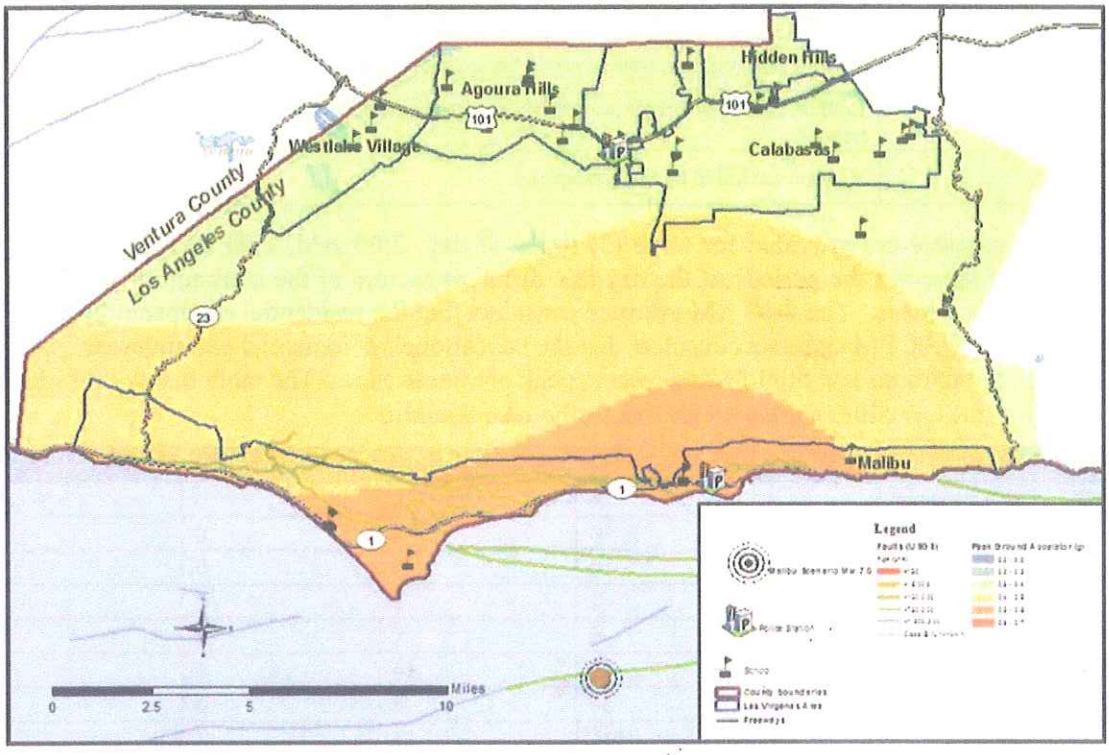



**Figure 58: Malibu Coast M7.0 EQ Peak Ground Acceleration Estimate**

Based on projected Peak Ground Acceleration, the greatest impact (and damage) will be along the coast in the central and eastern portions of Malibu (PGA 0.5 to 0.6). This corresponds to severe shaking and moderate to heavy damage. Though somewhat less intense, the northern sections of Malibu and the extreme southern tip of Calabasas (PGA 0.4 to 0.5) would also experience severe shaking and moderate to heavy damage. The cities of Agoura Hills, Hidden Hills, Westlake Village, and the majority of Calabasas, (PGA 0.3 to 0.4) would experience very strong shaking with moderate damage to severe shaking with moderate to heavy damage.

Additional projected impacts on the Las Virgenes-Malibu Council of Governments area are included in the following sections for:

- Casualties
- Shelter Requirements
- Fire
- Debris Generation
- Financial Impact to Infrastructure and Buildings
- Damage by Building and Facility Type
- Economic Loss

### Casualties

Hazus-MH 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. |

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 at maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are at maximum and 5:00 PM represents peak commute time. The table below provides a summary of the casualties estimated for this earthquake scenario.

| Time | Sector | Level 1 | Level 2 | Level 3 | Level 4 |
|---|---|---|---|---|---|
| **2 AM** | Commercial | 4 | 1 | 0 | 0 |
| | Commuting | 0 | 0 | 0 | 0 |
| | Educational | 0 | 0 | 0 | 0 |
| | Hotels | 2 | 1 | 0 | 0 |
| | Industrial | 6 | 1 | 0 | 0 |
| | Other-Residential | 62 | 14 | 1 | 2 |
| | Single Family | 56 | 7 | 0 | 1 |
| | **Total** | **130** | **24** | **2** | **4** |
| **2 PM** | Commercial | 235 | 62 | 10 | 19 |
| | Commuting | 0 | 1 | 1 | 0 |
| | Educational | 47 | 12 | 2 | 4 |
| | Hotels | 0 | 0 | 0 | 0 |
| | Industrial | 41 | 11 | 2 | 3 |
| | Other-Residential | 9 | 2 | 0 | 0 |
| | Single Family | 9 | 1 | 0 | 0 |
| | **Total** | **341** | **89** | **14** | **26** |
| **5 PM** | Commercial | 192 | 50 | 8 | 14 |
| | Commuting | 41 | 57 | 93 | 18 |
| | Educational | 8 | 2 | 0 | 1 |
| | Hotels | 1 | 0 | 0 | 0 |
| | Industrial | 26 | 7 | 1 | 2 |
| | Other-Residential | 23 | 5 | 1 | 1 |
| | Single Family | 21 | 3 | 0 | 0 |
| | **Total** | **310** | **123** | **102** | **36** |

**Table 78: Malibu Coast Fault M7.0 EQ Casualty Estimates**

**Shelter Requirement**
Hazus-MH 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 282 households to be displaced due to the earthquake. Of these, 151 people will seek temporary shelter in public shelters.

**Fires**
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-MH uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimated that there would be little or no impact of fires to the area.

**Debris Generation**
Hazus-MH estimates the amount of debris that will be generated by the earthquake. The model classifies 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 0.31 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 31.00% 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 12,280 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

**Financial Impact to Infrastructure and Buildings**
The following estimates were generated using Hazus-MH.

| System | Component | # Locations/ # Segments | Replacement Value (millions of dollars) |
|---|---|---|---|
| Highway | Bridges | 67 | 74.00 |
| | Segments | 28 | 832.50 |
| | Tunnels | 7 | 16.50 |
| | | **Total** | **923.00** |

**Table 79: Malibu Coast Fault M7.0 EQ Transportation System Lifeline Inventory Replacement Values**

| System | Component | # Locations / Segments | Replacement Value (millions of dollars) |
|---|---|---|---|
| Potable Water | Distribution Lines | NA | 26.40 |
| | Facilities | NA | - |
| | | Subtotal | 26.40 |
| Waste Water | Distribution Lines | NA | 15.90 |
| | Facilities | 2 | 157.20 |
| | | Subtotal | 173.00 |
| | | **Total** | **199.4** |

**Table 80: Malibu Coast Fault M7.0 EQ Water Utility Lifeline Inventory Replacement Values**

Note: Natural Gas, Electric Power, Communication, and Oil System data was not available (NA).

| Occupancy Type | None | | Slight | | Moderate | | Extensive | | Complete | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Count | (%) | Count | (%) | Count | (%) | Count | (%) | Count | (%) |
| Agriculture | 34 | 0.25 | 29 | 0.25 | 24 | 0.48 | 11 | 0.85 | 5 | 0.9 |
| Commercial | 637 | 4.60 | 500 | 4.37 | 549 | 10.86 | 272 | 20.98 | 107 | 18.5 |
| Education | 24 | 0.17 | 17 | 0.15 | 13 | 0.26 | 5 | 0.42 | 2 | 0.3 |
| Government | 10 | 0.07 | 8 | 0.07 | 8 | 0.16 | 5 | 0.36 | 2 | 0.3 |
| Industrial | 150 | 1.08 | 126 | 1.10 | 154 | 3.05 | 82 | 6.33 | 35 | 6.1 |
| Other Residential | 1,004 | 7.25 | 982 | 8.58 | 855 | 16.92 | 660 | 50.85 | 356 | 61.7 |
| Religion | 40 | 0.29 | 30 | 0.26 | 27 | 0.54 | 14 | 1.06 | 6 | 0.9 |
| Single Family | 11,944 | 86.28 | 9,749 | 85.21 | 3,422 | 67.72 | 249 | 19.15 | 63 | 10.9 |
| Total | **13,844** | | **11,441** | | **5,053** | | **1,298** | | **577** | |

**Table 81: Malibu Coast Fault M7.0 EQ Expected Building Damage by Occupancy**

## Damage by Building and Facility Type

| Building Type | None | | Slight | | Moderate | | Extensive | | Complete | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Count | (%) | Count | (%) | Count | (%) | Count | (%) | Count | (%) |
| Wood | 12,866 | 92.94 | 10648 | 93.06 | 3,788 | 74.98 | 289 | 22.29 | 82 | 14.28 |
| Steel | 145 | 1.05 | 130 | 1.14 | 218 | 4.31 | 137 | 10.55 | 55 | 9.61 |
| Concrete | 195 | 1.40 | 164 | 1.44 | 150 | 2.96 | 85 | 6.56 | 39 | 6.78 |
| Precast | 147 | 1.06 | 120 | 1.05 | 161 | 3.19 | 78 | 6.03 | 27 | 4.75 |
| RM | 416 | 3.01 | 207 | 1.81 | 234 | 4.64 | 116 | 8.96 | 32 | 5.54 |
| URM | 45 | 0.32 | 46 | 0.40 | 57 | 1.13 | 31 | 2.41 | 20 | 3.55 |
| MH | 30 | 0.21 | 127 | 1.11 | 444 | 8.79 | 561 | 43.21 | 320 | 55.48 |
| **Total** | **13,844** | | **11,441** | | **5,053** | | **1,298** | | **577** | |

**Table 82: Malibu Coast Fault M7.0 EQ Expected Building Damage by Building Type**

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

| Classification | Total | Number of Facilities | | |
|---|---|---|---|---|
| | | At Least Moderate Damage > 50% | Complete Damage > 50% | With Functionality > 50% on day 1 |
| Schools | 32 | 0 | 0 | 17 |

**Table 83: Malibu Coast Fault M7.0 EQ Expected Damage to Essential Facilities - Schools**

| 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 | Bridges | 67 | 6 | 0 | 59 | 63 |
| | Segments | 28 | 0 | 0 | 28 | 28 |
| | Tunnels | 7 | 0 | 0 | 7 | 7 |

**Table 84: Malibu Coast Fault M7.0 EQ Expected Damage to Transportation Systems**

| System | Total # | Number of Locations | | | |
|---|---|---|---|---|---|
| | | With at Least Mod. Damage | With Complete Damage | With Functionality > 50% | |
| | | | | After Day 1 | After Day 7 |
| Waste Water | 2 | 2 | 0 | 0 | 1 |

**Table 85: Malibu Coast Fault M7.0 EQ Expected Damage to Waste Water Utility Systems**

| System | Total Pipelines Length (kms) | Number of Leaks | Number of Breaks |
|---|---|---|---|
| Potable Water | 1,322 | 562 | 141 |
| Waste Water | 793 | 282 | 71 |
| Natural Gas | 529 | 97 | 24 |

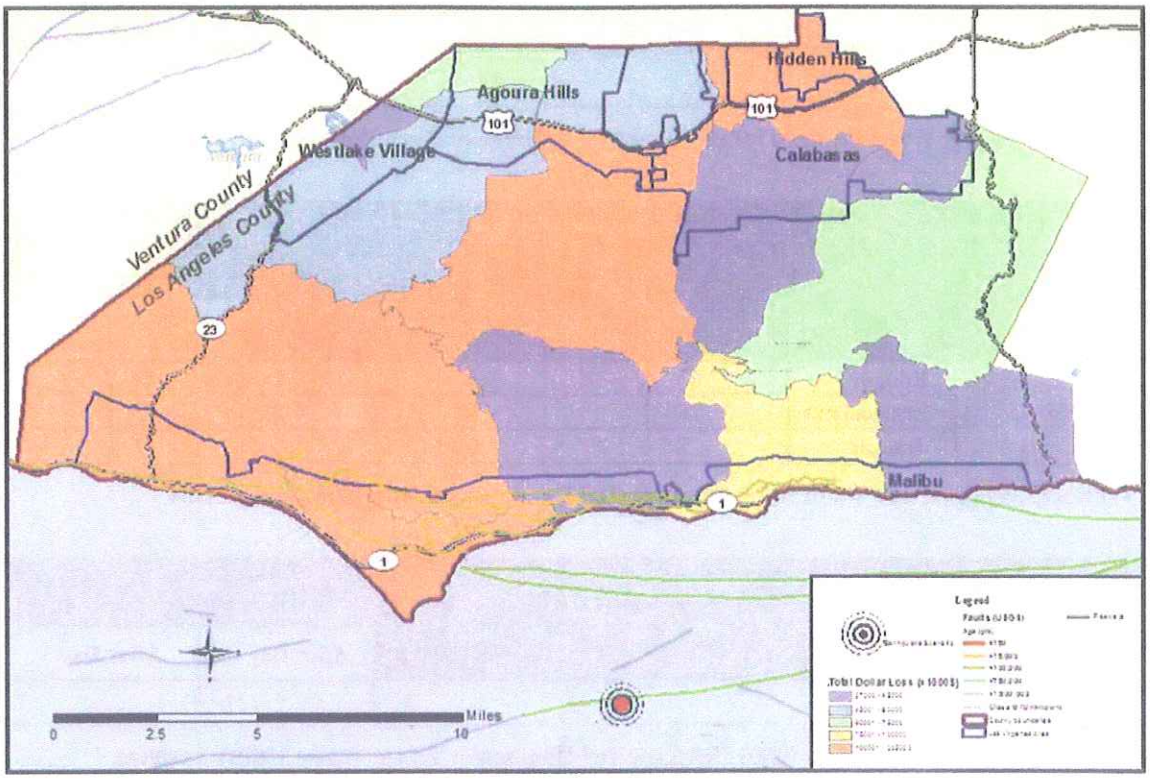
**Table 86: Malibu Coast Fault M7.0 EQ Expected Utility System Pipeline Damage**

| System | 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 | 29,844 | 13,044 | 6,109 | 0 | 0 | 0 |
| Electric | | 5,778 | 3,417 | 1,318 | 240 | 8 |

**Table 87: Malibu Coast Fault M7.0 EQ Expected Potable Water and Electric Power System Performance**

## Economic Loss

The total economic loss estimated for the earthquake is $1,284,000,000 which includes building and lifeline related losses based on the region's available inventory.




**Map 21: Malibu Coast M7.0 EQ Total $ Loss Estimate**

Losses are anticipated to be greatest in the western portion of Malibu as well as Hidden Hills and the southeastern area of Agoura Hills, and north and west portions of Calabasas. Additional details are provided in the following sections.

### *Building - Related Losses*

Building losses are segmented into two categories: direct building losses and business interruption losses. Direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. 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 estimated building-related losses are $1,215.64 million (19% 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.

The table below provides a summary of the losses associated with income and capital stock.

| Category | Area | Single Family $M | Other Residential $M | Commercial $M | Industrial $M | Others $M | Total $M |
|---|---|---|---|---|---|---|---|
| Income Losses | Wage | 0.00 | 1.54 | 42.38 | 0.88 | 1.53 | 46.32 |
| | Capital-Related | 0.00 | 0.67 | 51.20 | 0.52 | 0.37 | 52.75 |
| | Rental | 5.82 | 5.32 | 34.53 | 0.41 | 0.67 | 46.75 |
| | Relocation | 22.02 | 6.28 | 48.56 | 2.28 | 5.51 | 84.65 |
| | Subtotal | 27.84 | 13.80 | 176.66 | 4.09 | 8.07 | 230.47 |
| Capital Stock | Losses | | | | | | |
| | Structural | 48.73 | 12.65 | 67.34 | 6.12 | 6.18 | 141.02 |
| | Non-Structural | 273.47 | 60.91 | 224.10 | 21.95 | 19.34 | 599.77 |
| | Content | 98.18 | 14.59 | 103.61 | 14.25 | 9.92 | 240.56 |
| | Inventory | 0.00 | 0.00 | 1.44 | 2.19 | 0.18 | 3.81 |
| | Subtotal | 420.39 | 88.15 | 396.50 | 44.51 | 35.62 | 985.17 |
| | **Total** | **448.23** | **101.96** | **573.16** | **48.60** | **43.69** | **1,215.64** |

**Table 88: Malibu Coast Fault M7.0 EQ Building-Related Economic Loss Estimates**

### *Transportation and Utility Lifeline Losses*

For the transportation and utility lifeline systems, Hazus-MH computes the direct repair cost for each component only. There are no losses computed by Hazus-MH for business interruption due to lifeline outages. The following table provides a detailed breakdown in the expected lifeline losses for selected categories.

| System | Component | Inventory Value $M | Economic Loss $M | Loss Ratio (%) |
|---|---|---|---|---|
| Highway | Bridges | 74.00 | $7.12 | 9.62 |
| | Segments | 832.48 | $0.00 | 0.00 |
| | Tunnels | 16.53 | $0.88 | 5.32 |
| | **Total** | **923.00** | **8.00** | |

**Table 89: Malibu Coast Fault M7.0 EQ Transportation System Economic Losses**

| System | Component | Inventory Value $M | Economic Loss $M | Loss Ratio (%) |
|---|---|---|---|---|
| Potable Water | Distribution Lines | 26.40 | $2.53 | 9.57 |
| | Facilities | NA | - | - |
| | Subtotal | 26.45 | $2.53 | |
| Waste Water | Distribution Lines | 15.90 | $1.27 | 8.01 |
| | Facilities | 157.20 | $56.13 | 35.71 |
| | Subtotal | 173.04 | $57.40 | 173.04 |
| Natural Gas | Distribution Lines | 10.60 | $0.44 | 4.12 |
| | Facilities | NA | - | - |
| | Subtotal | 10.58 | $0.44 | |
| | **Total** | **210.07** | **$60.37** | |

**Table 90: Malibu Coast Fault M7.0 EQ Utility System Economic Losses**

Note: Electric Power, Communication, and Oil System data was not available (NA).

### *15 Year Projected Impact*

Hazus-MH 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.

| Year | Loss | Total | % |
|---|---|---|---|
| First Year | Employment Impact (# of people) | 0 | 0.00 |
| | Income Impact ($M) | <9> | -0.81 |
| Second Year | Employment Impact (# of people) | 0 | 0.00 |
| | Income Impact ($M) | <27> | -2.46 |
| Third Year | Employment Impact (# of people) | 0 | 0.00 |
| | Income Impact ($M) | <35> | -3.17 |
| Fourth Year | Employment Impact (# of people) | 0 | 0.00 |
| | Income Impact ($M) | <35> | -3.17 |
| Fifth Year | Employment Impact (# of people) | 0 | 0.00 |
| | Income Impact ($M) | <35> | -3.17 |
| Years 6 to 15 | Employment Impact (# of people) | 0 | 0.00 |
| | Income Impact ($M) | <35> | -3.17 |

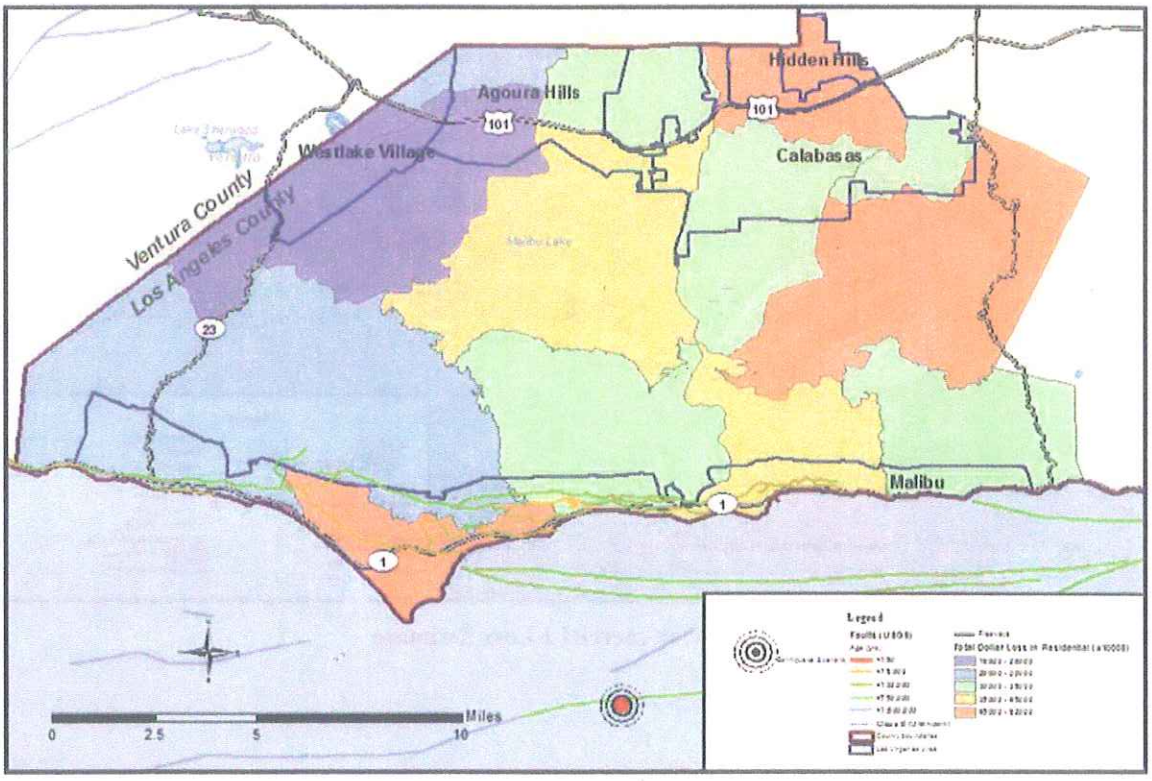
**Table 91: Malibu Coast Fault M7.0 EQ Indirect Economic Impact**

### Estimated Losses by City

The following dollar loss estimates for residential, commercial, and industrial facilities were generated utilizing Hazus-MH. Note: The total loss is not equal to the sum due to overlaps in structural and building losses.

| City Name | Residential Total Loss [$M] | Residential Structural Loss [$M] | Residential Non-Structural Loss [$M] | Residential Building Loss [$M] | Residential Content Loss [$M] |
|---|---|---|---|---|---|
| Agoura Hills (including Agoura) | 75.2 | 7.7 | 45.9 | 53.6 | 15.5 |
| Calabasas/Hidden Hills | 156.7 | 17.4 | 95.3 | 112.7 | 33.2 |
| Malibu | 218.0 | 25.4 | 132.1 | 157.5 | 43.0 |
| Westlake Village | 100.3 | 10.9 | 61.1 | 72.0 | 21.1 |
| **Totals** | **550.2** | **61.4** | **334.4** | **395.8** | **112.8** |

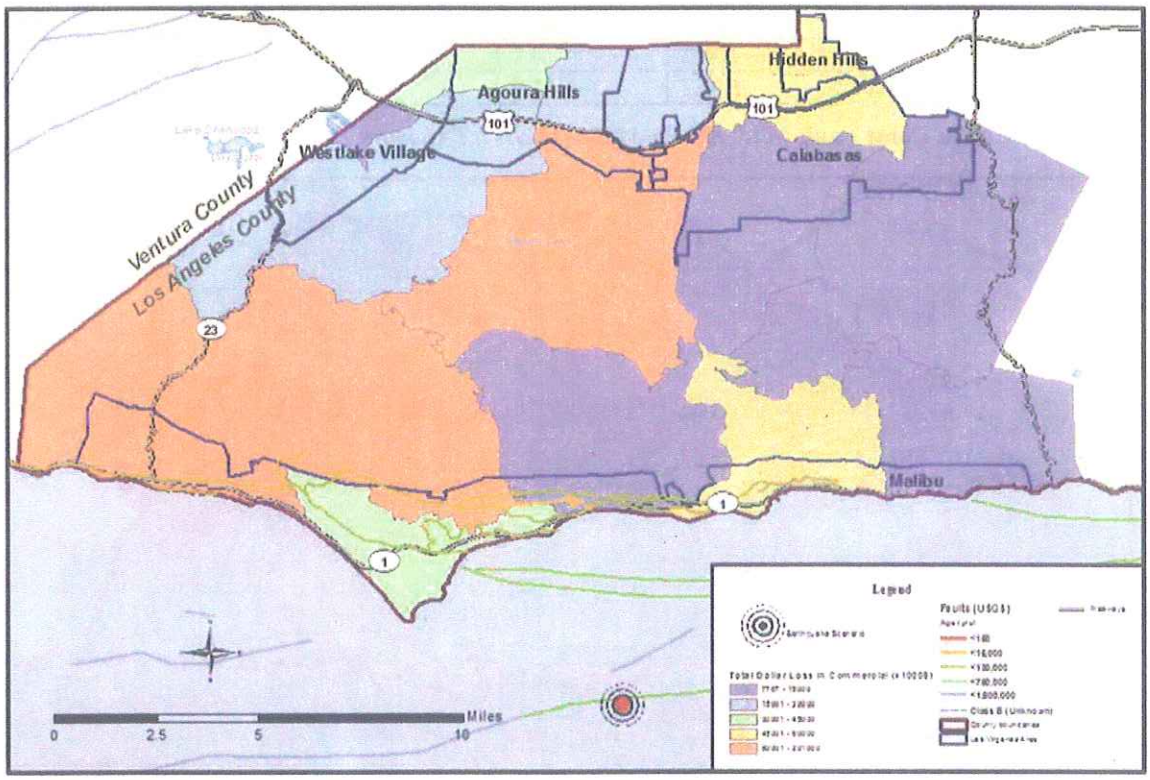
**Table 92: Malibu Coast Fault M7.0 EQ Residential Loss $ Exposure**




**Map 22: Malibu Coast Fault M7.0 EQ Residential $ Loss Estimate**

| City Name | Commercial Total Loss [$M] | Commercial Structural Loss [$M] | Commercial Non-Structural Loss [$M] | Commercial Building Loss [$M] | Commercial Content Loss [$M] |
|---|---|---|---|---|---|
| Agoura Hills (including Agoura) | 98.5 | 11.7 | 36.0 | 47.7 | 17.0 |
| Calabasas/Hidden Hills | 87.4 | 9.5 | 32.7 | 42.2 | 15.3 |
| Malibu | 297.2 | 35.2 | 121.7 | 156.9 | 54.9 |
| Westlake Village | 90.0 | 10.9 | 33.7 | 44.7 | 16.4 |
| **Totals** | **573.1** | **67.3** | **224.1** | **291.5** | **103.6** |

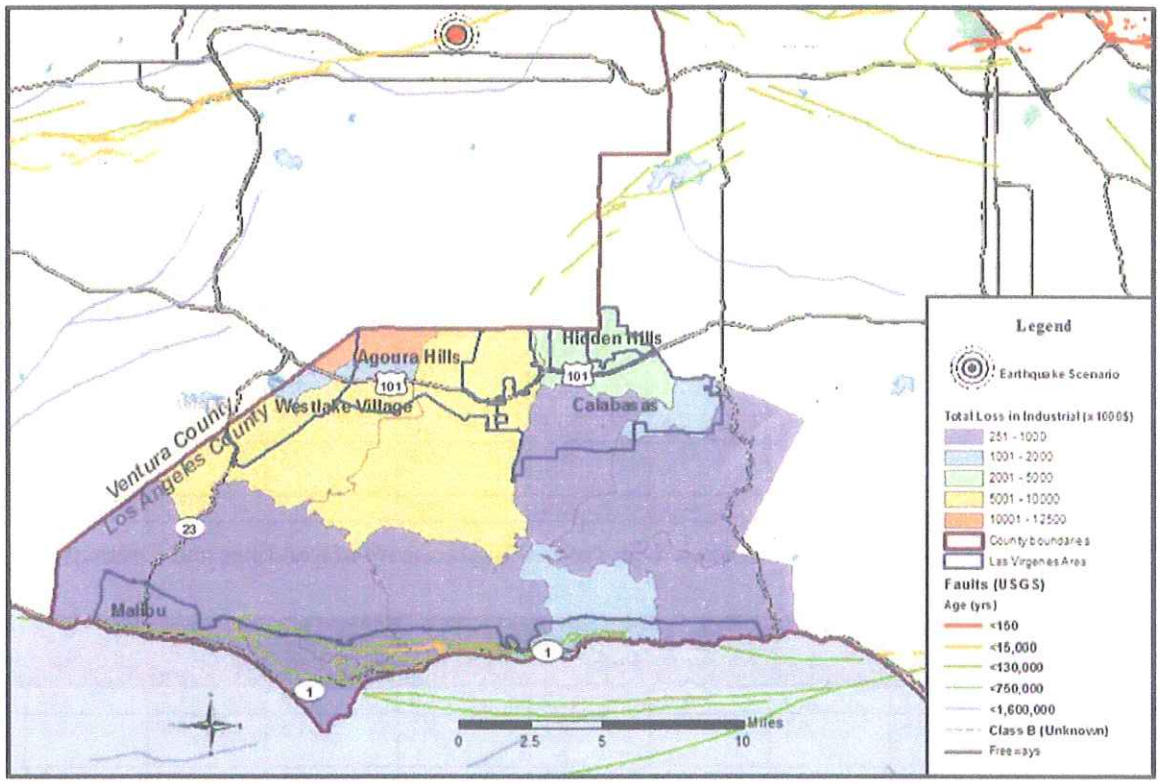
**Table 93: Malibu Coast Fault M7.0 EQ Commercial $ Loss**




**Map 23: Malibu Coast Fault M7.0 EQ Commercial $ Loss Estimate**

| City Name | Industrial Total Loss [$M] | Industrial Structural Loss [$M] | Industrial Non-Structural Loss [$M] | Industrial Building Loss [$M] | Industrial Content Loss [$M] |
|---|---|---|---|---|---|
| Agoura Hills (including Agoura) | 14.8 | 1.9 | 6.6 | 8.5 | 4.4 |
| Calabasas/Hidden Hills | 7.1 | 0.9 | 3.3 | 4.2 | 2.0 |
| Malibu | 18.7 | 1.8 | 6.5 | 8.3 | 4.1 |
| Westlake Village | 8.0 | 1.6 | 5.5 | 7.1 | 3.7 |
| **Totals** | **48.6** | **6.2** | **21.9** | **28.1** | **14.2** |

**Table 94: Malibu Coast Fault M7.0 EQ Industrial Loss $ Exposure**




**Map 24: Malibu Coast Fault M7.0 EQ Industrial $ Loss Estimate**

### *50-year Flood Scenario*

It is estimated that a 50-year Flood (riverine flooding) will result in damage to residential, commercial, and industrial properties. The table below depicts the estimated number of structures impacted.

| City Name | Building Count Residential | Building Count Commercial | Building Count Industrial |
|---|---|---|---|
| Agoura Hills | 152 | 3 | 0 |
| Calabasas /Hidden Hills | 89 | 0 | 0 |
| Malibu | 90 | 0 | 0 |
| Westlake Village | 510 | 0 | 0 |
| **Totals** | **841** | **3** | **0** |

**Table 95: 50-year Flood General Building Stock Damage Count**

Hazus-MH provides estimates of dollar losses to residential, commercial, and industrial facilities. Note: The total of building loss and content loss is not equal to total loss due to other costs such as inventory loss, relocation expense, and income loss. The tables below show the economic losses for the general building stock by census block (full replacement value and depreciated replacement value).

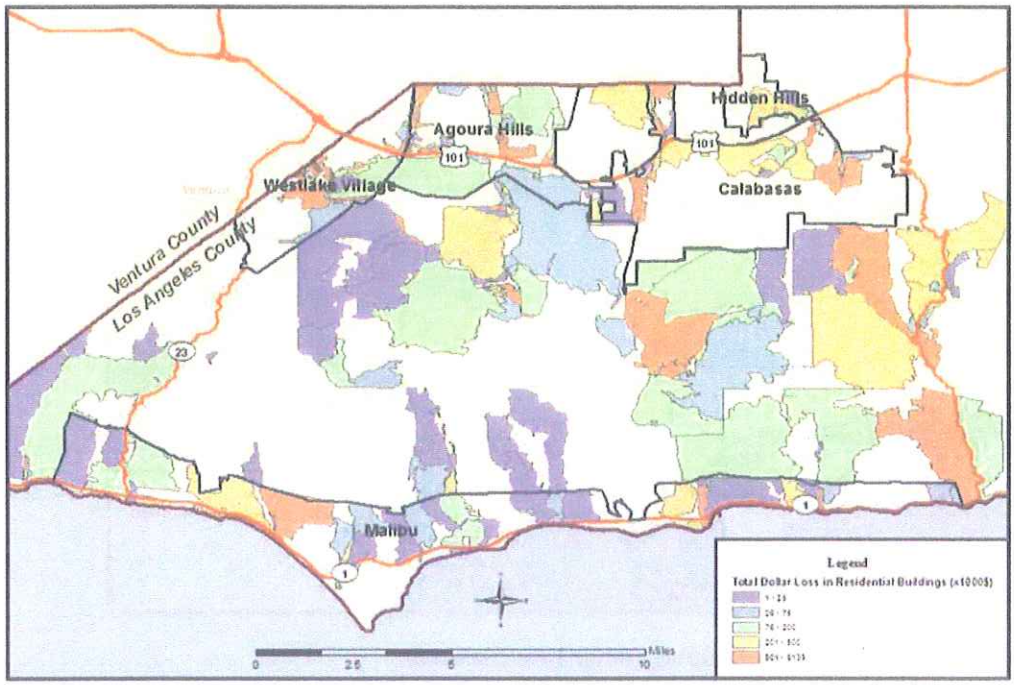
| City Name | Residential Total Loss [$M] | Residential Building Loss [$M] | Residential Content Loss [$M] | Commercial Total Loss [$M] | Commercial Building Loss [$M] | Commercial Content Loss [$M] | Industrial Total Loss [$M] | Industrial Building Loss [$M] | Industrial Content Loss [$M] |
|---|---|---|---|---|---|---|---|---|---|
| Agoura Hills | 29.0 | 17.8 | 11.2 | 27.7 | 7.9 | 19.3 | 2.6 | 0.7 | 1.7 |
| Calabasas/ Hidden Hills | 15.8 | 9.7 | 6.1 | 3.8 | 1.2 | 2.6 | 0.4 | 0.1 | 0.2 |
| Malibu | 16.2 | 10.0 | 6.3 | 7.4 | 2.6 | 4.8 | 1.8 | 0.6 | 1.1 |
| Westlake Village | 42.6 | 26.0 | 16.5 | 31.7 | 8.3 | 22.4 | 2.5 | 0.8 | 1.5 |
| Totals | **103.6** | 63.5 | 40.1 | **70.6** | 20.0 | 49.1 | **7.3** | 2.2 | 4.5 |

**Table 96: 50-year Flood Direct Economic Loss for Full Replacement of Buildings and Contents**

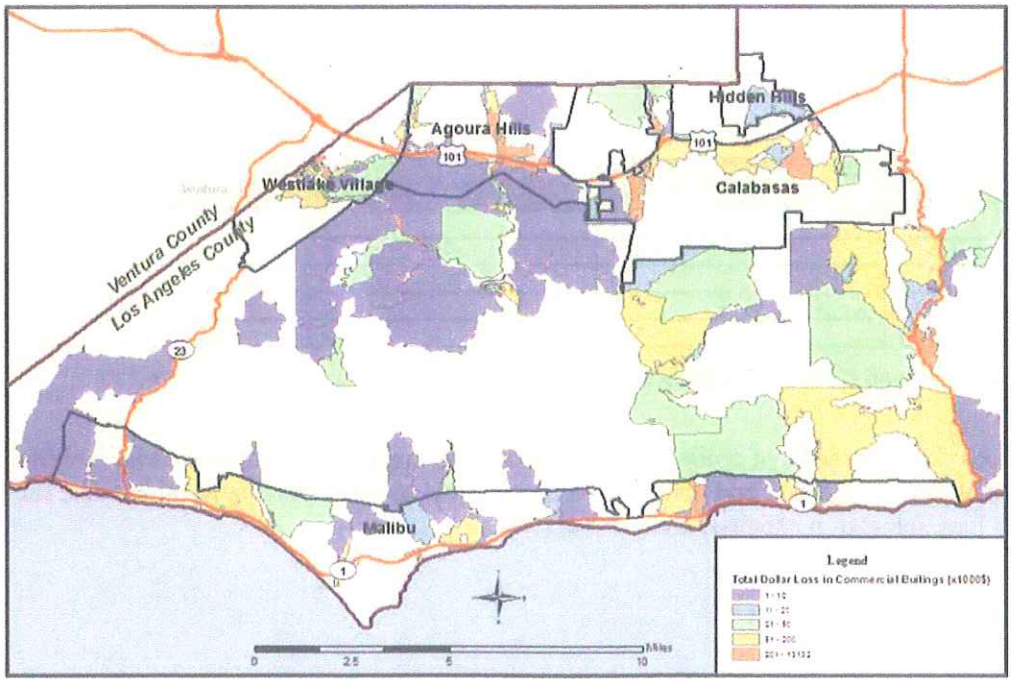
| City Name | Residential Total Loss [$M] | Residential Building Loss [$M] | Residential Content Loss [$M] | Commercial Total Loss [$M] | Commercial Building Loss [$M] | Commercial Content Loss [$M] | Industrial Total Loss [$M] | Industrial Building Loss [$M] | Industrial Content Loss [$M] |
|---|---|---|---|---|---|---|---|---|---|
| Agoura Hills | 20.7 | 12.7 | 8.0 | 17.2 | 5.0 | 12.2 | 1.5 | 0.4 | 1.1 |
| Calabasas/ Hidden Hills | 10.6 | 6.5 | 4.1 | 2.1 | 0.7 | 1.5 | 0.2 | 0.1 | 0.1 |
| Malibu | 10.7 | 6.6 | 4.1 | 4.1 | 1.4 | 2.7 | 1.0 | 0.3 | 0.7 |
| Westlake Village | 27.9 | 17.0 | 10.9 | 19.2 | 5.2 | 13.9 | 1.4 | 0.5 | 0.9 |
| Totals | **69.9** | 42.8 | 27.1 | **42.6** | 12.3 | 30.3 | **4.1** | 1.3 | 2.8 |

**Table 97: 50-year Flood Direct Economic Loss for Deprec. Replacement Value of Bdgs and Contents**

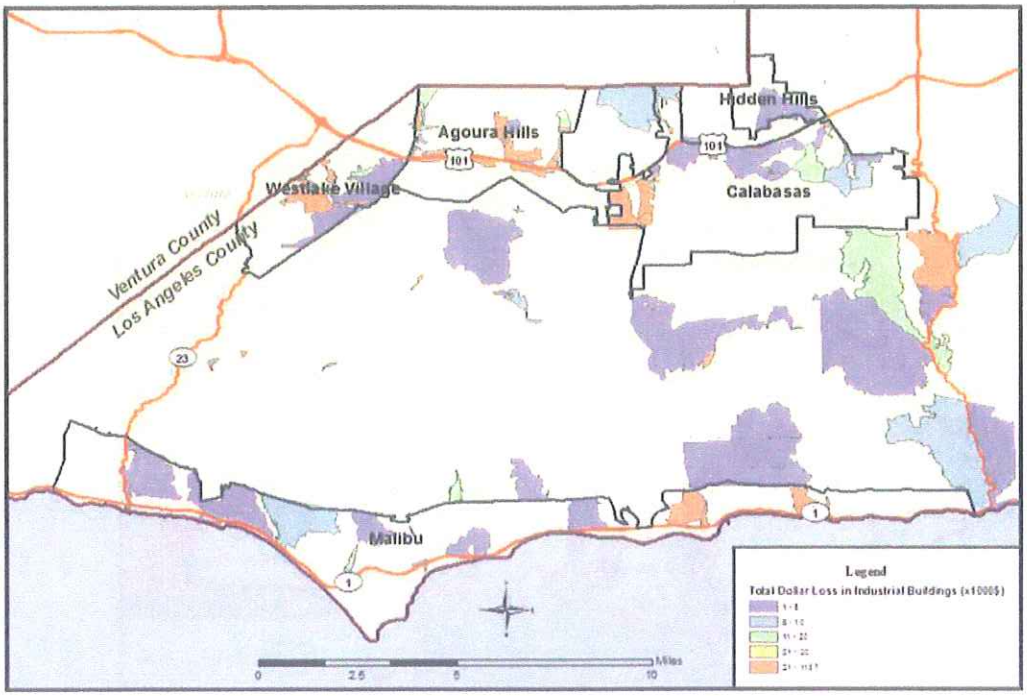
The maps below depict the 50-year Flood geographic distribution of losses for residential, commercial, and industrial facilities within the region.




**Map 25: 50-year Flood Residential Building Dollar Loss Estimate**




**Map 26: 50-year Flood Commercial Building Dollar Loss Estimate**




**Map 27: 50-year Flood Industrial Building Dollar Loss Estimate**

### *100-year Flood*

It is estimated that a 100-year Flood (riverine flooding) will result in damage to residential, commercial, and industrial properties. The table below depicts the estimated number of structures impacted.

| City Name | Building Count Residential | Building Count Commercial | Building Count Industrial |
|---|---|---|---|
| Agoura Hills | 171 | 3 | 0 |
| Calabasas /Hidden Hills | 107 | 0 | 0 |
| Malibu | 96 | 0 | 0 |
| Westlake Village | 542 | 0 | 0 |
| **Totals** | **916** | **3** | **0** |

**Table 98: 50-year Flood General Building Stock Damage Count**

Hazus-MH provides estimates of dollar losses to residential, commercial, and industrial facilities. Note: The total of building loss and content loss is not equal to total loss due to other costs such as inventory loss, relocation expense, and income loss.

The tables below show the economic losses for the general building stock by census block (full replacement value and depreciated replacement value).

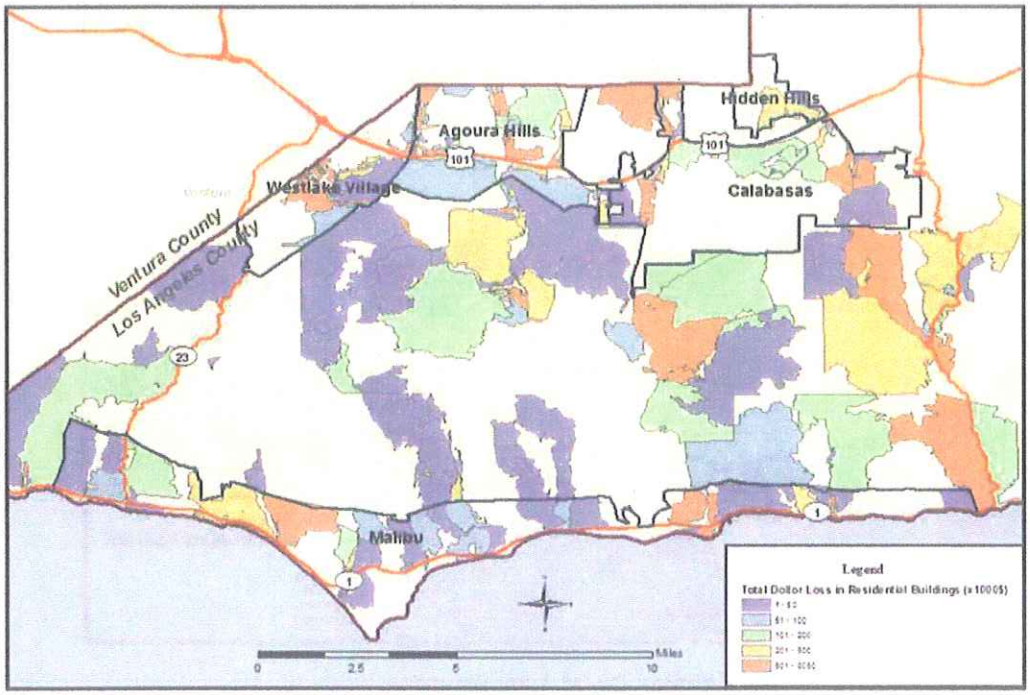
| City Name | Residential Total Loss [$M] | Residential Building Loss [$M] | Residential Content Loss [$M] | Commercial Total Loss [$M] | Commercial Building Loss [$M] | Commercial Content Loss [$M] | Industrial Total Loss [$M] | Industrial Building Loss [$M] | Industrial Content Loss [$M] |
|---|---|---|---|---|---|---|---|---|---|
| Agoura Hills | 34.5 | 21.2 | 13.3 | 39.2 | 11.7 | 26.8 | 3.7 | 1.1 | 2.4 |
| Calabasas/ Hidden Hills | 20.6 | 12.8 | 7.8 | 3.9 | 1.2 | 2.7 | 0.4 | 0.1 | 0.2 |
| Malibu | 19.8 | 12.2 | 7.7 | 9.4 | 3.0 | 6.2 | 2.1 | 0.7 | 1.3 |
| Westlake Village | 46.5 | 28.5 | 18.0 | 34.4 | 9.5 | 24.1 | 2.8 | 0.8 | 1.7 |
| Totals | **121.5** | 74.7 | 46.8 | **86.9** | 25.4 | 59.8 | **9.0** | 2.7 | 5.6 |

**Table 99: 100-year Flood Direct Economic Loss for Full Replacement of Buildings and Contents**

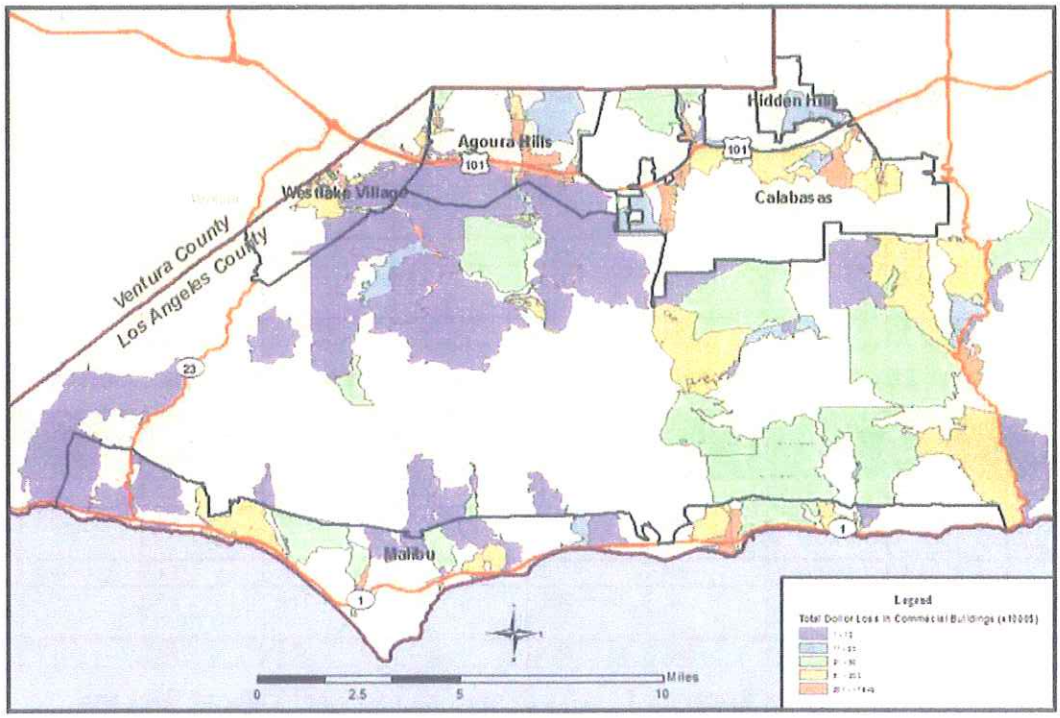
| City Name | Residential Total Loss [$M] | Residential Building Loss [$M] | Residential Content Loss [$M] | Commercial Total Loss [$M] | Commercial Building Loss [$M] | Commercial Content Loss [$M] | Industrial Total Loss [$M] | Industrial Building Loss [$M] | Industrial Content Loss [$M] |
|---|---|---|---|---|---|---|---|---|---|
| Agoura Hills | 17.1 | 10.5 | 6.6 | 24.5 | 7.4 | 17.1 | 2.2 | 0.7 | 1.5 |
| Calabasas/ Hidden Hills | 11.8 | 7.3 | 4.5 | 2.2 | 0.7 | 1.5 | 0.2 | 0.1 | 0.1 |
| Malibu | 11.5 | 7.1 | 4.4 | 5.2 | 1.7 | 3.5 | 1.1 | 0.4 | 0.7 |
| Westlake Village | 24.8 | 15.2 | 9.6 | 20.9 | 5.9 | 15.0 | 1.6 | 0.5 | 1.1 |
| Totals | **65.2** | 40.1 | 25.1 | **52.8** | 15.7 | 37.1 | **5.1** | 1.7 | 3.4 |

**Table 100: 100-year Flood Direct Economic Loss for Deprec. Replacement Value of Bdgs and Contents**

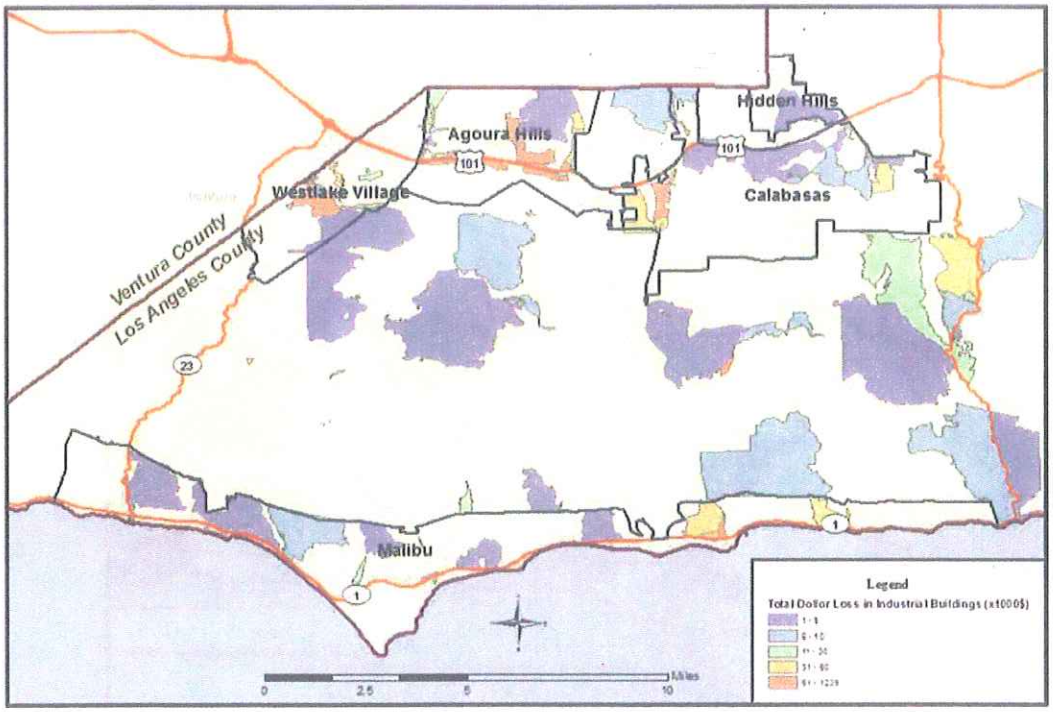
The maps below depict the 100-year Flood geographic distribution of losses for residential, commercial, and industrial facilities within the region.




**Map 28: 100-year Flood Residential Building Dollar Loss Estimate**




**Map 29: 100-year Flood Commercial Building Dollar Loss Estimate**




**Map 30: 100-year Flood Industrial Building Dollar Loss Estimate**

### Wildfire Loss Estimates

If widespread wildfires were to occur, the total potential land improvement loss in urban interface areas (buildings, parking structures, infrastructure, etc.) for all cities in the Las Virgenes-Malibu Council of Governments area has been estimated at $1,519,400,000. Note: Hazus-MH data for wildfires is not available at this time.

| City Name | Total Land Improvement Loss [M$] |
|---|---|
| Agoura Hills | 282.0 |
| Calabasas /Hidden Hills | 596.4 |
| Malibu | 557.2 |
| Westlake Village | 83.8 |
| **Totals** | **1,519.4** |

**Table 101: 50-year Flood General Building Stock Damage Count**

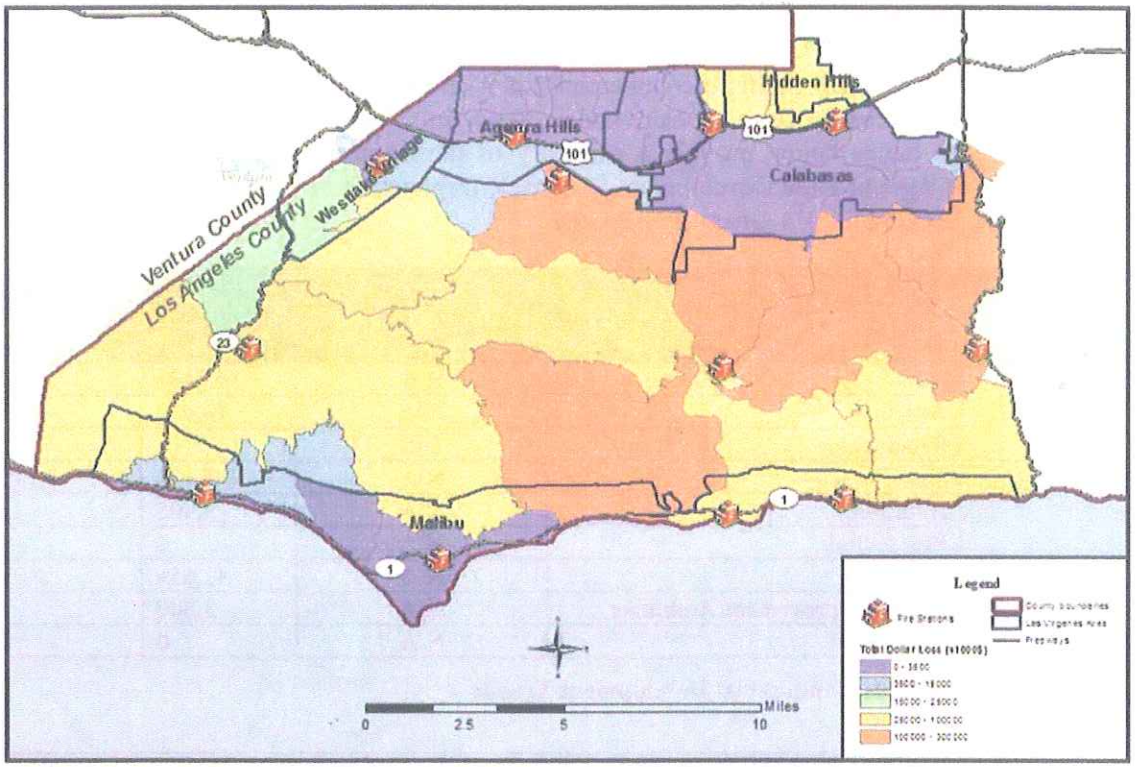



**Figure 59: Wildfire $ Loss Estimate**

Areas of highest potential loss from wildfire (Red=$100,000,000 to $3,000,000,000) include the southern border of Calabasas and north/central Malibu. At high risk of loss (Orange=$25,000,000 to $1,000,000,000) are Hidden Hills and portions of Malibu. The southwest portion of Westlake Village is at moderate risk of loss (Green=$15,000,000 to $25,000,000). Potential losses for all other areas remain a concern but are reduced (Light Blue=$3,500,000 to $15,000,000 and Purple=$0 to $3,500,000).

### Future Development Trends

The summaries below provide brief descriptions of development trends in the Las Virgenes-Malibu Council of Governments area. While all cities within the LVMCOG enforce building code requirements and restrictions in hazard zones, development trends provide an indication of future risk – either from urban area growth in previously undeveloped land (resulting in increased risk from wildfire, landslide, flood, etc.), changes in the building inventory, or increased population densities. Additional information is provided in Section 2: Community Profile for each city under Land Use and Housing Characteristics.

#### *Agoura Hills Development Trends*

Residential neighborhoods are fully developed and there are limited opportunities for infill development. Nevertheless from 2000 to 2010, the total number of residential housing units increased by approximately 10%. The greatest growth was in structures with 10 to 19 units while structures with 3 to 9 units decreased.

Agoura Hills also contains multiple commercial zones and established business centers. New commercial development, renovations/remodels, and mixed use construction have been increasing. The tables below provide a summary of development projects in Agoura Hills (Source: City of Agoura Hills Development Summary, Department of Planning and Community Development, December 2011 Quarterly Report).

| Status | Category | Number of Commercial and Mixed Use Units | Square Feet | Acres |
|---|---|---|---|---|
| In Review | New | N/A | 343,446 | 54.32 |
| | Additions | N/A | 14,850 | 8.95 |
| | Residential | 238 | | |
| Approved | New | N/A | 495,153 | 119 |
| | Additions | N/A | 5,405 | 2 |
| | Residential | N/A | 0 | 0 |
| Completed | New | N/A | 41,659 | 5.77 |
| | Tenant Improvement/Additions | N/A | 3,800 | |
| | Residential | N/A | 0 | 0 |

**Table 102: Agoura Hills Commercial Development Trends**

| Status | Category | Number of Residential Units | Square Feet | Acres |
|---|---|---|---|---|
| In Review | New | 51 | 132,239 | 17.79 |
| | Additions | 1 | 1,091 | 0.82 |
| Approved | New | 29 | 104,801 | 16.9 |
| | Additions | 4 | 5,068 | 2.63 |
| Completed | New | 2 | 12,422 | 1.99 |
| | Tenant Improvement/Additions | 0 | 0 | 0 |

**Table 103: Agoura Hills Residential Development Trends**

### *Calabasas Development Trends*

Most developable areas within the City are already built out and the majority of undeveloped land will remain undeveloped due to environmental constraints and terrain limitations. From 2000 to 2010, the total number of residential housing units increased by approximately 25% with the greatest growth in structures with 5 to 9 units.

Although the City is mainly residential, there are a number of established commercial business parks and shopping centers. The table below provides a summary of pending and current development projects in Calabasas (Source: City of Calabasas, Projects, Plans & Reports in the City of Calabasas as of 3/16/2012).
http://www.cityofcalabasas.com/projects.html

| Name | Location | Category | Number of Units | Size |
|---|---|---|---|---|
| Messenger Project | Intersection of Las Virgenes and Agoura Roads | Commercial | 21,400 | 2.52 acres |
| | | Residential – Senior Affordable Housing | 8 | 0.55 acres |
| | | Residential – Multi-Family | 75 | 4.71 acres |
| | | Residential – Single Family | 75 | 14.97 acres |
| Malamut Vintage Auto Dealership | 24439 Calabasas Road | Commercial | 1 | 20,983 sq. ft. |
| Summit at Calabasas Commercial Development | Corner of Lost Hills and Agoura Road | Commercial | 5 | 70,100 sq. ft. 7.2 acres |
| Canyon Creek Calabasas | 4803 El Canon Avenue | Residential – Senior Affordable Housing | 75 | 52,825 sq. ft. |
| The Horizons - Senior Condominiums | 26705 Malibu Hills Road | Residential – Senior Housing | 60 | |
| Village at Calabasas) | 23500 Park Sorrento (on existing commercial site | Residential – Senior Housing and Commercial Retail | 79 | 174,710 |

**Table 104: Calabasas Development Trends**

### *Hidden Hills Development Trends*

Hidden Hills is a fully developed master planned residential community with a small restricted commercial zone (a single real estate office). Any further development or home modifications must be approved by the Hidden Hills Community Association Architectural Committee. As a result, minimal or no new development is anticipated.

### *Malibu Development Trends*

Malibu is a beachfront community with the majority of residents living along Pacific Coast Highway (PCH) or in small residential communities. A number of existing residences are interspersed throughout the Santa Monica Mountains along canyons and hillsides (one mile or more inland). Malibu has experienced a great deal of 'in-fill' development, increasing population density. From 2000 to 2010, the total number of residential housing units decreased by approximately 10% with 1-unit structures (attached and detached) exhibiting a net decrease while multiple unit structures have been increasing.

There are also numerous established retail locations along Pacific Coast Highway including the Malibu Civic Center area. The table below provides a summary of new or remodel development projects (Source: City of Malibu Planning Department, Active Commercial Projects Report as of 2/28/2012). http://www.malibucity.org/download/index.cfm/fuseaction/download/cid/17670/

**Projects Submitted from 02/13/12 to 02/27/12**

| Street Address | Occupant | Zone | Description |
|---|---|---|---|
| 23401 Civic Center Way | Whole Foods Market | CV-1 | New Shopping Center - Whole Foods Market |
| 23465 Civic Center Way | Vacant Lot | TCO | La Paz Commercial Development - NO Municipal Use Option |

**Table 105: Malibu Development Trends - Pending**

**Active Projects**

| Street Address | Occupant | Zone | Description |
|---|---|---|---|
| 23465 Civic Center Way | Vacant Lot | TCO | La Paz Commercial - Proposed - Municipal Use Option |
| 29169 Heathercliff Rd | Savory Coffee | CC | New Restaurant - Village Café & Tenant Improvements |
| 4000 Malibu Canyon Rd | Vacant | CV-2 | New 146 room hotel, fractional ownership, related improvements |
| 22467 Pacific Coast Hwy | Vacant | CV-1 | New Commercial Building |
| 22706 Pacific Coast Hwy | Nobu Malibu | CV-1 | New Restaurant - Formerly Windsail |
| 22716 Pacific Coast Hwy | Vacant | CC | New Restaurant - Formerly Pierview |
| 22729 Pacific Coast Hwy | Vacant | CC | New Commercial Building, Demolition of Existing Gas Station |
| 22941 Pacific Coast Hwy | Chabad of Malibu | CV-1 | Addition & Remodel Existing Commercial Building |
| 22959 Pacific Coast Hwy | Vacant | CV-1 | New Commercial Building (office/retail), Grading, Retaining Walls, 31 Parking Spaces, New AOWTS |
| 24903 Pacific Coast Hwy | Vacant | CN | New Commercial Building |

**Table 106: Malibu Development Trends - Active**

### *Westlake Village*

Westlake Village is a master-planned community with an array of housing types including: townhomes, condominiums, mobile homes, single-family and lakefront residences, and view-oriented estates. From 2000 to 2010, the total number of residential housing units decreased by approximately 3% with 3 to 9 unit structures exhibiting the greatest decrease while structures comprised of 10 to 19 units growing by more than 22%.

Within Westlake Village, there are approximately 850 commercial and light industrial businesses. Future growth is controlled by the City Planning Department and City Council who work with active and organized homeowners associations to maintain the high quality of development within the City. (Source: The City of Westlake Village 2015 Strategic Plan, Volume One). http://www.wlv.org/whats_new/documents/2015_volume1.pdf

Currently there are two development projects in Westlake Village:

| Street Address | Occupant | Zone | Description |
|---|---|---|---|
| 31107 Thousand Oaks Boulevard | Vacant Lot | CR | 18 acre Community Park and YMCA facility (Commercial Recreation Project) Under Construction |
| Russell Ranch Road (no address yet) | Vacant Lot | MU | 243,000 square foot Russell Ranch Road Retail Center (Mixed Use Project) Under Review |

**Table 107: Westlake Village Development Trends - Active**

# SECTION 4. HAZARD MITIGATION GOALS AND STRATEGIES

This section describes the framework that focuses the plan on developing successful mitigation strategies. The framework is made up of three parts: the Mission, Goals, and Strategies.

## Mission

The mission of the Las Virgenes-Malibu Council of Governments Hazard Mitigation Plan is to promote sound public policy and programs designed to protect the public, critical facilities, infrastructure, private and public property and the environment from natural and manmade hazards. The mission is achieved by developing and implementing the Hazard Mitigation Plan to guide the Region towards creating and maintaining a safer and more sustainable community.

## Hazard Mitigation Plan Goals

The Hazard Mitigation Plan goals describe the overall direction that Las Virgenes-Malibu Council of Governments agencies, organizations, and citizens can take to minimize the impacts of hazards. The plan goals help to guide the direction of future activities aimed at reducing risk and preventing loss from hazards. The goals are stepping-stones between the broad direction of the mission and the specific recommendations that are outlined in the strategies.

### To Protect Life, Property, Environment

- Implement activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to hazards.
- Reduce losses and repetitive damages for chronic hazard events while promoting insurance coverage for catastrophic hazards.
- Encourage preventative measures for existing and new development in areas vulnerable to hazards.

### Public Awareness

- Develop and implement education and outreach programs to increase public awareness of the risks associated with hazards.
- Develop and implement education and outreach programs to increase public awareness of the mitigation measures associated with hazards.
- Provide information on tools, partnership opportunities, and funding resources to assist in implementing mitigation activities.

### Partnerships and Implementation

- Strengthen communication and coordinate participation among and within public agencies, citizens, non-profit organizations, business, and industry to gain a vested interest in implementation.
- Encourage leadership within public and private sector organizations to prioritize and implement local and Regional hazard mitigation activities.

### Emergency Management

- Establish policy to ensure implementation of mitigation projects for critical facilities, services, and infrastructure.
- Make recommendations for updating local ordinances, city guidelines, codes, and permitting processes and establish new ordinances that support mitigation.
- Strengthen emergency operations by increasing collaboration and coordination among departments, public agencies, non-profit organizations, business, and industry.
- Coordinate and integrate hazard mitigation activities (when appropriate) with emergency operations plans and procedures.

## Hazard Mitigation Strategies

The Hazard Mitigation Plan identifies action items developed and submitted through data collection, research, and the public participation process. Mitigation plan activities may be considered for funding through Federal and State grant programs as well as other funds made available to the LVMCOG and each city. To help ensure activity implementation, each action item includes estimated timeframes and a list of coordinating organizations.

Mitigation strategies were assigned a priority based on a combination of factors including urgency, importance, and cost/benefit. Constraints may apply to some of the action items. These constraints may be a lack of city staff, lack of funds, or vested property rights which might expose the Region to legal action as a result of adverse impacts on private property.

The matrix on the following page provides a summary of the Hazard Mitigation strategies developed for the Las Virgenes-Malibu Region.

## Hazard Mitigation Strategy Status Summary

The following matrix provides a summary of the Hazard Mitigation Projects implemented within the Las Virgenes-Malibu Region, the current status, and their impact on New Buildings, Existing Buildings, Infrastructure, and the Community.

### *Regional Mitigation Projects and Strategies*

| Type | Hazard | Project Name / Strategy | Priority | Status | Impact on Buildings, Infrastructure, and the Community | Comments |
|---|---|---|---|---|---|---|
| **Regional** | Multi-Hazard | Implement, Revise, and Maintain the Las-Virgenes-Malibu Hazard Mitigation Plan<br>Page 4-16 | 1 | Complete/Ongoing | • Facilitates planning for future events.<br>• Enables better response and coordination by city personnel during and after a hazardous event. | 2011 HMP update complete. Maintenance ongoing. |
| **Regional** | Multi-Hazard | Critical Infrastructure Assessment<br>Page 4-17 | 1 | Complete/Ongoing | • May add requirements to new construction permits for critical infrastructure.<br>• Will enable response and coordination by city personnel during and after a hazardous event. | Each city continually assesses the state of readiness of critical facilities within their jurisdictions. The City of Malibu has provided the Sheriff's Dept. with a list of critical infrastructure. The City of Westlake Village has provisioned two key sites with emergency power and supplies. |
| **Regional** | Multi-Hazard | Emergency Shelter Identification<br>Page 4-18 | 1 | Complete/Ongoing | • Provides for better response and coordination by city personnel during and after a hazardous event.<br>• Improves private sector (hotels and other) participation and awareness. | Each city identified emergency shelter locations and works with the American Red Cross to establish shelters. The City of Malibu instituted Tsunami Evacuation Sites and publicized locations via the city's website. |
| **Regional** | Multi-Hazard | Hazard Awareness Public / Private Partnerships<br>Page 4-20 | 1 | Complete/Ongoing | • Provides for better response and coordination by city personnel during and after a hazardous event.<br>• Improves public preparedness and mitigation education and hazard awareness. | Individual cities have implemented public awareness/business partnership events, task force meetings, and CERT programs. The City of Malibu and City of Calabasas are part of the Community Wildfire Protection Plan (CWPP) and member of the Santa Monica Fire Safe Alliance. Malibu is working with the Malibu Methodist Church and Noah's Wish to establish an animal emergency shelter. |

| Type | Hazard | Project Name / Strategy | Priority | Status | Impact on Buildings, Infrastructure, and the Community | Comments |
|---|---|---|---|---|---|---|
| **Regional** | Multi-Hazard | Tree Pruning Program and Fire Code Sections<br>Page 4-22 | 1 | Complete | • May result in additional maintenance requirements for new commercial and residential development properties. | All cities serviced by the Los Angeles County Fire Department and require tree pruning and brush clearance per LAC Fire Code and State Fire Code. Public information is distributed, e.g., "A Roadmap to Fire Safety" and annual brush clearance mailers. |
| **Regional** | Multi-Hazard | Pre-Established Contracts<br>p4-23 | 1 | Partially Complete | • Provides for better response and coordination by city personnel during and after a hazardous event. | Cities have identified critical vendors and contractors and maintain lists. While the City of Westlake Village has emergency agreements with private vendors, most cities have not established emergency contracts. |
| **Regional** | Multi-Hazard | Emergency Services Contractors<br>Page 4-24 | 1 | Removed | Not Applicable | Consolidated with Pre-Established Contracts strategy. |
| **Regional** | Multi-Hazard | Regional Public Safety Commission<br>Page 4-25 | 1 | Removed | Not Applicable | Removed – Each city manages public safety issues through their internal Public Safety Commissions. |
| **Regional** | Multi-Hazard | Communications Hardening<br>Page 4-26 | 2 | Complete/Ongoing | • Provides for better response and coordination by city personnel during and after a hazardous event. | All cities implemented Blackboard Connect Inc.'s Connect-CTY system, the Operational Area Response and Recovery System (OARRS), County-wide Integrated Radio System (CWIRS), and Sheriff's Department NIXLE system. Individual cities also implemented social media, public Wi-Fi, Amateur Radio groups, satellite telephones, radio repeaters, and back-up power generators. |
| **Regional** | Multi-Hazard | Emergency Preparedness Public Awareness Campaign<br>Page 4-28 | 2 | Complete/Ongoing | • Improves public preparedness and mitigation education and hazard awareness. | All cities implemented the Ready Set Go Wildfire Action Plan, are part of the CA Fire Alliance, and participate in the annual LA County Shake Out Earthquake Exercise. Individual city programs include local television programming, web site educational information, ongoing training and education events. The City of Calabasas has also implemented a "Map Your Neighborhood Program". |

| Type | Hazard | Project Name / Strategy | Priority | Status | Impact on Buildings, Infrastructure, and the Community | Comments |
|---|---|---|---|---|---|---|
| **Regional** | Multi-Hazard | Rehabilitation of Residential Properties<br>Page 4-30 | 2 | Complete/Ongoing | • Mitigates private residential property loss. | Cities implemented home renovation projects or programs (as applicable). |
| **Regional** | Multi-Hazard | US 101 Freeway Corridor Improvement Study<br>Page 4-31 | 2 | Complete | • May add infrastructure upgrades to local land use planning and zoning requirements for new commercial development.<br>• Will enable better response times for local emergency services personnel by improving local access routes. | US 101 Freeway Corridor Study complete. In addition improvements to transportation routes including the Kanan Road and Reyes Adobe Road Interchange projects have been completed.<br>The Chesebro/Lost Hills Interchange and Lindero Canyon/US 101 Interchange projects will be completed within the next 5 years. |
| **Regional** | Multi-Hazard | Risk Assessment Project<br>Page 4-32 | 2 | Partially Complete | • Enables better land use planning, building code, and zoning requirements. | All city General Plans include guidelines for risk reduction. Risk Assessment complete for the City of Agoura Hills. All cities except Hidden Hills have either mapped local hazards and/or upgraded their GIS capabilities. |
| **Regional** | Multi-Hazard | Citizen Corp<br>Page 4-34 | 2 | Removed | Not Applicable | Removed – Citizens Corps are managed by the State and County. |
| **Regional** | Multi-Hazard | Advanced Community Training<br>Page 4-35 | 3 | Complete/Ongoing | • Improves public preparedness and mitigation education and hazard awareness. | Each city offers CERT classes on an ongoing basis throughout the year. |